















SAYREVILLE BOARD OF EDUCATION

District-Wide Energy Savings Plan

A Do-It-Yourself Energy Savings Improvement Program

WILLDAN

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Table of Contents

Section 1. Executive Summary 1
Section 2. Facility Information 11
Section 3. Utility Summary and Benchmarking 46
Section 4. Energy Conservation Measures (ECMs) 82
Section 5. Utility and Other Rebates and Incentives Available for Project 139
Section 6. Measurement and Verification (M&V) Plan 145
Section 7. Project Development and Management Overview 151
Section 8. Appendices 159

List of Tables

Table 1: Sayreville Memorial HS Energy Savings 2
Table 2: Sayreville Middle School Energy Savings 2
Table 3: Emma L Arleth Elementary School Energy Savings 2
Table 4: Harry S Truman Elementary School Energy Savings 2
Table 5: Samsel Upper Elementary School Energy Savings 2
Table 6: Dwight Eisenhower Elementary School Energy Savings 2
Table 7: Woodrow Wilson Elementary School Energy Savings 2
Table 8: Selover School Energy Savings 2
Table 9: Energy Conservation Measures for Sayreville Schools for 20-year plan 3
Table 10: Energy Savings for Sayreville Schools for 20-year plan 4
Table 11: Sayreville BOE Form I 20-year plan 5
Table 12: Sayreville BOE Form II 20-year plan 6
Table 13: Sayreville BOE Form III 20-year plan 7
Table 14: Sayreville BOE Form IV 20-year plan 8
Table 15: Sayreville BOE Form V 20-year plan 9
Table 16: Sayreville BOE Form VI 20-year plan 10
Table 17: Sayreville HS Mechanical Schedule 14
Table 18: Sayreville HS Pump/Motor Schedule 16
Table 19: Sayreville MS Mechanical Schedule 21
Table 20: Sayreville MS Pump/Motor Schedule 22
Table 21: Samsel Upper Elementary School Mechanical Schedule 26
Table 22: Samsel Upper Elementary School Mechanical Schedule 27
Table 23: Harry S Truman ES Existing Lighting Fixtures 31
Table 24: Harry S Truman ES Existing Lighting Fixtures 32
Table 25: Wilson ES Existing Mechanical Schedule 39
Table 26: Wilson ES Existing Pump/Motor Schedule 40
Table 27: Emma Arleth ES Existing Mechanical Schedule 43
Table 28: Emma Arleth ES Existing Pump/Motor Schedule 44
Table 29: List of Schools 46
Table 30: District-Wide Utility Baseline 46
Table 31: Sayreville Memorial HS Electric Usage 47
Table 32: Sayreville Memorial HS Natural Gas Usage 49
Table 33: Sayreville Memorial HS Historical Natural Gas Usage 50
Table 34: Sayreville MS Electric Usage 52
Table 35: Sayreville MS Natural Gas Usage 54
Table 36: Samsel Upper ES Electric Usage 56
Table 37: Samsel Upper ES Natural Gas Usage 58
Table 38: Harry S Truman ES Electric Usage 60
Table 39: Harry S Truman ES Natural Gas Usage 62
Table 40: Dwight D Eisenhower ES Electric Usage 64
Table 41: Dwight D Eisenhower ES Natural Gas Usage 66
Table 42: Selover School Electric Usage 68

Table 43: Selover School Natural Gas Usage 70
Table 44: Woodrow Wilson Elementary School Electric Usage 72
Table 45: Woodrow Wilson Elementary School Natural Gas Usage 74
Table 46: Emma L Arleth Elementary School Electric Usage 76
Table 47: Emma L Arleth Elementary School Natural Gas Usage 78
Table 48: Sayreville Memorial High School Energy Benchmarking 80
Table 49: Sayreville Middle School Energy Benchmarking 80
Table 50: Samsel Upper Elementary School Energy Benchmarking 80
Table 51: Harry S Truman Elementary School Energy Benchmarking 80
Table 52: Dwight Eisenhower Elementary School Energy Benchmarking 81
Table 53: Selover School Energy Benchmarking 81
Table 54: Woodrow Wilson Elementary School Energy Benchmarking 81
Table 55: Emma L Arleth Elementary School Energy Benchmarking 81
Table 56: Sayreville HS ECMs 82
Table 57: Sayreville MS ECMs 89
Table 58: Samsel Upper ES ECMs 97
Table 59: Harry Truman ES ECMs 105
Table 60: Dwight Eisenhower ES ECMs 111
Table 61: Selover School ECMs 117
Table 62: Woodrow Wilson ES ECMs 123
Table 63: Emma Arleth ES ECMs 130
Table 64: Optional ECMs Not Considered 137
Table 65: District-Wide DI Incentives 141
Table 66: District-Wide SmartStart Incentives 142
Table 68: District-Wide PJM Incentives 144
Table 69: District-Wide Utility Baseline 146

List of Figures

Figure 1: Sayreville HS 11
Figure 2: Sayreville HS Exterior conditions 12
Figure 3: Sayreville HS Central Heating 13
Figure 4: Sayreville HS HVAC Systems (1) 13
Figure 5: Sayreville HS HVAC Systems (2) 14
Figure 6: Sayreville HS Domestic Hot Water 17
Figure 7: Sayreville HS Kitchen Equipment 17
Figure 8: Sayreville MS 19
Figure 10: Sayreville MS Exterior Conditions 19
Figure 11: Sayreville MS Heating System 20
Figure 12: Sayreville MS Cooling System 21
Figure 13: Sayreville MS DWH System 23
Figure 14: Sayreville MS Kitchen Equipment 23
Figure 15: Samsel Upper Elementary School 24
Figure 16: Samsel Upper Elementary School Exterior Conditions 24
Figure 17: Samsel Upper Elementary School Cooling Systems (1) 25
Figure 18: Samsel Upper Elementary School Cooling Systems (2) 25
Figure 19: Samsel Upper Elementary School Heating Systems 26
Figure 20: Samsel Upper Elementary School DHW Systems 28
Figure 21: Samsel Upper Elementary School Kitchen Equipment 28
Figure 22: Harry Truman ES 30
Figure 23: Harry Truman ES Exterior Conditions 30
Figure 24: Harry Truman ES Mechanical Systems 31
Figure 25: Harry Truman ES Kitchen Equipment 32
Figure 26: Dwight Eisenhower ES 33
Figure 27: Dwight Eisenhower ES Exterior Conditions 33
Figure 28: Dwight Eisenhower ES Mechanical Systems 34
Figure 29: Dwight Eisenhower ES Kitchen Equipment 35
Figure 30: Selover School 36
Figure 31: Selover School Exterior Condition 36
Figure 32: Selover School HVAC System 37
Figure 33: Wilson ES 38
Figure 34: Wilson ES Exterior Conditions 38
Figure 35: Wilson ES HVAC Systems 39
Figure 36: Wilson ES DWH Systems 40
Figure 37: Wilson ES Kitchen Equipment 40
Figure 38: Emma Arleth ES 42
Figure 39: Emma Arleth ES Exterior Conditions 42
Figure 40: Emma Arleth ES Mechanical System 43
Figure 41: Emma Arleth ES DWH 44
Figure 42: Emma Arleth ES Kitchen Equipment 45
Figure 43: Sayreville Memorial HS Electric Usage (kWh, kW) 48
Figure 44: Sayreville Memorial HS Electric Usage End Use Breakdown 48

Figure 45: Sayreville Memorial HS Natural Gas Usage (Therms) 49
Figure 46: Sayreville Memorial HS Natural Gas Usage End Use Breakdown 50
Figure 47: Sayreville Memorial HS Electric Usage (kWh, kW) 51
Figure 48: Sayreville MS Electric Usage (kWh, kW) 53
Figure 49: Sayreville MS Electric Usage End use Breakdown 53
Figure 50: Sayreville MS Natural Gas Usage (therms) 54
Figure 51: Sayreville MS Natural Gas Usage End Use Breakdown 55
Figure 52: Samsel Upper ES Electric Usage (kWh, kW) 57
Figure 53: Samsel Upper ES Electric Usage End Use Breakdown 57
Figure 54: Samsel Upper ES Natural Gas Usage (therms) 58
Figure 55: Samsel Upper ES Natural Gas Usage End Use Breakdown 59
Figure 56: Harry S Truman ES Electric Usage (kWh, kW) 61
Figure 57: Harry S Truman ES Electric Usage End Use Breakdown 61
Figure 58: Harry S Truman ES Natural Gas Usage (therms) 62
Figure 59: Harry S Truman ES Natural Gas Usage End Use Breakdown 63
Figure 60: Dwight D Eisenhower ES Electric Usage (kWh) 65
Figure 61: Dwight D Eisenhower ES Electric Usage End Use Breakdown 65
Figure 62: Dwight D Eisenhower ES Natural Gas Usage (therms) 66
Figure 63: Dwight D Eisenhower ES Natural Gas Usage End Use Breakdown 67
Figure 64: Selover ES Electric Usage (kWh) 69
Figure 65: Selover ES Electric Usage End Use Breakdown 69
Figure 66: Selover ES Natural Gas Usage (therms) 70
Figure 67: Selover ES Natural Gas Usage End Use Breakdown 71
Figure 68: Woodrow Wilson Elementary School Electric Usage (kWh) 73
Figure 69: Woodrow Wilson Elementary School Electric Usage End Use Breakdown 73
Figure 70: Woodrow Wilson Elementary School Natural Gas Usage (therms) 74
Figure 71: Woodrow Wilson Elementary School Natural Gas Usage End Use Breakdown 75
Figure 72: Emma L Arleth Elementary School Electric Usage (kWh) 77
Figure 73: Emma L Arleth Elementary School Electric Usage End Use Breakdown 77
Figure 74: Emma L Arleth Elementary School Natural Gas Usage (therms) 78
Figure 75: Emma L Arleth Elementary School Natural Gas Usage End Use Breakdown 79
Figure 76: Sayreville HS Transformer ECM 86
Figure 77: Samsel Upper ES Transformer ECM 103
Figure 78: Emma Arleth ES Transformer ECM 136

Section 1. Executive Summary

Willdan Energy Solutions was selected by Spiezle in December 2019 for engineering services related to the development of an Energy Savings Plan (ESP) to be used in a Do–It–Yourself (DIY) Energy Savings Improvement Program (ESIP). The scope of work is to develop an ESP for Sayreville district's eight (8) schools. This report includes ECMs that were based on site surveys, data collection, consulting facility personnel and reviewing baseline utility bills. This report includes a financially viable plan to implement the Energy Conservation Measures (ECMs) and achieve operational energy savings to comply with the requirements of New Jersey Energy Savings Improvement Program (NJ ESIP) in accordance with NJ PL2012, c.55.

The main requirement of NJ ESIP is to justify cost estimate and energy saving calculations for all the proposed ECMs that will pay for itself through energy savings over twenty (20) years. Pursuant to the NJ ESIP Law, N.J.S.A. 18A:18A-4.6(d)(2), the ESP shall:

- Contain the results of an Energy Audit.
- Describe the ECMs that will comprise the program.
- Estimate greenhouse-gas reductions resulting from those energy savings.
- Include an assessment of risks involved in the successful implementation of the plan.
- Identify the eligibility for, and the costs and revenues associated with the PJM Independent System Operator for demand response and curtailable service activities.
- Include schedules showing calculations of all costs of implementing the proposed energy conservation measures and the projected energy savings.
- Identify maintenance requirements necessary to ensure continued energy savings and describe how they will be fulfilled.

The purpose of this ESP report is to provide a district-wide NJ Do-It-Yourself (DIY) ESIP project with all the ECMs. There were many energy conservation measures evaluated during development of this ESP, and after careful consideration the list of ECMs were included in this report. This ESP is structured to comply with the ESIP Law with all the necessary information to make a firm decision. The possible areas of energy savings for Sayreville BOE and Spiezle, as described initially, are as follows:

- Lighting
- Roofing
- Unit Ventilators
- Windows
- Boilers
- Plug-Load Controllers
- Solar
- Rooftop Units and Air Handling Units

Willdan Energy Solutions has carefully considered the above possible areas of energy improvement and assessed the schools to present a feasible ESIP project. The energy cost savings for all schools have been derived through detailed energy analysis using both spreadsheet calculations and eQuest energy modeling to model the building system. The following tables highlight the overall energy savings per school. Note that the savings table does not include onsite electric generation potential from installation of solar PV panels.

Table 1: Sayreville Memorial HS Energy Savings

Savings		
Annual Electric Energy	308,850	kWh
Annual Electric Demand	80	kW
Annual Natural Gas	538	therms
Annual Utility Cost Savings	$37,736	

Table 2: Sayreville Middle School Energy Savings

Savings		
Annual Electric Energy	133,388	kWh
Annual Electric Demand	35	kW
Annual Natural Gas	14,377	therms
Annual Utility Cost Savings	$28,477	

Table 3: Emma L Arleth Elementary School Energy Savings

Savings		
Annual Electric Energy	107,014	kWh
Annual Electric Demand	27	kW
Annual Natural Gas	5,103	therms
Annual Utility Cost Savings	$17,308	

Table 4: Harry S Truman Elementary School Energy Savings

Savings		
Annual Electric Energy	62,101	kWh
Annual Electric Demand	15	kW
Annual Natural Gas	3,482	therms
Annual Utility Cost Savings	$10,493	

Table 5: Samsel Upper Elementary School Energy Savings

Savings		
Annual Electric Energy	299,974	kWh
Annual Electric Demand	77	kW
Annual Natural Gas	1,410	therms
Annual Utility Cost Savings	$37,415	

Table 6: Dwight Eisenhower Elementary School Energy Savings

Savings		
Annual Electric Energy	51,177	kWh
Annual Electric Demand	14	kW
Annual Natural Gas	3,480	therms
Annual Utility Cost Savings	$9,173	

Table 7: Woodrow Wilson Elementary School Energy Savings

Savings		
Annual Electric Energy	59,353	kWh
Annual Electric Demand	17	kW
Annual Natural Gas	4,094	therms
Annual Utility Cost Savings	$10,710	

Table 8: Selover School Energy Savings

Savings		
Annual Electric Energy	52,156	kWh
Annual Electric Demand	13	kW
Annual Natural Gas	1,359	therms
Annual Utility Cost Savings	$7,465	

Based on the Energy Conservation Measures (ECMs) included in this Energy Savings Plan, the following tables highlight the overall savings district-wide. The measures considered in this ESP could result in an annual utility savings of 1,074,197 kWh of electricity and 33,844 therms of natural gas. The project also includes installing 3.1 MW solar rooftop and canopy PV resulting total production of approximately 3.5 Million kWh. The project will also reduce energy cost by $3,933,261 over the life of the project. This project is estimated to receive a maximum financial incentive of $270,016 from NJOCE programs and PJM's Demand Response (DR) Program. This project shall also reduce Operational and Maintenance cost by $225,000. Additionally, these energy savings will result in a net reduction of greenhouse gases and will reduce the school district's carbon footprint by 2,028,753 lbs of CO2 annually.

Table 9: Energy Conservation Measures for Sayreville Schools for 20-year plan

ECM Description	Sayreville War Memorial HS	Sayreville MS	Emma L Arleth ES	Harry S Truman ES	Samsel Upper ES	Dwight Eisenhower ES	Woodrow Wilson ES	Selover School/BOE Offices
ECM#1 - LED Lighting	X	X	X	X	X	X	X	X
ECM#2 - Premium Efficiency Motors W/ VFD		X	X	X	X	X	X	X
ECM#3 - Install High Efficiency Roof Top Units	X	X			X		X	
ECM#4 - Install High Efficiency Hot Water Boilers		X	X	X		X	X	X
ECM#5 - Building Management System		X	X	X	X	X	X	X
ECM#6 - Install Unit Ventilators with cooling								
ECM#7 - Vending Misers	X	X	X	X	X	X	X	X
ECM#8 - Plug Load Controls	X	X	X	X	X	X	X	X
ECM#9 - Transformer Upgrades	X		X		X			
ECM#10 - Add Photovoltaic Systems	X	X	X	X	X	X	X	X
ECM#10.1 Enabler - Upgrade Roof	X	X	X	X		X	X	
ECM#11 - CHP	X							

Table 10: Energy Savings for Sayreville Schools for 20-year plan

ECMs	Measure	Annual Estimated Savings 20-Year Plan				Estimated Implementation Hard Cost ($)	Estimated Simple Payback Period (Years)
		Electricity (kWh)	Annual Demand (kW)	Natural Gas (Therms)	Cost Savings ($)		
ECM - 1	LED Lighting	846,996	248	-	$102,216	$783,675	7.7
ECM - 2	Premium Efficiency Motors W/ VFD	46,447	-	-	$5,605	$289,725	51.7
ECM - 3	Install High Efficiency Roof Top Units	(100,715)	1	3,120	($9,468)	$2,759,749	(291.5)
ECM - 4	Install High Efficiency Hot Water Boilers	-	-	27,294	$23,502	$1,844,434	78.5
ECM - 5	Building Management System (BMS)	14,793	8	3,429	$4,738	$642,500	137.5
ECM - 6	Install Unit Ventilators with Cooling	-	-	-	$-	$-	
ECM - 7	Vending Misers	12,896	2	-	$1,556	$4,800	3.1
ECM - 8	Plug Load Controls	119,556	-	-	$14,428	$174,450	12.1
ECM – 9	Transformer Upgrades	134,225	18	-	$16,198	$225,323	13.9
ECM - 10	Add Photovoltaic Systems	3,546,204	3,125	-	$391,150	$594,000	1.9
	Total	**4,620,402**	**3,402**	**33,844**	**$549,925**	**$7,318,656**	**13.4**

In accordance with the NJ ESIP process, the next step in the project development phase is for Willdan to work with Spiezle, Sayreville BOE, and Schiller & Hersh Associates to select the desired ECMs based on the Sayreville BOE's goals and objectives. The selection will consider project cost, projected energy saving and operation savings, available financing options at the time of the agreement, interest rates, length of term and Sayreville BOE's priorities, which will all play a part in the final selection and cash flow of ECMs. The definitive requirement under NJ PL2012, c. 55 is that the project is self-funding within the 20-year term as outlined in legislation.

Overall, it is evident that Sayreville BOE is well positioned to implement a program that will upgrade facility equipment, while funding itself within the requirements of the law. We look forward this opportunity to partner with Spiezle and Sayreville BOE to improve the comfort and efficiency of your facilities through the successful implementation of this Energy Savings Plan.

Willdan is supporting Sayreville Board of Education with a percentage of implementation costs through ESIP. From a list of improvements and additions, the chosen ECMs under this ESP have yield the following savings and cash flow.

Table 11: Sayreville BOE Form I 20-year plan

FORM I
ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
GENERAL INFORMATION: CONTRACTOR

Sayreville BOE

ENERGY SAVING IMPROVEMENT PROGRAM

1. Name of Firm	Willdan Energy Solutions
	3910 Park Ave, Suite 5 Edison,
2. Address	NJ 08820
3. Contact Person	Tejas Desai, VP
4. Telephone	646-357-6340
5. E-mail	tdesai@willdan.com

Lead Personnal for this project (persons who will have supervisory or other responsibilitiy for the work to be performed)

Name	Title
Tejas Desai, PE	Program Manager
Rahul Sheth, EIT	IGA Team lead
Patrick Sposato, PE	QA/QC
Robert Ventriglia	Senior Account Executive
Robert Braun, PE	Principal in Charge

Table 12: Sayreville BOE Form II 20-year plan

FORM II

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):

ENERGY CONSERVATION MEASUREs (ECMs) SUMMARY FORM

Sayreville BOE

ENERGY SAVING IMPROVEMENT PROGRAM

ESCO Name: Willdan Energy Solutions

Proposed Preliminary Energy Savings Plan: Base Project 20 years @ 2.5%

Energy Conservation Measures	Estimated Installed Hard Costs (1) ($)	Estimated Annual Savings ($)	Estimated Simple Payback (Yrs)
ECM#1 - LED Lighting	$783,675	$102,216	7.7
ECM#2 - Premium Efficiency Motors W/ VFD	$289,725	$5,605	51.7
ECM#3 - Install High Efficiency Roof Top Units	$2,759,749	($9,468)	(291.5)
ECM#4 - Install High Efficiency Hot Water Boilers	$1,844,434	$23,502	78.5
ECM#5 - Building Management System (BMS)	$642,500	$4,674	137.5
ECM#6 - Install Unit Ventilators with cooling	$-	$-	-
ECM#7 - Vending Misers	$4,800	$1,556	3.1
ECM#8 - Plug Load Controls	$174,450	$14,428	12.1
ECM#9 - Transformer Upgrades	$225,323	$16,198	13.9
ECM#10 - Add Photovoltaic Systems	$594,000	$317,166	1.9
ECM#11 - CHP	$35,518	$ (684)	(8.1)
Project Summary:	**$7,354,174**	**$549,241**	**13.4**

(1) The total value of Hard Costs is defined in accordance with standard AIA definitions that include: Labor Costs, Subcontractor Costs, Cost of Materials and Equipment, Temporary Facilities and Related Items, and Miscellaneous Costs such as Permits, Bonds Taxes, Insurance, Mark-ups, Overhead, Profit, etc.

Table 13: Sayreville BOE Form III 20-year plan

FORM III
ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):
PROJECTED ANNUAL ENERGY SAVINGS DATA FORM

Sayreville BOE

ENERGY SAVING IMPROVEMENT PROGRAM

ESCO Name: Willdan Energy Solutions

Proposed Preliminary Energy Savings Plan: Base Project 20 years @ 2.5%

Energy/Water	ESCO Developed Baseline (Units) (2)	ESCO Developed Baseline (Costs $) (2)	Proposed Annual Savings (Units) (3)	Proposed Annual Savings (Costs $) (3)
Electric Demand (kW)	1,580	$-	277	$5,955
Electric Energy (kWh)	5,273,289	$905,263	1,074,197	$129,634
Natural Gas (ccf)	259,288	$268,881	32,636	$29,141
Fuel Oil (gallons)	0	$-	0	$-
Steam (Lbs.)	0	$-	0	$-
Water (Gallons)	7,750,575	$147,261	36,815	$699
CHP (mmBTU)	0	$-	-133	$ (684)
AVOIDED EMISSIONS (1)	Provide in Pounds (Lbs)			
NOX	3,319	Lbs.		
SO_2	6,982	Lbs.		
CO_2	2,028,753	Lbs.		

(1) ESCOs are to use the rates provided as part of this RFP to calculate Avoided Emissions. Calculation for all project energy savings and greenhouse gas reductions will be conducted in accordance with adopted NJBPU protocols

(2) "ESCOs Developed Baseline": Board's current annual usages and costs as determined by the proposing ESCO; based off Board's utility information as provided to proposing ESCO.

(3) "Proposed Annual Savings": ESCOs proposed annual savings resulting from the Board's implementation of the proposed ESP, as based upon "ESCOs Developed Baseline".

Table 14: Sayreville BOE Form IV 20-year plan

FORM IV

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):

PROJECTED ANNUAL ENERGY SAVINGS DATA FORM IN MMBTUs

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):

PROJECTED ANNUAL ENERGY SAVINGS DATA FORM

Sayreville BOE

ENERGY SAVING IMPROVEMENT PROGRAM

ESCO Name: Willdan Energy Solutions

Proposed Preliminary Energy Savings Plan: Base Project 20 years @ 2.5%

The projected annual energy savings for each fuel type MUST be completed using the following format. Data should be given in equivalent MMBTUs.

ENERGY	ESCO Developed Baseline	ESCO Proposed Savings Annual	Comments
Electric Energy (MMBTUs)	1,799,246	366,516	
Natural Gas (MMBTUs)	31,228	3,264	
Fuel Oil (MMBTUs)	0	0	
Steam (MMBTUs)	0	0	
Other (Specify) **(MMBTUs)**	0	0	

NOTE: MMBTU Defined: A standard unit of measurement used to denote both the amount of heat energy in fuels and the ability of appliances and air conditioning systems to produce heating or cooling.

Table 15: Sayreville BOE Form V 20-year plan

FORM V

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):

ESCOs PROPOSED FINAL PROJECT COST FORM FOR 20-year

.

Sayreville BOE

ENERGY SAVING IMPROVEMENT PROGRAM

ESCO Name: Willdan Energy Solutions

Proposed Preliminary Energy Savings Plan: Base Project 20 years @ 2.5%

PROPOSED CONSTRUCTION FEES

Fee Category	Fees [1] Dollar ($) Value
Estimated Value of Hard Costs [2]:	$7,354,174
Project Service Fees	
Investment Grade Energy Audit	$172,000
Design Engineering Fees	$87,500
Construction Management & Project Administration	$75,000
System Commissioning	$67,500
Equipment Initial Training Fees	$22,500
Project Service Fees Sub Total	$424,500
Other costs	$724,741
TOTAL FINANCED PROJECT COSTS:	$8,503,415

PROPOSED ANNUAL SERVICE FEES

Fee Category	Fees [1] Dollar ($) Value
SAVINGS GUARANTEE (*OPTION*)	
ENERGY STAR™ Services (*optiona*l)	{3}
Post Construction Services *(If applicable)*	
Performance Monitoring	$7,500
On-going Training Services	$5,000
Verification Reports	$4,500
TOTAL FIRST YEAR ANNUAL SERVICES	$17,000

NOTES:

(1) Fees should include all mark-ups, overhead, and profit. Figures stated as a range will NOT be accepted.

(2) The total value of Hard Costs is defined in accordance with standard AIA definitions that include:

Labor Costs, Subcontractor Costs, Cost of Materials and Equipment, Temporary Facilities and Related Items, and Miscellaneous Costs such as Permits, Bonds Taxes, Insurance, Mark-ups, Overhead and Profit, etc.

(3) Willdan will charge $7,500 per building for Energy Star Certification for each qualified building.

Table 16: Sayreville BOE Form VI 20-year plan

FORM VI 20-Year Plan

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):

ESCO's PRELIMINARY ANNUAL CASH FLOW ANALYSIS FORM

Sayreville BOE

ENERGY SAVINGS IMPROVEMENT PROGRAM

ESCO Name: Willdan Energy Solutions

Proposed Preliminary Energy Savings Plan: Base Project 20 years @ 2.5%

Note: Respondents must use the following assumptions in all financial calculations:

(a) The cost of all types of energy should be assumed to inflate at ***2.4% gas, 2.2% electric*** per year; and

1. Term of Agreement: 20 years	(240 Months)
2. Construction Period [2] (months):	12
3. Cash Flow Analysis Format:	
4. ESP Fee	$424,500.00
5. AE Fee	$507,438.03
6. CA Fee	$132,375.14
7. Bond Fee	$38,713.82
8. Legal Fee	$38,713.82
9. Third Party Fee	$7,500.00
10. Project Hard Costs	$7,354,174.36

Project Cost [1]:	$8,495,915.17	Interest Rate to Be Used for Proposal Purposes:	2.45%

Year	Annual Energy Savings	Annual Operational Savings	Energy Rebates/ Incentives	Solar PPA	Total Annual Savings	Annual Project Costs	Net Cash-Flow to Client	Cumulative Cash Flow
1	$158,091	$45,000	$258,457	$391,150	$852,698	$849,712	$2,986	$2,986
2	$161,627	$45,000	$3,853	$395,844	$606,324	$603,338	$2,986	$5,973
3	$165,243	$45,000	$3,853	$400,594	$614,690	$611,704	$2,986	$8,959
4	$168,939	$45,000	$3,853	$405,401	$623,193	$620,207	$2,986	$11,945
5	$172,719	$45,000		$410,266	$627,984	$624,998	$2,986	$14,931
6	$176,583			$415,189	$591,772	$588,785	$2,986	$17,918
7	$180,533			$420,171	$600,704	$597,718	$2,986	$20,904
8	$184,572			$425,213	$609,785	$606,799	$2,986	$23,890
9	$188,701			$430,316	$619,017	$616,031	$2,986	$26,876
10	$192,923			$435,480	$628,403	$625,417	$2,986	$29,863
11	$197,240			$440,705	$637,945	$634,959	$2,986	$32,849
12	$201,653			$445,994	$647,647	$644,660	$2,986	$35,835
13	$206,165			$451,346	$657,511	$654,524	$2,986	$38,821
14	$210,778			$456,762	$667,540	$664,554	$2,986	$41,808
15	$215,494			$462,243	$677,737	$674,751	$2,986	$44,794
16	$220,316				$220,316	$217,330	$2,986	$47,780
17	$225,247				$225,247	$222,260	$2,986	$50,766
18	$230,287				$230,287	$227,301	$2,986	$53,753
19	$235,441				$235,441	$232,454	$2,986	$56,739
20	$240,710				$240,710	$237,723	$2,986	$59,725
Totals	**$3,933,261**	**$225,000**	**$270,016**	**$6,386,673**	**$10,814,951**	**$10,755,226**	**$59,725**	

NOTES:

(1) Includes: Hard costs and project service fees defined in ESCO's PROPOSED "FORM V"

(2) No payments are made by Board during the construction period.

(3) This figure should equal the value indicated on the ESCO's PROPOSED "FORM V". DO NOT include in the Financed Project Cost

(4) The Township did not provide additional cost for project including costs for legal fees, financing fees, and bond consulting. These costs will be included in the final Energy Savings Plan.

Section 2. Facility Information

Sayreville War Memorial High School



Figure 1: Sayreville HS

Sayreville War Memorial High School (Sayreville HS), built in 1962, is a two-story, 292,289 square foot building. The school is comprised of various space types such as classrooms, offices, auditorium, cafeteria, gym, clinic, locker rooms, mechanical rooms, corridor, and stairwells. The facility is 100% heated centrally and only 40% cooled.
The facility is occupied year-round with school hours from 7:00 am to 3:00 pm, Monday to Friday. The school has an occupancy of 1700 students accompanied with 150 staff members.

Building Condition

Envelop
The exterior walls are concrete blocks over structural steel with brick or stone façade. Classrooms facing the exteriors have wall-to-ceiling windows. The roof is flat and in fair condition. Based on the age of the school, the insulation is average with visible cracks at several intervals. Majority of the windows are double pane with internal shading. The window frame caulk is either deteriorating or is missing, like those for the exterior doors. Replacing roof/windows is an expensive measure and provide small savings, resulting in very long payback.



Figure 2: Sayreville HS Exterior conditions

Lighting

The interior lighting fixtures for the school mainly comprise of F32T8 linear fluorescent lamps. Various other fixtures are also in operating condition that illuminate the auditorium, gym, office space, kitchen, corridors and hallways. The lighting in the kitchen area is in poor condition. The classrooms are over lit on the other hand. The lighting fixtures are only controlled through a manual switch and occupancy sensors are only placed in limited spaces. The exterior lighting fixtures include wall packs, canopy lights and pole mounted area lights. Majority of the exterior fixtures are controlled by timed clocks, while a few are controlled through in-built photocells. Existing line-by-line fixture table is attached as an appendix.

Mechanical

The heating load for the school is served with three (3) AERCO gas-fired condensing boilers along with two (2) Universal Boiler Works gas-fired non-condensing boilers, within their expected useful life. These boilers operate as a hybrid system. The condensing boilers are utilized first to take as much of the load with their capacity as possible, then the large non-condensing boilers supplement. It is only on very cold days that the non-condensing boilers are used. A BMS controls the operation and staging of the boilers, varied by occupancy and outside air (OA) temperature. There are two separate hydronic loops serving the building, both only operating as hot water now. One is truly hot water only, the other is a 2-pipe chilled-hot system, however, the chiller is abandoned. The main hot water loop is pumped with a duty-standby set of 100 HP pumps. There is a VFD control on the distribution pumps. The 2-pipe loop is served by a set of 10 HP pumps, duty-standby. The main hot water loop serves all air handling system heating water coils,

excluding the library wing. The library wing is served by the 2-pipe system. The Aerco boilers each have a primary circulator of minimal horsepower. The UB boilers have local small blending pump but no primary pump. The loop operated at a supply temperature of 180F with an OA-Reset control to adjust the supply temperature at 120F when the OA is above 65F. In the utility bill analysis section, it shows that there was a significant drop in gas consumption in winter 2019, some of which can be attributed to a boiler retrofit that was recently completed.



Figure 3: Sayreville HS Central Heating

Several spaces in the school are served by gas-fired Make-up Air Units (MAU), including the kitchen and laboratory/science classroom wing, to bring in fresh air to the school and surrounding areas, controlled by a BMS system as well.



Figure 4: Sayreville HS HVAC Systems (1)

Unit ventilators are the majority system present in the schools that condition all the classrooms individually. They are equipped with ¼ HP motors with pneumatically controlled OA dampers, zone valves and economizers. There are several areas with newer unit ventilators whose motors are sized at 1/6 HP. The gym is equipped with four (4) heating ventilators to condition that space in the heating season. Additional unit heaters are also installed in the gymnasium for heating during low occupancy.



Figure 5: Sayreville HS HVAC Systems (2)

The school has several packaged Rooftop Units (RTUs) as shown in figure 13. They serve spaces like the library, offices, cafeteria and music rooms. The cafeteria and kitchen also have Energy Recovery Units (ERUs) serving the space, coupled with air cooled condensers to condition the space between 68F and 72F. Other smaller individual office and spaces have split heat pumps installed for cooling only purposes.

Table 17: Sayreville HS mechanical schedule

	Existing Conditions				
Location	**Area(s)/System(s) Served**	**System Quantity**	**System Type**	**Cooling Capacity per Unit (Tons)**	**Heating Capacity per Unit (MBh)**
Roof	ERU-1	1	Packaged AC	30	
Roof	ERU-2	1	Packaged AC	30	
Roof	ERU-7	1	Packaged AC	60	
Roof	RTU-1	1	Packaged AC	7.5	
Roof	RTU-2	1	Packaged AC	7.5	
Roof	RTU-3	1	Packaged AC	5	
Roof	RTU-4	1	Packaged AC	5	
Roof	RTU-5	1	Packaged AC	5	
Roof	RTU-6	1	Packaged AC	5	
Roof	Split Heat Pump System	3	Split-System AC	1	
Roof	Split Heat Pump System	2	Split-System Air-Source HP	3	36
Roof	Split AC System	2	Split-System AC	1	
Roof	Split AC System	1	Split-System AC	1	
Roof	Split AC System	1	Split-System AC	7.5	
Roof	Split AC System	1	Split-System AC	3	
Roof	Split AC System	1	Split-System AC	3	

Roof	Split Heat Pump System	2	Split-System Air-Source HP	4	54.5
Roof	Split AC System	1	Split-System AC	0.75	0
Roof	Split AC System	2	Split-System AC	5	0
Roof	Split AC System	2	Split-System AC	2	0
Roof	ACCU-1	1	Split-System AC	4	0
Roof	ACCU-2	1	Split-System AC	4	0
Roof	ACCU-3	1	Split-System AC	4	0
Roof	MRC-1	1	Split-System AC	3	0
Roof	MRC-2	1	Split-System AC	3	0
Roof	MRC-3	1	Split-System AC	3	0
Roof	MRC-4	1	Split-System AC	3	0
Exterior	Offices	2	Split-System Air-Source HP	2.62	33.6
Exterior	B-14, B-10 & B-8	3	Split-System Air-Source HP	3	33.6
Boiler Room	Hydronic Heating	1	Non-Condensing Hot Water Boiler	0	N/A
Boiler Room	Hydronic Heating	1	Non-Condensing Hot Water Boiler	0	N/A
Boiler Room	Hydronic Heating	1	Condensing Hot Water Boiler	0	N/A
Boiler Room	Hydronic Heating	1	Condensing Hot Water Boiler	0	N/A
Boiler Room	Hydronic Heating	1	Condensing Hot Water Boiler	0	N/A
Roof	MUA-1	1	Furnace	0	80
Roof	MUA-2 through MUA-7	6	Furnace	0	120
Roof	HV-2	1	Furnace	0	320
Roof	HV-3 through HV-5	3	Furnace	0	320
Roof	HV-6 through HV-8	3	Furnace	0	120
Roof	MUA-8 & MUA-9	2	Furnace	0	640
Roof	MUA-10	1	Furnace	0	320
Roof	ERU-1	2	Furnace	0	300
Roof	ERU-2	3	Furnace	0	300
Roof	ERU-7	3	Furnace	0	300

Table 18: Sayreville HS pump/motor schedule

	Existing Conditions				
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency
Boiler Room	Hydronic Heating	2	Heating Hot Water Pump	10	0.917
Boiler Room	Hydronic Heating	2	Heating Hot Water Pump	100	0.954
Boiler Room	Boiler Burners	2	Boiler Feed Water Pump	5	0.875
Boiler Room	Hot Water Circulator	2	Boiler Feed Water Pump	1	0.755
Boiler Room	DHW Circulator	3	Water Supply Pump	0.2	0.74
Boiler Room	DHW Burner	2	Water Supply Pump	0.3	0.74
Elevator	Elevator	2	Other	10	0.72
Kitchen	DHW Circulator & Burner	4	Water Supply Pump	0.3	0.74
High School	New Unit Ventilators	40	Supply Fan	0.3	0.74
High School	Old Unit Ventilators	40	Supply Fan	0.2	0.74

Building Management System (BMS)

An automated, Direct-Digital Control (DDC) BMS system (Automated Logic) has been implemented in the school that controls the heating and cooling system individually. The average heating/cooling setpoints were 70F / 74F, respectively. The schedule for most areas was 5am – 3pm, Mon – Fri. The BMS does not serve any of the equipment/systems in the Library wing; these systems have stand-alone (non-BAS) thermostats for fan control & heating coils without control valves (i.e. wild / always open).There are also several classrooms and offices which have ductless mini-split systems which are controlled with stand-alone (non-BAS) thermostats. Moreover, there are several classrooms which have portable AC units controlled by internal (non-BAS) thermostat.

Domestic Water Heater (DWH)

There are four tanked water heaters that produce hot water for the entire school including restroom, locker rooms and kitchen. Both units were recently installed and are equipped with multiple fractional HP circulating motors. There is very small amount of gas being used for domestic water heating as observed from gas consumption during non-heating months.



Figure 6: Sayreville HS Domestic hot water

Kitchen Equipment

The kitchen equipment is either electric or gas fired. All units are Energy Star certified. They also have several self-contained refrigerators and freezers for storage purposes. All equipment is in good condition, if not new.



Figure 7: Sayreville HS kitchen equipment

Plug loads

There are several vending machines in the cafeteria and corridors that are provided by 3rd party product suppliers. Each classroom is equipped with a computer, projector, television and a printer at minimum. Computer labs have the same level of basic plug. There are 280 total computers with additional 2101 Chromebooks and 55 printers. These plug loads potentially add significant electric consumption at the facility.

Plumbing Fixtures

The restrooms, locker rooms and kitchen are equipped with standard flowing plumbing fixtures. Sayreville School District does not pay for its water or sewer discharge.

Sayreville Middle School



Sayreville Middle School (Sayreville MS) is a two-story, 170,847 square foot building that was built in 1968. The school has various spaces including classrooms, gym, cafeteria, library, kitchen, offices, mechanical rooms and hallways. The building is 100% heated and only 10% cooled centrally. The building is occupied year-round with normal school operating season from September through June. The operating hours 7:00 am to 3:00 pm Monday to Friday with about 1475 students and 200 staff members.

Figure 8: Sayreville MS

Building Condition

Envelope

The exterior walls are concrete blocks over structural steel with brick or stone façade. Classrooms facing the exteriors have wall to ceiling windows. The roof is flat and in fair condition. Based on the age of the school, the insulation is average with visible cracks at several intervals. Majority of the windows are single pane with clear glass and internal shading. The caulking and weather stripping on the windows are poor if not average. Replacing roof/windows is an expensive measure and provide small saving, resulting in very long payback.



Figure 9: Sayreville MS exterior conditions

Lighting

Majority of the fixtures at the school are fitted with F32T8 linear fluorescent lamps however, those fixtures are in poor conditions in some areas. Other various types of fixtures are installed in the school with no automatic controls. Several spaces in the school are over lit while spaces like gym is under lit. Offices, restrooms, library and only a handful classrooms are equipped with occupancy sensors. The exterior lights consist of wall packs and pole mounted fixtures that are controlled by a time clock. Existing line-by-line fixture table is attached as an appendix.

Mechanical

The heating load for the school is distributed among three hot water plants/loops, each serving a portion of the school. The first area, E-wing, is served by a small, 215 MBH non-condensing boiler that is inefficient well into its expected life. The loop is primary-only with a relatively small constant speed circulator. The second area, D-wing, is served by two (2) 1,700 MBH condensing boilers from 2008 with ~85% efficiency. This system is a constant-primary, variable-secondary with (2) 7.5-HP primary boiler pumps and (2) 25-HP lead-lag building pumps. The remainder of the facility uses two (2), 5,022 MBH standard non-condensing boilers from 2000 in a lead-lag combination, very similar to the High School non-condensing boilers. This system uses a primary-only arrangement with (2) lead-lag 10-HP constant speed hot water pumps. The hot water is supplied to terminal units comprised of fin tube radiators, unit ventilators and heating-only air handlers. The hot water is set to be supplied at 185F with reset controls, reaching 135F supply temp when OA is 55F. The boilers are manually turned off during summer season.



Figure 10: Sayreville MS Heating system

The school does not have a central cooling system. Each classroom is equipped with a window AC or split heat pump that is used as per the requirement. However, there are some classrooms, office spaces and gym/cafeteria that is served by an RTU for cooling only. Several classrooms that have a dedicated RTU has gas fired heating as well. For classes with unit ventilators, the motors are ¼ HP with pneumatic OA dampers and zone valves. The operation of these unit ventilators is very poor.



Figure 11: Sayreville MS Cooling system

Table 19: Sayreville MS mechanical schedule

	Existing Conditions				
Location	**Area(s)/System(s) Served**	**System Quantity**	**System Type**	**Cooling Capacity per Unit (Tons)**	**Heating Capacity per Unit (MBh)**
Roof	Classrooms	1	Packaged AC	15	0
Roof	Classrooms	1	Packaged AC	15	0
Roof	Classrooms	1	Packaged AC	8	0
Roof	Blue Room	1	Packaged AC	30	0
Roof	Café/Gym	1	Packaged AC	60	0
Roof	B Wing	1	Split-System AC	3	0
Roof	C Wing	2	Split-System AC	3	0
Main Office	Main Office	2	Window AC	2	0
Offices	Offices	3	Window AC	2	0
Classrooms	Classrooms	3	Window AC	2	0
Offices	Offices	2	Window AC	1	0
Classrooms	Classrooms	2	Window AC	2	0
Classrooms	Classrooms	3	Window AC	2	0
Boiler Room #1	Hydronic Heating	1	Non-Condensing Hot Water Boiler	0	5022
Boiler Room #1	Hydronic Heating	1	Non-Condensing Hot Water Boiler	0	5022
Boiler Room #2	"D" Wing	1	Condensing Hot Water Boiler	0	1700
Boiler Room #2	"D" Wing	1	Condensing Hot Water Boiler	0	1700

Boiler Room #3	"E" Wing	1	Non-Condensing Hot Water Boiler	0	215
Roof	Classrooms	1	Furnace	0	237
Roof	Classrooms	1	Furnace	0	316
Roof	Classrooms	1	Furnace	0	108

Table 20: Sayreville MS pump/motor schedule

	Existing Conditions				
Location	**Area(s)/System(s) Served**	**Motor Quantity**	**Motor Application**	**HP Per Motor**	**Full Load Efficiency**
Boiler Room #1	Hydronic Heating	2	Heating Hot Water Pump	25	0.917
Boiler Room #1	Hydronic Heating	2	Heating Hot Water Pump	7.5	0.936
Boiler Room #1	Boiler Burners	2	Boiler Feed Water Pump	5	0.81
Boiler Room #2	Hydronic Heating	2	Heating Hot Water Pump	10	0.895
Various	Newer Unit Ventilators	15	Supply Fan	0.3	0.74
Various	Original Unit Ventilators	30	Supply Fan	0.2	0.74
Boiler Room #1	Domestic Hot Water	1	Water Supply Pump	0.2	0.74
Boiler Room #1	Hydronic Heating	1	Boiler Feed Water Pump	0.5	0.74
Boiler Room #2	Domestic Hot Water	2	Water Supply Pump	0.2	0.74

Building Management System (BMS)

The facility is served with 3 different BMS systems. First, D-wing has a modern, DDC (Automated Logic) system/platform. E-wing, which operates as a change-over bypass/variable volume, variable temperature system with zone dampers, sees its rooftop units on the Automated Logic system, but its zone dampers and rooms controls are an older disconnected zoning system. Lastly, the hot water plant serving the remainder of the facility is on a Johnson Controls Metasys system/platform. This platform has no graphic floorplans and is tree-logic only. The average heating/cooling setpoints were 70F/74F, respectively. The schedule for most areas was 7am – 3pm, Mon – Fri.

Domestic Hot Water (DHW)

A single gas-fired storage water heater, inefficient and well beyond its operating life, generates and stores DHW, along with two additional storage tanks, to serve domestic hot water load for the school that is supplied to kitchen, restrooms and locker rooms. Fractional HP pumps are installed for recirculation purpose with no control.



Figure 12: Sayreville MS DWH system

Kitchen Equipment

The kitchen equipment is either electric or gas fired. All units are energy star certified. They also have several self-contained refrigerators and freezers for storage purposes. All equipment is in good conditions if not new.



Figure 13: Sayreville MS kitchen equipment

Plug Loads

There are several vending machines in the cafeteria and corridors that are provided by 3rd party product suppliers. Each classroom is equipped with a computer, projector, television and a printer at minimum. Computer labs have the same level of basic plug load with additional computers, adding more heat to the space. There are 208 total computers along with 1542 Chromebooks and 29 printers. These plug loads potentially add significant electric consumption at the facility.

Plumbing Fixtures

The restrooms, locker rooms and kitchen are equipped with standard flowing plumbing fixtures. Sayreville School District does not pay for its water or sewer discharge.

Samsel Upper Elementary School



Figure 14: Samsel Upper Elementary School

Samsel Upper Elementary School (Samsel Upper ES) is a three-story building built in 1952 covering an area of 174,800 square foot. Spaces include classrooms, gymnasium, offices, cafeteria, corridors, kitchen and basement mechanical room.
The school is 100% heated and 40% cooled centrally. The building is occupied year-round with normal school operating season from September through June. The operating hours 7:00 am to 3:00 pm Monday to Friday with about 1700 students and 150 staff members.

Building Condition

Envelop
The exterior walls are concrete blocks over structural steel with brick or stone façade. Classrooms facing the exteriors have wall-to-ceiling windows. The roof is flat and in fair condition. Based on the age of the school, the insulation is average with visible cracks at several intervals. Some windows are double pane with either metal frame or wood frame. Weather stripping is extremely poor on doors and windows. Replacing roof/windows is an expensive measure and provide small savings, resulting in very long payback.



Figure 15: Samsel Upper Elementary School exterior conditions

Lighting
Majority of the fixtures at the school are fitted with F32T8 linear fluorescent lamps however, those fixtures are in poor conditions in some areas. Other various types of fixtures are installed which are in good condition. Interior lighting fixtures are controlled by manual switches. Majority of the classrooms are over lit. Building exterior fixtures include wall packs, flood fixtures as well as pole mounted shoe box fixtures. The exterior fixtures are controlled through an 11-hour clock scheduled year-round. Existing line-by-line fixture table is attached as an appendix.

Mechanical

The unit ventilators in the school are of similar vintage as the High School and D-wing of the Middle School as they were installed in the same year. They are powered by fractional HP motors with digitally controlled OA dampers and zone valves, controlled through BMS. Power ventilators are installed for general building exhaust. Office spaces, library and several other spaces are served by Air Handling Units (AHU) that have hot water coils for heating and DX coils for cooling. Several classrooms have dedicated RTUs that were installed over a decade ago, all controlled by BMS.



Figure 16: Samsel Upper Elementary School Cooling systems (1)

The cafeteria and gym have dedicated energy recovery units, custom made with gas burners for heating. Other smaller spaces have their dedicated split heat pumps for cooling purpose with remote controllers.



Figure 17: Samsel Upper Elementary School Cooling systems (2)

There are total of six (6) non-condensing boilers that satisfy the school's heating load. These boilers are 2060 MBH each and were from 2003, in a reasonable operating condition operating at about 85% efficiency. The boilers are staged using a heat-timer controller. The hot water loop is constant primary powered by two (2) 40 HP pumps in a lead-lag combination. The coil hot water valves are two-way, so the plant uses a pressure bypass valve to maintain system remote differential pressure. This allows the building to be variable flow, but the plant to be constant flow. The boiler is set to supply water at

180F with reset control to dial down that temperature to 130F when OA temperature is 55F.

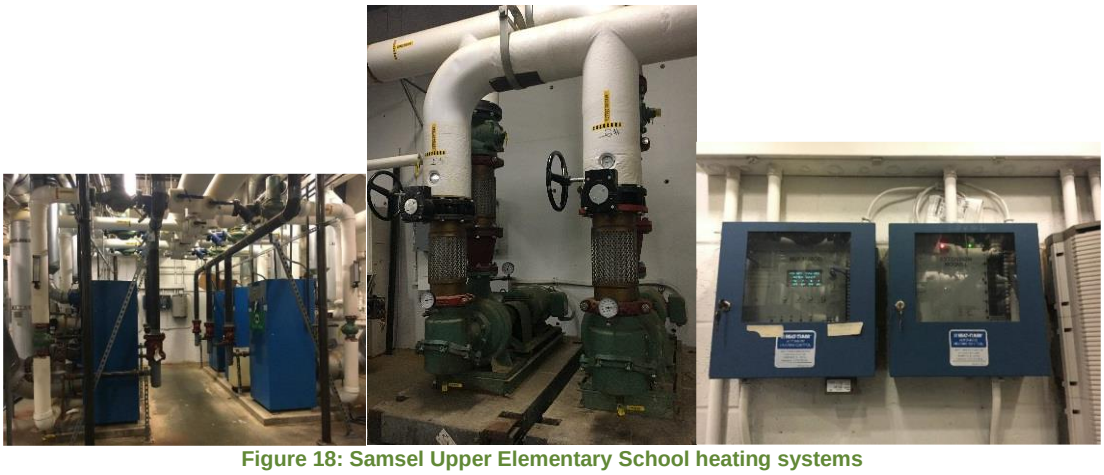


Figure 18: Samsel Upper Elementary School heating systems

Table 21: Samsel Upper Elementary School mechanical schedule

	Existing Conditions				
Location	**Area(s)/System(s) Served**	**System Quantity**	**System Type**	**Cooling Capacity per Unit (Tons)**	**Heating Capacity per Unit (MBh)**
Roof Above Café	RTU-1&3	2	Packaged AC	26	0
Roof Above Café	RTU-10	1	Packaged Air-Source HP	15	122.94
Roof Above Café	No Tag	1	Packaged AC	10	0
Roof Above Café	Split AC Outdoor Condensing Units (ODCs)	1	Split-System AC	1	0
Roof Above Gym	RTU-16&17	2	Packaged AC	26	0
Roof Above Gym	RTU-14&15	2	Packaged AC	26	0
Roof Above Gym	Split AC Outdoor Condensing Units (ODCs)	1	Split-System AC	2.5	0
Roof Above Gym	Split AC Outdoor Condensing Units (ODCs)	2	Split-System AC	1	0
Roof Above Gym	Split AC Outdoor Condensing Units (ODCs)	2	Split-System AC	0.75	0
Main Roof	Above Classroom Wing 359-375	2	Split-System Air-Source HP	4	28
Main Roof	Above Classroom Wing 359-375	1	Packaged Air-Source HP	15	122.94
Main Roof	Split AC Outdoor Condensing Units (ODCs)	1	Split-System AC	2	0
Main Roof	RTU-12 & 13 Serve the Guidance Office	2	Packaged AC	7.5	0
Main Roof	Above Classroom Wing 359-375 & 305-315	14	Split-System Air-Source HP	2	14
Main Roof	Above Classroom Wing 359-375 & 305-315	4	Split-System AC	1.5	0
Main Roof	Above Classroom Wing 359-375 & 305-315	1	Split-System AC	2.5	0

Main Roof	At Corner Junction near Faculty Room 317	1	Split-System AC	1.5	0
Main Roof	Above Classroom Wing 318-329	1	Split-System AC	1.5	0
Main Roof	RTU-8 Serves Library Area	1	Packaged AC	7.5	0
Main Roof	Split AC Outdoor Condensing Units (ODCs)	1	Split-System AC	3	0
Main Roof	RTU-11	1	Packaged AC	6	0
Main Roof	No Tag	1	Packaged Air-Source HP	17.5	122.94
Main Roof	RTU-2	1	Packaged AC	10	0
Main Roof	RTU-5	1	Packaged AC	7.5	0
Main Roof	Split AC Outdoor Condensing Units (ODCs)	1	Split-System AC	2	0
Main Roof	Split AC Outdoor Condensing Units (ODCs)	1	Split-System AC	1.5	0
Classrooms & Offices	Classrooms & Offices	24	Window AC	1	0
Boiler Room	Hydronic Heating	2	Condensing Hot Water Boiler	N/A	0
Boiler Room	Hydronic Heating	2	Condensing Hot Water Boiler	N/A	0
Boiler Room	Hydronic Heating	2	Condensing Hot Water Boiler	N/A	0
Roof Above Café	RTU-1 & 3	2	Furnace	0	320
Roof Above Gym	RTU-14 &15	2	Furnace	0	250
Roof Above Gym	RTU-16 &17	2	Furnace	0	250
Roof Above Café	No Tag	1	Furnace	0	158

Table 22: Samsel Upper Elementary School mechanical schedule

	Existing Conditions				
Location	**Area(s)/System(s) Served**	**Motor Quantity**	**Motor Application**	**HP Per Motor**	**Full Load Efficiency**
Boiler Room	Hydronic Heating	2	Heating Hot Water Pump	40	0.945
Boiler Room	Boiler Circulators	6	Boiler Feed Water Pump	1	0.825
Boiler Room	Boiler Burners	6	Boiler Feed Water Pump	0.8	0.74

Building Management System (BMS)

The school has a BMS control system through Johnson Controls that provides individual control to different systems. The average heating/cooling setpoints were 70F / 74F, respectively. The schedule for most areas was 6am – 3pm, Mon – Fri, with a couple areas scheduled until 6pm.

Domestic Water Heater (DWH)

Hot water is produced using a tanked gas fired water heater to satisfy the domestic water load in kitchen, restroom, and locker rooms. The pipes are insulated and in fair condition.



Figure 19: Samsel Upper Elementary School DHW systems

Kitchen equipment

The kitchen equipment is either electric or gas fired. All units are Energy Star certified. They also have several self-contained refrigerators and freezers for storage purposes. All equipment is in good condition, if not new.



Figure 20: Samsel Upper Elementary School kitchen equipment

Plug load

There are several vending machines in the cafeteria and corridors that are provided by 3rd party product suppliers. Each classroom is equipped with a computer, projector, television and a printer at minimum. Computer labs have the same level of basic plug load with additional computers, adding more heat to the space. There are 247 computers and 1128 Chromebooks along with 35 printers. These plug loads potentially add significant electric consumption at the facility.

Plumbing Fixtures

The restrooms, locker rooms, and kitchen are equipped with standard flowing plumbing fixtures. Sayreville School District does not pay for its water or sewer discharge.

Harry S Truman Elementary School



Figure 21: Harry Truman ES

Harry S Truman elementary School (Harry Truman ES) is a 53,275 square foot, single-story building built in 1971. The school has various spaces like classrooms, offices, gym, kitchen, media center and corridors. The building is occupied year-round with normal school schedule between September and June between 7:00 am to 3:00 pm, Monday to Friday. There is an occupancy of 550 students and 70 staff members.

Building Condition

Envelop

The school is built with concrete blocks on structural steel, brick façade. The roof is flat and in fair condition. Most of the windows are double pane and operable with clear glass and internal shading. Exterior doors are missing weather-stripping materials. There is evidence of excessive wear in the envelop. Replacing roof/windows is an expensive measure and provide small savings, resulting in very long payback.



Figure 22: Harry Truman ES exterior conditions

Lighting

Majority of the fixtures at the school are fitted with F32T8 linear fluorescent lamps however, those fixtures are in poor conditions in some areas. Other various types of fixtures are installed which are in good condition. Interior lighting fixtures are controlled by manual switches. Majority of the classrooms are over lit. Building exterior fixtures include wall packs, flood fixtures as well as pole mounted shoe box fixtures. The exterior fixtures are controlled through a 12-hour clock scheduled year-round. Existing line-by-line fixture table is attached as an appendix.

Mechanical

The school has existing unit ventilators in poor condition with 1/6 HP motors, whereas several areas have newly installed unit ventilators with ¼ HP motors which have pneumatically control OA dampers and zone valves. The building also has a common

AHU that has a chilled water and hot water coil which is in poor condition. Several smaller rooms have window ACs that are operated manually. The building's hot water load is satisfied by three (3) condensing boilers that were installed over a decade ago, still in good operating condition. However, they are reaching the end of useful life. The hydronic system is a 2-pipe system for hot and chilled water. Seasonal change begins when OA temperature is below 50F for the heating season. The hot water distribution is powered by 5 HP constant speed pump with another lag pump in sequence. Boilers provide hot water to unit ventilators, fin tube radiators, fan coil units and AHUs. A BMS system controls the operation of the boiler. The cooling of the school, centrally, is carried by a reciprocating liquid chiller which is located on the roof with a constant flow primary pump of 15 HP. The equipment is showing signs of poor operation.



Figure 23: Harry Truman ES mechanical systems

Table 23: Harry S Truman ES existing lighting fixtures

	Existing Conditions				
Location	**Area(s)/System(s) Served**	**System Quantity**	**System Type**	**Cooling Capacity per Unit (Tons)**	**Heating Capacity per Unit (mbh)**
Classrooms & Offices	Classrooms & Offices	2	Window AC	2.00	N/A
Roof	Chilled Water System	1	Air-Cooled Reciprocating Chiller	180	N/A
Boiler Room	Hydronic Heating	1	Condensing Hot Water Boiler	N/A	595
Boiler Room	Hydronic Heating	1	Condensing Hot Water Boiler	N/A	595
Boiler Room	Hydronic Heating	1	Condensing Hot Water Boiler	N/A	595

Table 24: Harry S Truman ES existing lighting fixtures

	Existing Conditions				
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency
Boiler Room	Hot Water Supply	1	Heating Hot Water Pump	5	87.5%
Boiler Room	Hot Water Supply	1	Heating Hot Water Pump	5	87.5%
Boiler Room	Boiler Circ Pumps	3	Boiler Feed Water Pump	1	85.5%
Boiler Room	Chilled Water Supply	1	Chilled Water Pump	15	87.5%
Classrooms & Offices	Fan Coil Units	36	Supply Fan	0.3	74.0%
Classrooms & Offices	New Unit Ventilators	4	Supply Fan	0.3	74.0%
Classrooms & Offices	Old Unit Ventilators	6	Supply Fan	0.2	63.0%

Domestic Hot Water (DHW)

The school has installed a small tanked water heater to satisfy the hot water needs for the school which is in a good working condition.

Kitchen equipment

The kitchen has all electric equipment used to prepare lunches. These are in good condition and highly efficient. They have self-contained walk-in cooler and freezer for storage purpose.



Figure 24: Harry Truman ES kitchen equipment

Plug Loads

There are several vending machines in the cafeteria and corridors that are provided by 3rd party product suppliers. Each classroom is equipped with a computer, projector, television and a printer at minimum. Computer labs have the same level of basic plug load with additional computers, adding more heat to the space. There are 10 commercial copiers, 79 computers and 447 Chromebook charging docks. These plug loads potentially add significant electric consumption at the facility.

Plumbing Fixtures

The restrooms, locker rooms, and kitchen are equipped with standard flowing plumbing fixtures. Sayreville School District does not pay for its water or sewer discharge.

Dwight D Eisenhower Elementary School



Dwight D Eisenhower Elementary School (Dwight Eisenhower ES) is a one-story school built in 1971 with a total area of 59,738 square foot. The building is 100% heated and 10% cooled centrally. The school us occupied from September to June between 7:00 am and 3:00 pm, Monday to Friday. Seasonal summer activities happen along with routine maintenance. The school has about 575 students along with 55 staff members.

Figure 25: Dwight Eisenhower ES

Building Condition

Envelop

The exterior walls are built with concrete blocks on structural steel. The façade is made of brick. The roof is flat and appears in average condition. Windows are double pane, operable and with internal shading. Window frames show wear in weather stripping. The exterior doors are in fair condition as well. Replacing roof/windows is an expensive measure and provide small savings, resulting in very long payback.



Figure 26: Dwight Eisenhower ES Exterior conditions

Lighting

Majority of the fixtures at the school are fitted with F32T8 linear fluorescent lamps however, those fixtures are in poor conditions in some areas. Other various types of fixtures are installed which are in good condition. Several classrooms are over lit with extra fixtures. The lights are controlled by manual switches. The exterior lighting fixtures are comprised of wall packs, flood lights and pole mounted high sodium pressure fixtures. They are controlled by a time clock, set to operate 12 hours every day. Existing line-by-line fixture table is attached as an appendix.

Mechanical

The classrooms are equipped with fractional horsepower motor unit ventilators with pneumatically controlled OA dampers and zone valves. The unit ventilators are operating in a poor condition. The cafeteria receives its heating through ceiling unit heaters. The gym has an AHU with hot water coil, supplying heating only to the space. Several smaller spaces and office areas have split heat pumps and ACs installed for conditioning, whereas classrooms have window AC units installed for cooling season. The heating load of the school is satisfied by four (4) condensing boilers configured in an automated control scheme. They are operating in a fairly good condition. This 2-pipe hydronic system has a constant primary flow with three (3) distribution pumps of 5 HP each with constant speed. The boilers provide hot water to fin tube radiators, unit ventilators and AHU throughout the building. There is not BMS system to control the HVAC system in the school.



Figure 27: Dwight Eisenhower ES Mechanical systems

Domestic Water Heater (DWH)

Hot water for domestic purpose is supplied by a tanked gas-fired water heater which is in a good condition. There is a fractional horespower motor attached for recirrculation purpose.

Kitchen equipment

The kitchen has all electric equipment used to prepare lunches. These are in good condition and highly efficient. They have self-contained walk-in cooler and freezer for storage purpose.



Figure 28: Dwight Eisenhower ES kitchen equipment

Plug Loads

There are several vending machines in the cafeteria and corridors that are provided by 3rd party product suppliers. Each classroom is equipped with a computer, projector, television and a printer at minimum. Computer labs have the same level of basic plug load with additional twenty-seven (27) computers, adding more heat to the space.

Plumbing Fixtures

The restrooms, locker rooms, and kitchen are equipped with standard flowing plumbing fixtures. Sayreville School District does not pay for its water or sewer discharge.

Selover School



Selover School is the BOE's office which is a two-story building of 36,153 square foot area built in 1952. It is comprised of classrooms, administration offices, warehouse storage and common areas like corridor. The building is 100% heated and 80% cooled. The school is occupied year-round with an occupancy of 60 students and 37 staff members, operating between 6:30 am till 5:00 pm, Monday to Friday.

Figure 29: Selover School

Building Condition

Envelop

The exterior walls are built with concrete blocks on structural steel. The façade is made of brick. The roof is flat and appears in average condition. The windows are single and double pane with metal frames and internal shading, showing excessive wear and tear. The exterior doors are metal frames and are in a poor condition on the old section of the building. Replacing roof/windows is an expensive measure and provide small saving, resulting in very long payback.



Figure 30: Selover School exterior condition

Lighting

Majority of the fixtures at the school are fitted with F32T8 linear fluorescent lamps however, those fixtures are in poor condition in some areas. Other various types of fixtures are installed which are inoperable condition. Several areas in the school are under lit. There is a huge storage warehouse where lighting is seldom used. Office spaces and several classrooms are controlled by occupancy sensors, while the rest of the school is controlled with manual switches. The exterior lighting fixtures are comprised of wall packs, flood lights and pole mounted high sodium pressure fixtures. They are controlled by a time clock, set to operate 12 hours every day. Existing line-by-line fixture table is attached as an appendix.

Mechanical

The installed unit ventilators have a ¼ HP motor with electronically controlled OA dampers, operating in a poor condition. Several areas are installed with newer unit ventilators powered by 1/6 HP motors, controlled through a BMS. The newer unit ventilators are equipped with economizers and are operating fairly. Spaces like conference room and individual rooms have split heat pumps installed and is remotely controlled by the occupants, primarily used for cooling. Other classrooms have window ACs installed for summer season. There are two (2) types of heating system installed in the school. The hot water hydronic system is heated by a non-condensing boiler which is fairly operating. The 2-pipe system is configured in a variable primary loop with two (2) 3 HP pumps in a lead-lag combination. The hot water is supplied to fin tube radiators and unit ventilators on the main floor of the building. The loop has an OA reset schedule. The basement and unit ventilators receive steam from the other heating system, which is operating very poorly.



Figure 31: Selover School HVAC system

Building Management System (BMS)

A Johnson Controls Metasys BMS manages the hot water system which serves the main building floor, as well as controls the space temperature.

Domestic Water Heater (DWH)

There are three (3) DWH in the school, one (1) electric and two (2) gas fired. The gas fired water heaters are operating beyond their useful life. The distribution pipes are missing adequate insulation.

Plug Loads

This building is mainly administrative and hence has 36 computers workstations and 24 operating laptops. Besides, the building has fridge and other typical office equipment.

Plumbing Fixtures

The restrooms, locker rooms, and kitchen are equipped with standard flowing plumbing fixtures. Sayreville School District does not pay for its water or sewer discharge.

Woodrow Wilson Elementary School



Woodrow Wilson Elementary School (Wilson ES) is a three-story 54,150 square foot school built in 1928. The space types include classrooms, cafeteria, gym, library, offices and common areas like corridor. The school is 100% heated and 5% cooled. The school is occupied from September to June with 400 students and 52 staff members, operating between 7:00 am and 4:00 pm, Monday to Friday.

Figure 32: Wilson ES

Building Condition

Envelop

Building walls are concrete block with a brick facade. The roof is part flat and part pitched appearing in fair condition. There are skylights which appear in fair condition as well. The walls are made of concrete masonry units (CMUs) with a brick veneer. Most of the windows are double pane, operable with metal frames, clear glass and internal shading. The window frame seals are in poor condition. Exterior doors are metal with metal frames and in fair condition, however they are typically missing or have worn weather-stripping materials. Replacing roof/windows is an expensive measure and provide small savings, resulting in very long payback.



Figure 33: Wilson ES exterior conditions

Lighting

Majority of the lighting fixtures are installed with F32T8 linear fluorescent lamps of various quantities. Most fixtures are in good condition. A newly renovated section of the school was retrofitted with LED and automatic controls. The old section of the school is controlled manually with switches. The exterior fixtures include wall packs and flood lights where some are LED. The exterior lights are controlled by a 12-hour clock daily. Existing line-by-line fixture table is attached as an appendix.

Mechanical

The school has fractional horsepower motor unit ventilator, electronically controls the OA dampers and zone valves. The system is operating poorly. There are RTUs that serve office spaces and other areas that are also nearing their end of useful life. Split heat pumps are installed in various classrooms, as well as window ACs for cooling. The hot

water for heating is supplied by two (2) non-condensing boilers that operate in a controlled sequence. The hydronic distribution occurs in a 2-pipe system with constant speed loop, powered by 10HP pump.



Figure 34: Wilson ES HVAC systems

Table 25: Wilson ES existing mechanical schedule

	Existing Conditions				
Location	**Area(s)/System(s) Served**	**System Quantity**	**System Type**	**Cooling Capacity per Unit (Tons)**	**Heating Capacity per Unit (MBh)**
Roof	Few Rooms	1	Packaged Air-Source HP	15	122.94
Roof	Few Rooms	1	Packaged AC	5	0
Roof	Few Rooms	1	Packaged AC	3.33	0
Roof	Split AC System for Server Room	1	Split-System AC	2	0
Main Office	Main Office	1	Window AC	2	0
Lounge	Lounge	1	Window AC	2	0
Office	Office	1	Window AC	1.5	0
Library	Library	1	Window AC	2	0
Office	Office	1	Window AC	1.5	0
Classroom	Classroom	1	Window AC	1.83	0
Classroom	Classroom	1	Window AC	1.83	0
Boiler Room	Hydronic Heating System	1	Non-Condensing Hot Water Boiler	N/A	0
Boiler Room	Hydronic Heating System	1	Non-Condensing Hot Water Boiler	N/A	0
Roof	Gas Fired RTU	1	Furnace	N/A	480
Roof	Gas Fired RTU	1	Furnace	N/A	320

Table 26: Wilson ES existing pump/motor schedule

	Existing Conditions				
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency
Boiler Room	Hydronic Heating	1	Heating Hot Water Pump	10	91.7%
Boiler Room	Hydronic Heating	1	Heating Hot Water Pump	10	91.7%
Cafeteria	Unit Ventilators	6	Supply Fan	0.2	74.0%
Classrooms & Offices	Unit Ventilators	26	Supply Fan	0.1	74.0%

Building Management System (BMS)

A Trane Tracer BMS system controls the heating system, exhaust system and space temperature.

Domestic Water Heater (DWH)

Hot water is produced by a tanked gas fired water heater that is supplied to kitchen, restroom and locker rooms. The equipment is beyond its useful life. The renovated restrooms have an electric water heater each.

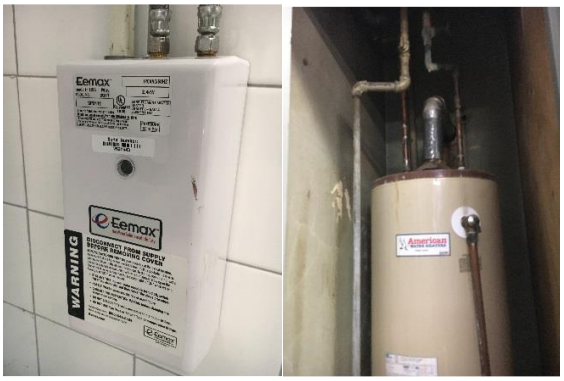


Figure 35: Wilson ES DWH systems

Kitchen equipment

The kitchen has mixed gas and electric equipment that is quite efficient and in good condition. The self-contained cooler and freezer are also efficient and Energy Star qualified for its age.



Figure 36: Wilson ES kitchen equipment

Plug loads
There are around 38 computers around the school along with a few vending machines and typical office use equipment.

Plumbing Fixtures
The restrooms, locker rooms and kitchen are equipped with standard flowing plumbing fixtures. Sayreville School District does not pay for its water or sewer discharge.

Emma L Arleth Elementary School



Emma L Arleth Elementary School (Emma Arleth ES) is a one-story 73,436 square foot building from 1959 which includes classrooms, gym, cafeteria, office space, library and common areas such as corridors. The school is 100% heated and 15% cooled. There has been some renovation over the years, improving the gym. The school operates from September to June with an occupancy of 500 students and 85 staff members. The school operates from 7:00 am to 4:00 pm, Monday to Friday.

Figure 37: Emma Arleth ES

Building Condition

Envelop

The building walls are concrete blocks with brick façade. The roof is flat and appears to be in a fair condition. Windows are single of double pane with metal frames. The frames are showing signs of excessive wear. Exterior doors are metal and in fair condition, missing weather stripping. Replacing roof/windows is an expensive measure and provide small savings, resulting in very long payback.



Figure 38: Emma Arleth ES exterior conditions

Lighting

The majority of the fixtures are fitted with F32T8 linear fluorescent lamps of various quantities, mainly in classrooms. There are several other compact fluorescent fixtures throughout the school. All classroom fixtures are controlled by occupancy sensors and the remaining areas are controlled by manual switches. Exterior fixtures include wall packs, flood lights, under canopy lights and pole mounted fixtures. All exterior fixtures are controlled by a 12-hour timed clock daily. Existing line-by-line fixture table is attached as an appendix.

Mechanical

The school still has original unit ventilators installed with fractional horsepower motors, pneumatically controlling OA dampers and zone valves. Because this is an original system, the unit ventilators are performing poorly. The newer unit ventilators are performing much better. The gym and media center are served by AHUs that has hot

water coil and a DX coil for conditioning. Other smaller spaces have split heat pumps and window ACs installed which are performing averagely. The heating for the school is supplied by three (3) non-condensing boilers which are operating poorly and beyond their useful life. The boilers are configured in a constant flow primary distribution with two (2) 7.5 HP constant speed pumps with various fractional pumps to boost the circulation. The boilers provide hot water to radiators, unit ventilators and AHUs.



Figure 39: Emma Arleth ES mechanical system

Table 27: Emma Arleth ES existing mechanical schedule

	Existing Conditions				
Location	**Area(s)/System(s) Served**	**System Quantity**	**System Type**	**Cooling Capacity per Unit (Tons)**	**Heating Capacity per Unit (MBh)**
Classrooms	Classrooms	2	Window AC	2	0
Server Room	Server Room	1	Window AC	2	0
Machine Room	Machine Room	1	Window AC	1	0
Main Office	Main Office	2	Split-System AC	0.75	0
Child's Study	Child's Study	1	Window AC	0.83	0
Classrooms	Classrooms	2	Window AC	2	0
Classrooms	Classrooms	1	Window AC	0.42	0
Office	Office	1	Split-System AC	1	0
Exterior	Outdoor Condensing Unit for Split AC System	1	Split-System AC	10	0
Exterior	Outdoor Condensing Unit for Split AC System	1	Split-System AC	6	0
Boiler Room	Hydronic Heating	1	Non-Condensing Hot Water Boiler	0	N/A
Boiler Room	Hydronic Heating	1	Non-Condensing Hot Water Boiler	0	0
Boiler Room	Hydronic Heating	1	Non-Condensing Hot Water Boiler	0	0

Table 28: Emma Arleth ES existing pump/motor schedule

	Existing Conditions				
Location	**Area(s)/System(s) Served**	**Motor Quantity**	**Motor Application**	**HP Per Motor**	**Full Load Efficiency**
Boiler Room	HWP-4	1	Heating Hot Water Pump	7.5	88.5%
Boiler Room	HWP-5	1	Heating Hot Water Pump	7.5	88.5%
Boiler Room	Boiler Circ Pumps	3	Boiler Feed Water Pump	0.8	74.0%
Boiler Room	HWP-2&3	2	Heating Hot Water Pump	0.8	74.0%
Boiler Room	HWP-1	1	Heating Hot Water Pump	1	85.5%
Unit Ventilators	Old Unit Ventilators	32	Supply Fan	0.2	74.0%
Unit Ventilators	New Unit Ventilators	12	Supply Fan	0.3	74.0%

Building Management System (BMS)

The BMS control is provided by United Technologies Automatic Logic that controls the HVAC equipment, boilers, AHUs, new unit ventilators and controls the space temperature.

Domestic Water Heater (DWH)

Hot water is produced by a tanked gas fired water heater which is a fair working condition, serves hot water to kitchen, restroom and locker rooms. The new wing has a dedicated electric water heater for restrooms.



Figure 40: Emma Arleth ES DWH

Kitchen equipment

The kitchen has mixed gas and electric equipment that is quite efficient and in good condition. The self-contained cooler and freezer are also efficient, and Energy Star qualified for its age.



Figure 41: Emma Arleth ES kitchen equipment

Plug loads

The school has around 97 computers and laptop carts around the school. Along with that are typical office equipment like printer, scanner, refrigerator, coffee machine. Several classrooms have Smart Board, projectors, speakers and TV.

Plumbing Fixtures

The restrooms, locker rooms and kitchen are equipped with standard flowing plumbing fixtures. Sayreville School District does not pay for its water or sewer discharge.

Section 3. Utility Summary and Benchmarking

Sayreville BOE has included eight (8) schools under their scope of work. The following is the list and location of these schools:

Table 29: List of schools

Sayreville Board of Education	
Sayreville War Memorial High School	820 Washington Rd, Parlin, NJ 08859
Sayreville Middle School	800 Washington Rd, Parlin, NJ 08859
Samsel Upper Elementary School	298 Ernston Rd, Parlin, NJ 08859
Harry S Truman Elementary School	1 Taft Pl, Parlin, NJ 08859
Dwight D Eisenhower Elementary School	601 Ernston Rd, Parlin, NJ 08859
Selover School	Selover School, South Amboy, NJ 08879
Woodrow Wilson Elementary School	65 Dane St, Sayreville, NJ 08872
Emma L Arleth Elementary School	3198 Washington Rd, Parlin, NJ 08859

In order to justify any energy savings, a baseline has to be set for comparison. The following tables and charts display the pre-construction utility analysis of all the schools.

Table 30: District-Wide Utility Baseline

	Total	Sayreville War Memorial HS	Sayreville MS	Emma L Arleth ES	HS Truman ES	Samsel Upper ES	Dwight Eisenhower ES	Wilson ES	Selover School
Area (sqft)	901,736	292,289	170,847	67,800	49,600	174,800	55,100	62,700	28,600
Annual utility $	$905,262.50	$277,973.20	$169,783.92	$80,380.42	$65,516.63	$154,696.21	$46,477.79	$67,119.93	$43,314.40
Total kBtu	49,219,991	10,747,954	10,614,980	5,440,280	3,133,668	7,909,652	3,132,168	4,774,122	3,467,168
Total therms	312,275	37,694	76,179	41,631	19,060	46,865	24,218	36,498	30,130
$ therms	$268,881.21	$37,798.31	$63,175.56	$35,216.93	$17,024.07	$40,374.08	$20,840.58	$28,477.62	$25,974.06
kW	1,580	530	265	114	212	268	71	81	40
Total kWh utility	5,273,289	2,045,300	878,400	374,320	359,800	944,640	208,200	329,520	133,109
$ kWh	$636,381.29	$240,174.89	$106,608.36	$45,163.49	$48,492.56	$114,322.13	$25,637.21	$38,642.31	$17,340.34
Total kWh	5,273,289	2,045,300	878,400	374,320	359,800	944,640	208,200	329,520	133,109
Number of stories		2	2	1	1	3	1	3	2
Yr Blt		1962	1968	1959	1971	1952/2004	1971	1928	1952
staff	799	150	200	85	70	150	55	52	37
students	6,920	1,700	1,475	500	510	1,700	575	400	60
$/kWh	$0.12	$0.12	$0.12	$0.12	$0.13	$0.12	$0.12	$0.12	$0.13
$/therm	$0.86	$1.00	$0.83	$0.85	$0.89	$0.86	$0.86	$0.78	$0.86
$/kBtu	$0.02	$0.03	$0.02	$0.01	$0.02	$0.02	$0.01	$0.01	$0.01
$/sf	$1.00	$0.95	$0.99	$1.19	$1.32	$0.88	$0.84	$1.07	$1.51
$/p	$117.28	$150.26	$101.36	$137.40	$112.96	$83.62	$73.77	$148.50	$446.54
kBtu/sf	542	37	62	80	63	45	57	76	121
kBtu/p	6,376	5,810	6,337	9,300	5,403	4,275	4,972	10,562	35,744

Sayreville Memorial High School

The following tables and figures breakdown the electric and natural gas usage at Sayreville Memorial High School. A typical high school operation with 100% heating and 100% cooling of the building would see a bell curve on electric consumption for summer months except for the months when schools are out of session with limited occupancy. The school would see similar increase in gas consumption for winter months. Based on utility bill consumption of the high school, we are observing following irregularities as highlighted below.

Willdan observed that the month of August, the consumption drops to about 100,000 kWh. Noticing a higher electric load during heating season leads to the following conclusions:

- Use of electric heaters (higher plug load)
- Lack of BMS controls, which allows the classrooms and other spaces meet its temperatures and also driving usage of certain equipment without a proper controls sequence programing

It was also apparent that the natural gas usage is showing high abnormalities with the month of March spiking at an actual consumption of 10,000 therms. There are many reasons such a consumption is reflected on the graph, weather being the most important factor. In order to better understand the gas usage for the High School, Willdan reviewed a set of historical gas consumptions. Based on the 2017 gas consumption, from the LGEA report, the school has shown a typical bell curve for the winter months, as shown below. The following facts were observed:

- Installation of condensing boilers between 2017-2018 and 2018-2019 heating months
- Installation of new motors with VFD controls for the hydronic system
- Installation of BMS for the entire heating system

Table 31: Sayreville Memorial HS Electric Usage

100 073 868 273				
Start Date	End Date	Usage (kWh)	Demand (kW)	Cost ($)
7/18/2018	8/15/2018	109,200	382	$13,328
8/16/2018	9/17/2018	189,800	653	$21,340
9/18/2018	10/16/2018	184,200	641	$22,220
10/17/2018	11/15/2018	175,800	521	$20,566
11/16/2018	12/14/2018	168,000	497	$19,541
12/15/2018	1/17/2019	188,700	505	$21,612
1/18/2019	2/15/2019	178,500	511	$20,595
2/16/2019	3/18/2019	179,700	497	$20,637
3/19/2019	4/16/2019	162,900	501	$19,021
4/17/2019	5/15/2019	150,600	507	$18,493
5/16/2019	6/17/2019	189,600	581	$22,252
6/18/2019	7/17/2019	168,300	564	$20,571
		2,045,300	**653**	**$240,175**

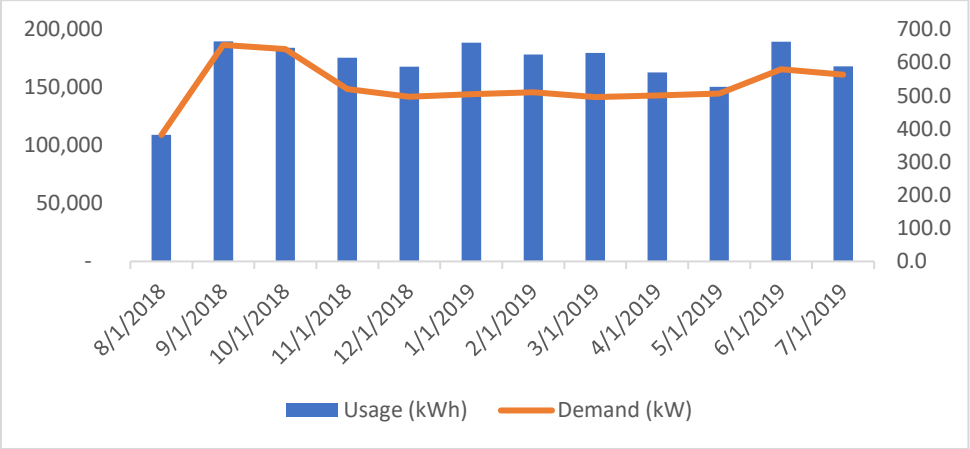


Figure 42: Sayreville Memorial HS Electric Usage (kWh, kW)

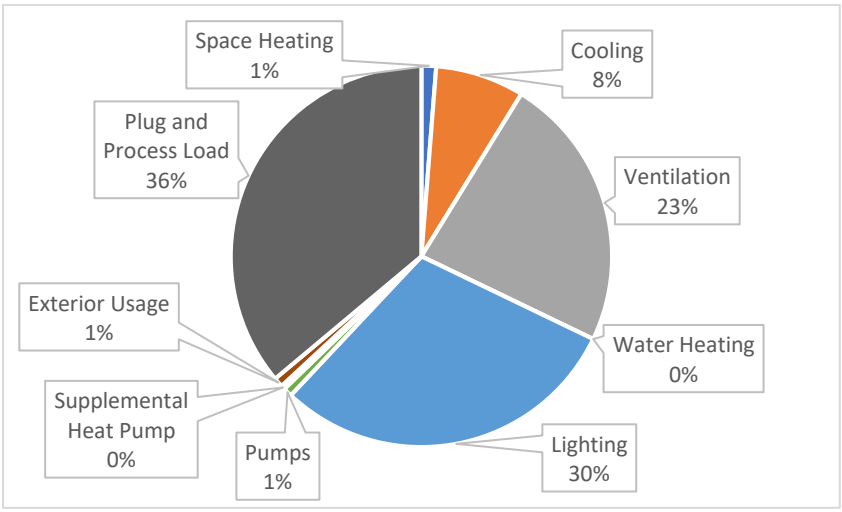


Figure 43: Sayreville Memorial HS Electric Usage End use Breakdown

Table 32: Sayreville Memorial HS Natural Gas Usage

73 376 951 01/ 73 376 947 09			
Start Date	End Date	Usage (Therms)	Cost ($)
7/7/2018	8/3/2018	741	$499
8/4/2018	9/4/2018	785	$599
9/5/2018	10/3/2018	3,270	$2,254
10/4/2018	11/1/2018	1,498	$3,989
11/2/2018	12/4/2018	3,251	$5,309
12/5/2018	1/4/2019	3,614	$5,207
1/5/2019	2/4/2019	4,225	$5,544
2/5/2019	3/6/2019	3,579	$3,261
3/7/2019	4/4/2019	9,652	$6,067
4/5/2019	5/6/2019	5,976	$3,861
5/7/2019	6/5/2019	716	$702
6/6/2019	7/5/2019	387	$506
		37,694	**$37,798**

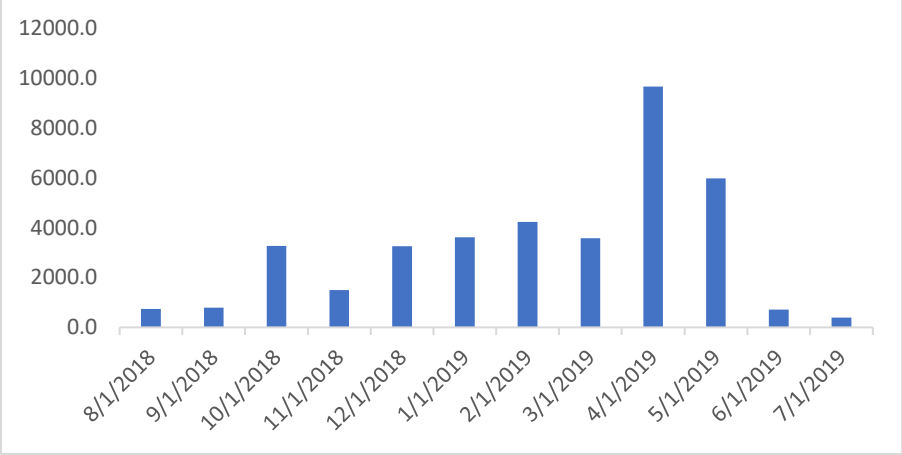


Figure 44: Sayreville Memorial HS Natural Gas Usage (Therms)

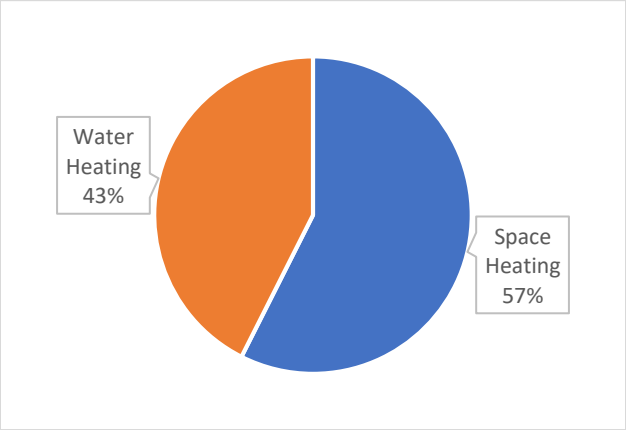


Figure 45: Sayreville Memorial HS Natural Gas Usage End use Breakdown

Table 33: Sayreville Memorial HS Historical Natural Gas Usage

73 376 951 01/ 73 376 947 09			
Start Date	End Date	Usage (Therms)	Cost ($)
3/7/2017	4/4/2017	16,264	$14,270
4/5/2017	5/3/2017	3,200	$2,808
5/4/2017	6/2/2017	1,560	$1,368
6/3/2017	7/5/2017	529	$464
7/6/2017	8/2/2017	638	$560
8/3/2017	9/1/2017	1,925	$1,758
9/2/2017	10/3/2017	5,156	$4,709
10/4/2017	11/3/2017	6,747	$6,163
11/4/2017	12/1/2017	9,549	$8,421
12/2/2017	1/3/2018	10,746	$9,340
1/4/2018	2/1/2018	20,864	$18,755
2/2/2018	3/6/2018	16,330	$15,281
		93,508	**$83,897**

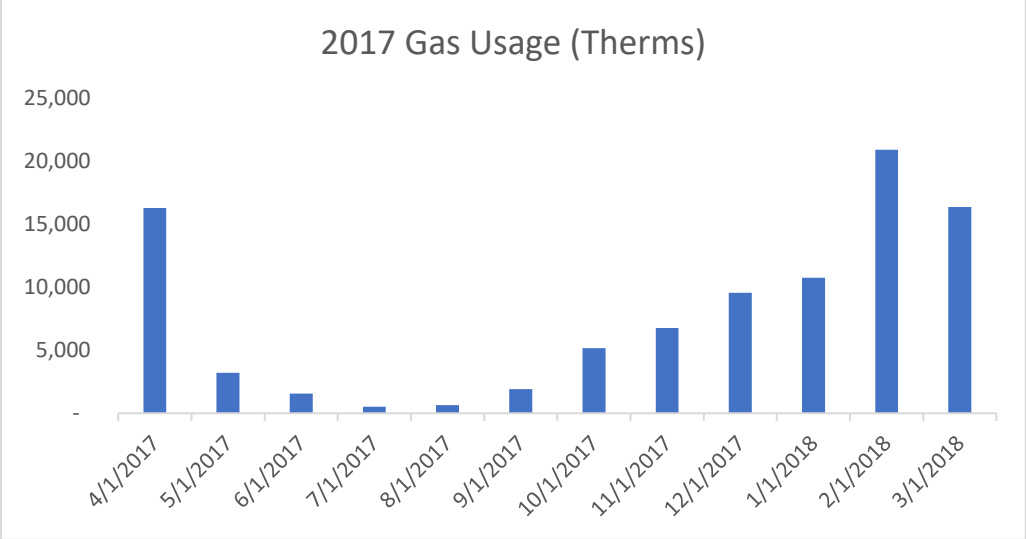


Figure 46: Sayreville Memorial HS Electric Usage (kWh, kW)

Sayreville Middle School

The following tables and figures breakdown the electric and natural gas usage at Sayreville Middle School. A typical school operation with 100% heating and 100% cooling of the building would see a bell curve on electric consumption for summer months except for the months, when schools are out of session with limited occupancy. The school would see similar increase in gas consumption for winter months. Based on utility bill consumption of the school, we are observing following irregularities as highlighted below.

Willdan observed a bell curve in the electrical usage but towards the winter months which points out the following observation:

- Use of electric heaters (higher plug load)
- Lack of BMS controls, which allows the classrooms and other spaces meet its temperatures and also driving usage of certain equipment without a proper controls sequence programing
- A spike for the month of May that justifies the use cooling.

It was also apparent that the school had an ideal bell curve on the natural gas side which shows that the heating system was operating typically along with reduced or no consumption during the summer months. A "0" therm usage for the month of July suggests that the school's gas-fired equipment are completely turned off during the vacation and is not required for on-going activities, if any.

Table 34: Sayreville MS Electric Usage

100 011 345 558 (100 129 863 948)				
Start Date	End Date	Usage (kWh)	Demand (kW)	Cost ($)
7/18/2018	8/15/2018	53,600	166	$5,394
8/16/2018	9/17/2018	59,600	305	$8,028
9/18/2018	10/16/2018	68,400	300	$8,705
10/17/2018	11/15/2018	80,800	256	$9,568
11/16/2018	12/14/2018	82,800	270	$9,877
12/15/2018	1/17/2019	89,600	270	$10,528
1/18/2019	2/15/2019	86,400	278	$10,233
2/16/2019	3/18/2019	87,200	288	$10,374
3/19/2019	4/16/2019	76,000	276	$9,224
4/17/2019	5/15/2019	64,000	255	$8,202
5/16/2019	6/17/2019	73,200	260	$8,933
6/18/2019	7/17/2019	56,800	260	$7,542
		848,400	**305**	**$106,608**

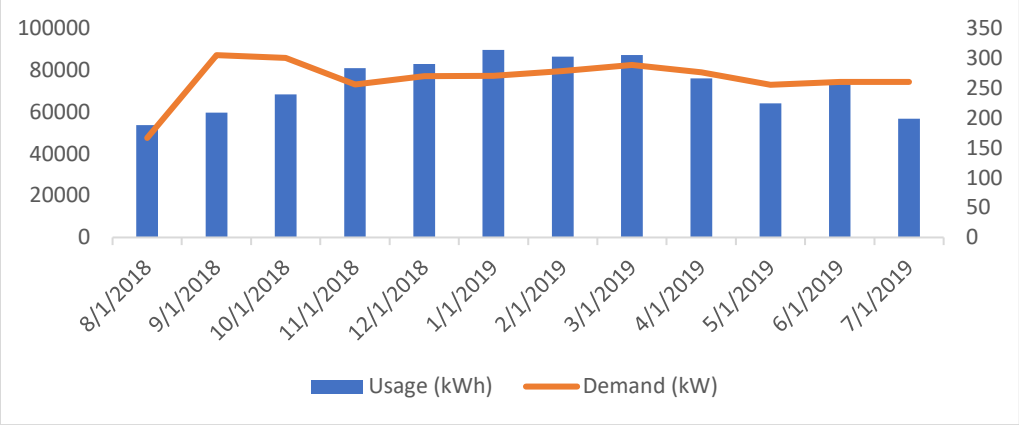


Figure 47: Sayreville MS Electric Usage (kWh, kW)

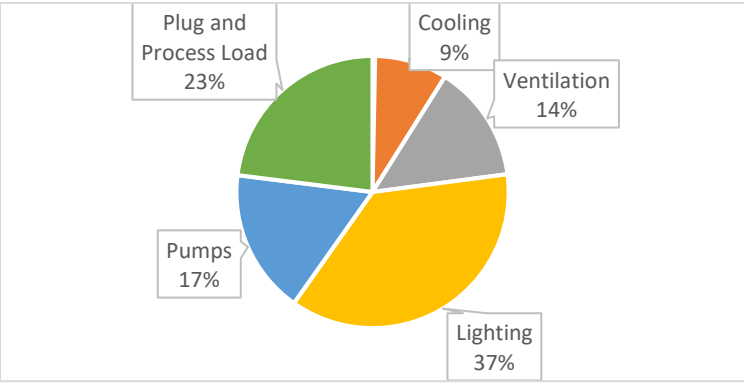


Figure 48: Sayreville MS Electric Usage End use Breakdown

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Table 35: Sayreville MS Natural Gas Usage

73 376 950 04			
Start Date	End Date	Usage (Therms)	Cost ($)
7/4/2018	8/2/2018	0	$107
8/3/2018	9/4/2018	11	$114
9/5/2018	10/2/2018	210	$238
10/3/2018	11/1/2018	3,899	$4,893
11/2/2018	12/4/2018	12,745	$11,059
12/5/2018	1/4/2019	13,966	$11,381
1/5/2019	2/4/2019	17,003	$14,202
2/5/2019	3/5/2019	13,585	$11,774
3/6/2019	4/3/2019	10,654	$6,535
4/4/2019	5/3/2019	3,211	$2,063
5/4/2019	6/4/2019	576	$481
6/5/2019	7/3/2019	320	$328
		76,179	**$63,176**

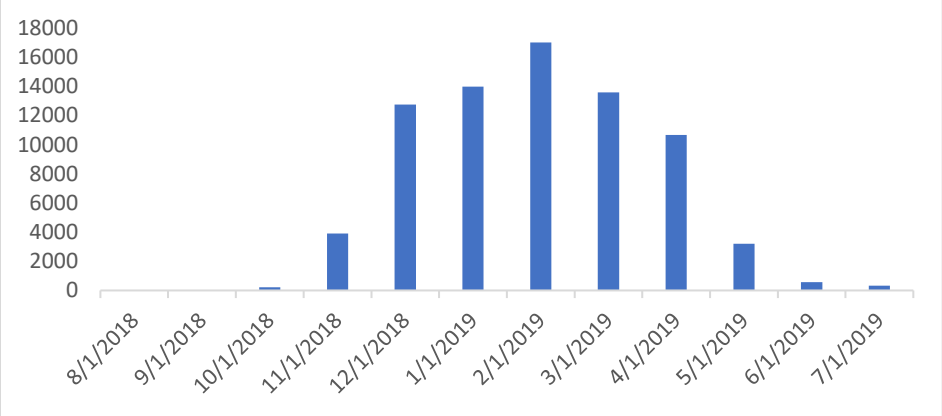


Figure 49: Sayreville MS Natural Gas Usage (therms)

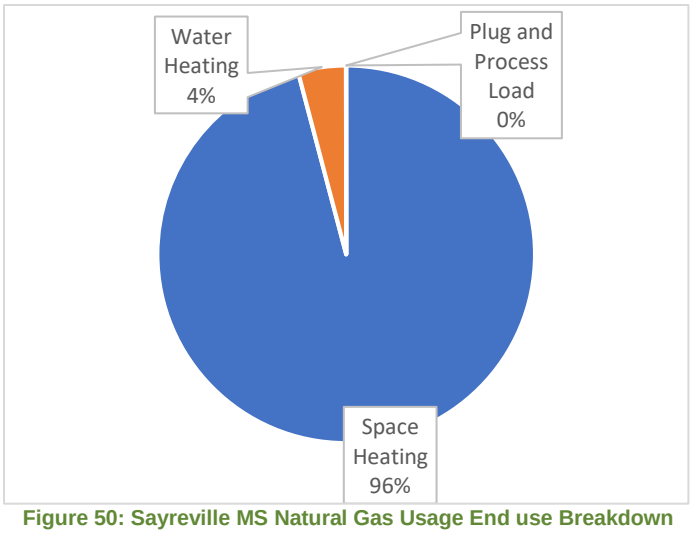


Figure 50: Sayreville MS Natural Gas Usage End use Breakdown

Samsel Upper Elementary School

The following tables and figures breakdown the electric and natural gas usage at Samsel Upper Elementary School. A typical school operation with 100% heating and 100% cooling of the building would see a bell curve on electric consumption for summer months except for the months, when schools are out of session with limited occupancy. The school would see similar increase in gas consumption for winter months. Based on utility bill consumption of the school, we are observing following irregularities as highlighted below.

Willdan observed a bell curve in the electrical usage but towards the winter months which points out the following observation:

- Use of electric heaters (higher plug load)
- Lack of BMS controls, which allows the classrooms and other spaces meet its temperatures and also driving usage of certain equipment without a proper controls sequence programing
- A spike for the month of May and June that justifies the use cooling.

It was also apparent that the school had an ideal bell curve on the natural gas side which shows that the heating system was operating typically along with reduced or no consumption during the summer months. Between June and September, the only observed gas-fired equipment running are Domestic Water Heaters and cooking equipment, which barely contribute towards the overall gas consumption for the entire year.

Table 36: Samsel Upper ES Electric Usage

100 046 243 497				
Start Date	End Date	Usage (kWh)	Demand (kW)	Cost ($)
7/15/2018	8/15/2018	75,120	290	$9,332
8/16/2018	9/14/2018	74,880	350	$9,901
9/15/2018	10/13/2018	85,680	332	$10,632
10/14/2018	11/13/2018	80,880	258	$9,693
11/14/2018	12/13/2018	81,000	234	$9,475
12/14/2018	1/16/2019	82,440	235	$9,623
1/17/2019	2/14/2019	81,240	237	$9,447
2/15/2019	3/15/2019	78,960	238	$9,227
3/16/2019	4/15/2019	78,600	236	$9,183
4/16/2019	5/14/2019	64,800	231	$8,094
5/15/2019	6/14/2019	79,200	285	$9,590
6/15/2019	7/16/2019	81,840	286	$10,126
		944,640	**350**	**$114,322**

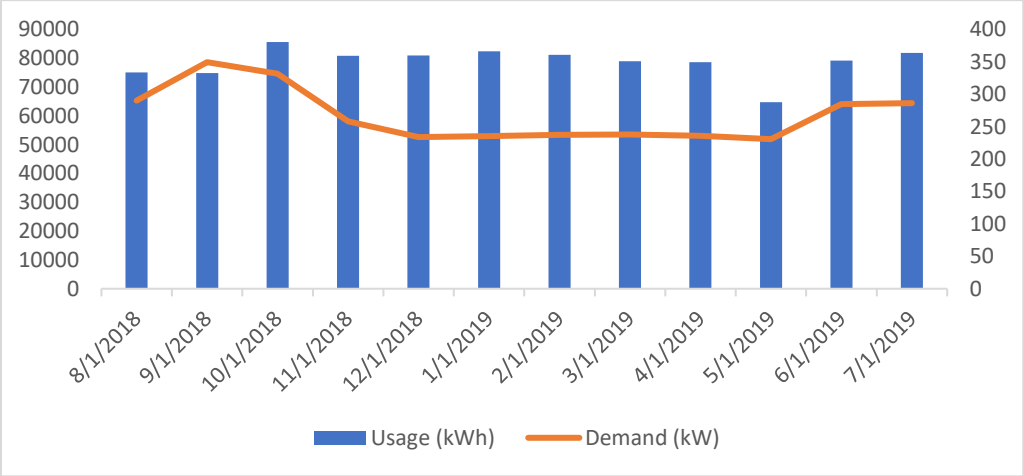


Figure 51: Samsel Upper ES Electric Usage (kWh, kW)

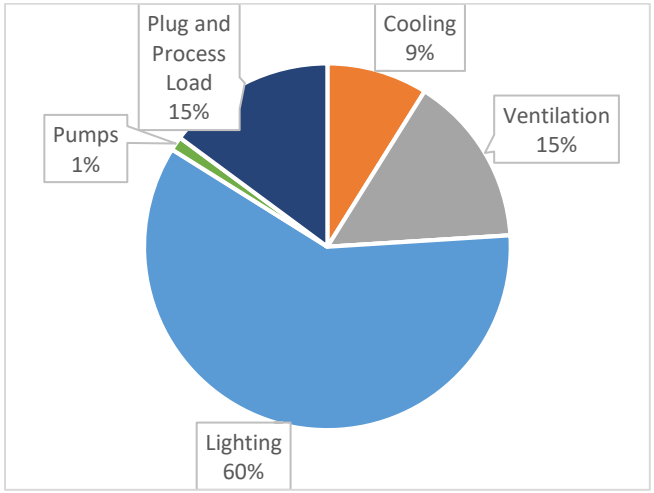


Figure 52: Samsel Upper ES Electric Usage End use Breakdown

Table 37: Samsel Upper ES Natural Gas Usage

73 376 954 03			
Start Date	End Date	Usage (Therms)	Cost ($)
7/10/2018	8/6/2018	170	$213
8/7/2018	9/5/2018	171	$213
9/6/2018	10/5/2018	267	$274
10/6/2018	11/2/2018	2737	$3,607
11/3/2018	12/5/2018	6910	$6,521
12/6/2018	1/7/2019	8226	$7,079
1/8/2019	2/6/2019	10495	$8,716
2/7/2019	3/7/2019	9152	$7,961
3/8/2019	4/5/2019	6129	$3,816
4/6/2019	5/8/2019	1955	$1,308
5/9/2019	6/6/2019	386	$368
6/7/2019	7/8/2019	267	$297
		46,865	**$40,374**

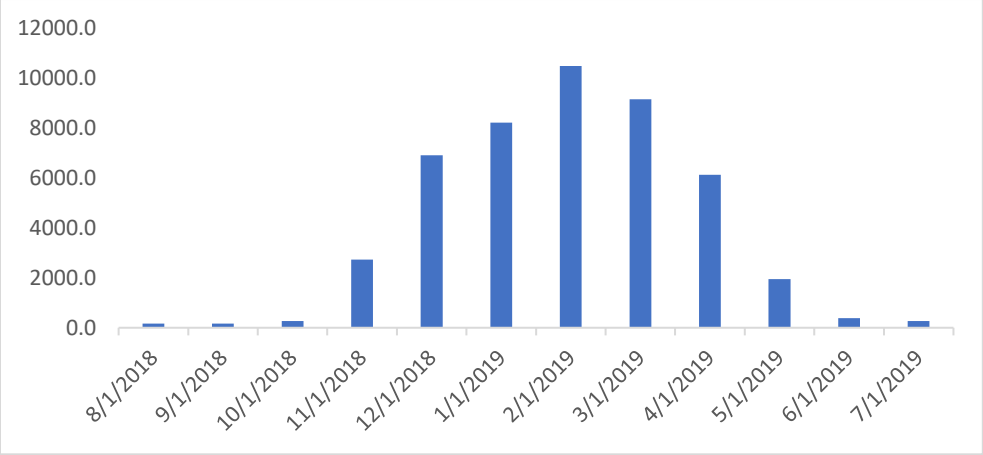


Figure 53: Samsel Upper ES Natural Gas Usage (therms)

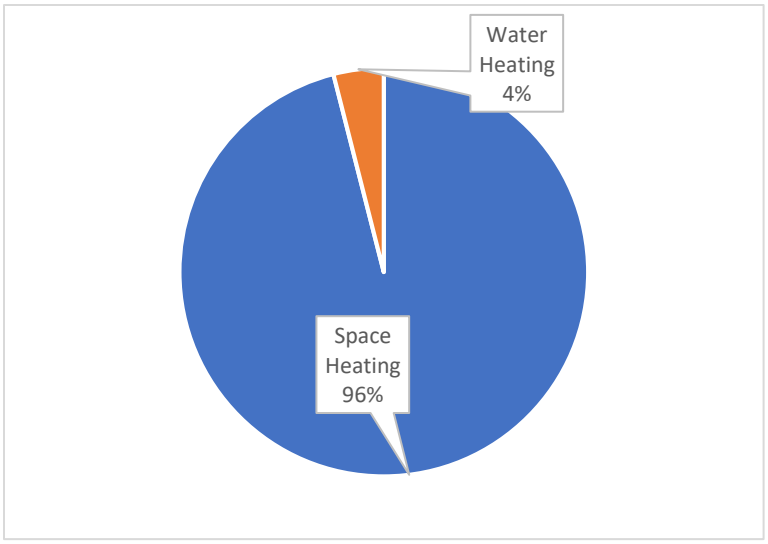


Figure 54: Samsel Upper ES Natural Gas Usage End use Breakdown

Harry S Truman Elementary School

The following tables and figures breakdown the electric and natural gas usage at Harry S Truman Elementary School. A typical school operation with 100% heating and 100% cooling of the building would see a bell curve on electric consumption for summer months except for the months, when schools are out of session with limited occupancy. The school would see similar increase in gas consumption for winter months. Willdan observed a typical bell curve in the electrical usage for the summer months which points out the following observation:

- Seasonal demand charges during the winter months.
- Lack of BMS controls, which allows the classrooms and other spaces meet its temperatures and also driving usage of certain equipment without a proper controls sequence programing
- A spike for the month of May through September that justifies the use of chiller for cooling the building.

It was also apparent that the school had an ideal bell curve on the natural gas side which shows that the heating system was operating typically, along with reduced or no consumption during the summer months. Between June and September, the only observed gas-fired equipment running are Domestic Water Heaters and cooking equipment, which barely contribute towards the overall gas consumption for the entire year.

Table 38: Harry S Truman ES Electric Usage

100 013 754 021				
Start Date	End Date	Usage (kWh)	Demand (kW)	Cost ($)
7/18/2018	8/16/2018	30,5400	233	$5,040
8/17/2018	9/15/2018	34,600	225	$5,011
9/16/2018	10/15/2018	33,600	220	$4,776
10/16/2018	11/14/2018	23,200	220	$3,091
11/15/2018	12/14/2018	25,000	220	$3,240
12/15/2018	1/17/2019	25,000	220	$3,242
1/18/2019	2/15/2019	24,400	220	$3,150
2/16/2019	3/18/2019	24,200	210	$3,136
3/19/2019	4/16/2019	22,400	210	$2,950
4/17/2019	5/16/2019	23,600	214	$3,794
5/17/2019	6/17/2019	41,600	175	$5,210
6/18/2019	7/16/2019	46,800	179	$5,855
		359,800	**233**	**$48,493**

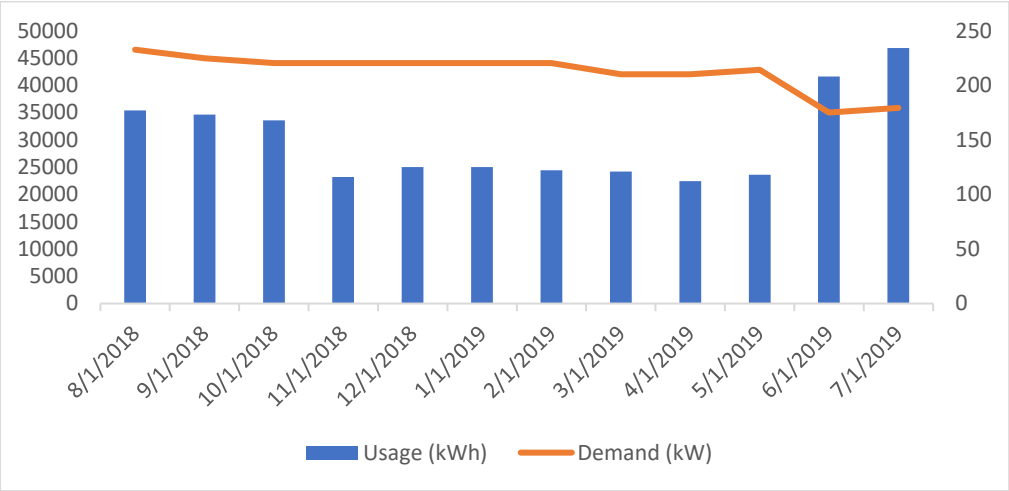


Figure 55: Harry S Truman ES Electric Usage (kWh, kW)

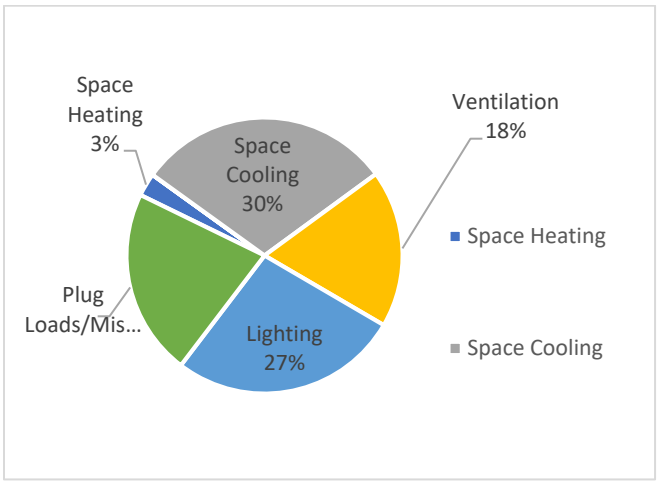


Figure 56: Harry S Truman ES Electric Usage End use Breakdown

Table 39: Harry S Truman ES Natural Gas Usage

73 376 952 09			
Start Date	End Date	Usage (Therms)	Cost ($)
7/7/2018	8/7/2018	37	$130
8/8/2018	9/5/2018	30	$125
9/6/2018	10/5/2018	36	$130
10/6/2018	11/2/2018	985	$1,353
11/3/2018	12/5/2018	2,519	$2,432
12/6/2018	1/8/2019	3,387	$2,950
1/9/2019	2/5/2019	4,324	$3,662
2/6/2019	3/7/2019	3,659	$3,246
3/8/2019	4/5/2019	2,658	$1,731
4/6/2019	5/7/2019	1,269	$896
5/8/2019	6/6/2019	80	$185
6/7/2019	7/8/2019	76	$182
		19,060	**$17,024**

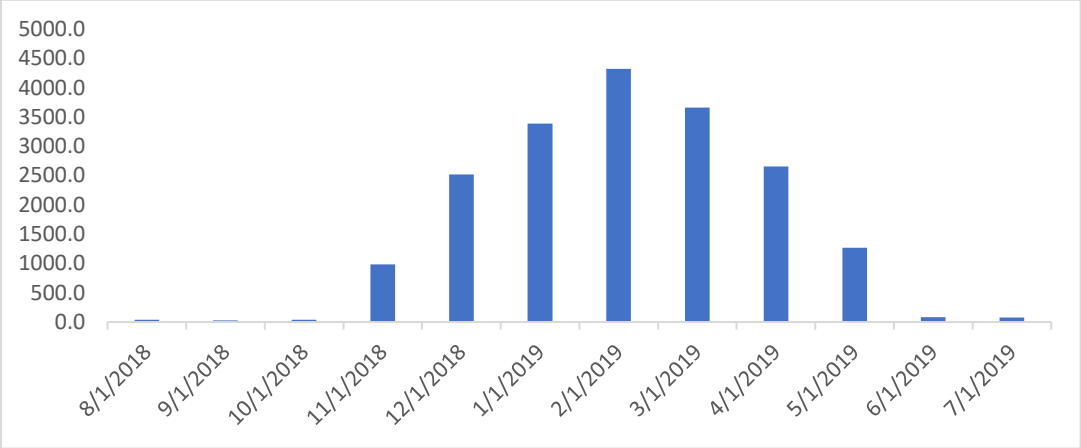


Figure 57: Harry S Truman ES Natural Gas Usage (therms)

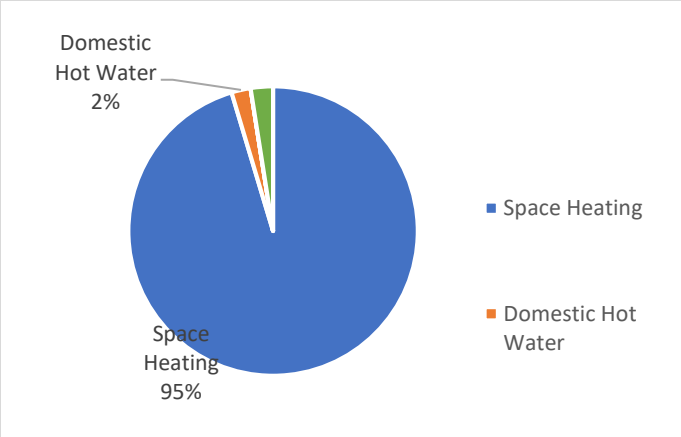


Figure 58: Harry S Truman ES Natural Gas Usage End use Breakdown

Dwight D Eisenhower Elementary School

The following tables and figures breakdown the electric and natural gas usage at Dwight Eisenhower Elementary School. A typical school operation with 100% heating and 100% cooling of the building would see a bell curve on electric consumption for summer months except for the months, when schools are out of session with limited occupancy. The school would see similar increase in gas consumption for winter months. Willdan observed a bell curve in the electrical usage but towards the winter months which points out the following observation:

- Seasonal demand charges during the summer months
- Use of electric heaters (higher plug load)
- Lack of BMS controls, which allows the classrooms and other spaces meet its temperatures and also driving usage of certain equipment without a proper controls sequence programing
- The increase in consumption between April and May shows the switch between heating and cooling seasons.

It was also apparent that the school had an ideal bell curve on the natural gas side which shows that the heating system was operating typically along with reduced or no consumption during the summer months. Between June and September, the only observed gas-fired equipment running are Domestic Water Heaters and cooking equipment, which barely contribute towards the overall gas consumption for the entire year.

Table 40: Dwight D Eisenhower ES Electric Usage

100 013 954 480				
Start Date	End Date	Usage (kWh)	Demand (kW)	Cost ($)
7/17/2018	8/15/2018	9,200	73	$1,196
8/16/2018	9/14/2018	13,000	88	$1,904
9/15/2018	10/15/2018	17,600	80	$2,256
10/16/2018	11/14/2018	18,000	63	$2,171
11/15/2018	12/13/2018	19,800	70	$2,370
12/14/2018	1/16/2019	22,000	66	$2,554
1/17/2019	2/14/2019	21,600	66	$2,496
2/15/2019	3/15/2019	20,400	66	$2,378
3/16/2019	4/16/2019	21,200	65	$2,451
4/17/2019	5/15/2019	16,600	64	$2,075
5/16/2019	6/14/2019	17,400	74	$2,159
6/15/2019	7/16/2019	11,400	72	$1,628
		208,200	**88**	**$25,637**

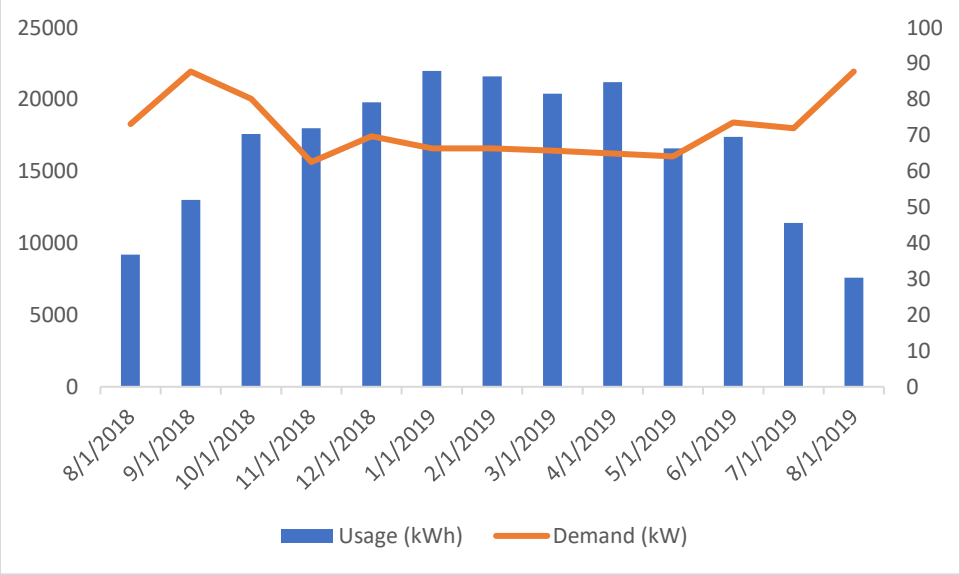


Figure 59: Dwight D Eisenhower ES Electric Usage (kWh)

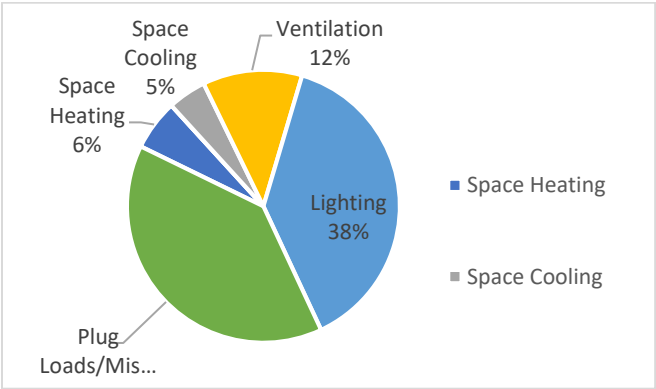


Figure 60: Dwight D Eisenhower ES Electric Usage End use Breakdown

Table 41: Dwight D Eisenhower ES Natural Gas Usage

72 376 945 04			
Start Date	End Date	Usage (Therms)	Cost ($)
7/9/2018	8/7/2018	23	$121
8/8/2018	9/7/2018	23	$121
9/8/2018	10/5/2018	56	$142
10/6/2018	11/5/2018	1,520	$1,910
11/6/2018	12/6/2018	3,640	$3,395
12/7/2018	1/7/2019	4,072	$3,034
1/8/2019	2/6/2019	5,240	$4,452
2/7/2019	3/8/2019	4,759	$4,190
3/9/2019	4/5/2019	3,246	$2,084
4/6/2019	5/8/2019	1,246	$883
5/9/2019	6/6/2019	331	$335
6/7/2019	7/8/2019	61	$173
		24,218	**$20,841**

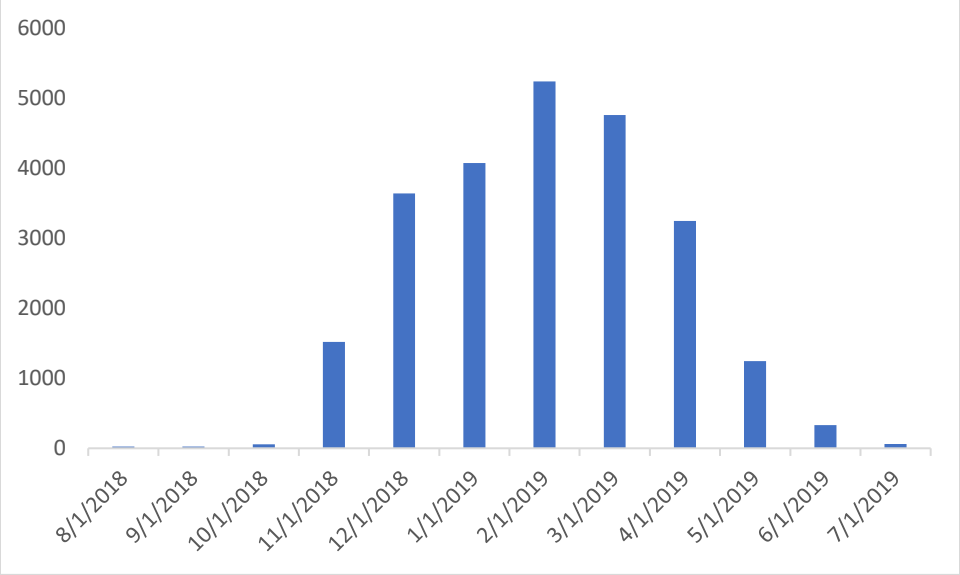


Figure 61: Dwight D Eisenhower ES Natural Gas Usage (therms)

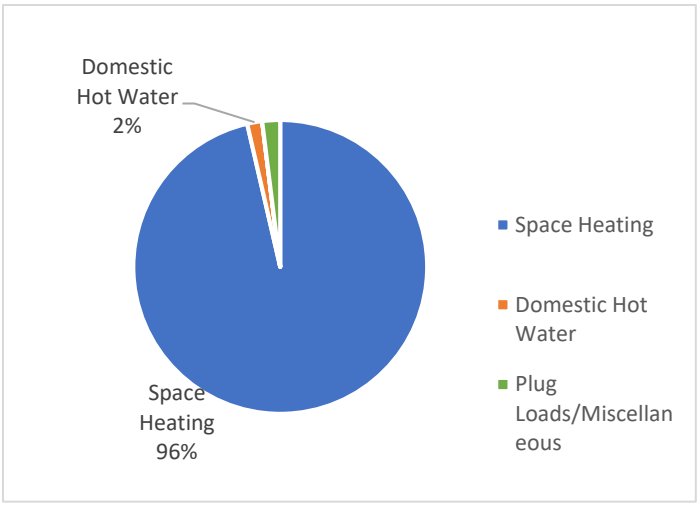


Figure 62: Dwight D Eisenhower ES Natural Gas Usage End use Breakdown

Selover School

The following tables and figures breakdown the electric and natural gas usage at Selover School. A typical school operation with 100% heating and 100% cooling of the building would see a bell curve on electric consumption for summer months except for the months, when schools are out of session with limited occupancy. However, this building is used for administration purposes which acts as an office with a handful of kindergarten classes in a section of the building. The school would see similar increase in gas consumption for winter months. Willdan observed an almost flat line rather than a bell curve in the electrical usage. The following observations will justify the graph:

- Lack of BMS controls, which allows the classrooms and other spaces meet its temperatures and also driving usage of certain equipment without a proper controls sequence programing
- Use of electric heaters (higher plug load)
- Use of space as office typically yields a flatter curve throughout the year
- The increase in consumption between June and September shows the office operation during summer vacation for board meetings and future planning

It was also apparent that the school had an ideal bell curve on the natural gas side which shows that the heating system was operating typically, along with reduced or no consumption during the summer months. Between June and September, the only observed gas-fired equipment running are Domestic Water Heaters and cooking equipment, which barely contributes toward the overall gas consumption for the entire year.

Table 42: Selover School Electric Usage

100 129 863 971/ 100 011 664 024				
Start Date	End Date	Usage (kWh)	Demand (kW)	Cost ($)
7/21/2018	8/20/2018	13,090	69	$1,759
8/21/2018	9/19/2018	12,212	72	$1,702
9/20/2018	10/18/2018	10,271	80	$1,424
10/19/2018	11/19/2018	10,558	42	$1,410
11/20/2018	12/18/2018	9,995	73	$1,153
12/19/2018	1/21/2019	10,952	75	$1,443
1/22/2019	2/19/2019	11,635	75	$1,311
2/20/2019	3/19/2019	10,633	73	$1,241
3/20/2019	4/19/2019	9,616	72	$1,294
4/20/2019	5/21/2019	10,276	75	$1,408
5/22/2019	6/19/2019	10,331	72	$1,373
6/20/2019	7/19/2019	13,540	72	$1,823
		133,109	**80**	**$17,340**

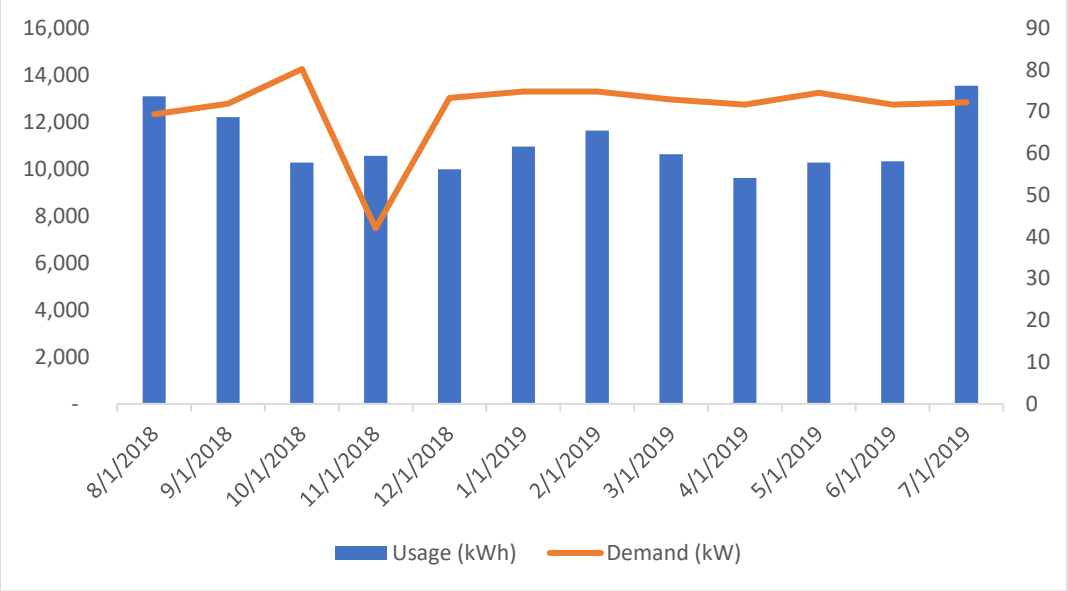


Figure 63: Selover ES Electric Usage (kWh)

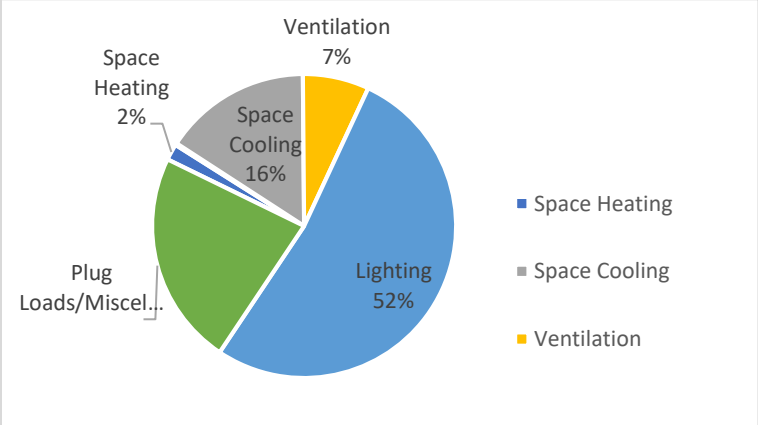


Figure 64: Selover ES Electric Usage End use Breakdown

Table 43: Selover School Natural Gas Usage

73 376 953 06/ 73 376 948 06			
Start Date	End Date	Usage (Therms)	Cost ($)
7/10/2018	8/9/2018	25	$229
8/10/2018	9/10/2018	25	$229
9/11/2018	10/8/2018	38	$237
10/9/2018	11/6/2018	2,285	$2,724
11/7/2018	12/7/2018	4,976	$4,611
12/8/2018	1/9/2019	5,530	$4,869
1/10/2019	2/7/2019	6,040	$3,310
2/8/2019	3/11/2019	5,661	$5,345
3/12/2019	4/9/2019	3,891	$2,605
4/10/2019	5/9/2019	1,271	$1,034
5/10/2019	6/10/2019	380	$501
6/11/2019	7/10/2019	8	$280
		30,130	**$25,974**

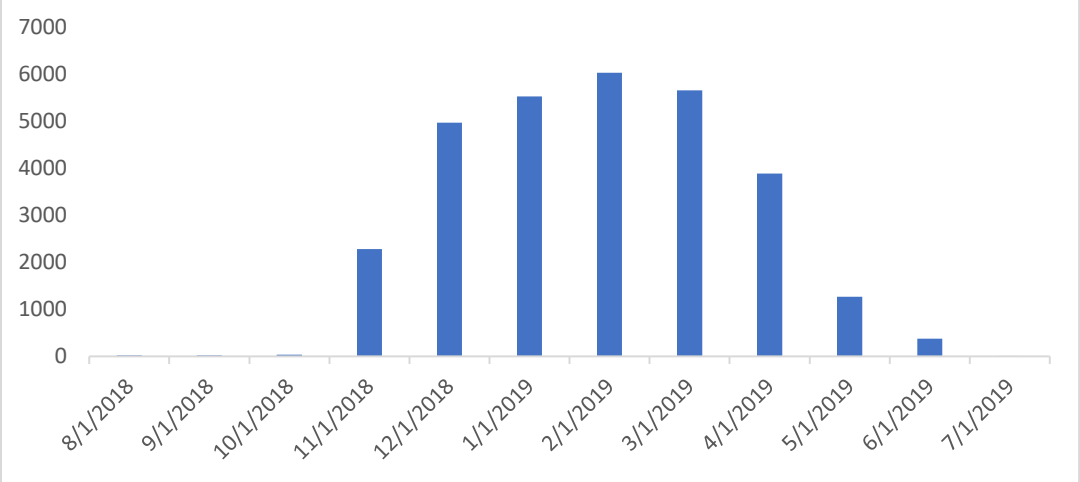


Figure 65: Selover ES Natural Gas Usage (therms)

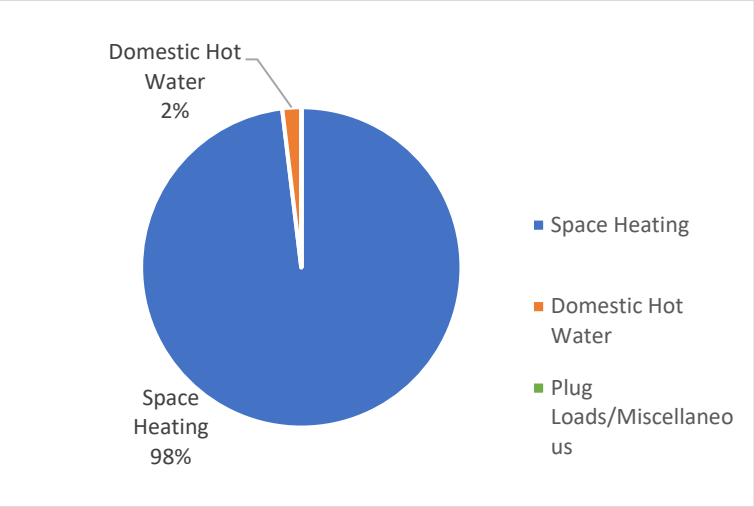


Figure 66: Selover ES Natural Gas Usage End use Breakdown

Woodrow Wilson Elementary School

The following tables and figures breakdown the electric and natural gas usage at Woodrow Wilson Elementary School. A typical school operation with 100% heating and 100% cooling of the building would see a bell curve on electric consumption for summer months except for the months, when schools are out of session with limited occupancy. The school would see similar increase in gas consumption for winter months. Willdan observed an almost typical bell curve in the electrical usage. The following observations will justify the graph:

- Use of electric heaters (higher plug load)
- Lack of BMS controls, which allows the classrooms and other spaces meet its temperatures and also driving usage of certain equipment without a proper controls sequence programing, driving a higher consumption

It was also apparent that the school had an ideal bell curve on the natural gas side which shows that the heating system was operating typically, along with reduced or no consumption during the summer months. Between June and September, the only observed gas-fired equipment running are Domestic Water Heaters and cooking equipment, which barely contribute towards the overall gas consumption for the entire year.

Table 44: Woodrow Wilson Elementary School Electric Usage

100 012 970 107				
Start Date	End Date	Usage (kWh)	Demand (kW)	Cost ($)
7/19/2018	8/17/2018	15,000	48	$1,839
8/18/2018	9/18/2018	17,840	71	$2,313
9/19/2018	10/17/2018	16,200	70	$2,098
10/18/2018	11/15/2018	26,400	71	$3,066
11/16/2018	12/17/2018	33,320	88	$3,814
12/18/2018	1/18/2019	32,200	86	$3,669
1/19/2019	2/18/2019	32,800	88	$3,723
2/19/2019	3/19/2019	33,320	80	$3,707
3/20/2019	4/17/2019	30,760	74	$3,428
4/18/2019	5/17/2019	30,120	84	$3,544
5/18/2019	6/18/2019	34,560	114	$4,081
6/19/2019	7/18/2019	27,000	101	$3,359
		375,640	**116**	**$38,642**

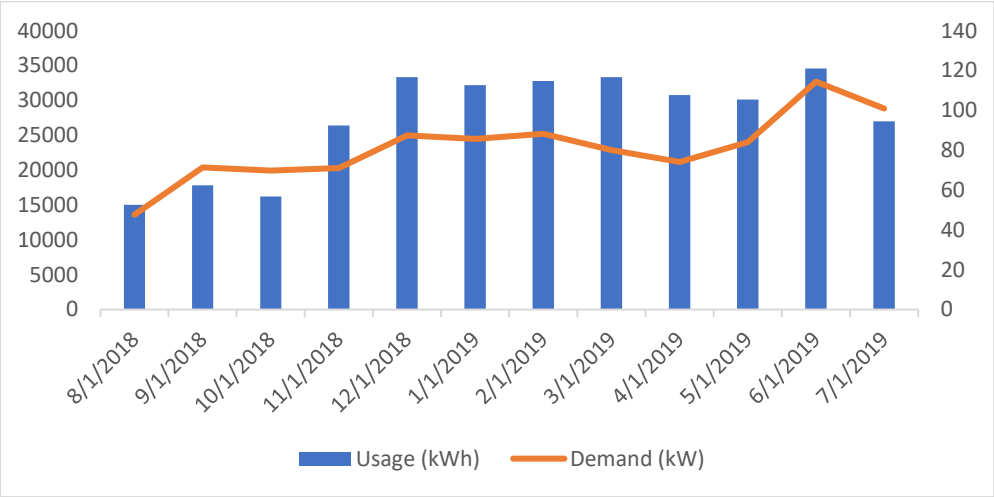


Figure 67: Woodrow Wilson Elementary School Electric Usage (kWh)

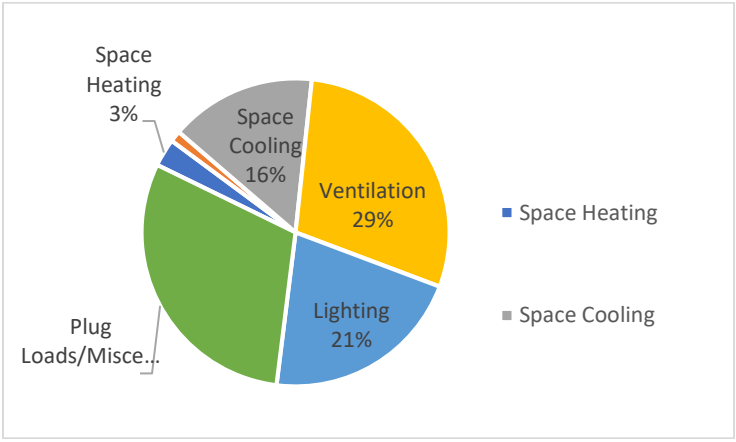


Figure 68: Woodrow Wilson Elementary School Electric Usage End use Breakdown

Table 45: Woodrow Wilson Elementary School Natural Gas Usage

73 376 949 03			
Start Date	End Date	Usage (Therms)	Cost ($)
7/5/2018	8/3/2018	28	$143
8/4/2018	9/4/2018	33	$147
9/5/2018	10/3/2018	44	$156
10/4/2018	11/1/2018	1,810	$2,414
11/2/2018	12/4/2018	5,471	$4,978
12/5/2018	1/4/2019	6,715	$5,722
1/5/2019	2/4/2019	8,802	$7,366
2/5/2019	3/5/2019	6,564	$2,682
3/6/2019	4/3/2019	4,765	$3,025
4/4/2019	5/3/2019	1,806	$1,244
5/4/2019	6/5/2019	423	$417
6/6/2019	7/5/2019	37	$183
		36,498	**$28,478**

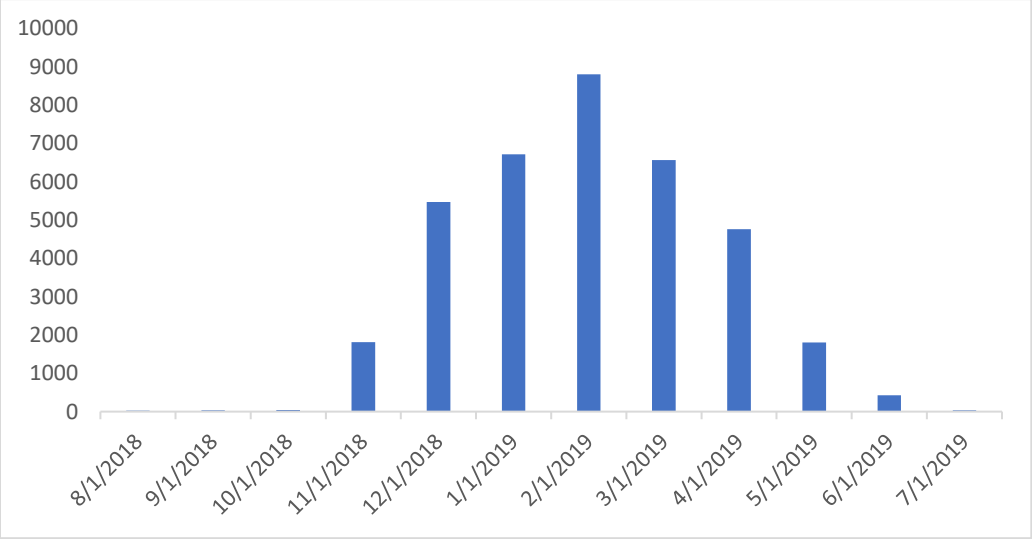


Figure 69: Woodrow Wilson Elementary School Natural Gas Usage (therms)

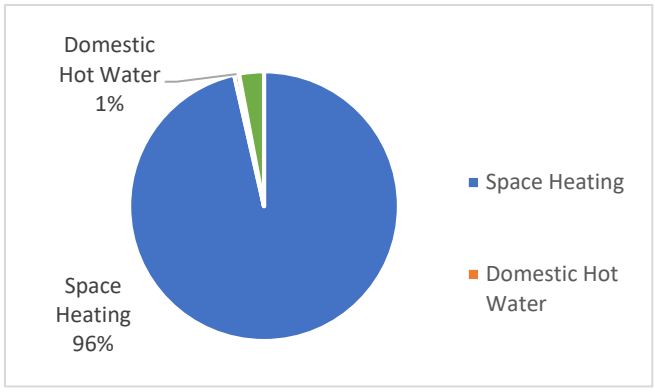


Figure 70: Woodrow Wilson Elementary School Natural Gas Usage End use Breakdown

Emma L Arleth Elementary School

The following tables and figures breakdown the electric and natural gas usage at Emma L Arleth Elementary School. A typical school operation with 100% heating and 100% cooling of the building would see a bell curve on electric consumption for summer months, except for the months when schools are out of session with limited occupancy. The school would see similar increase in gas consumption for winter months. Willdan observed an almost typical bell curve in the electrical usage. The following observations will justify the graph:

- Use of electric heaters (higher plug load)
- Lack of BMS controls, which allows the classrooms and other spaces meet its temperatures and also driving usage of certain equipment without a proper controls sequence programing, driving a higher consumption
- Increase in electric consumption between May and June suggests increased cooling of the space through window AC's and various split systems.

It was also apparent that the school had an ideal bell curve on the natural gas side which shows that the heating system was operating typically, along with reduced or no consumption during the summer months. Between June and September, the only observed gas-fired equipment running are Domestic Water Heaters and cooking equipment, which barely contribute towards the overall gas consumption for the entire year.

Table 46: Emma L Arleth Elementary School Electric Usage

100 013 951 908				
Start Date	End Date	Usage (kWh)	Demand (kW)	Cost ($)
7/18/2018	8/16/2018	13,760	115	$1,779
8/17/2018	9/15/2018	24,480	124	$3,276
9/16/2018	10/16/2018	30,400	125	$3,792
10/17/2018	11/14/2018	30,080	104	$3,606
11/15/2018	12/14/2018	33,120	105	$3,881
12/15/2018	1/17/2019	34,080	104	$3,967
1/18/2019	2/15/2019	36,160	109	$4,174
2/16/2019	3/18/2019	37,920	100	$4,286
3/19/2019	4/16/2019	31,360	99	$3,653
4/17/2019	5/16/2019	27,360	91	$3,333
5/17/2019	6/17/2019	28,800	116	$3,562
6/18/2019	7/16/2019	46,800	179	$5,855
		422,000	**179**	**$45,163**

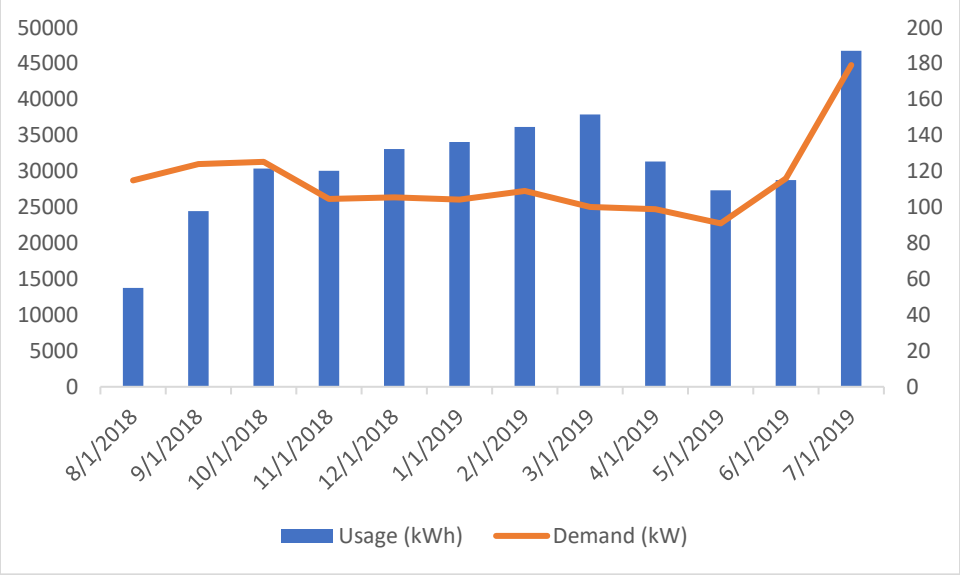


Figure 71: Emma L Arleth Elementary School Electric Usage (kWh)

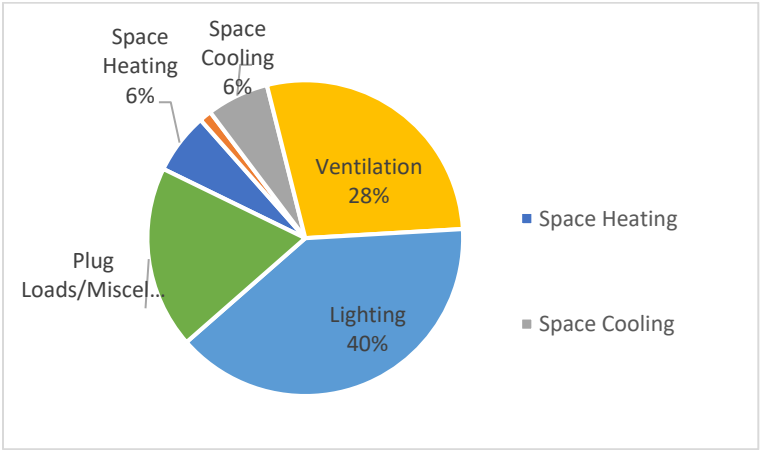


Figure 72: Emma L Arleth Elementary School Electric Usage End use Breakdown

Table 47: Emma L Arleth Elementary School Natural Gas Usage

73 376 946 01			
Start Date	End Date	Usage (Therms)	Cost ($)
7/6/2018	8/2/2018	92	$164
8/3/2018	9/4/2018	47	$136
9/5/2018	10/2/2018	73	$152
10/3/2018	11/1/2018	2301	$2,847
11/2/2018	12/4/2018	6096	$5,492
12/5/2018	1/4/2019	6908	$5,966
1/5/2019	2/4/2019	8713	$7,345
2/5/2019	3/5/2019	7766	$6,785
3/6/2019	4/3/2019	5912	$3,686
4/4/2019	5/3/2019	3364	$2,155
5/4/2019	6/4/2019	216	$265
6/5/2019	7/3/2019	144	$223
		41,631	**$35,217**

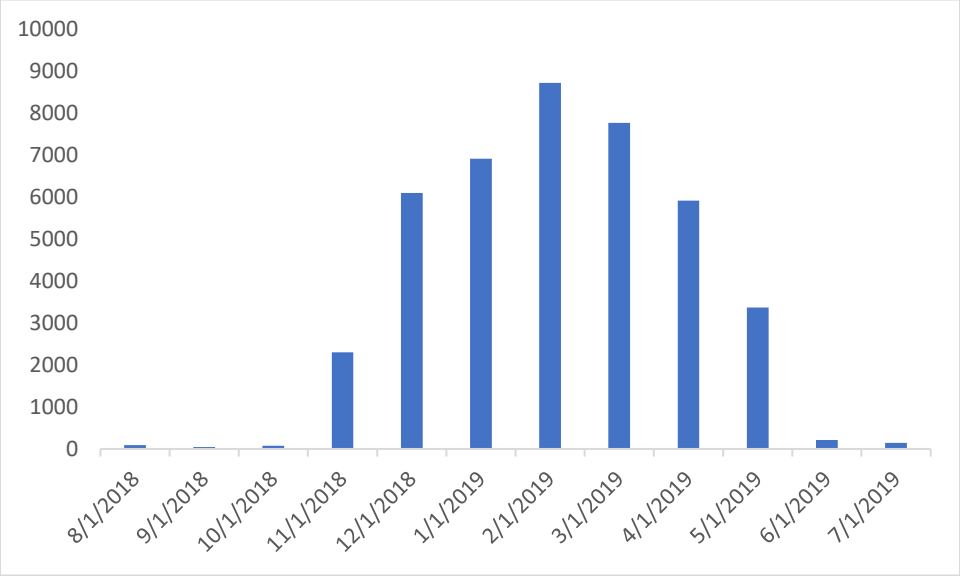


Figure 73: Emma L Arleth Elementary School Natural Gas Usage (therms)

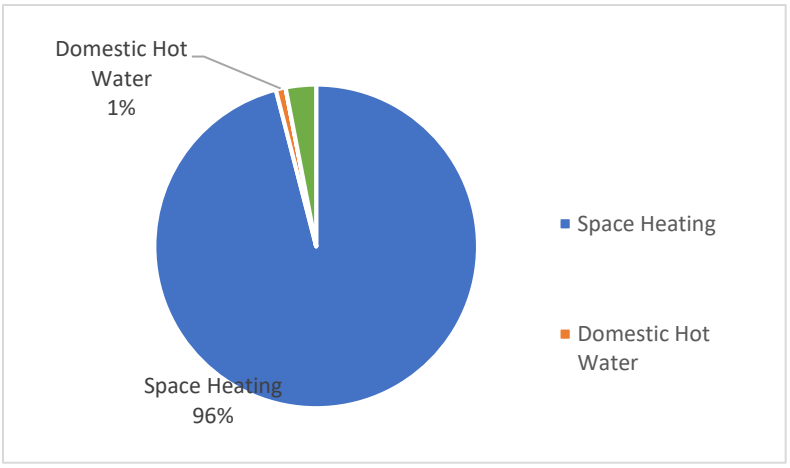


Figure 74: Emma L Arleth Elementary School Natural Gas Usage End use Breakdown

Energy Star Portfolio Benchmarking

Willdan uses the U.S. Environmental Protection Agency (EPA) Portfolio Manager to rate the building on a scale of 1 to 100, as defined by its Energy Star score. This score compares a property under consideration to similar properties nationwide. The building is compared using a database of similar buildings from a national survey conducted by the Department of Energy. An Energy Star score of 50 indicates that the building, from an energy consumption standpoint, performs better than 50% of all similar buildings nationwide, while a rating of 75 indicates that the building performs better than 75% of all similar buildings nationwide. The Site Energy Use Intensity (EUI) is the amount of heat and electricity consumed by a building, as commonly reflected in utility bills, divided by the facility's conditioned square footage. The Source EUI is the total amount of natural gas consumed in the generation and use of energy consumed at a building, such as electricity and Natural Gas, divided by the facility's square footage. A facility's site and source EUI can be obtained from the Statement of Performance (SOP) as seen below.

Table 48: Sayreville Memorial High School Energy Benchmarking

Benchmarking*	This Facility	National Median
Site Energy Use Intensity (EUI kBTU/sf/yr)*	37.1	55
Source Energy Use Intensity (EUI kBTU/sf/yr)*	81.9	121.2
Energy Star Score	83	50

With the absence of central cooling and a new hydronic heating system, the high school's site and source EUI is lower than national median. This would not have been the case if there were a centralized cooling system. Given the score is high, Willdan is projecting the score to go down once the new system is implemented after adding cooling to the space.

Table 49: Sayreville Middle School Energy Benchmarking

Benchmarking*	This Facility	National Median
Site Energy Use Intensity (EUI kBTU/sf/yr)*	62.3	66.2
Source Energy Use Intensity (EUI kBTU/sf/yr)*	96.1	102.2
Energy Star Score	56	50

Despite of the absence of a central cooling system, the middle school's site and source EUI is close to that of its median which shows that the school is performing at the national average based on the age. Willdan is projecting the score to increase slightly once the new system is implemented after adding cooling to the space.

Table 50: Samsel Upper Elementary School Energy Benchmarking

Benchmarking*	This Facility	National Median
Site Energy Use Intensity (EUI kBTU/sf/yr)*	45.3	57.3
Source Energy Use Intensity (EUI kBTU/sf/yr)*	79.8	101.1
Energy Star Score	72	50

With the absence of a central cooling system and an average performing heating system, the school's site and source EUI performance is depicted as efficient. However, Willdan projects that the school will be affected once the new system is implemented after adding cooling to the space.

Table 51: Harry S Truman Elementary School Energy Benchmarking

Benchmarking*	This Facility	National Median
Site Energy Use Intensity (EUI kBTU/sf/yr)*	59	73.4
Source Energy Use Intensity (EUI kBTU/sf/yr)*	102.4	127.4
Energy Star Score	70	50

Harry Truman is the only school that has a centralized heating as well as cooling system. As seen, the site and source EUI is lower than national median which marks it an efficient building for its age. Willdan believes that this building will be even more efficient once the school is upgraded with new and efficient equipment.



Table 52: Dwight Eisenhower Elementary School Energy Benchmarking

Benchmarking*	This Facility	National Median
Site Energy Use Intensity (EUI kBTU/sf/yr)*	52.4	63.1
Source Energy Use Intensity (EUI kBTU/sf/yr)*	75.8	91.2
Energy Star Score	67	50

Despite of the absence of a central cooling system, the school's site and source EUI is lower than its median which shows that the school is performing efficiently than the national average based on the age. Willdan is projecting the score to increase slightly once the new system is implemented after adding cooling to the space.

Table 53: Selover School Energy Benchmarking

Benchmarking*	This Facility	National Median
Site Energy Use Intensity (EUI kBTU/sf/yr)*	87.8	78.4
Source Energy Use Intensity (EUI kBTU/sf/yr)*	100	89.3
Energy Star Score	N/A	50

Selover school is not equipped with a central cooling system. Additionally, it runs on two different heating systems, steam and hydronic. Both systems are running inefficiently and serving different sections of the building. Willdan is projecting the site and Source EUI to go down once a new system is implemented.

Table 54: Woodrow Wilson Elementary School Energy Benchmarking

Benchmarking*	This Facility	National Median
Site Energy Use Intensity (EUI kBTU/sf/yr)*	88.2	60.4
Source Energy Use Intensity (EUI kBTU/sf/yr)*	128.9	88.3
Energy Star Score	16	50

Despite the lack of a central cooling system, the school's site and source EUI is higher than the national median which indicates towards inefficiency. Willdan is projecting the score to go up, ie, an efficient building once the new system is implemented.

Table 55: Emma L Arleth Elementary School Energy Benchmarking

Benchmarking*	This Facility	National Median
Site Energy Use Intensity (EUI kBTU/sf/yr)*	74.2	67.4
Source Energy Use Intensity (EUI kBTU/sf/yr)*	108.5	98.6
Energy Star Score	39	50

The site and source EUI for this school is indicating deficiencies in the existing system. While there is no central cooling system, the heating system, as well as other loads are utilizing more energy, making the building less efficient. With proper system implementations, Willdan is projecting the score to go up.

Section 4. Energy Conservation Measures (ECMs)

Sayreville Memorial High School

The table below highlights the ECMs considered and the overall savings for Sayreville Memorial High School.

Table 56: Sayreville HS ECMs

Measure		Annual Estimated Savings				CO_2 Emission Savings (lbs)	Estimated Implementation Cost ($)	Estimated Simple Payback Period
		Electricity (kWh)	Annual Demand (kW)	Natural Gas (Therms)	Cost Savings ($)			
ECM - 1	LED Lighting	259,631	76	-	$31,332	394,639	$294,294	9
ECM - 3	Install High Efficiency Roof Top Units	(21,249)	-	538	-$2,101	(26,000)	$715,000	-340
ECM - 7	Vending Misers	1,612	0	-	$195	2,450	$600	3
ECM - 8	Plug Load Controls	35,774	-	-	$4,317	54,377	$52,200	12
ECM - 9	Transformer Upgrades	33,082	4	-	$3,992	50,284	$58,148	15
ECM-10	Add Photovoltaic System	1,581,135	1,290	-	$157,968	-	$0	N/A
ECM-10.1	ECM 10 Enabler - Roof upgrade	-	-	-	$0	-	$14,000	N/A

ECM 1: LED Lighting Upgrades

Existing Conditions

A thorough survey was conducted at Sayreville Memorial High school. A variety of lighting fixtures exist at the school. The most prevalent lamp type used in the school is 4-feet 32-watt linear fluorescent T8 lamps in fixtures equipped with 2, 3 or 4 lamps per fixture. Additionally, the range of lamps used in interior lighting varies from 4-feet T5 & T12 linear fluorescent lamps, 2-feet T8 linear fluorescent lamps and T8 U-bend fluorescent tubes. Fixtures using T5 and T8 lamps are equipped with electronic ballasts while T12 lamps are used with magnetic ballasts. There are also compact fluorescent and incandescent lamps used for interior lighting.

ECM Description

Willdan recommends retrofitting fixtures with T5, T8 and T12 lamps with the more efficient Linear LED tubes eliminating ballast from the fixtures. The existing compact fluorescent and incandescent lamps will be replaced with compatible LED replacements. In addition to electric usage and demand savings, maintenance savings may also be achieved since LED lamps last longer than other light sources and therefore do not need to be replaced as often. All recommended lighting is DLC and/or Energy Star compliant. This ECM will be fulfilled through New Jersey Clean Energy Program's (NJCEP) SmartStart Program.

Measure Baseline and Proposed Upgrades

Baseline:

- Existing fluorescent

Proposed

- High-efficiency LED lighting fixtures

Calculation Methodology

Savings have been calculated using NJ Tech Manual FY20.



Maintenance Considerations

- None

ECM 3: Install High Efficiency Roof Top Units

Existing Conditions

A thorough survey was conducted at Sayreville High School. Currently, the media center/library does not have the capability of cooling the space.

ECM Description

Willdan recommends installation of either a rooftop unit or split system in the media center/library to add cooling to the space. From an energy savings point of view, adding cooling to the space yields a negative energy savings from existing conditions. However, this ECM accounts for energy savings.

Measure Baseline and Proposed Upgrades

Baseline:

- Four (4) Unit ventilators for heating only in the media center.

Proposed

- Two (2) Gas fired Rooftop Unit with DX cooling or split system with DX coils for the media center/library.

Calculation Methodology

Savings have been calculated using NJ Tech Manual FY20.

Design Considerations

- Integrating controls with BMS and hydronic distribution system.

Maintenance Considerations

- Equipment shall be maintained as per manufacturer's guidelines.
- Changing of filters at regular intervals.

ECM 7: Vending Machine Controls

Existing Conditions

There is one (1) refrigerated beverage vending machine at the School. It is currently not equipped with an occupancy-based control and is operated 24/7.

ECM Description

Willdan recommends installing occupancy sensor controls for vending machines. Vending machines operate continuously, even during unoccupied hours and consumes several hundred dollars per year in electrical energy costs. The installation of the Vending Miser product will reduce the run time of the vending machines during periods when no occupancy is sensed in the area surrounding the machines. The smart electronics in the device will ensure product is kept cold through a cycling process while reducing total energy consumption. Another benefit from implementing vending miser controls is extended useful equipment life due to reduced lifetime. Energy savings are dependent on

the vending machine and activity level in the area surrounding the machines.
This ECM can be successfully implemented with proper permissions from the supplier, if necessary.

Measure Baseline and Proposed Upgrades

Baseline

- One (1) existing refrigerated vending machine operated 24/7.

Proposed

- Install occupancy sensor (vending miser controls) for the refrigerated vending machines.

Calculation Methodology

Energy savings have been recognized using the NJ Tech Manual FY20.

Maintenance Considerations

- Ongoing maintenance shall be performed by the control's contractor.

ECM 8: Plug Load Controls

Existing Conditions

There are 348 plugged control points at High School that power Desktop PCs and printers. These devices have no control from the plug point.

ECM Description

Willdan recommends installing a wireless plug load device at these locations which enables a scheduled control of the devices throughout the year. Schneider Electric's BERT Control offers a user-friendly user interface that can be operated from the comfort of a Smartphone.

Measure Baseline and Proposed Upgrades

Baseline

- 348 Plug points, uncontrolled.

Proposed

- Simple plugging of BERT CONTROL plug to 348 plug points.

Calculation Methodology

Energy savings have been calculated using operational hours of the school and NJ Tech Manual FY20.

Maintenance Considerations

- Updating the front-end software.

ECM 9: Install Energy Efficient Transformers

Existing Conditions

An on-site detailed survey of the dry-type transformers throughout the facilities was performed by Powersmiths. The facility consists of eight (8) transformers with various kVA capacities ranging from 30 kVA to 75 kVA. The transformers are operating at a small fraction of their nameplate capacity, resulting in very low efficiency, and are often producing large amounts of excess heat, resulting in energy losses, and higher electric costs.

ECM Description

Willdan recommends replacing the dry-type transformers with E-Saver transformers. Designed to provide the lowest life cycle cost, the E-Saver goes beyond US DOE 2016 efficiency, ensuring lower operating losses than standard off-the-shelf transformers. To provide superior performance and reduce environmental impact, the E-Saver comes with a superior Nomex based insulation system impregnated with an organic epoxy adhesive. Superior insulation prevents shorts as well, substantially prolonging the life of the transformer. Based on the detailed field survey, the replacement E-Saver transformers will be a like-for-like, nominal kVA capacity, designed and manufactured to minimize losses for the application and fit within the existing constraints. This ECM can achieve energy saving by increasing the transformer efficiency.

Measure Baseline and Proposed Upgrades

Baseline

- Eight (8) transformers

Proposed

- Eight (8) E-Saver-80R transformers as basis of calculation; please refer to the table below.

								Adjustments						
Transformer Count	Tag Number	Location ID or Room #	Transformer Designation	Proposed Powersmiths OPAL Transformer	Baseline kVA	Replacement kVA	Replace	Bseline % Load During Normal Operating Hours	Baseline % Load Outside Operating Hours	Powersmiths % Load During Normal Operating Hours	Powersmiths % Load Outside Operating Hours	Equipment Operating hrs/ day	Equipment Operating days/yr	A/C System Performance (kW/ton)
1	78553	830 elec	Lp-1D	E-Saver-80R	75	75	1	8.4%	3.0%	8.4%	3.0%	16	200	0
2	78554	A 53	ILR	E-Saver-80R	50	50	1	8.6%	4.0%	8.6%	4.0%	16	200	0
3	78555	E-1 storage	R	E-Saver-80R	45	45	1	9.2%	4.0%	9.2%	4.0%	16	200	0
4	78556	Main Aux	Sylvania	E-Saver-80R	30	30	1	10.1%	5.0%	10.1%	5.0%	16	200	0
5	78557	Auto shop	Disconnect	E-Saver-80R	45	45	1	9.2%	4.0%	9.2%	4.0%	16	200	0.75
6	78558	Wood shop	SQD PNL	E-Saver-80R	30	30	1	10.1%	5.0%	10.1%	5.0%	16	200	0.75
7	78559	C-6	P-3	E-Saver-80R	30	30	1	10.1%	5.0%	10.1%	5.0%	16	200	0.75
8	78560	C-22	Fed Pac PNL	E-Saver-80R	30	30	1	10.1%	5.0%	10.1%	5.0%	16	200	0.75

Figure 75: Sayreville HS Transformer ECM

Calculation Methodology

Energy savings have been calculated using excel spreadsheet. As the schools were not operational during our survey, we were not able to perform testing that we typical perform. The saving was calculated with a conservative load on the transformer

Design Considerations

- Coordination with facility manager to minimize the effect on day-to-day operation.
- Disruption to electrical loads served by existing transformers.
- Seasonal loading on transformers.

Maintenance Considerations

- As recommended by the manufacturer

ECM-10/10.1: Install Solar PV Panels

Existing Conditions

There is no solar photovoltaic system installed at the school.

ECM Description

Willdan recommends installing a solar photovoltaic system to reduce dependence on the electric grid. The solar system can provide 1,470,455 kWh of electricity annually. Solar panels work by absorbing sunlight with photovoltaic cells, generating direct current (DC) energy and then converting it to usable alternating current (AC) energy with the help of inverter technology. AC energy then flows through the home's electrical panel and is distributed accordingly. In order to maximize the solar generation at the High School, some roof upgrades must be performed in order to obtain a desired roof warranty. A budget of $14,000 is allotted for the upgrade to enable the solar panels on the roof.

Design Considerations

- Effect on utility tariffs and rate structures.
- Integration with existing building infrastructure

Maintenance Considerations

- As agreed within the PPA.

ECM-11: Install On-site Power Generation

Existing Conditions

Sayreville High School currently purchases all of its electrical power from the local utility and there is no onsite power generation or heat recovery in the building.

ECM Description

This measure recommends installing 10 kW onsite power generation plant fueled by natural gas. A fraction of the power used in the building will be generated onsite, rather than being imported from the distribution grid thereby improving the building resiliency and reducing peak electrical demand from the grid purchased electricity. The onsite power generation plant will be integrated with the main building electrical distribution as part of the installation. Waste heat from onsite power generation will be not be recovered. Onsite power generation also minimizes transmission losses and hence improves the overall Source to Site EUI.

Measure Baseline and Proposed Upgrades

Baseline

- No onsite power generation

Proposed

- Install 10 kW natural gas fueled power plant to generate electricity onsite.

Note: CHP size is based on a preliminary analysis of the existing electric load profile. Further evaluation is required to evaluate the savings potential from implementing a 10 kW on-site combined heat & power plant.



Calculation Methodology

The calculation for the CHP generator is achieved using manufacturer's technical documents and projected site operation schedule.

Design Considerations

- Space considerations, rigging and general construction.
- A further study is recommended for sizing of the equipment based on building loads available for waste heat recovery and ease of connection and integration with existing heating system.
- Integration with existing electrical distribution system. The electrical distribution architecture has to be re-evaluated for CHP implementation. The electrical code compliance is not evaluated under this study. Compliance should be evaluated as part of the CHP design.
- Structural considerations shall be considered prior to the design and installation of the CHP plant.
- Vibration and noise levels have not been addressed and the noise levels should be addressed as part of the overall CHP implementation.
- Effect on stand-by rates/contract demand.
- Venting of flue gases and availability of natural gas.
- Applicability of tax credits (requires confirmation from accounting and finance).
- Changes in utility rate structures/stand-by charges and demand management.

Maintenance Considerations

- As recommended by the manufacturer.

Sayreville Middle School

The table below highlights the ECMs considered and the overall savings for Sayreville Middle School.

Table 57: Sayreville MS ECMs

Measure		Annual Estimated Savings				CO_2 Emission Savings (lbs)	Estimated Implementation Cost ($)	Estimated Simple Payback Period
		Electricity (kWh)	Annual Demand (kW)	Natural Gas (Therms)	Cost Savings ($)			
ECM-1	LED Lighting	120,846	35	-	$14,584	183,686	$178,632	12
ECM-2	Premium Efficiency Motors W/ VFD	16,266	-	-	$1,963	24,724	$94,250	48
ECM-3	Install High Efficiency Roof Top Units	(29,798)	-	839	-$2,874	(35,480)	$1,215,500	-423
ECM-4	Install High Efficiency Hot Water Boilers	-	-	13,273	$11,429	155,294	$565,000	49
ECM-5	Building Management System (BMS)	921	-	265	$340	4,506	$100,000	0
ECM-7	Vending Misers	1,612	0	-	$195	2,450	$600	3
ECM-8	Plug Load Controls	23,541	-	-	$2,841	35,783	$34,350	12
ECM-10	Add Photovoltaic System	724,421	597	-	$64,739	-	$0	N/A
ECM-10.1	ECM 10 Enabler - Roof upgrade	-	-	-	$0	-	$20,000	N/A

ECM 1: LED Lighting Upgrades

Existing Conditions

A thorough survey was conducted at Sayreville Middle school. A variety of lighting fixtures exist at the school. The most prevalent lamp type used in the school is 4-feet 32-watt linear fluorescent T8 lamps in fixtures equipped with 2, 3 or 4 lamps per fixture. Additionally, the range of lamps used in interior lighting varies from 4-feet T5 & T12 linear fluorescent lamps, 2-feet T8 linear fluorescent lamps and T8 U-bend fluorescent tubes. Fixtures using T5 and T8 lamps are equipped with electronic ballasts while T12 lamps are used with magnetic ballasts. There are also compact fluorescent and incandescent lamps used for interior lighting.

ECM Description

Willdan recommends retrofitting fixtures with T5, T8 and T12 lamps with the more efficient Linear LED tubes eliminating ballast. The existing compact fluorescent and incandescent lamps will be replaced with compatible LED replacements. In addition to electric usage and demand savings, maintenance savings may also be achieved since LED lamps last longer than other light sources, and therefore, do not need to be replaced as often. All recommended lighting is DLC and/or Energy Star compliant. This ECM will be fulfilled through New Jersey Clean Energy Program's (NJCEP) SmartStart Program.

Measure Baseline and Proposed Upgrades

Baseline:

- Existing fluorescent

Proposed

- High-efficiency LED lighting fixtures

Calculation Methodology

Savings have been calculated using NJ Tech Manual FY20

Maintenance Considerations

- None

ECM 2: Pump upgrades with VFD controls

Existing Conditions

A thorough survey was conducted at Sayreville Middle School. The school has six (6) circulation pumps for hot water, none equipped with controls. The pumps are operated at constant volume. Each set of pump serves the hot water loop for each section or wing of the school.

ECM Description

Willdan recommends a 1- for-1 replacement for four (4) out of six (6) existing pumps with premium efficiency motors for circulation. With the upgrade, Willdan also recommends installing VFD controls on all six (6) pumps, along with installing 2-way valves at the terminal units and a pressure differential sensor at the retuning end of the circulation loop to achieve the variable flow. Since motor power consumption is proportional to the cube of the shaft speed under ideal conditions, running pumps at lower speeds provides energy savings when compared to operating pumps at full speed. For example, a 20% reduction in pump motor speed results in approximately a 50% reduction in pumping energy consumption.

Measure Baseline and Proposed Upgrades

Baseline:

- Two (2) 25 HP pumps for hot water circulation.
- Two (2) 10 HP pump for hot water circulation.
- Two (2) 7.5 HP pump for hot water circulation.

Proposed

- Two (2) 25 HP premium efficiency pumps for hot water circulation.
- Two (2) 10 HP premium efficiency pump for hot water circulation.
- VFD control on all six (6) pumps.
- Conversion of all 3-way valves to 2-way valves for optimum variable flow.

Calculation Methodology

Savings have been calculated using NJ Tech Manual FY20.

Design Considerations

- Integrating controls with BMS and hydronic distribution system.

Maintenance Considerations

- VFDs, pumps and pump motors shall be maintained as per manufacturer's guidelines.

ECM 3: Install High Efficiency Roof Top Units

Existing Conditions

A thorough survey was conducted at Sayreville Middle School. Currently, the gymnasium and the library do not have the capability of cooling the space.

ECM Description

Willdan recommends installation of either a rooftop unit or split system in the gym and library to add cooling to the space. From an energy savings point of view, adding cooling to the space yields a negative energy savings from existing conditions. However, this ECM accounts for energy savings.

Measure Baseline and Proposed Upgrades

Baseline:

- Two (2) Unit ventilators for heating only in the gym.
- Two (2) Unit ventilators for heating only in the library.

Proposed

- Gas fired Rooftop Unit with DX cooling or split system with DX coils for the gym and the library.

Calculation Methodology

Savings have been calculated using NJ Tech Manual FY20.

Design Considerations

- Integrating controls with BMS and hydronic distribution system.

Maintenance Considerations

- Equipment shall be maintained as per manufacturer's guidelines.
- Changing of filters at regular intervals.

ECM 4: Replace existing boilers with Condensing Boilers

Existing Conditions

A thorough survey was conducted at Sayreville Middle School. The hydronic distribution system for the school is divided into three (3) section, each serving a wing of the school. Each of this loop has dedicated boiler(s). There are two (2) 5000 MBH boilers installed in 2000, two (2) 1700 MBH condensing boilers installed in 2008 and one (1) 215 MBH boiler installed in 2013 that fulfill the heating load of the school.

ECM Description

Willdan recommends replacing two (2) 5000 MBH existing gas-fired hot water boilers with 2) new 5,000MBH condensing boilers. The average expectancy of a traditional gas boiler is 20 years. The existing boilers inspected were inspected and found to be functional, but they are at the end of their useful service life. A condensing boiler extracts additional heat from the waste gases by condensing this water vapor to liquid water, thus recovering its latent heat of vaporization. While the effectiveness of the condensing process varies depending on the temperature of the water returning to the boiler, it is always at least as efficient as a non-condensing boiler. Compared to 77 - 80% with conventional designs, the proposed condensing boiler efficiency was conservatively taken as 88% based on the expected heating hot water return temperatures in the building. This ECM will be fulfilled through New Jersey Clean Energy Program's (NJCEP) SmartStart Program.

Measure Baseline and Proposed Upgrades

Baseline:

- Two (2) 5000 MBH Universal Boiler Works boilers.

Proposed

- Two (2) 5000 MBH Lochinvar Crest boilers.
- These boilers will operate at noncondensing boiler during design conditions, but will operate near condensing or condensing return hot water temperature during milder winter months or shoulder months

Calculation Methodology

Savings have been calculated using NJ Tech Manual FY20.

Design Considerations

- Integration with the energy management system and existing distribution system
- Install all new heating equipment sized with supply HW temperature at 140F and return below condensing range improving overall boiler efficiency
- Rigging & demolition of existing units.
- Scheduling of unit downtime during construction.
- New breeching and flue design

Maintenance Considerations

- Boilers shall be maintained as per manufacturer's guidelines.

ECM 5: Building Management System (BMS)

Existing Conditions

A thorough survey was conducted at Sayreville Middle school. The facility is served with 3 different BMS systems. First, D-wing has a modern, DDC (Automated Logic) system/platform. E-wing, which operates as a change-over bypass/variable volume, variable temperature system with zone dampers, sees its rooftop units on the Automated Logic system, but its zone dampers and rooms controls are an older, disconnected zoning system. Lastly, the hot water plant serving the remainder of the facility is on a Johnson Controls Metasys system/platform. This platform has no graphic floorplans and is tree-logic only.

ECM Description

Willdan recommends providing open protocol ALC front end and integrate existing BMS, as well as controls system for newly installed HVAC equipment. With the communication between the control devices and the new updated digital interface/software, will give the opportunity to take advantage of better scheduling, temperature set-back controls based on outside air temperature and occupancy levels while maintaining adequate heating, cooling and ventilation requirements in the facility. Implementation of this measure is also important in achieving full potential of other measures recommended by providing the necessary means of properly controlling the equipment.

Measure Baseline and Proposed Upgrades

Baseline:

- Automated Logic controlling heating system and several Energy Recovery units.
- No digital controls for the existing unit ventilators.
- Limited controls for few wings in high school, which operates many equipment longer than required

Proposed

- Install (1) front end web enabled ALC
- Integrate (3) hot water systems controls
- Integrate following equipment existing controls to new building management system
    - Gym and Library HVAC unit(s).
- Integrate condensing boilers.

Calculation Methodology

Savings have been calculated using New York Power Authority's Tech manual.

Design Considerations

- Resetting hot water loop based on Outside Air instead of demand.
- Scheduling setbacks for RTUs.
- Furnish owner training
- Setup data trending
- Setup remote alarming via email or SMS text
- Resetting hot water loop based on Outside Air instead of demand.



- Program demand control ventilation for all the open areas
- More detail is provided in the appendix

Maintenance Considerations

- Ongoing maintenance shall be performed by the control's contractor.

ECM 7: Vending Machine Controls

Existing Conditions

There is one (1) refrigerated beverage vending machine at the school. It is currently not equipped with an occupancy-based control and is operated 24/7.

ECM Description

Willdan recommends installing occupancy sensor controls for vending machines. Vending machines operate continuously, even during unoccupied hours and consumes several hundred dollars per year in electrical energy costs. The installation of the Vending Miser product will reduce the run time of the vending machines during periods when no occupancy is sensed in the area surrounding the machines. The smart electronics in the device will ensure product is kept cold through a cycling process while reducing total energy consumption. Another benefit from implementing vending miser controls is extended useful equipment life due to reduced lifetime. Energy savings are dependent on the vending machine and activity level in the area surrounding the machines. This ECM can be successfully implemented with proper permissions from the supplier, if necessary.

Measure Baseline and Proposed Upgrades

Baseline

- One (1) existing refrigerated vending machine operated 24/7.

Proposed

- Install occupancy sensor (vending miser controls) for the refrigerated vending machines.

Calculation Methodology

Energy savings have recognized from the NJ Tech Manual FY20.

Maintenance Considerations

Ongoing maintenance shall be performed by the control's contractor.

ECM 8: Plug Load Controls

Existing Conditions

There are 229 plugged control points at the Middle School that power Desktop PCs and printers. These devices have no control from the plug point.

ECM Description

Willdan recommends installing a wireless plug load device at these locations which enables a scheduled control of the devices throughout the year. Schneider Electric's BERT Control offers a user-friendly user interface that can be operated from the comfort of a Smartphone.

Measure Baseline and Proposed Upgrades

Baseline

- 229 Plug points, uncontrolled.

Proposed

- Simple plugging of BERT CONTROL plug to 229 plug points.

Calculation Methodology

Energy savings have been calculated using operational hours of the school and NJ Tech Manual FY20.

Maintenance Considerations

- Updating the front-end software.

ECM-10/10.1: Install Solar PV Panels

Existing Conditions

There is no solar photovoltaic system installed at the school.

ECM Description

Willdan recommends installing a solar photovoltaic system to reduce dependence on the electric grid. The solar system can provide 680,516 kWh of electricity annually. Solar panels work by absorbing sunlight with photovoltaic cells, generating direct current (DC) energy and then converting it to usable alternating current (AC) energy with the help of inverter technology. AC energy then flows through the home's electrical panel and is distributed accordingly. In order to maximize the solar generation at the middle school, some roof upgrades must be performed in order to obtain a desired roof warranty. A budget of $20,000 is allotted for the upgrade to enable the solar panels on the roof.

Design Considerations

- Effect on utility tariffs and rate structures.
- Integration with existing building infrastructure

Maintenance Considerations

- As agreed within the PPA

Samsel Upper Elementary School

The table below highlights the ECMs considered and the overall savings for Samsel Upper Elementary School.

Table 58: Samsel Upper ES ECMs

Measure		Annual Estimated Savings				CO_2 Emission Savings (lbs)	Estimated Implementation Cost ($)	Estimated Simple Payback Period
		Electricity (kWh)	Annual Demand (kW)	Natural Gas (Therms)	Cost Savings ($)			
ECM-1	LED Lighting	218,769	64	-	$26,401	332,529	$199,090	8
ECM-2	Premium Efficiency Motors W/ VFD	7,919	-	-	$956	12,037	$15,000	16
ECM-3	Install High Efficiency Roof Top Units	(51,746)	-	1,410	-$5,031	(62,158)	$807,950	-161
ECM-5	Building Management System (BMS)	1,193	-	-	$144	1,814	$100,000	694
ECM-7	Vending Misers	1,612	0	-	$195	2,450	$600	3
ECM-8	Plug Load Controls	25,494	-	-	$3,077	38,751	$37,200	12
ECM-9	Transformer Upgrades	96,733	13	-	$11,674	147,034	$159,907	14
ECM-10	Add Photovoltaic System	510,184	461	-	$56,642	-	$0	N/A

ECM 1: LED Lighting Upgrades

Existing Conditions

A thorough survey was conducted at Samsel Upper Elementary School. A variety of lighting fixtures exist at the school. The most prevalent lamp type used in the school is 4-feet 32-watt linear fluorescent T8 lamps in fixtures equipped with 2, 3 or 4 lamps per fixture. Additionally, the range of lamps used in interior lighting varies from 4-feet T5 & T12 linear fluorescent lamps, 2-feet T8 linear fluorescent lamps and T8 U-bend fluorescent tubes. Fixtures using T5 and T8 lamps are equipped with electronic ballasts while T12 lamps are used with magnetic ballasts. There are also compact fluorescent and incandescent lamps used for interior lighting.

ECM Description

Willdan recommends retrofitting fixtures with T5, T8 and T12 lamps with the more efficient Linear LED tubes eliminating ballasts. The existing compact fluorescent and incandescent lamps will be replaced with compatible LED replacements. In addition to electric usage and demand savings, maintenance savings may also be achieved since LED lamps last longer than other light sources and therefore do not need to be replaced as often. All recommended lighting is DLC and/or Energy Star compliant. This ECM will be fulfilled through New Jersey Clean Energy Program's (NJCEP) SmartStart Program.

Measure Baseline and Proposed Upgrades

Baseline:

- Existing fluorescent

Proposed

- High-efficiency LED lighting fixtures

Calculation Methodology

Savings have been calculated using NJ Tech Manual FY20.

Maintenance Considerations

- None

ECM 2: Pump upgrades with controls

Existing Conditions

A thorough survey was conducted at Samsel Upper Elementary school. The school has two (2) circulation pumps for hot water, none equipped with controls. The pumps are operated at constant volume.

ECM Description

Willdan recommends a 1-for-1 replacement of the existing pumps with premium efficiency motors for circulation. With the upgrade, Willdan also recommends installing VFD controls on the new pump, along with installing 2-way valves at the terminal units and a pressure differential sensor at the retuning end of the circulation loop to achieve the variable flow. Since motor power consumption is proportional to the cube of the shaft speed under ideal conditions, running pumps at lower speeds provides energy savings when compared to operating pumps at full speed. For example, a 20% reduction in pump motor speed results in approximately a 50% reduction in pumping energy consumption.

Measure Baseline and Proposed Upgrades

Baseline:

- Two (2) 40 HP pumps for hot water circulation.

Proposed

- VFD control on two (2) pumps.
- Conversion of all 3-way valves to 2-way valves for optimum variable flow.

Calculation Methodology

Savings have been calculated using NJ Tech Manual FY20.

Design Considerations

- Integrating controls with BMS and hydronic distribution system.

Maintenance Considerations

- VFDs, pumps and pump motors shall be maintained as per manufacturer's guidelines.

ECM 3: Install High Efficiency Roof Top Units

Existing Conditions

A thorough survey was conducted at Samsel Upper Elementary School. Currently, the gymnasium, auxiliary gymnasium and the cafeteria do not have the capability of cooling the space.

ECM Description

Willdan recommends installation of either a rooftop unit or split system in the gym, auxiliary gym and cafeteria to add cooling to the space. From an energy savings point of view, adding cooling the space yields a negative energy savings from existing conditions. However overall, this ECM is considered as an energy savings measure.

Measure Baseline and Proposed Upgrades

Baseline:

- Two (2) Unit ventilators for heating only in the gym.
- Two (2) Unit ventilators for heating only in the cafeteria.

Proposed

- Gas fired Rooftop Unit with DX cooling or split system with DX coils for the gym (4).
- Gas fired Rooftop Unit with DX cooling or split system with DX coils for the cafeteria (2).

Calculation Methodology

Savings have been calculated using NJ Tech Manual FY20.

Design Considerations

- Integrating controls with BMS and/or hydronic distribution system.

Maintenance Considerations

- Equipment shall be maintained as per manufacturer's guidelines.
- Changing of filters at regular intervals.

ECM 5: Building Management System (BMS)

Existing Conditions

A thorough survey was conducted at Samsel Upper Elementary school. The school has a BMS control system through Johnson Controls that provides individual control to different systems.

ECM Description

Willdan recommends providing open protocol ALC front end and integrate existing BMS, as well as controls system for newly installed HVAC equipment. With the communication between the control devices and the new updated digital interface/software, this will give the opportunity to take advantage of better scheduling, temperature set-back controls based on outside air temperature and occupancy levels while maintaining adequate heating, cooling and ventilation requirements in the facility. Implementation of this

measure is also important in achieving full potential of other measures recommended by providing the necessary means of properly controlling the equipment.

Measure Baseline and Proposed Upgrades

Baseline:

- Automated Logic controlling heating system and several Energy Recovery units.
- No digital controls for the existing unit ventilators.
- Limited controls for few wings in high school, which operates many equipment longer than required

Proposed

- Install (1) front end web enabled ALC
- Integrate hot water systems controls
- Integrate following equipment existing controls to new building management system
    - New Hot-water loop.
- Integrate condensing boilers.

Calculation Methodology

Savings have been calculated using New York Power Authority's Tech manual.

Design Considerations

- Resetting hot water loop based on Outside Air instead of demand.
- Scheduling setbacks for RTUs.
- Furnish owner training
- Setup data trending
- Setup remote alarming via email or SMS text
- Resetting hot water loop based on Outside Air instead of demand.
- Program demand control ventilation for all the open areas
- More detail is provided in the appendix

Maintenance Considerations

- Ongoing maintenance shall be performed by the control's contractor.

ECM 7: Vending Machine Controls

Existing Conditions

There is one (1) refrigerated beverage vending machine at the School. It is currently not equipped with an occupancy-based controls and is operated 24/7.

ECM Description

Willdan recommends installing occupancy sensor controls for vending machines. Vending machines operate continuously, even during unoccupied hours and consumes several hundred dollars per year in electrical energy costs. The installation of the Vending Miser product will reduce the run time of the vending machines during periods when no occupancy is sensed in the area surrounding the machines. The smart electronics in the device will ensure product is kept cold through a cycling process while reducing total energy consumption. Another benefit from implementing vending miser controls is extended useful equipment life due to reduced lifetime. Energy savings are dependent on the vending machine and activity level in the area surrounding the machines. This ECM can be successfully implemented with proper permissions from the supplier, if necessary.

Measure Baseline and Proposed Upgrades

Baseline

- One (1) existing refrigerated vending machine operated 24/7.

Proposed

- Install occupancy sensor (vending miser controls) for the refrigerated vending machines.

Calculation Methodology

Energy savings have been recognized from NJ Tech Manual FY20.

Maintenance Considerations

Ongoing maintenance shall be performed by the control's contractor.

ECM 8: Plug Load Controls

Existing Conditions

There are 248 plugged control points at Samsel Elementary School that power Desktop PCs and printers. These devices have no control from the plug point.

ECM Description

Willdan recommends installing a wireless plug load device at these locations which enables a scheduled control of the devices throughout the year. Schneider Electric's BERT Control offers a user-friendly user interface that can be operated from the comfort of a Smartphone.

Measure Baseline and Proposed Upgrades

Baseline

- 248 Plug points, uncontrolled.

Proposed

- Simple plugging of BERT CONTROL plug to 248 plug points.

Calculation Methodology

Energy savings have been calculated using operational hours of the school and NJ Tech Manual FY20.

Maintenance Considerations

- Updating the front-end software.

ECM 9: Install Energy Efficient Transformers

Existing Conditions

An on-site detailed survey of the dry-type transformers throughout the facilities was performed by Powersmiths. The facility consists of 22 transformers with various kVA capacities ranging from 15 kVA to 112.5 kVA. The transformers are operating at a small fraction of their nameplate capacity, resulting in very low efficiency, and are often producing large amounts of excess heat, resulting in energy losses, and higher electric costs.

ECM Description

Willdan recommends replacing the dry-type transformers with E-Saver transformers. Designed to provide the lowest life cycle cost, the E-Saver goes beyond US DOE 2016 efficiency, ensuring lower operating losses than standard off-the-shelf transformers. To provide superior performance and reduce environmental impact, the E-Saver comes with a superior Nomex based insulation system impregnated with an organic epoxy adhesive. Superior insulation prevents shorts as well, substantially prolonging the life of the transformer. Based on the detailed field survey, the replacement E-Saver transformers will be a like-for-like, nominal kVA capacity, designed and manufactured to minimize losses for the application and fit within the existing constraints. This ECM can achieve energy saving by increasing the transformer efficiency.

Measure Baseline and Proposed Upgrades

Baseline

- 22 transformers

Proposed

- 22 E-Saver-80R transformers as shown in the list below.

								Adjustments						
Transformer Count	Tag Number	Location ID or Room #	Transformer Designation	Proposed Powersmiths OPAL Transformer	Baseline kVA	Replacement kVA	Replace	Bseline % Load During Normal Operating Hours	Baseline % Load Outside Operating Hours	Powersmiths % Load During Normal Operating Hours	Powersmiths % Load Outside Operating Hours	Equipment Operating hrs/ day	Equipment Operating days/yr	A/C System Performance (kW/ton)
1	78530	Main elec	RBA	E-Saver-80R	75	75	1	8.4%	3.0%	8.4%	3.0%	12	200	0
2	78531	Main Elec	CBA	E-Saver-80R	15	15	1	13.2%	8.0%	13.2%	8.0%	12	200	0
3	78532	101 Storage	RBB	E-Saver-80R	112.5	112.5	1	9.3%	4.0%	9.3%	4.0%	12	200	0
4	78533	101 Storage	CBB	E-Saver-80R	30	30	1	10.1%	5.0%	10.1%	5.0%	12	200	0
5	78534	238 Storage	R1B	E-Saver-80R	112.5	112.5	1	9.3%	4.0%	9.3%	4.0%	12	200	0
6	78535	238 storage	R1BM	E-Saver-80R	30	30	1	10.1%	5.0%	10.1%	5.0%	12	200	0
7	78536	238 Storage	C1B	E-Saver-80R	45	45	1	9.2%	4.0%	9.2%	4.0%	12	200	0
8	78537	234 Closet	R1A	E-Saver-80R	75	75	1	8.4%	3.0%	8.4%	3.0%	12	200	0
9	78538	234 Storage	C1A	E-Saver-80R	15	15	1	13.2%	8.0%	13.2%	8.0%	12	200	0
10	78539	337 Storage	3H	E-Saver-80R	30	30	1	10.1%	5.0%	10.1%	5.0%	12	200	0
11	78540	332 Storage	C2D	E-Saver-80R	30	30	1	10.1%	5.0%	10.1%	5.0%	12	200	0
12	78541	332 Storage	R2D	E-Saver-80R	45	45	1	9.2%	4.0%	9.2%	4.0%	12	200	0
13	78542	316 Storage	R2C	E-Saver-80R	45	45	1	9.2%	4.0%	9.2%	4.0%	12	200	0
14	78543	316 Storage	C2C	E-Saver-80R	45	45	1	9.2%	4.0%	9.2%	4.0%	12	200	0
15	78544	316 Storage	R2C	E-Saver-80R	75	75	1	8.4%	3.0%	8.4%	3.0%	12	200	0
16	78545	376 Storage	R2B	E-Saver-80R	45	45	1	9.2%	4.0%	9.2%	4.0%	12	200	0
17	78546	376 Storage	R2B	E-Saver-80R	75	75	1	8.4%	3.0%	8.4%	3.0%	12	200	0
18	78547	376 Mech	C2B	E-Saver-80R	45	45	1	9.2%	4.0%	9.2%	4.0%	12	200	0
19	78549	344 Mech	C2A	E-Saver-80R	30	30	1	10.1%	5.0%	10.1%	5.0%	12	200	0.75
20	78550	344 Mech	AC-2	E-Saver-80R	30	30	1	10.1%	5.0%	10.1%	5.0%	12	200	0.75
21	78551	344 Mech	R2A	E-Saver-80R	45	45	1	9.2%	4.0%	9.2%	4.0%	12	200	0.75
22	78552	344 Mech	R2F	E-Saver-80R	30	30	1	10.1%	5.0%	10.1%	5.0%	12	200	0.75

Figure 76: Samsel Upper ES Transformer ECM



Calculation Methodology

Energy savings have been calculated using excel spreadsheet.

Design Considerations

- Coordination with facility manager to minimize the effect on day-to-day operation.
- Disruption to electrical loads served by existing transformers.
- Seasonal loading on transformers.

Maintenance Considerations

- As recommended by the manufacturer

ECM-10: Install Solar PV Panels

Existing Conditions

There is no solar photovoltaic system installed at the school.

ECM Description

Willdan recommends installing a solar photovoltaic system to reduce dependence on the electric grid. The solar system can provide 510,184 kWh of electricity annually. Solar panels work by absorbing sunlight with photovoltaic cells, generating direct current (DC) energy and then converting it to usable alternating current (AC) energy with the help of inverter technology. AC energy then flows through the home's electrical panel and is distributed accordingly.

Design Considerations

- Effect on utility tariffs and rate structures.
- Integration with existing building infrastructure

Maintenance Considerations

- As agreed within the PPA.

Harry S Truman Elementary School

The table below highlights the ECMs considered and the overall savings for Harry S Truman Elementary School.

Table 59: Harry Truman ES ECMs

Measure		Annual Estimated Savings				CO_2 Emission Savings (lbs)	Estimated Implementation Cost ($)	Estimated Simple Payback Period
		Electricity (kWh)	Annual Demand (kW)	Natural Gas (Therms)	Cost Savings ($)			
ECM-1	LED Lighting	45,535	15	-	$5,495	69,213	$30,931	6
ECM-2	Premium Efficiency Motors W/ VFD	8,381	-	-	$1,011	12,739	$48,500	48
ECM-4	Install High Efficiency Hot Water Boilers	-	-	2,569	$2,212	30,057	$210,000	95
ECM-5	Building Management System (BMS)	611	1	913	$860	11,611	$90,000	105
ECM-7	Vending Misers	1,612	0	-	$195	2,450	$600	3
ECM-8	Plug Load Controls	5,962	-	-	$720	9,063	$8,700	12
ECM-10	Add Photovoltaic	273,375	240	-	$34,111	-	$0	N/A
ECM-10.1	ECM 10 Enabler - Roof Upgrades	-	-	-	-	-	$15,000	N/A

ECM 1: LED Lighting Upgrades

Existing Conditions

A thorough survey was conducted at Harry Truman school. A variety of lighting fixtures exist at the school. The most prevalent lamp type used in the school is 4-feet 32-watt linear fluorescent T8 lamps in fixtures equipped with 2, 3 or 4 lamps per fixture. Additionally, the range of lamps used in interior lighting varies from 4-feet T5 & T12 linear fluorescent lamps, 2-feet T8 linear fluorescent lamps and T8 U-bend fluorescent tubes. Fixtures using T5 and T8 lamps are equipped with electronic ballasts while T12 lamps are used with magnetic ballasts. There are also compact fluorescent and incandescent lamps used for interior lighting.

ECM Description

Willdan recommends retrofitting fixtures with T5, T8 and T12 lamps with the more efficient Linear LED tubes, eliminating ballast from the fixtures. The existing compact fluorescent and incandescent lamps will be replaced with compatible LED replacements. In addition to electric usage and demand savings, maintenance savings may also be achieved since LED lamps last longer than other light sources, and therefore, do not need to be replaced as often. All recommended lighting is DLC and/or Energy Star compliant. This ECM will be fulfilled through New Jersey Clean Energy Program's (NJCEP) Direct Install (DI), an energy efficiency upgrade program for existing small to mid-size commercial and industrial facilities that pays up to 70% of the retrofit costs, dramatically improving the payback on the project. Entities owned or operated by municipalities, counties, K-12 public schools, and customers located in Urban Enterprise Zones or Opportunity Zones may be eligible for up to 80% of the cost of installed measures. Based on the yearly electric demand, Harry Truman school is slightly above the maximum threshold eligible under DI. However, Willdan has submitted an appeal to revoke the eligibility in order to benefit from program. Should the appeal be denied, Willdan will approach SmartStart as the choice of incentive program. Savings will remain consistent.

Measure Baseline and Proposed Upgrades

Baseline:

- Existing fluorescent

Proposed

- High-efficiency LED lighting fixtures

Calculation Methodology

Savings have been calculated using NJ Tech Manual FY20. A baseline excel calculation workbook has been setup to calibrate the existing school system and operation conditions against the utility bills. Savings from lighting upgrade have been calculated using the DI EAT tool V4c.

Maintenance Considerations

- None

ECM 2: Upgrade existing pumps with VFD controls

Existing Conditions

A thorough survey was conducted at Harry S Truman Elementary school. The school has two (2) circulation pumps for hot. The pumps are operated at constant volume.

ECM Description

Willdan recommends installing VFD controls on the circulation pumps along with installing 2-way valves at the terminal units and a pressure differential sensor at the retuning end of the circulation loop to achieve the variable flow. Since motor power consumption is proportional to the cube of the shaft speed under ideal conditions, running pumps at lower speeds provides energy savings when compared to operating pumps at full speed. For example, a 20% reduction in pump motor speed results in approximately a 50% reduction in pumping energy consumption.

Measure Baseline and Proposed Upgrades

Baseline:

- Two (2) 5 HP pumps for hot water circulation.
- One (1) 15 HP pump for chilled water circulation.

Proposed

- Two (2) 5 HP premium efficiency pumps for hot water circulation.
- One (1) 15 HP premium efficiency pump for chilled water circulation.
- VFD control on three (3) pumps.
- Conversion of all 3-way valves to 2-way valves for optimum variable flow.

Calculation Methodology

Savings have been calculated using NJ Tech Manual FY20. A baseline excel calculation workbook has been setup to calibrate the existing school system and operation conditions against the utility bills. Savings from pump upgrade have been calculated using the excel spreadsheet.

Design Considerations

- Integrating controls with BMS and hydronic distribution system.

Maintenance Considerations

- VFDs, pumps and pump motors shall be maintained as per manufacturer's guidelines.

ECM 4: Replace existing boilers with Condensing Boilers

Existing Conditions

A thorough survey was conducted at Harry Truman School. The hydronic distribution system for the school served by three (3) 700 MBH boilers installed in 2006.

ECM Description

Willdan recommends replacing three (3) existing gas-fired hot water heaters with condensing boilers. The average expectancy of a traditional gas boiler is 20 years. The existing boilers inspected were inspected and found to be functional, but they are at the end of their useful service life. A condensing boiler extracts additional heat from the waste gases by condensing this water vapor to liquid water, thus recovering its latent heat of vaporization. While the effectiveness of the condensing process varies depending on the temperature of the water returning to the boiler, it is always at least as efficient as a non-condensing boiler. Compared to 77 - 80% with conventional designs, the proposed condensing boiler efficiency was conservatively taken as 88% based on the expected heating hot water return temperatures in the building. This ECM will be fulfilled through New Jersey Clean Energy Program's (NJCEP) SmartStart prescriptive program.

Measure Baseline and Proposed Upgrades

Baseline:

- Three (3) 700 MBH Universal Boiler Works boilers.

Proposed

- Three (3) 800 MBH AERCO boilers.

Calculation Methodology

Savings have been calculated using NJ Tech Manual FY20. A baseline excel calculation workbook has been setup to calibrate the existing school system and operation conditions against the utility bills.

Design Considerations

- Integration with the energy management system and existing distribution system.
- Install all new heating equipment sized with supply HW temperature at 140F and return below condensing range, improving the overall boiler efficiency.
- Rigging & demolition of existing units.
- Scheduling of unit downtime during construction.
- New breeching and flue design

Maintenance Considerations

- Boilers shall be maintained as per manufacturer's guidelines.

ECM 5: Building Management System (BMS)

Existing Conditions

A thorough survey was conducted at Harry S Truman Elementary school. The school has no BMS control system.

ECM Description

Willdan recommends providing open protocol ALC front end and integrate existing BMS, as well as controls system for newly installed HVAC equipment. With the communication between the control devices and the new updated digital interface/software, this will give the opportunity to take advantage of better scheduling, temperature set-back controls based on outside air temperature and occupancy levels while maintaining adequate heating, cooling and ventilation requirements in the facility. Implementation of this measure is also important in achieving full potential of other measures recommended by providing the necessary means of properly controlling the equipment.

Measure Baseline and Proposed Upgrades

Baseline:

- No existing BMS.
- No digital controls for the existing unit ventilators.

Proposed

- Install (1) front end web enabled ALC
- Integrate (1) hot water system controls
- Integrate (1) chilled water system controls

Calculation Methodology

Savings have been calculated using New York Power Authority's Tech Manual.

Design Considerations

- Resetting hot water loop based on Outside Air instead of demand.
- Furnish 3-D Graphics
- Furnish owner training
- Setup data trending
- Setup remote alarming via email or SMS text
- Resetting hot water loop based on Outside Air instead of demand.
- Program demand control ventilation for all the open areas
- More detail is provided in the appendix

Maintenance Considerations

- Service Contract is recommended to maintain persistence of BMS measure.

ECM 7: Vending Machine Controls

Existing Conditions

There is one (1) refrigerated beverage vending machine at the School. It is currently not equipped with an occupancy-based controls and is operated 24/7.

ECM Description

Willdan recommends installing occupancy sensor controls for vending machines. Vending machines operate continuously, even during unoccupied hours and consumes several hundred dollars per year in electrical energy costs. The installation of the Vending Miser product will reduce the run time of the vending machines during periods when no occupancy is sensed in the area surrounding the machines. The smart electronics in the device will ensure product is kept cold through a cycling process while reducing total energy consumption. Another benefit from implementing vending miser controls is extended useful equipment life due to reduced lifetime. Energy savings are dependent on the vending machine and activity level in the area surrounding the machines. This ECM can be successfully implemented with proper permissions from the supplier, if necessary.

Measure Baseline and Proposed Upgrades

Baseline

- One (1) existing refrigerated vending machine operated 24/7.

Proposed

- Install occupancy sensor (vending miser controls) for the refrigerated vending machines.

Calculation Methodology

Energy savings have been recognized using the NJ Tech Manual FY20.

Maintenance Considerations

Ongoing maintenance shall be performed by the control's contractor.

ECM 8: Plug Load Controls

Existing Conditions

There are 58 plugged control points at Truman Elementary School that power Desktop PCs and printers. These devices have no control from the plug point.

ECM Description

Willdan recommends installing a wireless plug load device at these locations which enables a scheduled control of the devices throughout the year. Schneider Electric's BERT Control offers a user-friendly user interface that can be operated from the comfort of a Smartphone.

Measure Baseline and Proposed Upgrades

Baseline

- 58 Plug points, uncontrolled.

Proposed

- Simple plugging of BERT CONTROL plug to 58 plug points.

Calculation Methodology

Energy savings have been calculated using operational hours of the school and NJ Tech Manual FY20.

Maintenance Considerations

- Updating the front-end software.

ECM-10/10.1: Install Solar PV Panels

Existing Conditions

There is no solar photovoltaic system installed at the school.

ECM Description

Willdan recommends installing a solar photovoltaic system to reduce dependence on the electric grid. The solar system can provide 273,375 kWh of electricity annually. Solar panels work by absorbing sunlight with photovoltaic cells, generating direct current (DC) energy and then converting it to usable alternating current (AC) energy with the help of inverter technology. AC energy then flows through the home's electrical panel and is distributed accordingly. In order to maximize the solar generation at the school, some roof upgrades must be performed in order to obtain a desired roof warranty. A budget of $15,000 is allotted for the upgrade to enable the solar panels on the roof.

Design Considerations

- Effect on utility tariffs and rate structures.
- Integration with existing building infrastructure

Maintenance Considerations

- As agreed within the PPA.

Dwight D Eisenhower Elementary School

The table below highlights the ECMs considered and the overall savings for Dwight D Eisenhower Elementary School.

Table 60: Dwight Eisenhower ES ECMs

Measure		Annual Estimated Savings				CO_2 Emission Savings (lbs)	Estimated Implementation Cost ($)	Estimated Simple Payback Period
		Electricity (kWh)	Annual Demand (kW)	Natural Gas (Therms)	Cost Savings ($)			
ECM - 1	LED Lighting	39,317	13	-	$4,745	59,762	$21,354	132
ECM - 2	Premium Efficiency Motors W/ VFD	2,072	-	-	$250	3,149	$33,125	132
ECM - 4	Install High Efficiency Hot Water Boilers	-	-	2,997	$2,581	35,065	$356,400	138
ECM - 5	Building Management System (BMS)	1,186	1	483	$559	7,454	$95,000	170
ECM - 7	Vending Misers	1,612	0	-	$195	2,450	$600	3
ECM - 8	Plug Load Controls	6,990	-	-	$844	10,625	$10,200	12
ECM-10	Add Photovoltaic	153,044	135	-	$17,315	-	$0	N/A
ECM-10.1	ECM 10 Enabler - Roof Upgrades	-	-	-	-	-	$15,000	N/A

ECM 1: LED Lighting Upgrades

Existing Conditions

A thorough survey was conducted at Dwight Eisenhower school. A variety of lighting fixtures exist at the school. The most prevalent lamp type used in the school is 4-feet 32-watt linear fluorescent T8 lamps in fixtures equipped with 2, 3 or 4 lamps per fixture. Additionally, the range of lamps used in interior lighting varies from 4-feet T5 & T12 linear fluorescent lamps, 2-feet T8 linear fluorescent lamps and T8 U-bend fluorescent tubes. Fixtures using T5 and T8 lamps are equipped with electronic ballasts while T12 lamps are used with magnetic ballasts. There are also compact fluorescent and incandescent lamps used for interior lighting.

ECM Description

Willdan recommends retrofitting fixtures with T5, T8 and T12 lamps with the more efficient Linear LED tubes, eliminating ballasts from the fixtures. The existing compact fluorescent and incandescent lamps will be replaced with compatible LED replacements. In addition to electric usage and demand savings, maintenance savings may also be achieved since LED lamps last longer than other light sources, and therefore, do not need to be replaced as often. All recommended lighting is DLC and/or Energy Star compliant. This ECM will be fulfilled through New Jersey Clean Energy Program's (NJCEP) Direct Install (DI), an energy efficiency upgrade program for existing small to mid-size commercial and industrial facilities that pays up to 70% of the retrofit costs, dramatically improving the payback on the project. Entities owned or operated by municipalities, counties, K-12 public schools, and customers located in Urban Enterprise Zones or Opportunity Zones may be eligible for up to 80% of the cost of installed measures.

Measure Baseline and Proposed Upgrades

Baseline:

- Existing fluorescent

Proposed

- High-efficiency LED lighting fixtures



Calculation Methodology

Savings have been calculated using NJ Tech Manual FY20. A baseline excel calculation workbook has been setup to calibrate the existing school system and operation conditions against the utility bills. Savings from lighting upgrade have been calculated using the DI EAT tool V4c.

Maintenance Considerations

- None

ECM 2: Pump upgrades with controls

Existing Conditions

A thorough survey was conducted at Dwight Eisenhower School. The school has three (3) circulation pumps for hot water. The pumps are operated at constant volume with no controls.

ECM Description

Willdan recommends a 1-for-1 replacement of the existing pumps with premium efficiency motors for circulation. With the upgrade, Willdan also recommends installing VFD control on the new pumps along with installing 2-way valves at the terminal units and a pressure differential sensor at the retuning end of the circulation loop to achieve the variable flow. Since motor power consumption is proportional to the cube of the shaft speed under ideal conditions, running pumps at lower speeds provides energy savings when compared to operating pumps at full speed. For example, a 20% reduction in pump motor speed results in approximately a 50% reduction in pumping energy consumption.

Measure Baseline and Proposed Upgrades

Baseline:

- Three (3) 5 HP pumps for hot water circulation.

Proposed

- Three (3) 5 HP premium efficiency pumps for hot water circulation.
- VFD control on three (3) pumps.
- Conversion of all 3-way valves to 2-way valves for optimum variable flow.

Calculation Methodology

Savings have been calculated using NJ Tech Manual FY20. A baseline excel calculation workbook has been setup to calibrate the existing school system and operation conditions against the utility bills. Savings from pump upgrade have been calculated using the excel spreadsheet.

Design Considerations

- Integrating controls with BMS and hydronic distribution system.

Maintenance Considerations

- VFDs, pumps and pump motors shall be maintained as per manufacturer's guidelines.

ECM 4: Replace existing boilers with Condensing Boilers

Existing Conditions

A thorough survey was conducted at Dwight Eisenhower School. The hydronic distribution system for the school served by four (4) 2000 MBH boilers installed in 2006.

ECM Description

Willdan recommends replacing four (4) existing gas-fired hot water heaters with condensing boilers. The average expectancy of a traditional gas boiler is 20 years. The existing boilers inspected were inspected and found to be functional, but they are at the end of their useful service life. A condensing boiler extracts additional heat from the waste gases by condensing this water vapor to liquid water, thus recovering its latent heat of vaporization. While the effectiveness of the condensing process varies depending on the temperature of the water returning to the boiler, it is always at least as efficient as a non-condensing boiler. Compared to 77 - 80% with conventional designs, the proposed condensing boiler efficiency was conservatively taken as 88% based on the expected heating hot water return temperatures in the building. This ECM will be fulfilled through

New Jersey Clean Energy Program's (NJCEP) SmartStart prescriptive program. An important fact to consider is the selection of the heating coils for the unit ventilators.

Measure Baseline and Proposed Upgrades

Baseline:

- Four (4) 2000 MBH Patterson-Kelly.

Proposed

- Four (4) 2000 MBH Aerco boilers.

Calculation Methodology

Savings have been calculated using NJ Tech Manual FY20. A baseline excel calculation workbook has been setup to calibrate the existing school system and operation conditions against the utility bills.

Design Considerations

- Integration with the energy management system and existing distribution system.
- Install all new heating equipment sized with supply HW temperature at 140F and return below condensing range to improve the overall boiler efficiency
- Rigging & demolition of existing units.
- Scheduling of unit downtime during construction.
- New breeching and flue design

Maintenance Considerations

- Boilers shall be maintained as per manufacturer's guidelines.

ECM 5: Building Management System (BMS)

Existing Conditions

A thorough survey was conducted at Dwight Eisenhower Elementary school. The school has no BMS control system.

ECM Description

Willdan recommends providing open protocol ALC front end and integrate existing BMS, as well as controls system for newly installed HVAC equipment. With the communication between the control devices and the new updated digital interface/software, this will give the opportunity to take advantage of better scheduling, temperature set-back controls based on outside air temperature and occupancy levels while maintaining adequate heating, cooling and ventilation requirements in the facility. Implementation of this measure is also important in achieving full potential of other measures recommended by providing the necessary means of properly controlling the equipment.

Measure Baseline and Proposed Upgrades

Baseline:

- No existing BMS.
- No digital controls for the existing unit ventilators.

Proposed

- Install (1) front end web enabled ALC
- Integrate (1) hot water system controls
- Integrate proposed Rooftop Units or Split systems.

Calculation Methodology

Savings have been calculated using New York Power Authority's Tech Manual.

Design Considerations

- Resetting hot water loop based on Outside Air instead of demand.
- Furnish 3-D Graphics
- Furnish owner training
- Setup data trending
- Setup remote alarming via email or SMS text
- Resetting hot water loop based on Outside Air instead of demand.
- Program demand control ventilation for all the open areas
- More detail is provided in the appendix

Maintenance Considerations

- Service Contract is recommended to maintain persistence of BMS measure.

ECM 7: Vending Machine Controls

Existing Conditions

There is one (1) refrigerated beverage vending machine at the School. It is currently not equipped with an occupancy-based controls and is operated 24/7.

ECM Description

Willdan recommends installing occupancy sensor controls for vending machines. Vending machines operate continuously, even during unoccupied hours and consumes several hundred dollars per year in electrical energy costs. The installation of the Vending Miser product will reduce the run time of the vending machines during periods when no occupancy is sensed in the area surrounding the machines. The smart electronics in the device will ensure product is kept cold through a cycling process while reducing total energy consumption. Another benefit from implementing vending miser controls is extended useful equipment life due to reduced lifetime. Energy savings are dependent on the vending machine and activity level in the area surrounding the machines. This ECM can be successfully implemented with proper permissions from the supplier, if necessary.

Measure Baseline and Proposed Upgrades

Baseline

- One (1) existing refrigerated vending machine operated 24/7.

Proposed

- Install occupancy sensor (vending miser controls) for the refrigerated vending machines.

Calculation Methodology

Energy savings have been recognized using the NJ Tech Manual FY20.

Maintenance Considerations

Ongoing maintenance shall be performed by the control's contractor.

ECM 8: Plug Load Controls

Existing Conditions

There are 68 plugged control points at Eisenhower Elementary School that power Desktop PCs and printers. These devices have no control from the plug point.

ECM Description

Willdan recommends installing a wireless plug load device at these locations which enables a scheduled control of the devices throughout the year. Schneider Electric's BERT Control offers a user-friendly user interface that can be operated from the comfort of a Smartphone.

Measure Baseline and Proposed Upgrades

Baseline

- 68 Plug points, uncontrolled.

Proposed

- Simple plugging of BERT CONTROL plug to 68 plug points.

Calculation Methodology

Energy savings have been calculated using operational hours of the school and NJ Tech Manual FY20.

Maintenance Considerations

- Updating the front-end software.

ECM-10/10.1: Install Solar PV Panels

Existing Conditions

There is no solar photovoltaic system installed at the school.

ECM Description

Willdan recommends installing a solar photovoltaic system to reduce dependence on the electric grid. The solar system can provide 153,044 kWh of electricity annually. Solar panels work by absorbing sunlight with photovoltaic cells, generating direct current (DC) energy and then converting it to usable alternating current (AC) energy with the help of inverter technology. AC energy then flows through the home's electrical panel and is distributed accordingly. In order to maximize the solar generation at the school, some roof upgrades must be performed in order to obtain a desired roof warranty. A budget of $15,000 is allotted for the upgrade to enable the solar panels on the roof.

Design Considerations

- Effect on utility tariffs and rate structures.
- Integration with existing building infrastructure

Maintenance Considerations

- As agreed within the PPA.

Selover School

The table below highlights the ECMS considered and the overall savings for Selover School.

Table 61: Selover School ECMs

Measure		Annual Estimated Savings				CO_2 Emission Savings (lbs)	Estimated Implementation Cost ($)	Estimated Simple Payback Period
		Electricity (kWh)	Annual Demand (kW)	Natural Gas (Therms)	Cost Savings ($)			
ECM-1	LED Lighting	40,372	11	-	$4,872	61,365	$20,615	4
ECM-2	Premium Efficiency Motors W/ VFD	1,286	-	-	$155	1,955	$19,125	123
ECM-4	Install High Efficiency Hot Water Boilers	-	-	937	$807	10,968	$149,284	185
ECM-5	Building Management System (BMS)	1,176	1	422	$505	6,725	$85,000	168
ECM-7	Vending Misers	1,612	0	-	$195	2,450	$600	3
ECM-8	Plug Load Controls	7,710	-	-	$930	11,719	$11,250	12
ECM-10	Add Photovoltaic	81,968	144	-	$8,055	-	$0	N/A

ECM 1: LED Lighting Upgrades

Existing Conditions

A thorough survey was conducted at Selover school. A variety of lighting fixtures exist at the school. The most prevalent lamp type used in the school is 4-feet 32-watt linear fluorescent T8 lamps in fixtures equipped with 2, 3 or 4 lamps per fixture. Additionally, the range of lamps used in interior lighting varies from 4-feet T5 & T12 linear fluorescent lamps, 2-feet T8 linear fluorescent lamps and T8 U-bend fluorescent tubes. Fixtures using T5 and T8 lamps are equipped with electronic ballasts while T12 lamps are used with magnetic ballasts. There are also compact fluorescent and incandescent lamps used for interior lighting.

ECM Description

Willdan recommends retrofitting fixtures with T5, T8 and T12 lamps with the more efficient Linear LED tubes, eliminating ballast from the fixtures. The existing compact fluorescent and incandescent lamps will be replaced with compatible LED replacements. In addition to electric usage and demand savings, maintenance savings may also be achieved since LED lamps last longer than other light sources, and therefore, do not need to be replaced as often. All recommended lighting is DLC and/or Energy Star compliant. This ECM will be fulfilled through New Jersey Clean Energy Program's (NJCEP) Direct Install (DI), an energy efficiency upgrade program for existing small to mid-size commercial and industrial facilities that pays up to 70% of the retrofit costs, dramatically improving the payback on the project. Entities owned or operated by municipalities, counties, K-12 public schools, and customers located in Urban Enterprise Zones or Opportunity Zones may be eligible for up to 80% of the cost of installed measures.

Measure Baseline and Proposed Upgrades

Baseline:

- Existing fluorescent

Proposed

- High-efficiency LED lighting fixtures



Calculation Methodology

Savings have been calculated using NJ Tech Manual FY20. A baseline excel calculation workbook has been setup to calibrate the existing school system and operation conditions against the utility bills. Savings from lighting upgrade have been calculated using the DI EAT tool V4c.

Maintenance Considerations

- None

ECM 2: Pump upgrades with controls

Existing Conditions

A thorough survey was conducted at Selover School. The school has one (1) circulation pump for hot water and one (1) circulation pump for steam. The pumps are operated at constant volume with no controls.

ECM Description

Willdan recommends a 1-for-1 replacement of the existing pumps with premium efficiency motors for circulation. With the upgrade, Willdan also recommends installing VFD control on the new pumps along with installing 2-way valves at the terminal units and a pressure differential sensor at the retuning end of the circulation loop to achieve the variable flow. Since motor power consumption is proportional to the cube of the shaft speed under ideal conditions, running pumps at lower speeds provides energy savings when compared to operating pumps at full speed. For example, a 20% reduction in pump motor speed results in approximately a 50% reduction in pumping energy consumption.

Measure Baseline and Proposed Upgrades

Baseline:

- Two (2) 3 HP pumps for hot water circulation.

Proposed

- Two (2) 3 HP premium efficiency pumps for hot water circulation.
- VFD control on two (2) pumps.
- Conversion of all 3-way valves to 2-way valves for optimum variable flow.
- Decommissioning of two (2) condensate pumps from the steam system.

Calculation Methodology

Savings have been calculated using NJ Tech Manual FY20. A baseline excel calculation workbook has been setup to calibrate the existing school system and operation conditions against the utility bills. Savings from pump upgrade have been calculated using the excel spreadsheet.

Design Considerations

- Integrating controls with BMS and hydronic distribution system.

Maintenance Considerations

- VFDs, pumps and pump motors shall be maintained as per manufacturer's guidelines.

ECM 4: Replace existing boilers with Condensing Boilers

Existing Conditions

A thorough survey was conducted at Selover School. The heating a served by a hydronic system as well as steam system.

ECM Description

Willdan recommends replacing the existing hot water boiler with an efficient condensing boiler. A condensing boiler extracts additional heat from the waste gases by condensing this water vapor to liquid water, thus recovering its latent heat of vaporization. While the effectiveness of the condensing process varies depending on the temperature of the water returning to the boiler, it is always at least as efficient as a non-condensing boiler. Compared to 77 - 80% with conventional designs, the proposed condensing boiler efficiency was conservatively taken as 88% based on the expected heating hot water return temperatures in the building. This ECM will be fulfilled through New Jersey Clean Energy Program's (NJCEP) SmartStart prescriptive program as well as Direct Install program. Based on the calculation, Willdan is adding another boiler as redundancy.

Measure Baseline and Proposed Upgrades

Baseline:

- One (1) 1500 MBH hot water boiler from Weil McLain.

Proposed

- One (1) 1500 MBH AERCO boilers.

Calculation Methodology

Savings have been calculated using NJ Tech Manual FY20. A baseline excel calculation workbook has been setup to calibrate the existing school system and operation conditions against the utility bills.

Design Considerations

- Integration with the energy management system and existing distribution system.
- Install all new heating equipment sized with supply HW temperature at 140F and return below condensing range to improve the overall boiler efficiency
- Rigging & demolition of existing units.
- Scheduling of unit downtime during construction.
- New breeching and flue design

Maintenance Considerations

- Boilers shall be maintained as per manufacturer's guidelines.

ECM 5: Building Management System (BMS)

Existing Conditions

A thorough survey was conducted at Selover school. The school has no BMS control system.

ECM Description

Willdan recommends providing open protocol ALC front end and integrate existing BMS, as well as controls system for newly installed HVAC equipment. With the communication between the control devices and the new updated digital interface/software, this will give the opportunity to take advantage of better scheduling, temperature set-back controls based on outside air temperature and occupancy levels while maintaining adequate heating, cooling and ventilation requirements in the facility. Implementation of this measure is also important in achieving full potential of other measures recommended by providing the necessary means of properly controlling the equipment.

Measure Baseline and Proposed Upgrades

Baseline:

- No existing BMS.
- No digital controls for the existing unit ventilators.

Proposed

- Install (1) front end web enabled ALC
- Integrate (1) hot water system controls

Calculation Methodology

Savings have been calculated using New York Power Authority's Tech Manual.

Design Considerations

- Resetting hot water loop based on Outside Air instead of demand.
- Furnish 3-D Graphics
- Furnish owner training
- Setup data trending
- Setup remote alarming via email or SMS text
- Resetting hot water loop based on Outside Air instead of demand.
- Program demand control ventilation for all the open areas
- More detail is provided in the appendix

Maintenance Considerations

- Service Contract is recommended to maintain persistence of BMS measure.

ECM 7: Vending Machine Controls

Existing Conditions

There is one (1) refrigerated beverage vending machine at the School. It is currently not equipped with an occupancy-based controls and is operated 24/7.

ECM Description

Willdan recommends installing occupancy sensor controls for vending machines. Vending machines operate continuously, even during unoccupied hours and consumes several hundred dollars per year in electrical energy costs. The installation of the Vending Miser product will reduce the run time of the vending machines during periods when no occupancy is sensed in the area surrounding the machines. The smart electronics in the device will ensure product is kept cold through a cycling process while reducing total energy consumption. Another benefit from implementing vending miser controls is extended useful equipment life due to reduced lifetime.

Energy savings are dependent on the vending machine and activity level in the area surrounding the machines. This ECM can be successfully implemented with proper permissions from the supplier, if necessary.

Measure Baseline and Proposed Upgrades

Baseline

- One (1) existing refrigerated vending machine operated 24/7.

Proposed

- Install occupancy sensor (vending miser controls) for the refrigerated vending machines.

Calculation Methodology

Energy savings have been recognized from NJ Tech Manual FY20.

Maintenance Considerations

Ongoing maintenance shall be performed by the control's contractor.

ECM 8: Plug Load Controls

Existing Conditions

There are 75 plugged control points at Selover School that power Desktop PCs and printers. These devices have no control from the plug point.

ECM Description

Willdan recommends installing a wireless plug load device at these locations which enables a scheduled control of the devices throughout the year. Schneider Electric's BERT Control offers a user-friendly user interface that can be operated from the comfort of a Smartphone.

Measure Baseline and Proposed Upgrades

Baseline

- 75 Plug points, uncontrolled.

Proposed

- Simple plugging of BERT CONTROL plug to 75 plug points.

Calculation Methodology

Energy savings have been calculated using operational hours of the school and NJ Tech Manual FY20.

Maintenance Considerations

- Updating the front-end software.

ECM-10: Install Solar PV Panels

Existing Conditions

There is no solar photovoltaic system installed at the school.

ECM Description

Willdan recommends installing a solar photovoltaic system to reduce dependence on the electric grid. The solar system can provide 81,968 kWh of electricity annually. Solar panels work by absorbing sunlight with photovoltaic cells, generating direct current (DC) energy and then converting it to usable alternating current (AC) energy with the help of inverter technology. AC energy then flows through the home's electrical panel and is distributed accordingly. In order to maximize the solar generation on the roof, Sayreville District is planning to spend their capital reserves to upgrade the roof warranties to accommodate the proposed solar panels.

Design Considerations

- Effect on utility tariffs and rate structures.
- Integration with existing building infrastructure

Maintenance Considerations

- As agreed within the PPA.

Woodrow Wilson Elementary School

The table below highlights the ECMs considered and the overall savings for Woodrow Wilson Elementary School.

Table 62: Woodrow Wilson ES ECMs

Measure		Annual Estimated Savings				CO_2 Emission Savings (lbs)	Estimated Implementation Cost ($)	Estimated Simple Payback Period
		Electricity (kWh)	Annual Demand (kW)	Natural Gas (Therms)	Cost Savings ($)			
ECM - 1	LED Lighting	40,458	11	-	$4,882	61,496	$12,330	3
ECM - 2	Premium Efficiency Motors W/ VFD	2,524	-	-	$305	3,836	$41,250	135
ECM - 3	Install High Efficiency Roof Top Units	2,078	1	333	$537	7,055	$21,299	40
ECM - 4	Install High Efficiency Hot Water Boilers	-	-	3,197	$2,753	37,405	$223,850	81
ECM - 5	Building Management System (BMS)	7,312	4	564	$1,368	17,713	$87,500	64
ECM - 7	Vending Misers	1,612	0	-	$195	2,450	$600	3
ECM - 8	Plug Load Controls	5,551	-	-	$670	8,438	$8,100	12
ECM-10	Add Photovoltaic	119,998	102	-	$12,872	-	$0	N/A
ECM-10.1	ECM 10 Enabler - Roof Upgrades	-	-	-	-	-	$520,000	N/A

ECM 1: LED Lighting Upgrades

Existing Conditions

A thorough survey was conducted at Woodrow Wilson school. A variety of lighting fixtures exist at the school. The most prevalent lamp type used in the school is 4-feet 32-watt linear fluorescent T8 lamps in fixtures equipped with 2, 3 or 4 lamps per fixture. Additionally, the range of lamps used in interior lighting varies from 4-feet T5 & T12 linear fluorescent lamps, 2-feet T8 linear fluorescent lamps and T8 U-bend fluorescent tubes. Fixtures using T5 and T8 lamps are equipped with electronic ballasts while T12 lamps are used with magnetic ballasts. There are also compact fluorescent and incandescent lamps used for interior lighting.

ECM Description

Willdan recommends retrofitting fixtures with T5, T8 and T12 lamps with the more efficient Linear LED tubes, eliminating ballast from the fixtures. The existing compact fluorescent and incandescent lamps will be replaced with compatible LED replacements. In addition to electric usage and demand savings, maintenance savings may also be achieved since LED lamps last longer than other light sources, and therefore, do not need to be replaced as often. All recommended lighting is DLC and/or Energy Star compliant. This ECM will be fulfilled through New Jersey Clean Energy Program's (NJCEP) Direct Install (DI), an energy efficiency upgrade program for existing small to mid-size commercial and industrial facilities that pays up to 70% of the retrofit costs, dramatically improving the payback on the project. Entities owned or operated by municipalities, counties, K-12 public schools, and customers located in Urban Enterprise Zones or Opportunity Zones may be eligible for up to 80% of the cost of installed measures.



Measure Baseline and Proposed Upgrades

Baseline:

- Existing fluorescent

Proposed

- High-efficiency LED lighting fixtures

Calculation Methodology

Savings have been calculated using NJ Tech Manual FY20. A baseline excel calculation workbook has been setup to calibrate the existing school system and operation conditions against the utility bills. Savings from lighting upgrade have been calculated using the DI EAT tool V4c.

Maintenance Considerations

- None

ECM 2: Pump upgrades with controls

Existing Conditions

A thorough survey was conducted at Woodrow Wilson School. The school has two (2) circulation pumps for hot water. The pumps are operated at constant volume with no controls.

ECM Description

Willdan recommends replacement of the existing pumps with premium efficiency motors for circulation. With the upgrade, Willdan also recommends installing VFD controls on the new pumps, along with installing 2-way valves at the terminal units and a pressure differential sensor at the retuning end of the circulation loop to achieve the variable flow. Since motor power consumption is proportional to the cube of the shaft speed under ideal conditions, running pumps at lower speeds provides energy savings when compared to operating pumps at full speed. For example, a 20% reduction in pump motor speed results in approximately a 50% reduction in pumping energy consumption.

Measure Baseline and Proposed Upgrades

Baseline:

- Two (2) 10 HP pumps for hot water circulation.

Proposed

- Two (2) 10 HP premium efficiency pumps for hot water circulation.
- VFD control on two (2) pumps.
- Conversion of all 3-way valves to 2-way valves for optimum variable flow.

Calculation Methodology

Savings have been calculated using NJ Tech Manual FY20. A baseline excel calculation workbook has been setup to calibrate the existing school system and operation conditions against the utility bills. Savings from pump upgrade have been calculated using the excel spreadsheet.

Design Considerations

- Integrating controls with BMS and hydronic distribution system.

Maintenance Considerations

- VFDs, pumps and pump motors shall be maintained as per manufacturer's guidelines.

ECM 3: Install High Efficiency Roof Top Units

Existing Conditions

A thorough survey was conducted at Woodrow Wilson Elementary School. Currently, the gymnasium, auxiliary gymnasium and the cafeteria have a dedicated rooftop unit each with DX cooling and gas heating.

ECM Description

Willdan recommends replacement of the rooftop units with a new, efficient rooftop unit to enhance energy savings.

Measure Baseline and Proposed Upgrades

Baseline:

- One (1) RTU in the gym.
- One (1) RTU in the cafeteria/aux gym.

Proposed

- One-for-one replacement of the rooftop unit which will be fulfilled under the Direct Install program of NJCEP.

Calculation Methodology

Savings have been calculated using NJ Tech Manual FY20.

Design Considerations

- Integrating controls with BMS.

Maintenance Considerations

- Equipment shall be maintained as per manufacturer's guidelines.
- Changing of filters at regular intervals.

ECM 4: Replace existing boilers with Condensing Boilers

Existing Conditions

A thorough survey was conducted at Woodrow Wilson School. The hydronic distribution system for the school served by two (2) 2000 MBH boilers installed in 2005.

ECM Description

Willdan recommends replacing both existing gas-fired hot water heaters with condensing boilers. The average expectancy of a traditional gas boiler is 20 years. The existing boilers inspected were inspected and found to be functional, but they are at the end of their useful service life. A condensing boiler extracts additional heat from the waste gases by condensing this water vapor to liquid water, thus recovering its latent heat of vaporization. While the effectiveness of the condensing process varies depending on the temperature

of the water returning to the boiler, it is always at least as efficient as a non-condensing boiler. Compared to 77 - 80% with conventional designs, the proposed condensing boiler efficiency was conservatively taken as 88% based on the expected heating hot water return temperatures in the building. This ECM will be fulfilled through New Jersey Clean Energy Program's (NJCEP) Direct Install program.

Measure Baseline and Proposed Upgrades

Baseline:

- Two (2) 2000 MBH Patterson-Kelly.

Proposed

- Two (2) 2000 MBH AERCO boilers.

Calculation Methodology

Savings have been calculated using NJ Tech Manual FY20. A baseline excel calculation workbook has been setup to calibrate the existing school system and operation conditions against the utility bills.

Design Considerations

- Integration with the energy management system and existing distribution system.
- Install all new heating equipment sized with supply HW temperature at 140F and return below condensing range to improve the overall boiler efficiency
- Rigging & demolition of existing units.
- Scheduling of unit downtime during construction.
- New breeching and flue design

Maintenance Considerations

- Boilers shall be maintained as per manufacturer's guidelines.

ECM 5: Building Management System (BMS)

Existing Conditions

A thorough survey was conducted at Woodrow Wilson school. The school has no BMS control system.

ECM Description

Willdan recommends providing open protocol ALC front end and integrate existing BMS, as well as controls system for newly installed HVAC equipment. With the communication between the control devices and the new updated digital interface/software, will give the opportunity to take advantage of better scheduling, temperature set-back controls based on outside air temperature and occupancy levels while maintaining adequate heating, cooling and ventilation requirements in the facility. Implementation of this measure is also important in achieving full potential of other measures recommended by providing the necessary means of properly controlling the equipment.

Measure Baseline and Proposed Upgrades

Baseline:

- No existing BMS.
- No digital controls for the existing unit ventilators.

Proposed

- Install (1) front end web enabled ALC
- Integrate (1) hot water system controls

Calculation Methodology

Savings have been calculated using New York Power Authority's Tech Manual.

Design Considerations

- Resetting hot water loop based on Outside Air instead of demand.
- Furnish 3-D Graphics
- Furnish owner training
- Setup data trending
- Setup remote alarming via email or SMS text
- Resetting hot water loop based on Outside Air instead of demand.
- Program demand control ventilation for all the open areas
- More detail is provided in the appendix

Maintenance Considerations

- Service Contract is recommended to maintain persistence of BMS measure.

ECM 7: Vending Machine Controls

Existing Conditions

There is one (1) refrigerated beverage vending machine at the School. It is currently not equipped with an occupancy-based controls and is operated 24/7.

ECM Description

Willdan recommends installing occupancy sensor controls for vending machines. Vending machines operate continuously, even during unoccupied hours and consumes several hundred dollars per year in electrical energy costs. The installation of the Vending Miser product will reduce the run time of the vending machines during periods when no occupancy is sensed in the area surrounding the machines. The smart electronics in the device will ensure product is kept cold through a cycling process while reducing total energy consumption. Another benefit from implementing vending miser controls is extended useful equipment life due to reduced lifetime. Energy savings are dependent on the vending machine and activity level in the area surrounding the machines. This ECM can be successfully implemented with proper permissions from the supplier, if necessary.

Measure Baseline and Proposed Upgrades

Baseline

- One (1) existing refrigerated vending machine operated 24/7.

Proposed

- Install occupancy sensor (vending miser controls) for the refrigerated vending machines.

Calculation Methodology

Energy savings have been calculated using NJ Tech Manual FY20.

Maintenance Considerations

Ongoing maintenance shall be performed by the control's contractor.

ECM 8: Plug Load Controls

Existing Conditions

There are 54 plugged control points at Wilson Elementary School that powers Desktop PCs and printers. These devices have no control from the plug point.

ECM Description

Willdan recommends installing a wireless plug load device at these locations which enables a scheduled control of the devices throughout the year. Schneider Electric's BERT Control offers a user-friendly user interface that can be operated from the comfort of a Smartphone.

Measure Baseline and Proposed Upgrades

Baseline

- 54 Plug points, uncontrolled.

Proposed

- Simple plugging of BERT CONTROL plug to 54 plug points.

Calculation Methodology

Energy savings have been calculated using operational hours of the school and NJ Tech Manual FY20.

Maintenance Considerations

- Updating the front-end software.

ECM-10/10.1: Install Solar PV Panels

Existing Conditions

There is no solar photovoltaic system installed at the school.

ECM Description

Willdan recommends installing a solar photovoltaic system to reduce dependence on the electric grid. The solar system can provide 119,998 kWh of electricity annually. Solar panels work by absorbing sunlight with photovoltaic cells, generating direct current (DC) energy and then converting it to usable alternating current (AC) energy with the help of inverter technology. AC energy then flows through the home's electrical panel and is distributed accordingly. In order to maximize the solar generation at the school, some roof upgrades must be performed in order to obtain a desired roof warranty. A budget of $520,000 is allotted for the upgrade to enable the solar panels on the roof.

Design Considerations

- Effect on utility tariffs and rate structures.
- Integration with existing building infrastructure

Maintenance Considerations

- As agreed within the PPA.

Emma L Arleth Elementary School

The table below highlights the ECMs considered and the overall savings for Emma Arleth Elementary School.

Table 63: Emma Arleth ES ECMs

Measure		Annual Estimated Savings				CO_2 Emission Savings (lbs)	Estimated Implementation Cost ($)	Estimated Simple Payback Period
		Electricity (kWh)	Annual Demand (kW)	Natural Gas (Therms)	Cost Savings ($)			
ECM-1	LED Lighting	82,068	24	-	$9,904	124,743	$26,431	3
ECM-2	Premium Efficiency Motors W/ VFD	7,999	-	-	$965	12,158	$38,475	40
ECM-4	Install High Efficiency Hot Water Boilers	-	-	4,321	$3,721	50,556	$339,900	91
ECM-5	Building Management System (BMS)	2,393	2	782	$962	12,787	$85,000	88
ECM-7	Vending Misers	1,612	0	-	$195	2,450	$600	3
ECM-8	Plug Load Controls	8,532	-	-	$1,030	12,969	$12,450	12
ECM-9	Transformer Upgrades	4,410	1	-	$532	6,703	$7,268	14
ECM-10	Add Photovoltaic System	256,663	228	-	$28,401	-	$0	N/A
ECM-10.1	ECM 10 Enabler - Roof upgrade	-	-	-	$0	-	$10,000	N/A

ECM 1: LED Lighting Upgrades

Existing Conditions

A thorough survey was conducted at Emma Arleth school. A variety of lighting fixtures exist at the school. The most prevalent lamp type used in the school is 4-feet 32-watt linear fluorescent T8 lamps in fixtures equipped with 2, 3 or 4 lamps per fixture. Additionally, the range of lamps used in interior lighting varies from 4-feet T5 & T12 linear fluorescent lamps, 2-feet T8 linear fluorescent lamps and T8 U-bend fluorescent tubes. Fixtures using T5 and T8 lamps are equipped with electronic ballasts while T12 lamps are used with magnetic ballasts. There are also compact fluorescent and incandescent lamps used for interior lighting.

ECM Description

Willdan recommends retrofitting fixtures with T5, T8 and T12 lamps with the more efficient Linear LED tubes. The existing compact fluorescent and incandescent lamps will be replaced with compatible LED replacements, eliminating ballast from the fixtures. In addition to electric usage and demand savings, maintenance savings may also be achieved since LED lamps last longer than other light sources, and therefore, do not need to be replaced as often. All recommended lighting is DLC and/or Energy Star compliant. This ECM will be fulfilled through New Jersey Clean Energy Program's (NJCEP) Direct Install (DI), an energy efficiency upgrade program for existing small to mid-size commercial and industrial facilities that pays up to 70% of the retrofit costs, dramatically improving the payback on the project. Entities owned or operated by municipalities, counties, K-12 public schools, and customers located in Urban Enterprise Zones or Opportunity Zones may be eligible for up to 80% of the cost of installed measures.

Measure Baseline and Proposed Upgrades

Baseline:

- Existing fluorescent

Proposed

- High-efficiency LED lighting fixtures

Calculation Methodology

Savings have been calculated using NJ Tech Manual FY20. A baseline excel calculation workbook has been setup to calibrate the existing school system and operation conditions against the utility bills. Savings from lighting upgrade have been calculated using the DI EAT tool V4c.

Maintenance Considerations

- None

ECM 2: Pump upgrades with controls

Existing Conditions

A thorough survey was conducted at Emma Arleth School. The school has two (2) circulation pumps for hot water. Additionally, the loop has three (3) circulation pumps that direct the flow in various directions of the school. The pumps are operated at constant volume with no controls.

ECM Description

Willdan recommends a 1-for-1 replacement of the existing pumps with premium efficiency motors for circulation. With the upgrade, Willdan also recommends installing VFD controls on the new pumps. along with installing 2-way valves at the terminal units and a pressure differential sensor at the retuning end of the circulation loop to achieve the variable flow. Since motor power consumption is proportional to the cube of the shaft speed under ideal conditions, running pumps at lower speeds provides energy savings when compared to operating pumps at full speed. For example, a 20% reduction in pump motor speed results in approximately a 50% reduction in pumping energy consumption.

Measure Baseline and Proposed Upgrades

Baseline:

- Two (2) 7.5 HP pumps for hot water circulation.
- Three (3) 0.8 HP circulation pump.

Proposed

- Two (2) 7.5 HP premium efficiency pumps for hot water circulation.
- Three (3) 0.8 HP premium efficiency pumps for hot water circulation.
- VFD control on two (2) pumps.
- Conversion of all 3-way valves to 2-way valves for optimum variable flow.

Calculation Methodology

Savings have been calculated using NJ Tech Manual FY20. A baseline excel calculation workbook has been setup to calibrate the existing school system and operation conditions against the utility bills. Savings from pump upgrade have been calculated using the excel spreadsheet.

Design Considerations

- Integrating controls with BMS and hydronic distribution system.

Maintenance Considerations

- VFDs, pumps and pump motors shall be maintained as per manufacturer's guidelines.

ECM 4: Replace existing boilers with Condensing Boilers

Existing Conditions

A thorough survey was conducted at Emma Arleth School. The hydronic distribution system for the school served by two (2) 2000 MBH boilers installed in 2005. The existing pipe insulation is also below average.

ECM Description

Willdan recommends replacing both existing gas-fired hot water heaters with condensing boilers. The average expectancy of a traditional gas boiler is 20 years. The existing boilers inspected were inspected and found to be functional, but they are at the end of their useful service life. A condensing boiler extracts additional heat from the waste gases by condensing this water vapor to liquid water, thus recovering its latent heat of vaporization. While the effectiveness of the condensing process varies depending on the temperature of the water returning to the boiler, it is always at least as efficient as a non-condensing boiler. Compared to 77 - 80% with conventional designs, the proposed condensing boiler efficiency was conservatively taken as 88% based on the expected heating hot water return temperatures in the building. Along with the boilers, new pipe insulation will be installed as well to reduce the heat loss. This ECM will be fulfilled through New Jersey Clean Energy Program's (NJCEP) Direct Install program.

Measure Baseline and Proposed Upgrades

Baseline:

- Three (3) 2000 MBH RBI boilers.

Proposed

- Four (3) 2000 MBH AERCO boilers.
- New Circulation pipe insulation.

Calculation Methodology

Savings have been calculated using NJ Tech Manual FY20. A baseline excel calculation workbook has been setup to calibrate the existing school system and operation conditions against the utility bills.



Design Considerations

- Integration with the energy management system and existing distribution system.
- Install all new heating equipment sized with supply HW temperature at 140F and return below condensing range to improve the overall boiler efficiency
- Rigging & demolition of existing units.
- Scheduling of unit downtime during construction.
- New breeching and flue design

Maintenance Considerations

- Boilers shall be maintained as per manufacturer's guidelines.

ECM 5: Building Management System (BMS)

Existing Conditions

A thorough survey was conducted at Emma Arleth school. The school has no BMS control system.

ECM Description

Willdan recommends providing open protocol ALC front end and integrate existing BMS, as well as controls system for newly installed HVAC equipment. With the communication between the control devices and the new updated digital interface/software, will give the opportunity to take advantage of better scheduling, temperature set-back controls based on outside air temperature and occupancy levels while maintaining adequate heating, cooling and ventilation requirements in the facility. Implementation of this measure is also important in achieving full potential of other measures recommended by providing the necessary means of properly controlling the equipment.

Measure Baseline and Proposed Upgrades

Baseline:

- No existing BMS.
- No digital controls for the existing unit ventilators.

Proposed

- Install (1) front end web enabled ALC
- Integrate (1) hot water system controls

Calculation Methodology

Savings have been calculated using New York Power Authority's Tech Manual.

Design Considerations

- Resetting hot water loop based on Outside Air instead of demand.
- Furnish 3-D Graphics
- Furnish owner training
- Setup data trending
- Setup remote alarming via email or SMS text
- Resetting hot water loop based on Outside Air instead of demand.
- Program demand control ventilation for all the open areas
- More detail is provided in the appendix



Maintenance Considerations

- Service Contract is recommended to maintain persistence of BMS measure.

ECM 7: Vending Machine Controls

Existing Conditions

There is one (1) refrigerated beverage vending machine at the School. It is currently not equipped with an occupancy-based controls and is operated 24/7.

ECM Description

Willdan recommends installing occupancy sensor controls for vending machines. Vending machines operate continuously, even during unoccupied hours and consumes several hundred dollars per year in electrical energy costs. The installation of the Vending Miser product will reduce the run time of the vending machines during periods when no occupancy is sensed in the area surrounding the machines. The smart electronics in the device will ensure product is kept cold through a cycling process while reducing total energy consumption. Another benefit from implementing vending miser controls is extended useful equipment life due to reduced lifetime. Energy savings are dependent on the vending machine and activity level in the area surrounding the machines. This ECM can be successfully implemented with proper permissions from the supplier, if necessary.

Measure Baseline and Proposed Upgrades

Baseline

- One (1) existing refrigerated vending machine operated 24/7.

Proposed

- Install occupancy sensor (vending miser controls) for the refrigerated vending machines.

Calculation Methodology

Energy savings have been recognized using NJ Tech Manual FY20.

Maintenance Considerations

Ongoing maintenance shall be performed by the control's contractor.

ECM 8: Plug Load Controls

Existing Conditions

There are 83 plugged control points at Arleth Elementary School that powers Desktop PCs and printers. These devices have no control from the plug point.

ECM Description

Willdan recommends installing a wireless plug load device at these locations which enables a scheduled control of the devices throughout the year. Schneider Electric's BERT Control offers a user-friendly user interface that can be operated from the comfort of a Smartphone.

Measure Baseline and Proposed Upgrades

Baseline

- 83 Plug points, uncontrolled.

Proposed

- Simple plugging of BERT CONTROL plug to 83 plug points.

Calculation Methodology

Energy savings have been calculated using operational hours of the school and NJ Tech Manual FY20.

Maintenance Considerations

- Updating the front-end software.

ECM 9: Install Energy Efficient Transformers

Existing Conditions

An on-site detailed survey of the dry-type transformers throughout the facilities was performed by Powersmiths. The facility consists of 1 transformer with kVA capacity of 45 kVA. The transformers are operating at a small fraction of their nameplate capacity, resulting in very low efficiency, and are often producing large amounts of excess heat, resulting in energy losses, and higher electric costs.

ECM Description

Willdan recommends replacing the dry-type transformers with E-Saver transformers. Designed to provide the lowest life cycle cost, the E-Saver goes beyond US DOE 2016 efficiency, ensuring lower operating losses than standard off-the-shelf transformers. To provide superior performance and reduce environmental impact, the E-Saver comes with a superior Nomex based insulation system impregnated with an organic epoxy adhesive. Superior insulation prevents shorts as well, substantially prolonging the life of the transformer. Based on the detailed field survey, the replacement E-Saver transformers will be a like-for-like, nominal kVA capacity, designed and manufactured to minimize losses for the application and fit within the existing constraints. This ECM can achieve energy saving by increasing the transformer efficiency.

Measure Baseline and Proposed Upgrades

Baseline

- 1 transformer

Proposed

- 1 E-Saver-80R transformers as shown in the figure below.

													Variables		
Transformer Count	Tag Number	Location ID or Room #	Transformer Designation	Proposed Powersmiths OPAL Transformer	Baseline kVA	Replacement kVA	Replace	Bseline % Load During Normal Operating Hours	Baseline % Load Outside Operating Hours	Powersmiths % Load During Normal Operating Hours	Powersmiths % Load Outside Operating Hours	Equipment Operating hrs/ day	Equipment Operating days/yr	A/C System Performance (kW/ton)
1	Arleth ES	78529	Elec Rm	E-Saver-80R	45	45	1	9.2%	4.0%	9.2%	4.0%	12	200	0

Figure 77: Emma Arleth ES Transformer ECM

Calculation Methodology

Energy savings have been calculated using excel spreadsheet.

Design Considerations

- Coordination with facility manager to minimize the effect on day-to-day operation.
- Disruption to electrical loads served by existing transformers.
- Seasonal loading on transformers.

Maintenance Considerations

- As recommended by the manufacturer

ECM-10/10.1: Install Solar PV Panels

Existing Conditions

There is no solar photovoltaic system installed at the school.

ECM Description

Willdan recommends installing a solar photovoltaic system to reduce dependence on the electric grid. The solar system can provide 256,663 kWh of electricity annually. Solar panels work by absorbing sunlight with photovoltaic cells, generating direct current (DC) energy and then converting it to usable alternating current (AC) energy with the help of inverter technology. AC energy then flows through the home's electrical panel and is distributed accordingly. In order to maximize the solar generation at the school, some roof upgrades must be performed in order to obtain a desired roof warranty. A budget of $10,000 is allotted for the upgrade to enable the solar panels on the roof.

Design Considerations

- Effect on utility tariffs and rate structures.
- Integration with existing building infrastructure

Maintenance Considerations

- As agreed within the PPA.



Willdan also recognized other ECMs as well that have the potential towards energy savings and energy cost savings. However, attempting to stay within the rules of ESIP, Willdan was able to consider a handful of ECMs. If additional savings or funding becomes available after the bidding process, these ECM's will be considered with District and Architect input. The table below highlights the ECMs that are viable but not considered at this time.

Table 64: Optional ECMs not considered

Optional ECM: Considered, but not included with base project at this time	Sayreville War Memorial HS	Sayreville MS	EL Arleth ES	HS Truman ES	Samsel Upper ES	Dwight Eisenhower ES	Wilson ES	Selover BOE Offices
Window Replacement/ Upgrade	X	X	X	X	X	X	X	X
Unit Ventilators	X	X	X	X	X	X	X	X
Packaged Rooftop Units			X	X		X		X
Split Systems	X	X	X	X	X	X	X	X
Exhaust Fans	X	X	X	X	X	X	X	X
Kitchen Hood	X	X	X	X	X	X	X	X
Condensing Units	X	X	X	X	X	X	X	X
VRF System								X
Dedicated Outside Air Unit								X
Chiller Replacement	X			X				



Assessment of Risks

Willdan has considered the above ECMs based on the current facility operational method and condition of the schools. This assessment of risks is meant to provide Sayreville an idea of potential risks that lie within ESIP. These risks are, by no means, intended to eliminate responsibility of the ESCO to provide an ESP that meets industry standards of energy analysis and expertise. This section is included just to help Sayreville understand avoidable failure points that would result in lower energy savings or operational issues.

- Overall energy savings may be impacted if existing operational conditions are altered from what is laid out as the baseline in this ESP report, which includes following parameters including but not limited to occupancy of the buildings, operating hours, space type changes and override on controls equipment.
- Equipment which are proposed to be controlled automatically can impact energy savings if manually overridden. While such actions might be needed for regular maintenance or emergency work, the equipment control must be reset to regain automation and energy savings.
- Equipment maintenance and/or upgrades must be performed as recommended by the manufacturer. Failure to comply may impact energy savings.

Section 5. Utility and Other Rebates and Incentives Available for Project

A detailed description of all State and Federal tax benefits and energy grants, rebates and incentive programs Proposer anticipates incorporating into its proposal shall be provided as Section H-2.

Willdan has worked with various NJOCE Programs, as well as utility programs in New Jersey. Willdan serves NJBPU as an approved Direct Install Program Implementation contractor. Willdan is the only ESCO that has been approved by NJOCE as a Direct Install Implementation Contractor, so will be able to help Sayreville Board of Education to apply as many measures under Direct Install program for qualified buildings. To date, Willdan has completed 400 projects under direct Install program. Willdan is also an approved Pay for Performance partner, so any building that qualifies for Pay for Performance program, we would be able to help Sayreville to apply under NJOCE Pay for Performance Program. Willdan has help more than 200 customers with NJOCE SmartStart Program.

Willdan will work with Sayreville BOE to apply for and maximize all available rebates, utility incentives, PJM incentives or tax incentives. Willdan will also work with Sayreville BOE to explore all available markets for Carbon Credits. There are a number of programs available to help incentivize utility customers to reduce their dependence on the grid and move towards more energy efficient technology. The developers of the incentive programs understand, as we do, that the most efficient technology is not always the least expensive from a “first cost” standpoint, but they will lead to reduced operational costs and an improved environment over the “lifecycle” of your facilities.

Some of those rebates may include but are not limited to:

- Rebates and incentives available through the NJ SmartStart Program (via the NJ Clean Energy Program) – Equipment Incentives
- New Jersey Clean Energy “Pay for Performance” Incentive Program
- Energy Efficiency and Conservation Block Grants (New Jersey)
- (Recovery Act)
- Renewable Energy Incentive Program (REIP) (New Jersey)
- PJM Interconnection Incentive Programs (Demand Response and Frequency Regulation)
- Federal Government Energy Policy Act (Renewable Energy Technologies Tax Credits and Funding Grants)

Stimulus Funding Sources

- State Fiscal Stabilization Fund
- Qualified Zone Academy Bonds
- Qualified School Construction Bonds
- Energy Efficiency and Conservation Block Grants
- Qualified Energy Conservation Bonds
- Recovery Zone Bonds
- Build America Bonds

1. New Jersey Office of Clean Energy Direct Install Program

As indicated above, Willdan is an approved Direct Install Program Contractor, selected by NJBPU to implement Direct Install Program. As outlined in table 65 below, five of the buildings would qualify for Direct Install Program. Sayreville BOE has a potential of implementing ECMs worth $500,000 through this program with up to 53% of the above project cost, paid by the NJOCE Program.

Existing small to mid-sized commercial and industrial facilities with an average peak electric demand that did not exceed 200 kW in any of the preceding 12 months are eligible to participate in Direct Install. Sayreville BOE will submit 12 months of electric utility bills to manifest their eligibility.

Included Measures:

- Lighting
- Heating, Cooling & Ventilation (HVAC)
- Pipe Insulation
- Low Flow Aerators

Measures eligible for Direct Install are limited to specific equipment categories, types and capacities. Boilers may not exceed 1,500,000 Btuh and furnaces may not exceed 140,000 Btuh. Limitations on packaged HVAC, motors and other equipment also apply. Larger capacity equipment may be eligible for financial incentives through NJ SmartStart Buildings.

See how other small businesses owners have saved! View a step-by-step description of the program or read the Program Guide to understand what to expect.

A. CONTACT US
Give us a call at 866-NJSMART to learn more about this offer. If your building meets eligibility requirements, we'll refer you to the Participating Contractor serving your region to schedule an Energy Assessment. Or, if you prefer, you may contact the contractor right away to get started!

B. REVIEW RESULTS
After the energy assessment, the contractor will review the results with you, including what measures qualify and your share of the project cost.

C. MOVE FORWARD
You will sign a scope of work document to proceed with implementation of qualifying measures and arrange for payment of your portion of the project costs with your contractor.

D. ARRANGE INSTALLATION
You and your contractor will set a convenient start date for the installation.

E. CONFIRM INSTALLATION
Once the participating contractor completes the installation, you accept the work by signing a project completion form.
F. COMPLETE TRANSACTION

Sayreville BOE is responsible for paying the remaining 47% of the project's hard cost, as well as any extra costs that incur in order to implement the ECMs. Willdan, Sayreville BOE's ESCO, was successfully able to finance the remaining costs under the ESIP program.

Benefit of Direct Install Program:

- Turnkey Process - A network of selected participating contractors addresses your project from start to finish, beginning with an assessment of your facility, and ending with the installation of eligible energy-efficient equipment.
- Minimal Cost - Your share of the project's cost could be as low as 20%, in which case the program pays the remaining amount. With incentives so dramatic, your upgrade project can very quickly pay for itself.
- Fast Turnaround Time - Project installations are typically completed within 90 days from the time of scheduling your energy assessment.
- Ongoing Savings - Your new energy-efficient equipment will provide savings for years to come through dramatically reduced energy costs on your monthly utility bills.

Table 65: District-Wide DI Incentives

School Name	NJOCE Direct Install
Sayreville Memorial High School	N/A
Sayreville Middle School	N/A
Samsel Upper Elementary School	N/A
Emma L Arleth Elementary School	$62,786
Woodrow Wilson Elementary School	$47,588
Selover School	$50,491
Dwight D Eisenhower Elementary School	$43,940
Harry S Truman Elementary School	$73,619

2. New Jersey Office of Clean Energy Smart Start Program

Incentives for Qualifying Equipment and Projects

A. Financial incentives are available for size projects which can offset some - or maybe even all - of the added cost to purchase qualifying energy-efficient equipment.
B. Support for Custom Energy-Efficiency Measures
C. Custom measures give you the opportunity to receive an incentive for unique energy-efficiency measures that are not on the prescriptive equipment list but are new/innovative or project/facility specific.

Application and Eligibility Process

A pre-approval is no longer required for prescriptive measures, with the exception of prescriptive & performance lighting, lighting controls and custom measure applications. Please note that implementing an ECM without Program Manager's approval does so at owner's own risk. The following table highlights the potential incentives for Sayreville BOE.

Table 66: District-Wide SmartStart Incentives

School Name	NJOCE SmartStart
Sayreville Memorial High School	$69,961
Sayreville Middle School	$34,086
Samsel Upper Elementary School	$72,455
Emma L Arleth Elementary School	$31,085
Woodrow Wilson Elementary School	$17,600
Selover School	$0
Dwight D Eisenhower Elementary School	$34,225
Harry S Truman Elementary School	$2,225

3. New Jersey Office of Clean Energy Combined Heat and Power Program

NJOCE Program support CHP projects and pays for up to 30-40% of the project cost. Willdan has evaluated this option and concluded not to pursue this program even though the CHP is added as an enabler. This ECM only extend the financing for 20 years yielding a negative energy savings.

4. Energy Star Award Program

As part of the traditional guarantee measurement and guarantee process, Willdan will enroll Sayreville BOE schools into the EPA/DOE Energy Star program. The Energy Star Program has been developed by the EPA/DOE to reduce national energy dependency and pollution emissions. To achieve these ends, the program entices building owners to implement energy saving projects. These projects may include lighting, controls, HVAC replacement. Willdan will perform an Energy Star analysis for each building in this program. The Energy Star Benchmarking Tool provides a 1-100 ranking of a building's energy performance relative to the national building market. A higher SEP indicates a more energy efficient building. A score of 75 or higher is needed to qualify for the Energy Star label. Willdan will prepare the information needed – utility bills and building information – for submittal to the EPA through our EnergyCAP™ program. EnergyCAP™ has a partnership with the EPA and Portfolio Manager and their program will assist in the information gathering and submittal process. After the original benchmark score, the data can be submitted monthly to see how the benchmark changes and also to renew the Energy Star rating on an annual basis. The decal will state the year in which the Energy Star rating was earned. Before the building can be Energy Star designated it must be audited by a third-party engineer. As a participant, Sayreville BOE can expect free press, on both the local and national levels, to promote the positive impact of the project.

5. PJM Incentives

PJM's Energy Efficiency program pays businesses for permanent load reduction resulting from energy efficiency projects they have completed or will be complete in the future. The program pays organization capacity revenue for up to four years following the completion of a qualified project. Qualifying projects include those with permanent energy reductions involving lighting, refrigeration equipment, HVAC, motors, VFDs, and more. There is revenue to be earned from your organization using less energy and helping PJM reduce the overall load on the grid.

- Summer EE performance period: June- Aug between 2-6pm not including weekends or public holidays
- Winter EE performance period: Jan-Feb between 7-9am and between 6-8pm not including weekends or public holidays
- Solar PV systems are not eligible as PJM Energy Efficiency Resources
- BMS Systems load reductions are difficult to qualify under PJM's Manual 18B as "permanent, continuous"
- Savings achieved by fuel switching are not eligible as PJM EE Resources.
- Transformers and Motors/VFDs may have potential but at this stage for estimated value it is not simple enough to be viable to make that analysis.
- Lighting upgrades have represented almost 100% of the PJM EE Capacity kWs that we have qualified with PJM for school district projects (>50 school districts in NJ in last five years). We have qualified some PTAC units which were utilized in the winter for heating as well as in summer for cooling but that was not a typical ECMs.

Table 67: District-Wide PJM Incentives

School Name	PJM Savings
DY 2021/22	$5,955
DY 2022/23	$3,853
DY 2023/24	$3,853
DY 2024/25	$3,853
TOTAL	**$17,514**

6. Operational and Maintenance Savings

ESIP Law allows energy savings as an energy cost reduction and maintenance cost reduction resulting from implementing energy conservation measures, when compared against established baseline of a previous energy cost, operating and maintenance cost including but not limited to future capital expenditure avoided because of equipment installed or services performed as part of the ESIP program. Willdan interviewed the site maintenance head and was made aware that Sayreville board of Education spent an amount of $120,000 annually for regular operation and maintenance costs. Additionally, the board also reserves another $180,000 annually for incidental and other direct costs towards building operation and maintenance. Willdan is projecting an O&M savings of $45,000 from Lighting only for five years. Majority of the lighting fixtures throughout the district are florescent tubes with electrical ballast. Over a period of time, 10% of these ballasts are proved to fail every year which add significant maintenance cost. With the replacement to LED fixtures, a conservative 3,000 ballast replacements will be avoided, totaling the O&M cost of $45,000 per annuum. Given a total budget of $300,000, this accounts for a 15% reduction.

Section 6. Measurement and Verification (M&V) Plan

Measurement and Verification

The M&V protocol developed collaboratively between Willdan and Sayreville Board of Education during the IGA process and as outlined in the M&V Plan will be utilized to measure and verify the project energy savings. Willdan will assign a dedicated M&V engineer familiar with Sayreville Board of Education facilities and its systems to work on-site throughout the M&V period. The dedicated M&V engineer will work closely with Sayreville staff on continuous optimization and commissioning of systems to ensure savings are achieved.

The International Performance Measurement and Verification Protocol (IPMVP) is the industry standard protocol that Willdan follows. The IPMVP provides four methods to measure energy savings. Willdan generally prefers IPMVP Option C – *measuring savings at the utility meter* – in cases where realizing the project savings on the utility bill is critical; however, Option C is limited on a facility that undergoes significant changes or projects that also impact the utility meter. For this reason, more measure-specific savings tracking using submetering may be most appropriate.

Computation of Baseline

Willdan's preferred approach, IPMVP Option C: Whole Facility, whenever appropriate based upon ECM selection, facility type, and customer preference. Willdan's straightforward calculations for both the baseline and any adjustments are outlined in this section.

Methodology to Determine Baseline Energy Use

In the simplest terms, the baseline is the sum of the energy consumption and costs for a specific, 12-month period prior to the installation of an energy efficiency project. The Baseline Year is the period that establishes the pre-retrofit conditions used as the point of reference for calculating energy savings. This baseline is developed prior to contract execution and established with input and agreement of Sayreville Board of Education.

Willdan's approach to calculating a baseline for Option C is summarized in this section; Option A and B baselines are customized based on ECMs implemented and measured.

Data Collection

Building and system information gathered during the IGEA is documented in the Energy Savings M&V Plan to document the conditions present that resulted in the baseline energy use. This data includes, but is not limited to:

- Building metered utility data (from utility provider meters)
- Weather conditions collected from the nearest National Weather Service Station
- A lighting level survey, with a count of the number of burned out lamps
- A summary of typical space temperatures during occupied periods

- An inventory of the HVAC and domestic water heating systems serving the building
- The operating hours of each building
- Function and utilization of each space within the building
- Building plans showing current construction and floorplans showing physical layout of spaces

Baseline Year Consumption Calculations – IPMVP Option C: Whole Facility

For IPMVP Option C: Whole Facility M&V methodology, utility consumption and demand are obtained from utility bills, shown below, for the Guarantee Meters during the baseline period, which forms the basis of the energy baseline.

The following equations will be used to determine baseline electrical consumption and demand:

Baseline Energy (or Demand) Consumption = ∑ Tracked Utility Meters' Consumption (of Demand) ± Baseline Adjustments, where:

Baseline Adjustment = ∑ ± Routine Adjustment to reporting period conditions ± Non-Routine Adjustments to reporting-period conditions

Routine Adjustments include, but are not limited to, weather and billing period length

Non-Routine Adjustments include changes in key conditions from the baseline period to the reporting period, including, but no limited to, occupancy; hours of operation; changes to building function and use; changes to operation, capacity or quantity of equipment or systems within the facility; and additions to the building

Table 68: District-Wide Utility Baseline

	Total	Sayreville War Memorial HS	Sayreville MS	Emma L Arleth ES	HS Truman ES	Samsel Upper ES	Dwight Eisenhower ES	Wilson ES	Selover School
Area (sqft)	901,736	292,289	170,847	67,800	49,600	174,800	55,100	62,700	28,600
Annual utility $	$905,262.50	$277,973.20	$169,783.92	$80,380.42	$65,516.63	$154,696.21	$46,477.79	$67,119.93	$43,314.40
Total kBtu	49,219,991	10,747,954	10,614,980	5,440,280	3,133,668	7,909,652	3,132,168	4,774,122	3,467,168
Total therms	312,275	37,694	76,179	41,631	19,060	46,865	24,218	36,498	30,130
$ therms	$268,881.21	$37,798.31	$63,175.56	$35,216.93	$17,024.07	$40,374.08	$20,840.58	$28,477.62	$25,974.06
kW	1,580	530	265	114	212	268	71	81	40
Total kWh utility	5,273,289	2,045,300	878,400	374,320	359,800	944,640	208,200	329,520	133,109
$ kWh	$636,381.29	$240,174.89	$106,608.36	$45,163.49	$48,492.56	$114,322.13	$25,637.21	$38,642.31	$17,340.34
Total kWh	5,273,289	2,045,300	878,400	374,320	359,800	944,640	208,200	329,520	133,109
Number of stories		2	2	1	1	3	1	3	2
Yr Blt		1962	1968	1959	1971	1952/2004	1971	1928	1952
staff	799	150	200	85	70	150	55	52	37
students	6,920	1,700	1,475	500	510	1,700	575	400	60
$/kWh	$0.12	$0.12	$0.12	$0.12	$0.13	$0.12	$0.12	$0.12	$0.13
$/therm	$0.86	$1.00	$0.83	$0.85	$0.89	$0.86	$0.86	$0.78	$0.86
$/kBtu	$0.02	$0.03	$0.02	$0.01	$0.02	$0.02	$0.01	$0.01	$0.01
$/sf	$1.00	$0.95	$0.99	$1.19	$1.32	$0.88	$0.84	$1.07	$1.51
$/p	$117.28	$150.26	$101.36	$137.40	$112.96	$83.62	$73.77	$148.50	$446.54
kBtu/sf	542	37	62	80	63	45	57	76	121
kBtu/p	6,376	5,810	6,337	9,300	5,403	4,275	4,972	10,562	35,744

M&V activities are performed to assure guaranteed savings are met to satisfy the contract and legislation. A general M&V approach is necessary to outline the methods that will significantly affect how the baseline is defined and the energy savings justified. An Adjusted Baseline is also used to incorporate any changes with facility use, such as operating hours, occupancy, renovation or any other reason that will impact a significant use in energy as compared to the baseline. Willdan Energy Solutions calculates the baseline for any facility based on actual existing systems and operating conditions. There are various approached that WES takes to accumulate the necessary data to construct the baseline. Such methods are listed below:

- Site measurements for electrical loads such as lighting, HVAC equipment, plug loads, circulation pumps, process loads, etc.
- Equipment operating hours based on trend data

This section contains a description of the types of Measurement and Verification (M&V) methodologies that Willdan Energy Solutions will use to guarantee the performance of this project.
They have been developed and defined by two independent authorities:

- International Performance Measurement and Verification Protocol (IPMVP)
- Federal Energy Management Program (FEMP)

There are four guarantee options that may be used to measure and verify the performance of a particular energy conservation measure. Each of the option is described below.

Option A – Retrofit Isolation: Key Parameter Measurement

Energy savings is determined by field measurement of the key parameters affecting the energy use of the system(s) to which an improvement measure was applied separate from the energy use of the rest of the facility. Measurement frequency ranges from short-term to continuous, depending on the expected variations in the measured parameter, and the length of the reporting period.

Measurement of key parameters means that those parameters not selected for field measurement will be estimated. Estimates can be based on historical data, manufacturer's specifications, or engineering judgment. Documentation of the source or justification of the estimated parameter will be described in the M&V plan in the contract. Energy savings is determined through engineering calculations of the baseline and post-retrofit energy used based on the combination of measured and estimated parameters, along with any routine adjustments.

Option B – Retrofit Isolation: All Parameter Measurement

Like Option A, energy savings is determined by field measurement of the energy use of the systems to which an improvement measure was applied separate from the energy use of the rest of the facility. However, all of the key parameters affecting energy use are measured; there are no estimated parameters used for Option B. Measurement

frequency ranges from short-term to continuous, depending on the expected variations in the savings and the length of the reporting period. Energy savings is determined through engineering calculations of the baseline and post-retrofit energy used based on the measured parameters, along with any routine adjustments.

Option C – Whole Building Metering/Utility Bill Comparisons

Option C involves the use of utility meters or whole building sub-meters to assess the energy performance of a total building. Option C assesses the impact of any type of improvement measure, but not individually if more than one is applied to an energy meter. This option determines the collective savings of all improvement measures applied to the part of the facility monitored by the energy meter. In addition, since whole building meters are used, savings reported under Option C include the impact of any other change made in facility energy use (positive or negative).

Option C may be used in cases where there is a high degree of interaction between installed improvement measures or between improvement measures and the rest of the building or the isolation and measurement of individual improvement measures is difficult or too costly.

This Option is intended for projects where savings are expected to be large enough to be discernable from the random or unexplained energy variations that are normally found at the level of the whole facility meter. The larger the savings, or the smaller the unexplained variations in the baseline, the easier it will be to identify savings. In addition, the longer the period of savings analysis after installing the improvement measure, the less significant is the impact of short-term unexplained variations. Typically, savings should be more than 20% of the baseline energy use if they are to be separated from the noise in the baseline data.

Periodic inspections should be made of all equipment and operations in the facility after the improvement measure installation. These inspections will identify changes from baseline conditions or intended operations. Accounting for changes (other than those caused by the improvement measures) is the major challenge associated with Option C-particularly when savings are to be monitored for long periods.
Savings are calculated through analysis of whole facility utility meter or sub-meter data using techniques from simple comparison to regression analysis.

Option D – Calibrated Simulation

Option D involves the use of computer simulation software to predict energy use, most often in cases where baseline data does not exist. Such simulation models must be calibrated so that it predicts an energy use and demand pattern that reasonably matches actual utility consumption and demand data from either the base-year or a post-retrofit year. Option D may be used to assess the performance of all improvement measures in a facility, akin to Option C. However, different from Option C, multiple runs of the simulation in Option D allow estimates of the savings attributable to each improvement measure within a multiple improvement measure project.

Option D may also be used to assess just the performance of individual systems within a facility, akin to Option A and B. In this case, the system's energy use must be isolated from that of the rest of the facility by appropriate meters.

Savings are calculated using energy use simulation models, calibrated with hourly or monthly utility billing data and/or end-use metering. Using the given options, Sayreville schools will be going through various M&V options. The following is the decision per school

Sayreville Memorial High School

Willdan has recommended option A for Measurement and Verification at Sayreville Memorial High School. Existing building has been modeled using eQuest 3.65-7173. A site survey was conducted to gather information on existing system and the maintenance department was interviewed for operational conditions. The baseline has been calibrated against recent 12 months of utility bills. This calibration has given an understanding of the building's operating schedule.

Sayreville Middle School

Willdan has recommended option A for Measurement and Verification at Sayreville Middle School. Existing building has been modeled using eQuest 3.65-7173. A site survey was conducted to gather information on existing system and the maintenance department was interviewed for operational conditions. The baseline has been calibrated against recent 12 months of utility bills. This calibration has given an understanding of the building's operating schedule. The energy savings from proposed ECMs have been calculated based off the adjusted baseline. Savings calculated will be verified using 12 months of utility bills post installation to justify the interactive effects between newly installed system and the building as whole.

Samsel Upper Elementary School

Willdan has recommended option A for Measurement and Verification at Samsel Upper Elementary School. Existing building has been modeled using eQuest 3.65-7173. A site survey was conducted to gather information on existing system and the maintenance department was interviewed for operational conditions. The baseline has been calibrated against recent 12 months of utility bills. This calibration has given an understanding of the building's operating schedule. The energy savings from proposed ECMs have been calculated based off the adjusted baseline. Savings calculated will be verified using 12 months of utility bills post installation to justify the interactive effects between newly installed system and the building as whole.

Harry S Truman Elementary School

Willdan has recommended option A for Measurement and Verification at Harry S Truman Elementary School. The energy consumption for the existing building has been calculated using the guidelines set forth in the New Jersey Clean Energy Program's Savings Protocol FY19 and calibrated against recent 12 months of utility bills. The calibration has given an understanding of the building's operating schedule. The energy savings from proposed ECMs have been calculated based off the adjusted baseline. Savings calculated will be verified using 12 months of utility bills post installation to justify the interactive effects between newly installed system and the building as whole.

Dwight D Eisenhower Elementary School

Willdan has recommended option A for Measurement and Verification at Dwight Eisenhower Elementary School. The energy consumption for the existing building has been calculated using the guidelines set forth in the New Jersey Clean Energy Program's Savings Protocol FY19 and calibrated against recent 12 months of utility bills. The calibration has given an understanding of the building's operating schedule. The energy savings from proposed ECMs have been calculated based off the adjusted baseline. Savings calculated will be verified using 12 months of utility bills post installation to justify the interactive effects between newly installed system and the building as whole.

Selover School

Willdan has recommended option A for Measurement and Verification at Dwight Eisenhower Elementary School. The energy consumption for the existing building has been calculated using the guidelines set forth in the New Jersey Clean Energy Program's Savings Protocol FY19 and calibrated against recent 12 months of utility bills. The calibration has given an understanding of the building's operating schedule. The energy savings from proposed ECMs have been calculated based off the adjusted baseline. Savings calculated will be verified using 12 months of utility bills post installation to justify the interactive effects between newly installed system and the building as whole.

Woodrow Wilson Elementary School

Willdan has recommended option A for Measurement and Verification at Dwight Eisenhower Elementary School. The energy consumption for the existing building has been calculated using the guidelines set forth in the New Jersey Clean Energy Program's Savings Protocol FY19 and calibrated against recent 12 months of utility bills. The energy savings from proposed ECMs have been calculated based off the adjusted baseline. Savings calculated will be verified using 12 months of utility bills post installation to justify the interactive effects between newly installed system and the building as whole.

Emma L Arleth Elementary School

Willdan has recommended option A for Measurement and Verification at Dwight Eisenhower Elementary School. The energy consumption for the existing building has been calculated using the guidelines set forth in the New Jersey Clean Energy Program's Savings Protocol FY19 and calibrated against recent 12 months of utility bills. The calibration has given an understanding of the building's operating schedule. The energy savings from proposed ECMs have been calculated based off the adjusted baseline. Savings calculated will be verified using 12 months of utility bills post installation to justify the interactive effects between newly installed system and the building as whole.

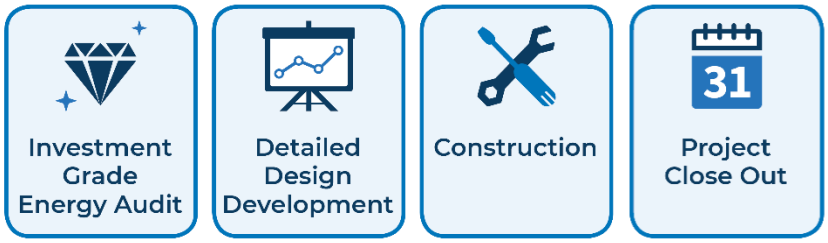
Section 7. Project Development and Management Overview

Project Development and Management Overview

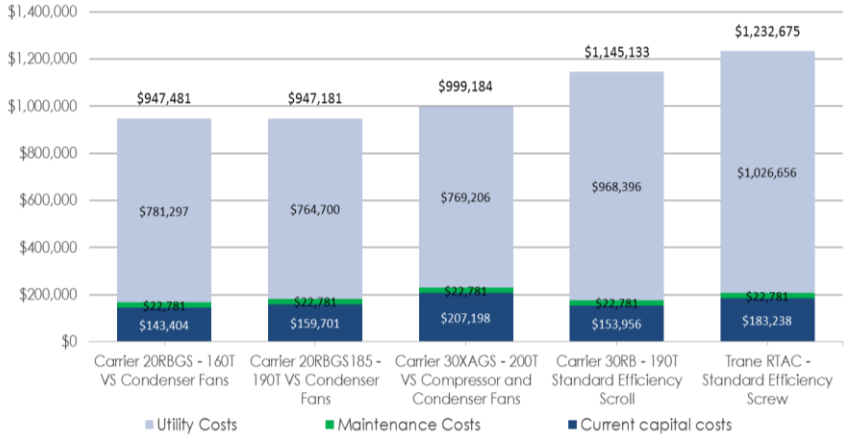
Energy Performance project development and management Approach

Willdan's approach to energy performance project development and management of Energy Savings Plans (ESP) and Energy Savings Improvement Plans (ESIP) intentionally evolved to address the common pitfalls we experienced while working for vendor based ESCOs as well as managing "traditional" performance contracting projects from the owner's side of the table. Our ESP process is designed around core principles that have earned us the reputation of delivering the best value to our clients.

The following components set our ESP and ESIP process apart from others for Sayreville Board of Education:



Detailed Design Development
Willdan's Product and Vendor Independent Approach



Willdan does not manufacture, sell, distribute or install any specific equipment or system and are not tied to any brand. We recommend equipment based on customer preference, what is best and most cost effective for the application. Our standard approach is to select the best long-term equipment and systems based on Life Cycle Cost (LCC) analysis and then competitively bid sub-contracted work to obtain the best price value for our clients.

Willdan knows a competitive atmosphere is essential to ensuring that our clients receive the highest quality project delivered at the lowest total cost. Willdan's independence from specific equipment or contractors provides us the freedom to incorporate our clients' preferences for products and contractors on every project.

Our engineering team will work closely with Spiezle, Sayreville Board of Education's engineering and facilities staff to understand their product preferences. Qualitative and quantitative benefits of these preferred products relative to alternatives will be evaluated and discussed with staff to arrive at a final basis of design and to inform the project specifications.

Willdan began as – and remains – an engineering company with the in-house engineering resources to effectively serve public entities.

Our engineers will work with Spiezle to develop design documents. They remain involved in the construction management process to ensure that the design intent and requirements are properly installed, preventing contractors from omitting, neglecting, or modifying essential components of the original design intent.

Table 5 compares the traditional ESCO approach with Willdan's approach to energy performance contacting.

Construction

The top priority of Willdan's project implementation team is to ensure that the installed project stays on schedule, maintains the highest standards during installations, and promptly addresses Sayreville Board of Education's questions or concerns. Willdan will provide as requested oversight during construction.

Willdan's Construction Management Process Key Elements

Process Element	Overview
Equipment Submittals	Willdan's methodical approach to receiving and reviewing equipment submittals from contractors is essential because it ensures that appropriate equipment is ordered and installed. Detailed submittal requirements are presented in "SECTION 013300 - SUBMITTAL PROCEDURES" of Willdan's standard specification package.
Construction Oversight	The construction management team works with the design engineer to ensure systems are properly installed and operating efficiently, comfortably, and with minimal maintenance. Willdan monitors project installation daily, and all construction issues are addressed by our team.
Client Communication	Willdan ensures contractors implement projects as designed, and keeps clients apprised of the project through construction update meetings, update memos, and additional avenues as requested. Any challenges, scheduling conflicts, etc., are resolved at these meetings.
Operations and Maintenance Manuals	Prior to closing out projects, contractors are required to submit detailed Operation and Maintenance manuals for all equipment specified. Detailed Operations and Maintenance requirements are presented in "SECTION 017823 - OPERATION AND MAINTENANCE" of Willdan's specification package.
Warranty Procedures	Willdan protects equipment warranties and lays out expectations and requirements related to warranties in "SECTION 016000 - PRODUCT REQUIREMENTS" of our specification package. This portion – in addition to the remainder of Willdan's specifications – will be transferred to s. Willdan maximizes the benefit of warranties to our clients by providing subcontractors with specific required steps and actions related to product, manufacturers', and workmanship warranties.

During the design phase of our projects, Willdan selects systems, regardless of manufacturer or distributor. Every facility will receive customized solutions designed to maximize occupant comfort, efficiency, maintenance, and total life cycle cost.

Throughout the project Willdan is the sole source of contact and accountability for Sayreville Board of Education for warranty-related issues. These costs are included within the Willdan standard pricing model.



Safety Practices and Procedures

All Willdan employees and managed contractors are required to follow well-defined safety procedures that not only protect themselves, but more importantly, protect Sayreville Board of Education students, staff and the general public. Incident prevention is our highest priority. As such, our Safety Coordinator will perform risk assessments of all projects and develop Site- and Task-Specific Safety Plans. Well-marked access restrictions, visible signage, and daily clean-ups all are strictly enforced to ensure the safety of everyone at the facility. Willdan's safety plan and procedures are consistent with the requirements of the State of New Jersey and Sayreville Board of Education. Willdan maintains an impeccable safety record and continues to promote safety as its #1 priority.

Management of Hazardous Materials

Willdan adheres to a Corporate Environmental Health and Safety Plan (EHASP) that provides the basic policies, objectives, organizational structure, and guidelines that govern all work we perform. The EHASP identifies potential hazards and specifies an appropriate level of response to protect the health and safety of our workers, subcontractors, clients and the public. This includes the management of hazardous materials encountered in the installation of energy conservation measures, such as asbestos, PCB ballasts, lead, etc. For each contract, Willdan updates our EHASP to account for specific hazards that may be encountered.

Willdan will assign Gerard Mondesir, Safety Officer, to ensure environmental health and safety principles are strictly adhered to by all program staff. Gerard will engage with AON (the world's largest construction insurance broker), CNA (Willdan's insurance carrier) and Willdan's Senior Management to identify best practices for safety. Under Gerard's leadership, Willdan has experienced four consecutive years of improving Experience Modification Rate scores with an excellent score of 0.77 as of 2016 (a business with a score of <1 is safer than average).

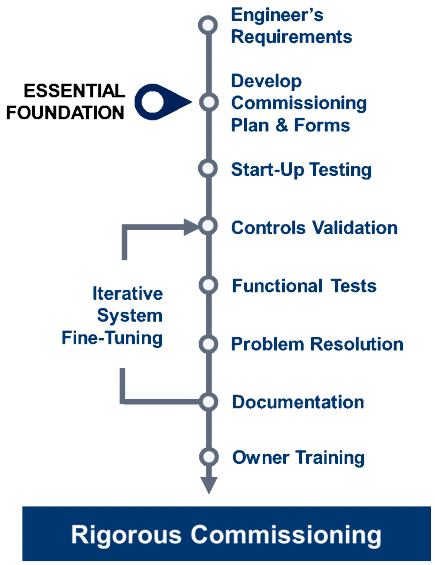
Project Closeout

Construction close-out inspections, punch lists, operation and management documents, owner training, commissioning, and warranty information are all important to the successful completion of any project. Willdan takes this process one step further with its comprehensive commissioning process described below.

Systems Commissioning

Commissioning (Cx) is the systematic process of ensuring that all facility systems perform interactively and acceptable to the owner's operational needs and Willdan's design intent. This process requires the preparation of facility operations personnel, as all HVAC, controls, and lighting systems will be commissioned.

Willdan's commissioning process is the fundamental quality control mechanism that ensures the final installation efficiently satisfies the Owner's Project Requirement (OPR). This process begins at project inception and remains in operation throughout project development to prevent – or catch – potential issues during design, construction, and final system testing. Ideally, this process works preemptively, but Willdan also recognizes the importance of continuous commissioning after construction completion to guarantee appropriate system installation and optimized system performance.



The Willdan team uses a systematic commissioning process that eliminates the common disconnects between the owner's goals, the engineers' design, the contractor installation, and the final operation and performance of each building system.

It is this systematic process, coupled with our use of in-house commissioning group, that eliminates disjointed hand-offs. Willdan's commissioning process begins in the pre-design phase and ends one-year after construction. At the commencement of construction system functional testing is conducted.

Subsequent testing of HVAC systems and controls continues to capture performance in all four seasons. A comprehensive commissioning plan, extensive documentation, and a complete "issues checklist" is maintained through project management software. This rigorous process ensures every issue is corrected before the project is considered complete.

Specific components of our commissioning process are described in more detail below.

- *Continual Quality Assurance* – Willdan's engineers and construction teams continually build quality into all project phases. They monitor construction progress and verify compliance with design and specification documents and overall standards of quality to preemptively address issues. This attention to detail throughout the construction process means issues that could potentially cost a great deal of time, money, and aggravation are eliminated before they have a chance to fester.
- *Commissioning Plan* – Willdan develops and utilizes the Commissioning Plan to define the scope and format of the commissioning process and the responsibilities of all involved parties. This plan is provided to all commissioning team members to inform them of the commissioning work intent and scope, ensure inclusion in the project scope, document all process steps, and expedite the overall commissioning process.
- *Preparation for Functional Testing* – Willdan's commissioning team verifies preparations before functional testing begins by reviewing construction documents, submittals, and signed documentation from contractors certifying all systems are installed in compliance with the construction documents and

manufacturer's recommendations, are clean and properly prepared for operation, are functional for test and balance (TAB), and are ready for functional performance testing.

- *Functional Testing* – Willdan's engineers verify proper sequencing, operation, and performance of installed equipment and systems under real operating conditions, including seasonal commissioning. Qualified technicians working for the contractor who installed the equipment and implemented the programming perform these tests under Willdan's certified commissioning engineers' supervision.
- *Documentation* – Startup forms, TAB forms, and functional test procedures guide the commissioning process, and specific written documentation is maintained for all commissioning activities. Willdan's commissioning team generates commissioning reports documenting project issues and resolutions, deficiencies, and the status of testing, and these reports are tracked for the duration of a project.
- *Problem Resolution* – When a report is issued to address an identified deficiency, Willdan's construction manager forwards it to the appropriate parties to initiate immediate corrective action. Willdan's engineers are responsible for any design modification and issuing final design details.

Provision of Record Drawings

Accurate as-built drawings are as important to future facility operation as the O&M manuals delivered at the end of the construction process. Up-to-date documentation makes the generation of record drawings seamless at the end of construction and provide an accurate basis for discussion of field changes with all project stakeholders when they occur. Documents are provided in both hard copy and electronic form (AutoCAD and PDF format) to our clients, or as requested.

Provision of Records

As-Built Construction Drawings
Commissioning Plan/Issues Log
Pre-Functional Checklist
Scope Change Documentation
Operations & Maintenance Manuals
Manufacturers Testing/Inspection Report
Design Clarifications
Design Change Documentation
Final Measurement & Verification Plan
Equipment Start-Up Report
Plan Review Changes
Warranty Letters
Functional Performance Test Report
Test & Balance Report
Service Contact Information

Post-Implementation Reporting

Willdan will provide Sayreville Board of Education a full description of the energy baseline(s) corresponding with the M&V plan at the end of the construction period during a dedicated M&V kickoff meeting. This report details parameters that describe both the energy and water consumed in the baseline year and the conditions that caused that consumption to occur to facilitate accurate M&V of guaranteed savings.

Factors including utility consumption and demand data; weather; building physical and thermal properties; energy consuming equipment and system parameters; space temperature setpoints and schedules; facility use and occupancy schedules; and other key information describing base-year conditions are outlined in this report. Willdan does not adjust our baseline or savings for changes necessary for project implementation. Only

Sayreville Board of Education-initiated scope changes during construction are subject to adjustment.

Description of Post Construction Training and Services

Flexibility in Assignment of Operation and Maintenance Responsibilities

Willdan does not use Operation and Maintenance services as a source of profit; our role is to ensure Sayreville Board of Education has resources in place to provide sufficient ongoing maintenance – either with a third-party subcontractor or using in-house personnel. If outside assistance is desired or required, Willdan facilitates a competitive process to obtain preventative maintenance from local, high-quality contractors.

Sayreville Board of Education Staff Training

Willdan recognizes that the success – both in terms of performance and client satisfaction – hinges on operators understanding how to properly operate and maintain the systems. We will deliver technical training to Sayreville Board of Education staff and operations personnel on all new equipment and dynamic systems. We will arrange and facilitate these trainings at Sayreville Board of Education, and we bring in equipment experts to provide advanced technical training and advocate that Sayreville engineering and facilities staff participate in the functional testing of major systems to gain first-hand knowledge of their design and operation.

Customized Maintenance Staff Training and Cross Training:

Personal interviews of maintenance staff are conducted by Willdan as an integral part of the equipment handover process. We then can develop a maintenance staff training program targeted to staff skill levels, experience, education, and prior training. Interviews conducted during IGA site surveys and equipment installation provides an opportunity to educate the maintenance staff about the project, as well as obtain their support and assistance from the beginning of the project. Willdan will work with Sayreville Board of Education personnel to evaluate individual capabilities and propose tailored training programs that meet the needs of the staff.

Willdan has significant in-house resources and advanced technical capabilities to provide Sayreville Board of Education with a better understanding of energy conservation technologies and their energy usage. The complete understanding of overall facility operations and energy consumption that Willdan incorporates into its energy cost reduction training will be of great benefit to Sayreville. The use of in-house Willdan personnel for this component of the training, and their extensive experience in identifying and implementing energy conservation methods, will ensure the Board realizes all available energy and operational savings.

Manufacturer Training

Willdan is vendor and product neutral, with no vested interest in any vendor or manufacturer. This impartiality allows us to incorporate the training from the appropriate manufacturer or service provider as the situation warrants. Most manufacturing companies offer excellent training programs, but the training is often focused solely on their product lines. Willdan will coordinate and organize vendor training on proper



equipment operation for personnel and will work with the manufacturer of each major piece of equipment to develop training manuals and a core curriculum that includes assembly/reassembly instructions, troubleshooting tips and parts lists.

This training will include operation, maintenance, and troubleshooting for all major equipment items. Willdan provides on-site training for all equipment installed under the performance contracting program. Our research indicates that the most effective training takes place when performed on the actual equipment.

Training is performed throughout the term of the contract to update skills, provide the latest information and train new personnel. Training programs are recorded as a reference tool for personnel and new staff. Willdan will prepare tutorials and other training materials (including videos, CDs, and text) that will assist the Board of Education in training new staff, as well as providing a library of training materials for existing personnel.

Section 8. Appendices

Attached in this section are appendices and supporting documents as follows:

- Appendix A: Statement of Performance
- Appendix B: Existing Lighting Fixtures
- Appendix C: Solar PV
- Appendix D: Direct Install Proposal
- Appendix E: Proposed Equipment
- Appendix F: Formulae
- Appendix G: AHSRAE 90.1 Minimum Performance Requirement and Baseline HVAC System Types

Appendix A
Statement of Performance (Energy Star Portfolio)

ENERGY STAR® Statement of Energy Performance

83

ENERGY STAR® Score[1]

Sayreville War Memorial High School

Primary Property Type: K-12 School
Gross Floor Area (ft²): 292,289
Built: 1962

For Year Ending: August 31, 2019
Date Generated: March 28, 2020

1. The ENERGY STAR score is a 1-100 assessment of a building's energy efficiency as compared with similar buildings nationwide, adjusting for climate and business activity.

Property & Contact Information

Property Address	Property Owner	Primary Contact
Sayreville War Memorial High School 820 Washington Road Parlin, New Jersey 08859	_____ , (____)____-_____	____ _____ , (____)____-_____ _____

Property ID: 6563198

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
37.1 kBtu/ft²

Source EUI
81.9 kBtu/ft²

Annual Energy by Fuel	
Natural Gas (kBtu)	3,687,388 (34%)
Electric - Grid (kBtu)	7,165,629 (66%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	55
National Median Source EUI (kBtu/ft²)	121.2
% Diff from National Median Source EUI	-32%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	922

Signature & Stamp of Verifying Professional

I _____ (Name) verify that the above information is true and correct to the best of my knowledge.

LP Signature: _____Date: _____

Licensed Professional

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(____)____-_____
_____

Professional Engineer or Registered Architect Stamp (if applicable)

ENERGY STAR® Statement of Energy Performance

56

ENERGY STAR® Score[1]

Sayreville Middle School

Primary Property Type: K-12 School
Gross Floor Area (ft²): 170,847
Built: 1968

For Year Ending: August 31, 2019
Date Generated: March 28, 2020

1. The ENERGY STAR score is a 1-100 assessment of a building's energy efficiency as compared with similar buildings nationwide, adjusting for climate and business activity.

Property & Contact Information

Property Address
Sayreville Middle School
800 Washington Road
Parlin, New Jersey 08859

Property ID: 6563197

Property Owner
_____
,
(____)____-_____

Primary Contact
____ _____
,
(____)____-_____
_____

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
62.3 kBtu/ft²

Source EUI
96.1 kBtu/ft²

Annual Energy by Fuel

Natural Gas (kBtu)	7,637,068 (72%)
Electric - Grid (kBtu)	3,002,229 (28%)

National Median Comparison

National Median Site EUI (kBtu/ft²)	66.2
National Median Source EUI (kBtu/ft²)	102.2
% Diff from National Median Source EUI	-6%

Annual Emissions

Greenhouse Gas Emissions (Metric Tons CO2e/year)	710

Signature & Stamp of Verifying Professional

I _____ (Name) verify that the above information is true and correct to the best of my knowledge.

LP Signature: _____Date: _____

Licensed Professional

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(____)____-_____
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Professional Engineer or Registered Architect Stamp (if applicable)

ENERGY STAR® Statement of Energy Performance

72

ENERGY STAR® Score[1]

Samsuel Upper Elementary School

Primary Property Type: K-12 School
Gross Floor Area (ft²): 174,800
Built: 1960

For Year Ending: July 31, 2019
Date Generated: March 28, 2020

1. The ENERGY STAR score is a 1-100 assessment of a building's energy efficiency as compared with similar buildings nationwide, adjusting for climate and business activity.

Property & Contact Information

Property Address
Samsuel Upper Elementary School
298 Ernston Road
Parlin, New Jersey 08859

Property ID: 6563196

Property Owner
_____
,
(____)____-_____

Primary Contact
____ _____
,
(____)____-_____
_____

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
45.3 kBtu/ft²

Source EUI
79.8 kBtu/ft²

Annual Energy by Fuel

Natural Gas (kBtu)	4,686,681 (59%)
Electric - Grid (kBtu)	3,225,028 (41%)

National Median Comparison

National Median Site EUI (kBtu/ft²)	57.3
National Median Source EUI (kBtu/ft²)	101.1
% Diff from National Median Source EUI	-21%

Annual Emissions

Greenhouse Gas Emissions (Metric Tons CO2e/year)	576

Signature & Stamp of Verifying Professional

I _____ (Name) verify that the above information is true and correct to the best of my knowledge.

LP Signature: _____Date: _____

Licensed Professional

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(____)____-_____
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Professional Engineer or Registered Architect Stamp (if applicable)

ENERGY STAR® Statement of Energy Performance

39

ENERGY STAR® Score[1]

Emma L Arleth School

Primary Property Type: K-12 School
Gross Floor Area (ft²): 73,426
Built: 1959

For Year Ending: July 31, 2019
Date Generated: March 28, 2020

1. The ENERGY STAR score is a 1-100 assessment of a building's energy efficiency as compared with similar buildings nationwide, adjusting for climate and business activity.

Property & Contact Information

Property Address	Property Owner	Primary Contact
Emma L Arleth School 3198 Washington Rd Parlin, New Jersey 08859	_____ , (____)____-_____	____ _____ , (____)____-_____ _____

Property ID: 6563191

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
74.2 kBtu/ft²

Source EUI
108.5 kBtu/ft²

Annual Energy by Fuel	
Natural Gas (kBtu)	4,163,155 (76%)
Electric - Grid (kBtu)	1,284,856 (24%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	67.4
National Median Source EUI (kBtu/ft²)	98.6
% Diff from National Median Source EUI	10%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	351

Signature & Stamp of Verifying Professional

I _____ (Name) verify that the above information is true and correct to the best of my knowledge.

LP Signature: _____Date: _____

Licensed Professional

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(____)____-_____
_____

Professional Engineer or Registered Architect Stamp (if applicable)

ENERGY STAR® Statement of Energy Performance

70

ENERGY STAR® Score[1]

Harry S. Truman School

Primary Property Type: K-12 School
Gross Floor Area (ft²): 53,275
Built: 1973

For Year Ending: July 31, 2019
Date Generated: March 28, 2020

1. The ENERGY STAR score is a 1-100 assessment of a building's energy efficiency as compared with similar buildings nationwide, adjusting for climate and business activity.

Property & Contact Information

Property Address	Property Owner	Primary Contact
Harry S. Truman School 1 Taft Place Parlin, New Jersey 08859	_____ , (___)___-_____	____ _____ , (___)___-_____ _____

Property ID: 6563194

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
59 kBtu/ft²

Source EUI
102.4 kBtu/ft²

Annual Energy by Fuel	
Natural Gas (kBtu)	1,913,356 (61%)
Electric - Grid (kBtu)	1,231,697 (39%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	73.4
National Median Source EUI (kBtu/ft²)	127.4
% Diff from National Median Source EUI	-20%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	226

Signature & Stamp of Verifying Professional

I _____ (Name) verify that the above information is true and correct to the best of my knowledge.

LP Signature: _____Date: _____

Licensed Professional

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(___)___-_____
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Professional Engineer or Registered Architect Stamp (if applicable)

ENERGY STAR® Statement of Energy Performance

67

ENERGY STAR® Score[1]

Dwight D. Eisenhower School

Primary Property Type: K-12 School
Gross Floor Area (ft²): 59,738
Built: 1969

For Year Ending: July 31, 2019
Date Generated: March 28, 2020

1. The ENERGY STAR score is a 1-100 assessment of a building's energy efficiency as compared with similar buildings nationwide, adjusting for climate and business activity.

Property & Contact Information

Property Address
Dwight D. Eisenhower School
601 Ernston Road
Parllin, New Jersey 08859

Property ID: 6563192

Property Owner
_____
,
(___)___-_____

Primary Contact
____ _____
,
(___)___-_____
_____

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
52.4 kBtu/ft²

Source EUI
75.8 kBtu/ft²

Annual Energy by Fuel

Natural Gas (kBtu)	2,422,120 (77%)
Electric - Grid (kBtu)	708,096 (23%)

National Median Comparison

National Median Site EUI (kBtu/ft²)	63.1
National Median Source EUI (kBtu/ft²)	91.2
% Diff from National Median Source EUI	-17%

Annual Emissions

Greenhouse Gas Emissions (Metric Tons CO2e/year)	200

Signature & Stamp of Verifying Professional

I _____ (Name) verify that the above information is true and correct to the best of my knowledge.

LP Signature: _____Date: _____

Licensed Professional

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(___)___-_____
_____

Professional Engineer or Registered Architect Stamp (if applicable)

ENERGY STAR® Statement of Energy Performance

BOE Office (formerly Selover School)

Primary Property Type: Other
Gross Floor Area (ft²): 36,153
Built: 1954

For Year Ending: July 31, 2019
Date Generated: March 28, 2020

ENERGY STAR® Score[1]

N/A

1. The ENERGY STAR score is a 1-100 assessment of a building's energy efficiency as compared with similar buildings nationwide, adjusting for climate and business activity.

Property & Contact Information

Property Address	Property Owner	Primary Contact
BOE Office (formerly Selover School) 150 Lincoln Street South Amboy, New Jersey 08879	_____ , (____)____-_____	____ _____ , (____)____-_____ _____

Property ID: 6563193

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
87.8 kBtu/ft²

Source EUI
100 kBtu/ft²

Annual Energy by Fuel	
Electric - Grid (kBtu)	161,405 (5%)
Natural Gas (kBtu)	3,011,262 (95%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	78.4
National Median Source EUI (kBtu/ft²)	89.3
% Diff from National Median Source EUI	12%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	176

Signature & Stamp of Verifying Professional

I _____ (Name) verify that the above information is true and correct to the best of my knowledge.

LP Signature: _____Date: _____

Licensed Professional

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(____)____-_____
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Professional Engineer or Registered Architect Stamp (if applicable)

ENERGY STAR® Statement of Energy Performance

16

ENERGY STAR® Score[1]

Wilson School

Primary Property Type: K-12 School
Gross Floor Area (ft²): 54,150
Built: 1929

For Year Ending: July 31, 2019
Date Generated: March 28, 2020

1. The ENERGY STAR score is a 1-100 assessment of a building's energy efficiency as compared with similar buildings nationwide, adjusting for climate and business activity.

Property & Contact Information

Property Address	Property Owner	Primary Contact
Wilson School 65 Dane Street Sayreville, New Jersey 08872	_____ , (____)____-_____	____ _____ , (____)____-_____ _____

Property ID: 6563195

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
88.2 kBtu/ft²

Source EUI
128.9 kBtu/ft²

Annual Energy by Fuel	
Natural Gas (kBtu)	3,649,269 (76%)
Electric - Grid (kBtu)	1,124,489 (24%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	60.4
National Median Source EUI (kBtu/ft²)	88.3
% Diff from National Median Source EUI	46%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	308

Signature & Stamp of Verifying Professional

I _____ (Name) verify that the above information is true and correct to the best of my knowledge.

LP Signature: _____Date: _____

Licensed Professional

____ _____
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(____)____-_____
_____

Professional Engineer or Registered Architect Stamp (if applicable)

Appendix B
Existing Lighting

SAYREVILLE HS

Location						Existing											
	Building (from 'Area Identification')	Building Area (from 'Area Identification')	Building Type (from 'Area Identification')	Floor #	Area and/or Room/Unit Number	Technology Type	Fixture/Lamp Description	Ballast	Default Watts / Fixture	Actual Watts/Fixture (if different from default)	Watts/Fixture Source	Fixture Qty.	Control Type	Default Reduction Factor	Actual Reduction Factor (if different from default)	Controls Qty.	Total Watts
Ex	Building 1	Classroom/Lecture/Training	Education – Primary School	Ground Floor	Classroom 101	Linear Fluorescent - T12	4' T12 (40W) - 3L	Magnetic	127			2	Occ. Sensor Ceiling Mount (low volt)	0.3		1	254
1	Sayreville WMHS		Education – Primary School	2nd floor	room A201	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
2	Sayreville WMHS		Education – Primary School	2nd floor	room A238 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
3	Sayreville WMHS		Education – Primary School	2nd floor	room A238	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
4	Sayreville WMHS		Education – Primary School	2nd floor	boys room A	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			3		0.0			279
5	Sayreville WMHS		Education – Primary School	2nd floor	janitor closet A	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
6	Sayreville WMHS		Education – Primary School	2nd floor	room A234 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
7	Sayreville WMHS		Education – Primary School	2nd floor	girls room A	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			3		0.0			279
8	Sayreville WMHS		Education – Primary School	2nd floor	room A202	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
9	Sayreville WMHS		Education – Primary School	2nd floor	room A232 (work room)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
10	Sayreville WMHS		Education – Primary School	2nd floor	room A203	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
11	Sayreville WMHS		Education – Primary School	2nd floor	room A231	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
12	Sayreville WMHS		Education – Primary School	2nd floor	room A204	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
13	Sayreville WMHS		Education – Primary School	2nd floor	room A230	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
14	Sayreville WMHS		Education – Primary School	2nd floor	room A205	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
15	Sayreville WMHS		Education – Primary School	2nd floor	room A229	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
16	Sayreville WMHS		Education – Primary School	2nd floor	room A206	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
17	Sayreville WMHS		Education – Primary School	2nd floor	room A228	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
18	Sayreville WMHS		Education – Primary School	2nd floor	room A207 (restroom L201)	Linear Fluorescent - T8	2' T8 (17W) - 3L	Electronic	53			1		0.0			53
19	Sayreville WMHS		Education – Primary School	2nd floor	room A207 (restroom L202)	Linear Fluorescent - T8	2' T8 (17W) - 3L	Electronic	53			1		0.0			53
20	Sayreville WMHS		Education – Primary School	2nd floor	room A207	Linear Fluorescent - T8	2' T8 (17W) - 2L	Electronic	33			1		0.0			33
21	Sayreville WMHS		Education – Primary School	2nd floor	room A207	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			8		0.0			496
22	Sayreville WMHS		Education – Primary School	2nd floor	room L204	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
23	Sayreville WMHS		Education – Primary School	2nd floor	room L205	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
24	Sayreville WMHS		Education – Primary School	2nd floor	room L206	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
25	Sayreville WMHS		Education – Primary School	2nd floor	room L221	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			4		0.0			456
26	Sayreville WMHS		Education – Primary School	2nd floor	room L219	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			14		0.0			868
27	Sayreville WMHS		Education – Primary School	2nd floor	room L218	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			4		0.0			248
28	Sayreville WMHS		Education – Primary School	2nd floor	room L218	LED - Screw-In	PAR30	N/A	N/A	12		1		0.0			12
29	Sayreville WMHS		Education – Primary School	2nd floor	room L218	Incandescent	Standard	N/A	N/A	65	e	1		0.0			65
30	Sayreville WMHS		Education – Primary School	2nd floor	room L216	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
31	Sayreville WMHS		Education – Primary School	2nd floor	room L223	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
32	Sayreville WMHS		Education – Primary School	2nd floor	room L215	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			8		0.0			496
33	Sayreville WMHS		Education – Primary School	2nd floor	room L211	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			3		0.0			186
34	Sayreville WMHS		Education – Primary School	2nd floor	room L209	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			4		0.0			248
35	Sayreville WMHS		Education – Primary School	2nd floor	room L209	LED - Screw-In	PAR30	N/A	N/A	12		8		0.0			96
36	Sayreville WMHS		Education – Primary School	2nd floor	room L208	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			14		0.0			868
37	Sayreville WMHS		Education – Primary School	2nd floor	room A208	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
38	Sayreville WMHS		Education – Primary School	2nd floor	room A225	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
39	Sayreville WMHS		Education – Primary School	2nd floor	room A209	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
40	Sayreville WMHS		Education – Primary School	2nd floor	room A224	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
41	Sayreville WMHS		Education – Primary School	2nd floor	room A210	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
42	Sayreville WMHS		Education – Primary School	2nd floor	room A223	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
43	Sayreville WMHS		Education – Primary School	2nd floor	room A211	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
44	Sayreville WMHS		Education – Primary School	2nd floor	room A222	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
45	Sayreville WMHS		Education – Primary School	2nd floor	room A221 (inside A220)	Linear Fluorescent - T8	2' T8 (17W) - 1L	Electronic	22			1		0.0			22
46	Sayreville WMHS		Education – Primary School	2nd floor	room A220	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			1		0.0			114
47	Sayreville WMHS		Education – Primary School	2nd floor	room A212	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
48	Sayreville WMHS		Education – Primary School	2nd floor	boys room B	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
49	Sayreville WMHS		Education – Primary School	2nd floor	janitor closet B	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
50	Sayreville WMHS		Education – Primary School	2nd floor	room A217 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			2		0.0			64
51	Sayreville WMHS		Education – Primary School	2nd floor	girls room B	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			3		0.0			279
52	Sayreville WMHS		Education – Primary School	2nd floor	room A213	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			6		0.0			684
53	Sayreville WMHS		Education – Primary School	2nd floor	room D200 (storage)				0			0		0.0			0
54	Sayreville WMHS		Education – Primary School	2nd floor	womens room A (faculty)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			1		0.0			93
55	Sayreville WMHS		Education – Primary School	2nd floor	mens room A (faculty)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			1		0.0			93
56	Sayreville WMHS		Education – Primary School	2nd floor	room D201 (teachers room)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
57	Sayreville WMHS		Education – Primary School	2nd floor	room D202	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			8		0.0			744
58	Sayreville WMHS		Education – Primary School	2nd floor	room D203	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
59	Sayreville WMHS		Education – Primary School	2nd floor	room D204	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
60	Sayreville WMHS		Education – Primary School	2nd floor	room D205	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			5		0.0			310
61	Sayreville WMHS		Education – Primary School	2nd floor	room D206	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
62	Sayreville WMHS		Education – Primary School	2nd floor	room D207	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			8		0.0			496
63	Sayreville WMHS		Education – Primary School	2nd floor	room D208 (electric panel)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
64	Sayreville WMHS		Education – Primary School	2nd floor	room D209	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
65	Sayreville WMHS		Education – Primary School	2nd floor	room D209	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
66	Sayreville WMHS		Education – Primary School	2nd floor	room D219	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
67	Sayreville WMHS		Education – Primary School	2nd floor	room D218	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
68	Sayreville WMHS		Education – Primary School	2nd floor	room D216	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
69	Sayreville WMHS		Education – Primary School	2nd floor	room D215	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			18		0.0			1,674
70	Sayreville WMHS		Education – Primary School	2nd floor	room D214A (prep room)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			8		0.0			496
71	Sayreville WMHS		Education – Primary School	2nd floor	room D214	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			18		0.0			1,674
72	Sayreville WMHS		Education – Primary School	2nd floor	room D213	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			18		0.0			1,674
73	Sayreville WMHS		Education – Primary School	2nd floor	room D212A (prep room)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			8		0.0			496
74	Sayreville WMHS		Education – Primary School	2nd floor	room D212	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			18		0.0			1,674
75	Sayreville WMHS		Education – Primary School	2nd floor	room D210	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			5		0.0			465
76	Sayreville WMHS		Education – Primary School	2nd floor	room B224	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			8		0.0			496
77	Sayreville WMHS		Education – Primary School	2nd floor	room B223	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			8		0.0			912
78	Sayreville WMHS		Education – Primary School	2nd floor	room B223	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			4		0.0			248
79	Sayreville WMHS		Education – Primary School	2nd floor	room B222A/B222	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			16		0.0			992
80	Sayreville WMHS		Education – Primary School	2nd floor	girls room C	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			5		0.0			465
81	Sayreville WMHS		Education – Primary School	2nd floor	boys room C	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			5		0.0			465
82	Sayreville WMHS		Education – Primary School	2nd floor	room B218	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			3		0.0			279
83	Sayreville WMHS		Education – Primary School	2nd floor	room B217	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			8		0.0			912
84	Sayreville WMHS		Education – Primary School	2nd floor	room B217	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			4		0.0			248

85	Sayreville WMHS		Education – Primary School	2nd floor	room B216	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
86	Sayreville WMHS		Education – Primary School	2nd floor	janitor closet C	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
87	Sayreville WMHS		Education – Primary School	2nd floor	room B214 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
88	Sayreville WMHS		Education – Primary School	2nd floor	room B213 (electric panel)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			4		0.0			248
89	Sayreville WMHS		Education – Primary School	2nd floor	room B212/B212A	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			16		0.0			992
90	Sayreville WMHS		Education – Primary School	2nd floor	room B211/B211A	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			16		0.0			992
91	Sayreville WMHS		Education – Primary School	2nd floor	room B209/B209A	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			16		0.0			992
92	Sayreville WMHS		Education – Primary School	2nd floor	room B210/B210A	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			16		0.0			992
93	Sayreville WMHS		Education – Primary School	2nd floor	room B208/B208A	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			16		0.0			992
94	Sayreville WMHS		Education – Primary School	2nd floor	room B207/B207A	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			16		0.0			992
95	Sayreville WMHS		Education – Primary School	2nd floor	room B206	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
96	Sayreville WMHS		Education – Primary School	2nd floor	room B205	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
97	Sayreville WMHS		Education – Primary School	2nd floor	room B203	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
98	Sayreville WMHS		Education – Primary School	2nd floor	room B204	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
99	Sayreville WMHS		Education – Primary School	2nd floor	room B202	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
100	Sayreville WMHS		Education – Primary School	2nd floor	room B201	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
101	Sayreville WMHS		Education – Primary School	2nd floor	hallway	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			115		0.0			7,130
102	Sayreville WMHS		Education – Primary School	2nd floor	hallway	Compact Fluorescent	Screw-In	Electronic	N/A	52	e	9		0.0			468
103	Sayreville WMHS		Education – Primary School	1st floor	janitor closet A	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			1		0.0			93
104	Sayreville WMHS		Education – Primary School	1st floor	girls room A	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			3		0.0			186
105	Sayreville WMHS		Education – Primary School	1st floor	room A80	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			15		0.0			1,395
106	Sayreville WMHS		Education – Primary School	1st floor	room A53	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			2		0.0			228
107	Sayreville WMHS		Education – Primary School	1st floor	room A53A (electric panel)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
108	Sayreville WMHS		Education – Primary School	1st floor	room A81	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			15		0.0			1,395
109	Sayreville WMHS		Education – Primary School	1st floor	room A54	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			8		0.0			912
110	Sayreville WMHS		Education – Primary School	1st floor	room A54 (office)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
111	Sayreville WMHS		Education – Primary School	1st floor	room A54 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
112	Sayreville WMHS		Education – Primary School	1st floor	room A82	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			15		0.0			1,395
113	Sayreville WMHS		Education – Primary School	1st floor	room A55	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
114	Sayreville WMHS		Education – Primary School	1st floor	room A83 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
115	Sayreville WMHS		Education – Primary School	1st floor	room A84A (office)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
116	Sayreville WMHS		Education – Primary School	1st floor	room G120	Linear Fluorescent - T8	2' T8 (17W) - 3L	Electronic	53			16		0.0			848
117	Sayreville WMHS		Education – Primary School	1st floor	room G122	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
118	Sayreville WMHS		Education – Primary School	1st floor	room G125	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
119	Sayreville WMHS		Education – Primary School	1st floor	room G123	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
120	Sayreville WMHS		Education – Primary School	1st floor	room G126	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
121	Sayreville WMHS		Education – Primary School	1st floor	room G124	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
122	Sayreville WMHS		Education – Primary School	1st floor	room G127	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
123	Sayreville WMHS		Education – Primary School	1st floor	room G128	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
124	Sayreville WMHS		Education – Primary School	1st floor	guidence hallway	Linear Fluorescent - T8	2' T8 (17W) - 3L	Electronic	53			6		0.0			318
125	Sayreville WMHS		Education – Primary School	1st floor	room G129	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
126	Sayreville WMHS		Education – Primary School	1st floor	room L109	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
127	Sayreville WMHS		Education – Primary School	1st floor	room L108	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
128	Sayreville WMHS		Education – Primary School	1st floor	library	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			63		0.0			3,906
129	Sayreville WMHS		Education – Primary School	1st floor	library 2-pin	Compact Fluorescent	Screw-In	Electronic	N/A	26	e	28		0.0			728
130	Sayreville WMHS		Education – Primary School	1st floor	library	Linear Fluorescent - T5HO	4' T5HO (54W) - 4L	Electronic	234			16		0.0			3,744
131	Sayreville WMHS		Education – Primary School	1st floor	library	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			12		0.0			384
132	Sayreville WMHS		Education – Primary School	1st floor	room L103	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
133	Sayreville WMHS		Education – Primary School	1st floor	room L102	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
134	Sayreville WMHS		Education – Primary School	1st floor	room A58/A62	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			4		0.0			248
135	Sayreville WMHS		Education – Primary School	1st floor	room A58/A62 vestibule	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			2		0.0			64
136	Sayreville WMHS		Education – Primary School	1st floor	room A60 (faculty mens room)	LED - Fixtures			0	32	e	1		0.0			32
137	Sayreville WMHS		Education – Primary School	1st floor	room A61 (faculty womens room)	LED - Fixtures			0	32	e	1		0.0			32
138	Sayreville WMHS		Education – Primary School	1st floor	room A89	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
139	Sayreville WMHS		Education – Primary School	1st floor	room A90	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
140	Sayreville WMHS		Education – Primary School	1st floor	room A63	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
141	Sayreville WMHS		Education – Primary School	1st floor	room A91	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
142	Sayreville WMHS		Education – Primary School	1st floor	room A64	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
143	Sayreville WMHS		Education – Primary School	1st floor	room A92	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
144	Sayreville WMHS		Education – Primary School	1st floor	room A65	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
145	Sayreville WMHS		Education – Primary School	1st floor	room A74	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
146	Sayreville WMHS		Education – Primary School	1st floor	room A73	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
147	Sayreville WMHS		Education – Primary School	1st floor	room A72	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
148	Sayreville WMHS		Education – Primary School	1st floor	room A65	Linear Fluorescent - T8	2' T8 (17W) - 1L	Electronic	22			1		0.0			22
149	Sayreville WMHS		Education – Primary School	1st floor	room A66	Linear Fluorescent - T8	2' T8 (17W) - 1L	Electronic	22			1		0.0			22
150	Sayreville WMHS		Education – Primary School	1st floor	room A67	Linear Fluorescent - T8	2' T8 (17W) - 1L	Electronic	22			1		0.0			22
151	Sayreville WMHS		Education – Primary School	1st floor	room A68	Linear Fluorescent - T8	2' T8 (17W) - 1L	Electronic	22			1		0.0			22
152	Sayreville WMHS		Education – Primary School	1st floor	room A70	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			4		0.0			248
153	Sayreville WMHS		Education – Primary School	1st floor	room A92	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
154	Sayreville WMHS		Education – Primary School	1st floor	room A93	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
155	Sayreville WMHS		Education – Primary School	1st floor	girls room B	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			5		0.0			310
156	Sayreville WMHS		Education – Primary School	1st floor	janitor closet B/ office restroom	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
157	Sayreville WMHS		Education – Primary School	1st floor	room A96 (girls locker room)	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			5		0.0			570
158	Sayreville WMHS		Education – Primary School	1st floor	room A75	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
159	Sayreville WMHS		Education – Primary School	1st floor	room A106 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			1		0.0			32
160	Sayreville WMHS		Education – Primary School	1st floor	room A96E (storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
161	Sayreville WMHS		Education – Primary School	1st floor	room A101 (restroom A)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
162	Sayreville WMHS		Education – Primary School	1st floor	room A100 (janitor closet)	Linear Fluorescent - T8	2' T8 (17W) - 1L	Electronic	22			1		0.0			22
163	Sayreville WMHS		Education – Primary School	1st floor	room A96 (restroom B)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
164	Sayreville WMHS		Education – Primary School	1st floor	room A96 (office)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			1		0.0			93
165	Sayreville WMHS		Education – Primary School	1st floor	room A96/A97	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			27		0.0			2,511
166	Sayreville WMHS		Education – Primary School	1st floor	main GYM	Linear Fluorescent - T5HO	4' T5HO (54W) - 4L	Electronic	234			40		0.0			9,360
167	Sayreville WMHS		Education – Primary School	1st floor	room A99 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			1		0.0			32
168	Sayreville WMHS		Education – Primary School	1st floor	boys room B	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			4		0.0			372
169	Sayreville WMHS		Education – Primary School	1st floor	janitor storage A	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			3		0.0			279
170	Sayreville WMHS		Education – Primary School	1st floor	hall storage A	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			3		0.0			186
171	Sayreville WMHS		Education – Primary School	1st floor	weight room				0			0		0.0			0
172	Sayreville WMHS		Education – Primary School	1st floor	room A134 (boys locker office A restroom)	Linear Fluorescent - T8	2' T8 (17W) - 1L	Electronic	22			1		0.0			22
173	Sayreville WMHS		Education – Primary School	1st floor	room A100B office	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
174	Sayreville WMHS		Education – Primary School	1st floor	boys locker shower	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			3		0.0			279

175	Sayreville WMHS		Education – Primary School	1st floor	boys locker restroom	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
176	Sayreville WMHS		Education – Primary School	1st floor	room A100C (office restroom)	Linear Fluorescent - T8	2' T8 (17W) - 1L	Electronic	22			1		0.0			22
177	Sayreville WMHS		Education – Primary School	1st floor	room A100C (office)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
178	Sayreville WMHS		Education – Primary School	1st floor	room A100 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			4		0.0			456
179	Sayreville WMHS		Education – Primary School	1st floor	room A103 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
180	Sayreville WMHS		Education – Primary School	1st floor	room A103 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
181	Sayreville WMHS		Education – Primary School	1st floor	boys locker room	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			26		0.0			1,612
182	Sayreville WMHS		Education – Primary School	1st floor	girls team room shower/restroom	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			8		0.0			496
183	Sayreville WMHS		Education – Primary School	1st floor	girls team room/exits	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			13		0.0			1,482
184	Sayreville WMHS		Education – Primary School	1st floor	room A110 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			6		0.0			684
185	Sayreville WMHS		Education – Primary School	1st floor	room A157 restroom in A109)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
186	Sayreville WMHS		Education – Primary School	1st floor	room A109 (office)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			4		0.0			248
187	Sayreville WMHS		Education – Primary School	1st floor	room A106 (office)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			4		0.0			248
188	Sayreville WMHS		Education – Primary School	1st floor	room A157 (restroom inside A106)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
189	Sayreville WMHS		Education – Primary School	1st floor	room A107 (trainer)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			4		0.0			248
190	Sayreville WMHS		Education – Primary School	1st floor	room A107 (trainer)	Linear Fluorescent - T8	2' T8 (17W) - 3L	Electronic	53			2		0.0			106
191	Sayreville WMHS		Education – Primary School	1st floor	room A107 (restroom)	Linear Fluorescent - T8	2' T8 (17W) - 3L	Electronic	53			1		0.0			53
192	Sayreville WMHS		Education – Primary School	1st floor	room A105 (office)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
193	Sayreville WMHS		Education – Primary School	1st floor	room A104 (office)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
194	Sayreville WMHS		Education – Primary School	1st floor	boys team room shower	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			2		0.0			228
195	Sayreville WMHS		Education – Primary School	1st floor	boys team room restroom	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			3		0.0			186
196	Sayreville WMHS		Education – Primary School	1st floor	boys team room locker	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			12		0.0			1,368
197	Sayreville WMHS		Education – Primary School	1st floor	Aux GYM A	Linear Fluorescent - T5HO	4' T5HO (54W) - 4L	Electronic	234			18		0.0			4,212
198	Sayreville WMHS		Education – Primary School	1st floor	Aux GYM A (storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			4		0.0			248
199	Sayreville WMHS		Education – Primary School	1st floor	fitness room	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			25		0.0			2,325
200	Sayreville WMHS		Education – Primary School	1st floor	fitness room locker	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
201	Sayreville WMHS		Education – Primary School	1st floor	fitness room	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			10		0.0			930
202	Sayreville WMHS		Education – Primary School	1st floor	fitness room	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
203	Sayreville WMHS		Education – Primary School	1st floor	room D20C (office)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
204	Sayreville WMHS		Education – Primary School	1st floor	room D20B (office)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
205	Sayreville WMHS		Education – Primary School	1st floor	room D20A (office)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
206	Sayreville WMHS		Education – Primary School	1st floor	fitness room (storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
207	Sayreville WMHS		Education – Primary School	1st floor	room D21 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			3		0.0			186
208	Sayreville WMHS		Education – Primary School	1st floor	room D21 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
209	Sayreville WMHS		Education – Primary School	1st floor	Aux GYM B (storage)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			3		0.0			279
210	Sayreville WMHS		Education – Primary School	1st floor	Aux GYM B	Linear Fluorescent - T5HO	4' T5HO (54W) - 4L	Electronic	234			24		0.0			5,616
211	Sayreville WMHS		Education – Primary School	1st floor	room D18	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
212	Sayreville WMHS		Education – Primary School	1st floor	room D17	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			18		0.0			1,674
213	Sayreville WMHS		Education – Primary School	1st floor	room D16 (prep room)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			8		0.0			496
214	Sayreville WMHS		Education – Primary School	1st floor	room D15	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			18		0.0			1,674
215	Sayreville WMHS		Education – Primary School	1st floor	room D15A (prep room)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			18		0.0			1,674
216	Sayreville WMHS		Education – Primary School	1st floor	room D14	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
217	Sayreville WMHS		Education – Primary School	1st floor	room D14	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			12		0.0			744
218	Sayreville WMHS		Education – Primary School	1st floor	room D14 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			4		0.0			248
219	Sayreville WMHS		Education – Primary School	1st floor	room D3	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			8		0.0			744
220	Sayreville WMHS		Education – Primary School	1st floor	room D4/D4A	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			16		0.0			992
221	Sayreville WMHS		Education – Primary School	1st floor	room D5/D5A	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			16		0.0			992
222	Sayreville WMHS		Education – Primary School	1st floor	room D6/D6A	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			16		0.0			992
223	Sayreville WMHS		Education – Primary School	1st floor	room D7 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
224	Sayreville WMHS		Education – Primary School	1st floor	room D9 (electrical)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
225	Sayreville WMHS		Education – Primary School	1st floor	room D10 (supplies)				0			0		0.0			0
226	Sayreville WMHS		Education – Primary School	1st floor	room D11 (fire alarm)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
227	Sayreville WMHS		Education – Primary School	1st floor	room D11 (fire alarm)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
228	Sayreville WMHS		Education – Primary School	1st floor	elevator room A	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			4		0.0			248
229	Sayreville WMHS		Education – Primary School	1st floor	room B19E	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
230	Sayreville WMHS		Education – Primary School	1st floor	room 19D	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
231	Sayreville WMHS		Education – Primary School	1st floor	room B19C (restroom)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			1		0.0			93
232	Sayreville WMHS		Education – Primary School	1st floor	room B19C	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			1		0.0			93
233	Sayreville WMHS		Education – Primary School	1st floor	room B19B	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
234	Sayreville WMHS		Education – Primary School	1st floor	walk in 1-3				0	12		3		0.0			36
235	Sayreville WMHS		Education – Primary School	1st floor	kitchen	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			15		0.0			1,395
236	Sayreville WMHS		Education – Primary School	1st floor	kitchen	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			8		0.0			496
237	Sayreville WMHS		Education – Primary School	1st floor	kitchen storage A	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
238	Sayreville WMHS		Education – Primary School	1st floor	food court	Linear Fluorescent - T5	2' T5 (14W) - 2L	Electronic	34			32		0.0			1,088
239	Sayreville WMHS		Education – Primary School	1st floor	food court	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			12		0.0			1,368
240	Sayreville WMHS		Education – Primary School	1st floor	teachers lunch room	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
241	Sayreville WMHS		Education – Primary School	1st floor	teachers lunch room (restroom A)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			1		0.0			93
242	Sayreville WMHS		Education – Primary School	1st floor	teachers lunch room (restroom B)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			1		0.0			93
243	Sayreville WMHS		Education – Primary School	1st floor	cafeteria (storage A)	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			7		0.0			798
244	Sayreville WMHS		Education – Primary School	1st floor	cafeteria	Linear Fluorescent - T5	4' T5 (28W) - 3L	Electronic	90			80		0.0			7,200
245	Sayreville WMHS		Education – Primary School	1st floor	cafeteria	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			20		0.0			1,240
246	Sayreville WMHS		Education – Primary School	1st floor	cafeteria (storage B)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
247	Sayreville WMHS		Education – Primary School	1st floor	cafeteria (storage C)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
248	Sayreville WMHS		Education – Primary School	1st floor	cafeterai (snack room)	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			5		0.0			570
249	Sayreville WMHS		Education – Primary School	1st floor	room B24	Linear Fluorescent - T5	4' T5 (28W) - 3L	Electronic	90			12		0.0			1,080
250	Sayreville WMHS		Education – Primary School	1st floor	room B23A/B23	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			16		0.0			992
251	Sayreville WMHS		Education – Primary School	1st floor	room B22	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			16		0.0			992
252	Sayreville WMHS		Education – Primary School	1st floor	girls room C	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			9		0.0			837
253	Sayreville WMHS		Education – Primary School	1st floor	janitor closet B	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
254	Sayreville WMHS		Education – Primary School	1st floor	room B3D (office)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
255	Sayreville WMHS		Education – Primary School	1st floor	room B3E (office)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
256	Sayreville WMHS		Education – Primary School	1st floor	room B3F (office)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
257	Sayreville WMHS		Education – Primary School	1st floor	room B3 (electrical panel)	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0			62
258	Sayreville WMHS		Education – Primary School	1st floor	room B3 B	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			4		0.0			372
259	Sayreville WMHS		Education – Primary School	1st floor	room B3 A	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
260	Sayreville WMHS		Education – Primary School	1st floor	room B3 hallway	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
261	Sayreville WMHS		Education – Primary School	1st floor	room B1	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
262	Sayreville WMHS		Education – Primary School	1st floor	room B2	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
263	Sayreville WMHS		Education – Primary School	1st floor	room B4	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116

264	Sayreville WMHS		Education – Primary School	1st floor	room B5	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
265	Sayreville WMHS		Education – Primary School	1st floor	room B7/B7A	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			16		0.0			992
266	Sayreville WMHS		Education – Primary School	1st floor	room B6/B6A	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			16		0.0			992
267	Sayreville WMHS		Education – Primary School	1st floor	room B8/B8A	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			16		0.0			992
268	Sayreville WMHS		Education – Primary School	1st floor	room B9/B9A	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			16		0.0			992
269	Sayreville WMHS		Education – Primary School	1st floor	room B11/B11A	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			16		0.0			992
270	Sayreville WMHS		Education – Primary School	1st floor	room B10/B10A	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			16		0.0			992
271	Sayreville WMHS		Education – Primary School	1st floor	boys room C	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
272	Sayreville WMHS		Education – Primary School	1st floor	room B13	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0			558
273	Sayreville WMHS		Education – Primary School	1st floor	room B14	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			11		0.0			682
274	Sayreville WMHS		Education – Primary School	1st floor	room B14 (restroom A)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			1		0.0			93
275	Sayreville WMHS		Education – Primary School	1st floor	room B14 (restroom B)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			1		0.0			93
276	Sayreville WMHS		Education – Primary School	1st floor	room C26	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			11		0.0			1,023
277	Sayreville WMHS		Education – Primary School	1st floor	room C15	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			8		0.0			912
278	Sayreville WMHS		Education – Primary School	1st floor	room C36	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			4		0.0			248
279	Sayreville WMHS		Education – Primary School	1st floor	room C12 2-pin	Compact Fluorescent	Screw-In	Electronic	N/A	26	e	1		0.0			26
280	Sayreville WMHS		Education – Primary School	1st floor	room C12	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			1		0.0			32
281	Sayreville WMHS		Education – Primary School	1st floor	room C23	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			20		0.0			1,860
282	Sayreville WMHS		Education – Primary School	1st floor	room C23 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			3		0.0			279
283	Sayreville WMHS		Education – Primary School	1st floor	room C9	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			16		0.0			1,488
284	Sayreville WMHS		Education – Primary School	1st floor	room C6	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
285	Sayreville WMHS		Education – Primary School	1st floor	room C6	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			2		0.0			124
286	Sayreville WMHS		Education – Primary School	1st floor	room C7 (storage in C6)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
287	Sayreville WMHS		Education – Primary School	1st floor	room C2 (woodshop)	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			14		0.0			1,596
288	Sayreville WMHS		Education – Primary School	1st floor	room C3 (finish room)	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			2		0.0			228
289	Sayreville WMHS		Education – Primary School	1st floor	room C4 (office)				0	75	e	2		0.0			150
290	Sayreville WMHS		Education – Primary School	1st floor	room C5 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			4		0.0			248
291	Sayreville WMHS		Education – Primary School	1st floor	room C16	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			15		0.0			1,710
292	Sayreville WMHS		Education – Primary School	1st floor	room C17 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			3		0.0			186
293	Sayreville WMHS		Education – Primary School	1st floor	room C19 (prep)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			3		0.0			279
294	Sayreville WMHS		Education – Primary School	1st floor	room C19 (prep)	Linear Fluorescent - T8	2' T8 (17W) - 2L	Electronic	33			1		0.0			33
295	Sayreville WMHS		Education – Primary School	1st floor	room C19	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			20		0.0			1,860
296	Sayreville WMHS		Education – Primary School	1st floor	room C22 (prep)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			4		0.0			248
297	Sayreville WMHS		Education – Primary School	1st floor	room C21 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			4		0.0			248
298	Sayreville WMHS		Education – Primary School	1st floor	room C22	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			12		0.0			1,368
299	Sayreville WMHS		Education – Primary School	1st floor	room C22	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			4		0.0			248
300	Sayreville WMHS		Education – Primary School	1st floor	room E1 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			4		0.0			372
301	Sayreville WMHS		Education – Primary School	1st floor	room E2 (server/storage)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			4		0.0			372
302	Sayreville WMHS		Education – Primary School	1st floor	room E2	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			20		0.0			1,860
303	Sayreville WMHS		Education – Primary School	1st floor	room E3	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			20		0.0			1,860
304	Sayreville WMHS		Education – Primary School	1st floor	room A47	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			28		0.0			3,192
305	Sayreville WMHS		Education – Primary School	1st floor	Room A47C	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			5		0.0			310
306	Sayreville WMHS		Education – Primary School	1st floor	room A47A (office)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
307	Sayreville WMHS		Education – Primary School	1st floor	room A47B	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			4		0.0			248
308	Sayreville WMHS		Education – Primary School	1st floor	room A48	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
309	Sayreville WMHS		Education – Primary School	1st floor	room A46A (office)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
310	Sayreville WMHS		Education – Primary School	1st floor	room A45 (library)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
311	Sayreville WMHS		Education – Primary School	1st floor	room A42	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
312	Sayreville WMHS		Education – Primary School	1st floor	room A43	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			36		0.0			4,104
313	Sayreville WMHS		Education – Primary School	1st floor	room A43A	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
314	Sayreville WMHS		Education – Primary School	1st floor	choir hallway	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			11		0.0			682
315	Sayreville WMHS		Education – Primary School	1st floor	auditorium	Linear Fluorescent - T8	4' T8 (32W) - 6L	Electronic	176			9		0.0			1,584
316	Sayreville WMHS		Education – Primary School	1st floor	auditorium	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			2		0.0			228
317	Sayreville WMHS		Education – Primary School	1st floor	control booth A	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			1		0.0			32
318	Sayreville WMHS		Education – Primary School	1st floor	control booth B	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			1		0.0			32
319	Sayreville WMHS		Education – Primary School	1st floor	room A5 (security)	LED - Fixtures			0	12		4		0.0			48
320	Sayreville WMHS		Education – Primary School	1st floor	room A4	LED - Fixtures			0	12		6		0.0			72
321	Sayreville WMHS		Education – Primary School	1st floor	room A8 (main office restroom)	LED - Fixtures			0	12		1		0.0			12
322	Sayreville WMHS		Education – Primary School	1st floor	room A12	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
323	Sayreville WMHS		Education – Primary School	1st floor	room A13	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
324	Sayreville WMHS		Education – Primary School	1st floor	room A18	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
325	Sayreville WMHS		Education – Primary School	1st floor	room A14 (restroom)	Linear Fluorescent - T8	2' T8 (17W) - 2L	Electronic	33			1		0.0			33
326	Sayreville WMHS		Education – Primary School	1st floor	room A22	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			4		0.0			372
327	Sayreville WMHS		Education – Primary School	1st floor	room A20	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
328	Sayreville WMHS		Education – Primary School	1st floor	room A25/A9/A10	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			17		0.0			1,581
329	Sayreville WMHS		Education – Primary School	1st floor	room A28	Linear Fluorescent - T5	4' T5 (28W) - 1L	Electronic	30			1		0.0			30
330	Sayreville WMHS		Education – Primary School	1st floor	room A29	Linear Fluorescent - T5	4' T5 (28W) - 1L	Electronic	30			1		0.0			30
331	Sayreville WMHS		Education – Primary School	1st floor	room A30 (electrical room)	Linear Fluorescent - T5	4' T5 (28W) - 1L	Electronic	30			1		0.0			30
332	Sayreville WMHS		Education – Primary School	1st floor	hallway	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			245		0.0			15,190
333	Sayreville WMHS		Education – Primary School	1st floor	stair A	Linear Fluorescent - T8	2' T8 (17W) - 4L	Electronic	63			4		0.0			252
334	Sayreville WMHS		Education – Primary School	1st floor	stair B	Linear Fluorescent - T8	2' T8 (17W) - 4L	Electronic	63			3		0.0			189
335	Sayreville WMHS		Education – Primary School	1st floor	stair B	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
336	Sayreville WMHS		Education – Primary School	1st floor	stair C(3)	Linear Fluorescent - T8	2' T8 (17W) - 4L	Electronic	63			3		0.0			189
337	Sayreville WMHS		Education – Primary School	1st floor	stair E	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
338	Sayreville WMHS		Education – Primary School	1st floor	stair F	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
339	Sayreville WMHS		Education – Primary School	1st floor	stair D	Linear Fluorescent - T8	2' T8 (17W) - 4L	Electronic	63			3		0.0			189
340	Sayreville WMHS		Education – Primary School	1st floor	stair G	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			4		0.0			248
341	Sayreville WMHS		Education – Primary School	1st floor	stair G	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
342	Sayreville WMHS		Education – Primary School	1st floor	stair H	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			9		0.0			558
343	Sayreville WMHS		Education – Primary School	1st floor	stair H	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
344	Sayreville WMHS		Education – Primary School	1st floor	stair I	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			5		0.0			310
345	Sayreville WMHS		Education – Primary School	1st floor	Stair I	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62

SAYREVILLE MS

	Location					Existing											
	Building (from 'Area Identification')	Building Area (from 'Area Identification')	Building Type (from 'Area Identification')	Floor #	Area and/or Room/Unit Number	Technology Type	Fixture/Lamp Description	Ballast	Default Watts / Fixture	Actual Watts/Fixture (if different from default)	Watts/Fixture Source	Fixture Qty.	Control Type	Default Reduction Factor	Actual Reduction Factor (if different from default)	Controls Qty.	Total Watts
Ex	Building 1	Classroom/Lecture/Training	Education – Primary School	Ground Floor	Classroom 101	Linear Fluorescent - T12	4' T12 (40W) - 3L	Magnetic	127			2	Occ. Sensor Ceiling Mount (low volt)	0.3		1	254
1	Sayreville MS		Education – Primary School	3rd	C75	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			9		0.0			558
2	Sayreville MS		Education – Primary School	3rd	Closet	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
3	Sayreville MS		Education – Primary School	3rd	C73	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			9		0.0			558
4	Sayreville MS		Education – Primary School	3rd	C72	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
5	Sayreville MS		Education – Primary School	3rd	C71	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			9		0.0			558
6	Sayreville MS		Education – Primary School	3rd	C70	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			9		0.0			558
7	Sayreville MS		Education – Primary School	3rd	C69	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			9		0.0			558
8	Sayreville MS		Education – Primary School	3rd	C68	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			9		0.0			558
9	Sayreville MS		Education – Primary School	3rd	C67	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			9		0.0			558
10	Sayreville MS		Education – Primary School	3rd	C66	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			9		0.0			558
11	Sayreville MS		Education – Primary School	3rd	C65	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			9		0.0			558
12	Sayreville MS		Education – Primary School	3rd	C64	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			9		0.0			558
13	Sayreville MS		Education – Primary School	3rd	C63	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			9		0.0			558
14	Sayreville MS		Education – Primary School	3rd	C62	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			9		0.0			558
15	Sayreville MS		Education – Primary School	3rd	C61	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			9		0.0			558
16	Sayreville MS		Education – Primary School	3rd	C60	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			9		0.0			558
17	Sayreville MS		Education – Primary School	3rd	Boys Room	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
18	Sayreville MS		Education – Primary School	3rd	Faculty Restroom #1	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
19	Sayreville MS		Education – Primary School	3rd	Faculty Restroom #2	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
20	Sayreville MS		Education – Primary School	3rd	C57	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			9		0.0			558
21	Sayreville MS		Education – Primary School	3rd	Custodian	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			1		0.0			32
22	Sayreville MS		Education – Primary School	3rd	Copy Room	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			4		0.0			248
23	Sayreville MS		Education – Primary School	3rd	C52	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			5		0.0			310
24	Sayreville MS		Education – Primary School	3rd	C52	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			3		0.0			96
25	Sayreville MS		Education – Primary School	3rd	Girls Restroom	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
26	Sayreville MS		Education – Primary School	3rd	C50	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			9		0.0			558
27	Sayreville MS		Education – Primary School	3rd	C49	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
28	Sayreville MS		Education – Primary School	3rd	C49	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			2		0.0			64
29	Sayreville MS		Education – Primary School	3rd	C48	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
30	Sayreville MS		Education – Primary School	3rd	Gym	Linear Fluorescent - T5HO	4' T5HO (54W) - 4L	Electronic	234			2		0.0			468
31	Sayreville MS		Education – Primary School	3rd	Gym	Exit Signs	LED	Electronic	2			4		0.0			8
32	Sayreville MS		Education – Primary School	3rd	Boys Locker Vestibule	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			1		0.0			32
33	Sayreville MS		Education – Primary School	3rd	Boys Locker	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			9		0.0			288
34	Sayreville MS		Education – Primary School	3rd	Office/ Restroom	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
35	Sayreville MS		Education – Primary School	3rd	Office/ Restroom	Linear Fluorescent - T8	2' T8 (17W) - 1L	Electronic	22			1		0.0			22
36	Sayreville MS		Education – Primary School	3rd	Office/ Restroom	Compact Fluorescent	Screw-In	Electronic	N/A	42	e	6		0.0			252
37	Sayreville MS		Education – Primary School	3rd	Girls Locker Vestibule	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			1		0.0			32
38	Sayreville MS		Education – Primary School	3rd	Girls Locker	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			9		0.0			288
39	Sayreville MS		Education – Primary School	3rd	Gym	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
40	Sayreville MS		Education – Primary School	3rd	Gym Closet			Electronic	0					0.0			0
41	Sayreville MS		Education – Primary School	3rd	Hallway	Compact Fluorescent	Twin/Triple/Quad Tube	Electronic	N/A	32	e	3		0.0			96
42	Sayreville MS		Education – Primary School	3rd	Hallway	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			60		0.0			3,720
43	Sayreville MS		Education – Primary School	3rd	Hallway	Exit Signs	LED	Electronic	2			7		0.0			14
44	Sayreville MS		Education – Primary School	2nd	D1	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			9		0.0			558
45	Sayreville MS		Education – Primary School	2nd	D2	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
46	Sayreville MS		Education – Primary School	2nd	D3	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
47	Sayreville MS		Education – Primary School	2nd	D4	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
48	Sayreville MS		Education – Primary School	2nd	D5	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
49	Sayreville MS		Education – Primary School	2nd	D6	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
50	Sayreville MS		Education – Primary School	2nd	D7	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
51	Sayreville MS		Education – Primary School	2nd	D8	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
52	Sayreville MS		Education – Primary School	2nd	D9	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
53	Sayreville MS		Education – Primary School	2nd	D10	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
54	Sayreville MS		Education – Primary School	2nd	D11	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
55	Sayreville MS		Education – Primary School	2nd	D12	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
56	Sayreville MS		Education – Primary School	2nd	Restroom	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			5		0.0			570
57	Sayreville MS		Education – Primary School	2nd	Restroom	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0			62
58	Sayreville MS		Education – Primary School	2nd	Janitors	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
59	Sayreville MS		Education – Primary School	2nd	Restroom	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			4		0.0			456
60	Sayreville MS		Education – Primary School	2nd	Restroom	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			2		0.0			124
61	Sayreville MS		Education – Primary School	2nd	D16	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
62	Sayreville MS		Education – Primary School	2nd	D17	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			9		0.0			558
63	Sayreville MS		Education – Primary School	2nd	D17	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			3		0.0			96
64	Sayreville MS		Education – Primary School	2nd	Faculty Restroom	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			1		0.0			32
65	Sayreville MS		Education – Primary School	2nd	Faculty Restroom	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			1		0.0			32
66	Sayreville MS		Education – Primary School	2nd	Copy Room	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
67	Sayreville MS		Education – Primary School	2nd	D23	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
68	Sayreville MS		Education – Primary School	2nd	D24	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
69	Sayreville MS		Education – Primary School	2nd	D25	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			9		0.0			558
70	Sayreville MS		Education – Primary School	2nd	D26	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			9		0.0			558
71	Sayreville MS		Education – Primary School	2nd	D28A	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
72	Sayreville MS		Education – Primary School	2nd	D28A	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			11		0.0			682
73	Sayreville MS		Education – Primary School	2nd	D22	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
74	Sayreville MS		Education – Primary School	2nd	D29	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
75	Sayreville MS		Education – Primary School	2nd	Vestibule	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
76	Sayreville MS		Education – Primary School	2nd	Vestibule	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			1		0.0			32
77	Sayreville MS		Education – Primary School	2nd	D30	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
78	Sayreville MS		Education – Primary School	2nd	Boys Restroom	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			5		0.0			570
79	Sayreville MS		Education – Primary School	2nd	Boys Restroom	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0			62
80	Sayreville MS		Education – Primary School	2nd	Janitors	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
81	Sayreville MS		Education – Primary School	2nd	Girls Restroom	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			5		0.0			570
82	Sayreville MS		Education – Primary School	2nd	Girls Restroom	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0			62
83	Sayreville MS		Education – Primary School	2nd	D34	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
84	Sayreville MS		Education – Primary School	2nd	D35	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
85	Sayreville MS		Education – Primary School	2nd	D36	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
86	Sayreville MS		Education – Primary School	2nd	D37	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
87	Sayreville MS		Education – Primary School	2nd	D38	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
88	Sayreville MS		Education – Primary School	2nd	D39	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
89	Sayreville MS		Education – Primary School	2nd	D40	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
90	Sayreville MS		Education – Primary School	2nd	D41	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
91	Sayreville MS		Education – Primary School	2nd	D42	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
92	Sayreville MS		Education – Primary School	2nd	D43	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744

93	Sayreville MS		Education – Primary School	2nd	D44	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
94	Sayreville MS		Education – Primary School	2nd	D45	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
95	Sayreville MS		Education – Primary School	2nd	Hallway	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			52		0.0			3,224
96	Sayreville MS		Education – Primary School	2nd	Hallway	Exit Signs	LED	Electronic	2			6		0.0			12
97	Sayreville MS		Education – Primary School	2nd	Hallway	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
98	Sayreville MS		Education – Primary School	1st	1st Fl Boys Room	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			2		0.0			228
99	Sayreville MS		Education – Primary School	1st	Girls Room	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			2		0.0			228
100	Sayreville MS		Education – Primary School	1st	Cafeteria	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			45		0.0			2,790
101	Sayreville MS		Education – Primary School	1st	Cafeteria	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			47		0.0			4,371
102	Sayreville MS		Education – Primary School	1st	Cafeteria	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			12		0.0			744
103	Sayreville MS		Education – Primary School	1st	Lounge	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			4		0.0			248
104	Sayreville MS		Education – Primary School	1st	Kitchen	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			30		0.0			1,860
105	Sayreville MS		Education – Primary School	1st	Library	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			66		0.0			4,092
106	Sayreville MS		Education – Primary School	1st	Library	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			17		0.0			1,581
107	Sayreville MS		Education – Primary School	1st	Office #1	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
108	Sayreville MS		Education – Primary School	1st	Office #2	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
109	Sayreville MS		Education – Primary School	1st	A1	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			3		0.0			342
110	Sayreville MS		Education – Primary School	1st	A1	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			2		0.0			124
111	Sayreville MS		Education – Primary School	1st	Vestibule	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0			62
112	Sayreville MS		Education – Primary School	1st	Conference Room	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			3		0.0			186
113	Sayreville MS		Education – Primary School	1st	Main Office	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			9		0.0			1,026
114	Sayreville MS		Education – Primary School	1st	Main Office	Linear Fluorescent - T8	2' T8 (17W) - 2L	Electronic	33			1		0.0			33
115	Sayreville MS		Education – Primary School	1st	Office	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			3		0.0			186
116	Sayreville MS		Education – Primary School	1st	Office	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
117	Sayreville MS		Education – Primary School	1st	Mens Room	Linear Fluorescent - T8	2' T8 (17W) - 2L	Electronic	33			1		0.0			33
118	Sayreville MS		Education – Primary School	1st	Womens Room	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			1		0.0			32
119	Sayreville MS		Education – Primary School	1st	Nurses Office	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			9		0.0			558
120	Sayreville MS		Education – Primary School	1st	Nurses Office	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			6		0.0			192
121	Sayreville MS		Education – Primary School	1st	Nurses Office	Linear Fluorescent - T8	2' T8 (17W) - 2L	Electronic	33			1		0.0			33
122	Sayreville MS		Education – Primary School	1st	Nurses Office	Linear Fluorescent - T8	2' T8 (17W) - 1L	Electronic	22			1		0.0			22
123	Sayreville MS		Education – Primary School	1st	Restrooms	Linear Fluorescent - T8	2' T8 (17W) - 2L	Electronic	33			3		0.0			99
124	Sayreville MS		Education – Primary School	1st	B5	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
125	Sayreville MS		Education – Primary School	1st	B5	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			3		0.0			96
126	Sayreville MS		Education – Primary School	1st	B7	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
127	Sayreville MS		Education – Primary School	1st	B7	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			13		0.0			416
128	Sayreville MS		Education – Primary School	1st	B8	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			17		0.0			1,054
129	Sayreville MS		Education – Primary School	1st	Janitors	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
130	Sayreville MS		Education – Primary School	1st	Restroom	Linear Fluorescent - T8	2' T8 (17W) - 1L	Electronic	22			1		0.0			22
131	Sayreville MS		Education – Primary School	1st	Boiler	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			10		0.0			620
132	Sayreville MS		Education – Primary School	1st	Roof Access	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			1		0.0			32
133	Sayreville MS		Education – Primary School	1st	Staff Only #1	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			1		0.0			32
134	Sayreville MS		Education – Primary School	1st	Staff Only #2	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
135	Sayreville MS		Education – Primary School	1st	B13	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			9		0.0			558
136	Sayreville MS		Education – Primary School	1st	Vestibule	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			3		0.0			186
137	Sayreville MS		Education – Primary School	1st	B15	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			14		0.0			868
138	Sayreville MS		Education – Primary School	1st	B16	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			14		0.0			868
139	Sayreville MS		Education – Primary School	1st	B18	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			10		0.0			320
140	Sayreville MS		Education – Primary School	1st	B18	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
141	Sayreville MS		Education – Primary School	1st	B17	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
142	Sayreville MS		Education – Primary School	1st	B19	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
143	Sayreville MS		Education – Primary School	1st	C1	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
144	Sayreville MS		Education – Primary School	1st	Girls	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
145	Sayreville MS		Education – Primary School	1st	C6	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
146	Sayreville MS		Education – Primary School	1st	Tech Office	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
147	Sayreville MS		Education – Primary School	1st	C4	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
148	Sayreville MS		Education – Primary School	1st	Elevator Control	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			1		0.0			32
149	Sayreville MS		Education – Primary School	1st	Faculty #1	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			1		0.0			32
150	Sayreville MS		Education – Primary School	1st	Faculty #2	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			1		0.0			32
151	Sayreville MS		Education – Primary School	1st	Boys Room	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
152	Sayreville MS		Education – Primary School	1st	C9	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
153	Sayreville MS		Education – Primary School	1st	C10	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
154	Sayreville MS		Education – Primary School	1st	C11	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
155	Sayreville MS		Education – Primary School	1st	C12	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
156	Sayreville MS		Education – Primary School	1st	C13	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
157	Sayreville MS		Education – Primary School	1st	C14	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
158	Sayreville MS		Education – Primary School	1st	C15	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
159	Sayreville MS		Education – Primary School	1st	C16	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
160	Sayreville MS		Education – Primary School	1st	C17	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
161	Sayreville MS		Education – Primary School	1st	C18	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
162	Sayreville MS		Education – Primary School	1st	C19	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
163	Sayreville MS		Education – Primary School	1st	C20	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
164	Sayreville MS		Education – Primary School	1st	C21	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			11		0.0			682
165	Sayreville MS		Education – Primary School	1st	C22	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			3		0.0			186
166	Sayreville MS		Education – Primary School	1st	C23	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
167	Sayreville MS		Education – Primary School	1st	Hallway	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			40		0.0			2,480
168	Sayreville MS		Education – Primary School	1st	Hallway	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			4		0.0			248
169	Sayreville MS		Education – Primary School	1st	Hallway	Linear Fluorescent - T8	2' T8 (17W) - 3L	Electronic	53			12		0.0			636
170	Sayreville MS		Education – Primary School	1st	Hallway	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			22		0.0			2,046
171	Sayreville MS		Education – Primary School	1st	Hallway	Compact Fluorescent	Twin/Triple/Quad Tube	Electronic	N/A	32	e	16		0.0			512
172	Sayreville MS		Education – Primary School	1st	Hallway	Compact Fluorescent	Twin/Triple/Quad Tube	Electronic	N/A	32	e	8		0.0			256
173	Sayreville MS		Education – Primary School	1st	Hallway	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			5		0.0			570
174	Sayreville MS		Education – Primary School	1st	Hallway	Compact Fluorescent	Screw-In	N/A	N/A	23	e	4		0.0			92
175	Sayreville MS		Education – Primary School	1st	Hallway	Exit Signs	LED		2			6		0.0			12
176	Sayreville MS		Education – Primary School	1st	Security Room	LED - Linear Tubes	4' LED Tube		18			4		0.0			72
177	Sayreville MS		Education – Primary School	1st	501	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
178	Sayreville MS		Education – Primary School	1st	501	Linear Fluorescent - T8	2' T8 (17W) - 2L	Electronic	33			3		0.0			99
179	Sayreville MS		Education – Primary School	1st	501	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			3		0.0			96
180	Sayreville MS		Education – Primary School	1st	Janitors	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
181	Sayreville MS		Education – Primary School	1st	502	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
182	Sayreville MS		Education – Primary School	1st	502	Linear Fluorescent - T8	2' T8 (17W) - 2L	Electronic	33			3		0.0			99
183	Sayreville MS		Education – Primary School	1st	502	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			3		0.0			96
184	Sayreville MS		Education – Primary School	1st	503	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
185	Sayreville MS		Education – Primary School	1st	503	Linear Fluorescent - T8	2' T8 (17W) - 2L	Electronic	33			3		0.0			99
186	Sayreville MS		Education – Primary School	1st	503	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			3		0.0			96
187	Sayreville MS		Education – Primary School	1st	504	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
188	Sayreville MS		Education – Primary School	1st	504	Linear Fluorescent - T8	2' T8 (17W) - 2L	Electronic	33			3		0.0			99
189	Sayreville MS		Education – Primary School	1st	504	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			3		0.0			96
190	Sayreville MS		Education – Primary School	1st	506	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372

191	Sayreville MS		Education – Primary School	1st	506	Linear Fluorescent - T8	2' T8 (17W) - 2L	Electronic	33			3		0.0			99
192	Sayreville MS		Education – Primary School	1st	506	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			3		0.0			96
193	Sayreville MS		Education – Primary School	1st	505	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
194	Sayreville MS		Education – Primary School	1st	505	Linear Fluorescent - T8	2' T8 (17W) - 2L	Electronic	33			3		0.0			99
195	Sayreville MS		Education – Primary School	1st	505	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			3		0.0			96
196	Sayreville MS		Education – Primary School	1st	507	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
197	Sayreville MS		Education – Primary School	1st	507	Linear Fluorescent - T8	2' T8 (17W) - 2L	Electronic	33			3		0.0			99
198	Sayreville MS		Education – Primary School	1st	507	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			3		0.0			96
199	Sayreville MS		Education – Primary School	1st	508	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
200	Sayreville MS		Education – Primary School	1st	508	Linear Fluorescent - T8	2' T8 (17W) - 2L	Electronic	33			3		0.0			99
201	Sayreville MS		Education – Primary School	1st	508	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			3		0.0			96
202	Sayreville MS		Education – Primary School	1st	510	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
203	Sayreville MS		Education – Primary School	1st	510	Linear Fluorescent - T8	2' T8 (17W) - 2L	Electronic	33			3		0.0			99
204	Sayreville MS		Education – Primary School	1st	510	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			3		0.0			96
205	Sayreville MS		Education – Primary School	1st	509	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
206	Sayreville MS		Education – Primary School	1st	509	Linear Fluorescent - T8	2' T8 (17W) - 2L	Electronic	33			3		0.0			99
207	Sayreville MS		Education – Primary School	1st	509	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			3		0.0			96
208	Sayreville MS		Education – Primary School	1st	511	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
209	Sayreville MS		Education – Primary School	1st	511	Linear Fluorescent - T8	2' T8 (17W) - 2L	Electronic	33			3		0.0			99
210	Sayreville MS		Education – Primary School	1st	511	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			3		0.0			96
211	Sayreville MS		Education – Primary School	1st	513	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
212	Sayreville MS		Education – Primary School	1st	513	Linear Fluorescent - T8	2' T8 (17W) - 2L	Electronic	33			3		0.0			99
213	Sayreville MS		Education – Primary School	1st	513	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			3		0.0			96
214	Sayreville MS		Education – Primary School	1st	512	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
215	Sayreville MS		Education – Primary School	1st	512	Linear Fluorescent - T8	2' T8 (17W) - 2L	Electronic	33			3		0.0			99
216	Sayreville MS		Education – Primary School	1st	512	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			3		0.0			96
217	Sayreville MS		Education – Primary School	1st	514	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
218	Sayreville MS		Education – Primary School	1st	514	Linear Fluorescent - T8	2' T8 (17W) - 2L	Electronic	33			3		0.0			99
219	Sayreville MS		Education – Primary School	1st	514	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			3		0.0			96
220	Sayreville MS		Education – Primary School	1st	515	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
221	Sayreville MS		Education – Primary School	1st	515	Linear Fluorescent - T8	2' T8 (17W) - 2L	Electronic	33			3		0.0			99
222	Sayreville MS		Education – Primary School	1st	515	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			3		0.0			96
223	Sayreville MS		Education – Primary School	1st	517	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
224	Sayreville MS		Education – Primary School	1st	517	Linear Fluorescent - T8	2' T8 (17W) - 2L	Electronic	33			3		0.0			99
225	Sayreville MS		Education – Primary School	1st	517	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			3		0.0			96
226	Sayreville MS		Education – Primary School	1st	516	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
227	Sayreville MS		Education – Primary School	1st	516	Linear Fluorescent - T8	2' T8 (17W) - 2L	Electronic	33			3		0.0			99
228	Sayreville MS		Education – Primary School	1st	516	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			3		0.0			96
229	Sayreville MS		Education – Primary School	1st	518	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
230	Sayreville MS		Education – Primary School	1st	518	Linear Fluorescent - T8	2' T8 (17W) - 2L	Electronic	33			3		0.0			99
231	Sayreville MS		Education – Primary School	1st	518	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			3		0.0			96
232	Sayreville MS		Education – Primary School	1st	519	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
233	Sayreville MS		Education – Primary School	1st	519	Linear Fluorescent - T8	2' T8 (17W) - 2L	Electronic	33			3		0.0			99
234	Sayreville MS		Education – Primary School	1st	519	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			3		0.0			96
235	Sayreville MS		Education – Primary School	1st	520	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
236	Sayreville MS		Education – Primary School	1st	520	Linear Fluorescent - T8	2' T8 (17W) - 2L	Electronic	33			3		0.0			99
237	Sayreville MS		Education – Primary School	1st	520	Linear Fluorescent - T8	4' T8 (32W) - 1L	Electronic	32			3		0.0			96
238	Sayreville MS		Education – Primary School	1st	Hallway	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			20		0.0			1,240
239	Sayreville MS		Education – Primary School	1st	Hallway	Linear Fluorescent - T8	2' T8 (17W) - 2L	Electronic	33			20		0.0			660
240	Sayreville MS		Education – Primary School	1st	Hallway	Exit Signs	LED		2			4		0.0			8
241	Sayreville MS		Education – Primary School	1st	Stairs A	Compact Fluorescent	Twin/Triple/Quad Tube	Magnetic	N/A	26	e	6		0.0			156
242	Sayreville MS		Education – Primary School	1st	Stairs B	Compact Fluorescent	Twin/Triple/Quad Tube	Magnetic	N/A	26	e	4		0.0			104
243	Sayreville MS		Education – Primary School	1st	Vestibule	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			7		0.0			434
244	Sayreville MS		Education – Primary School		Stairs C	Compact Fluorescent	Twin/Triple/Quad Tube	Magnetic	N/A	26	e	7		0.0			182
245	Sayreville MS		Education – Primary School		Stairs D	Compact Fluorescent	Twin/Triple/Quad Tube	Magnetic	N/A	26	e	7		0.0			182
246	Sayreville MS		Education – Primary School		Stairs E	Compact Fluorescent	Twin/Triple/Quad Tube	Magnetic	N/A	26	e	8		0.0			208

SAMSEL UPPER ELEMENTARY SCHOOL

Existing											
Technology Type	**Fixture/Lamp Description**	**Ballast**	**Default Watts / Fixture**	**Actual Watts/Fixture** (if different from default)	**Watts/Fixture Source**	**Fixture Qty.**	**Control Type**	**Default Reduction Factor**	**Actual Reduction Factor** (if different from default)	**Controls Qty.**	**Total Watts**
HID	High-Pressure Sodium	Magnetic	N/A	125	b	2	None	0.0		1	250
Compact Fluorescent	Screw-In	Electronic	N/A	84	e	25		0.0			2,100
HID	Metal Halide	Electronic	N/A	150	e			0.0			0

Location						Existing											
	Building (from 'Area Identification')	Building Area (from 'Area Identification')	Building Type (from 'Area Identification')	Floor #	Area and/or Room/Unit Number	Technology Type	Fixture/Lamp Description	Ballast	Default Watts / Fixture	Actual Watts/Fixture (if different from default)	Watts/Fixture Source	Fixture Qty.	Control Type	Default Reduction Factor	Actual Reduction Factor (if different from default)	Controls Qty.	Total Watts
Ex	Building 1	Classroom/Lecture/Training	Education – Primary School	Ground Floor	Classroom 101	Linear Fluorescent - T12	4' T12 (40W) - 3L	Magnetic	127			2	Occ. Sensor Ceiling Mount (low volt)	0.3		1	254
1	Samsel Upper ES		Education – Primary School	3rd floor	Aux Gym(339)	Compact Fluorescent	Screw-In	Electronic	N/A	160	e	16		0.0			2,560
2	Samsel Upper ES		Education – Primary School	3rd floor	girls room A	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			1		0.0			93
3	Samsel Upper ES		Education – Primary School	3rd floor	girls room A	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
4	Samsel Upper ES		Education – Primary School	3rd floor	girls room A	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0			62
5	Samsel Upper ES		Education – Primary School	3rd floor	boys room A	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			1		0.0			93
6	Samsel Upper ES		Education – Primary School	3rd floor	boys room A	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
7	Samsel Upper ES		Education – Primary School	3rd floor	boys room A	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0			62
8	Samsel Upper ES		Education – Primary School	3rd floor	room 338	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			15		0.0			1,395
9	Samsel Upper ES		Education – Primary School	3rd floor	room 337(storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
10	Samsel Upper ES		Education – Primary School	3rd floor	room 336	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			15		0.0			1,395
11	Samsel Upper ES		Education – Primary School	3rd floor	room 335	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			15		0.0			1,395
12	Samsel Upper ES		Education – Primary School	3rd floor	room 334	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			15		0.0			1,395
13	Samsel Upper ES		Education – Primary School	3rd floor	room 333	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			15		0.0			1,395
14	Samsel Upper ES		Education – Primary School	3rd floor	room 332(storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			4		0.0			248
15	Samsel Upper ES		Education – Primary School	3rd floor	room 331	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
16	Samsel Upper ES		Education – Primary School	3rd floor	room 330	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			4		0.0			248
17	Samsel Upper ES		Education – Primary School	3rd floor	room 329	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
18	Samsel Upper ES		Education – Primary School	3rd floor	room 326	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			8		0.0			744
19	Samsel Upper ES		Education – Primary School	3rd floor	room 328	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
20	Samsel Upper ES		Education – Primary School	3rd floor	room 327	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
21	Samsel Upper ES		Education – Primary School	3rd floor	room 325	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			8		0.0			744
22	Samsel Upper ES		Education – Primary School	3rd floor	room 323	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			8		0.0			744
23	Samsel Upper ES		Education – Primary School	3rd floor	room 324	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
24	Samsel Upper ES		Education – Primary School	3rd floor	room 320	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			8		0.0			744
25	Samsel Upper ES		Education – Primary School	3rd floor	room 322	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			8		0.0			744
26	Samsel Upper ES		Education – Primary School	3rd floor	room 321	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
27	Samsel Upper ES		Education – Primary School	3rd floor	room 319	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			8		0.0			744
28	Samsel Upper ES		Education – Primary School	3rd floor	room 318	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
29	Samsel Upper ES		Education – Primary School	3rd floor	room 317 (teachers room)	U-Bend Fluorescent - T8	U T8 (32W) - 3L	Electronic	92			12		0.0			1,104
30	Samsel Upper ES		Education – Primary School	3rd floor	room 317 (womens room)	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0			62
31	Samsel Upper ES		Education – Primary School	3rd floor	room 317 (mens room)	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0			62
32	Samsel Upper ES		Education – Primary School	3rd floor	room 315	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
33	Samsel Upper ES		Education – Primary School	3rd floor	room 316 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
34	Samsel Upper ES		Education – Primary School	3rd floor	room 314	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
35	Samsel Upper ES		Education – Primary School	3rd floor	room 313	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
36	Samsel Upper ES		Education – Primary School	3rd floor	room 311	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
37	Samsel Upper ES		Education – Primary School	3rd floor	room 312	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			21		0.0			1,953
38	Samsel Upper ES		Education – Primary School	3rd floor	room 310	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
39	Samsel Upper ES		Education – Primary School	3rd floor	room 309	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
40	Samsel Upper ES		Education – Primary School	3rd floor	room 308 (library)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			52		0.0			4,836
41	Samsel Upper ES		Education – Primary School	3rd floor	room 308 (library)	Compact Fluorescent	Screw-In	Electronic	N/A	52	e	14		0.0			728
42	Samsel Upper ES		Education – Primary School	3rd floor	room 308 (library)	U-Bend Fluorescent - T8	U T8 (32W) - 3L	Electronic	92			2		0.0			184
43	Samsel Upper ES		Education – Primary School	3rd floor	room 308 (office)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			4		0.0			372
44	Samsel Upper ES		Education – Primary School	3rd floor	room 308 (office)	U-Bend Fluorescent - T8	U T8 (32W) - 3L	Electronic	92			1		0.0			92
45	Samsel Upper ES		Education – Primary School	3rd floor	room 307	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
46	Samsel Upper ES		Education – Primary School	3rd floor	room 306	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
47	Samsel Upper ES		Education – Primary School	3rd floor	room 304	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			9		0.0			837
48	Samsel Upper ES		Education – Primary School	3rd floor	room 304	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
49	Samsel Upper ES		Education – Primary School	3rd floor	room 304	U-Bend Fluorescent - T8	U T8 (32W) - 3L	Electronic	92			3		0.0			276
50	Samsel Upper ES		Education – Primary School	3rd floor	room 304	Compact Fluorescent	Screw-In	Electronic	N/A	52	e	2		0.0			104
51	Samsel Upper ES		Education – Primary School	3rd floor	room 304 (A/V room)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			3		0.0			279
52	Samsel Upper ES		Education – Primary School	3rd floor	room 305	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
53	Samsel Upper ES		Education – Primary School	3rd floor	room 303	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			8		0.0			744
54	Samsel Upper ES		Education – Primary School	3rd floor	room 379	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
55	Samsel Upper ES		Education – Primary School	3rd floor	room 302	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			8		0.0			744
56	Samsel Upper ES		Education – Primary School	3rd floor	room 378	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
57	Samsel Upper ES		Education – Primary School	3rd floor	room 377 (teachers room)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			8		0.0			744
58	Samsel Upper ES		Education – Primary School	3rd floor	room 377 (womens room)	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0			62
59	Samsel Upper ES		Education – Primary School	3rd floor	room 377 (mens room)	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0			62
60	Samsel Upper ES		Education – Primary School	3rd floor	boys room B	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			3		0.0			186
61	Samsel Upper ES		Education – Primary School	3rd floor	boys room B	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0			62
62	Samsel Upper ES		Education – Primary School	3rd floor	janitor closet A	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
63	Samsel Upper ES		Education – Primary School	3rd floor	room 376	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
64	Samsel Upper ES		Education – Primary School	3rd floor	girls room B	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			3		0.0			186
65	Samsel Upper ES		Education – Primary School	3rd floor	girls room B	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0			62
66	Samsel Upper ES		Education – Primary School	3rd floor	room 375	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			8		0.0			744
67	Samsel Upper ES		Education – Primary School	3rd floor	room 374	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
68	Samsel Upper ES		Education – Primary School	3rd floor	room 373	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
69	Samsel Upper ES		Education – Primary School	3rd floor	room 372	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
70	Samsel Upper ES		Education – Primary School	3rd floor	room 370	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
71	Samsel Upper ES		Education – Primary School	3rd floor	room 371	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
72	Samsel Upper ES		Education – Primary School	3rd floor	room 369	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			8		0.0			744
73	Samsel Upper ES		Education – Primary School	3rd floor	room 368	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			8		0.0			744
74	Samsel Upper ES		Education – Primary School	3rd floor	room 366	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
75	Samsel Upper ES		Education – Primary School	3rd floor	room 367	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
76	Samsel Upper ES		Education – Primary School	3rd floor	room 365	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			8		0.0			744
77	Samsel Upper ES		Education – Primary School	3rd floor	room 364	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			8		0.0			744
78	Samsel Upper ES		Education – Primary School	3rd floor	room 362	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
79	Samsel Upper ES		Education – Primary School	3rd floor	room 363	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
80	Samsel Upper ES		Education – Primary School	3rd floor	room 361	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
81	Samsel Upper ES		Education – Primary School	3rd floor	boys room C	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			3		0.0			279
82	Samsel Upper ES		Education – Primary School	3rd floor	boys room C	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0			62
83	Samsel Upper ES		Education – Primary School	3rd floor	janitor closet B	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0			62
84	Samsel Upper ES		Education – Primary School	3rd floor	room 360	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
85	Samsel Upper ES		Education – Primary School	3rd floor	room 359	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			16		0.0			1,488
86	Samsel Upper ES		Education – Primary School	3rd floor	room 358	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			8		0.0			744
87	Samsel Upper ES		Education – Primary School	3rd floor	room 358	U-Bend Fluorescent - T8	U T8 (32W) - 3L	Electronic	92			1		0.0			92
88	Samsel Upper ES		Education – Primary School	3rd floor	girls room C	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			3		0.0			279

89	Samsel Upper ES		Education – Primary School	3rd floor	girls room C	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0		62
90	Samsel Upper ES		Education – Primary School	3rd floor	room 357	U-Bend Fluorescent - T8	U T8 (32W) - 3L	Electronic	92			1		0.0		92
91	Samsel Upper ES		Education – Primary School	3rd floor	room 357	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			8		0.0		744
92	Samsel Upper ES		Education – Primary School	3rd floor	room 356	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			11		0.0		1,023
93	Samsel Upper ES		Education – Primary School	3rd floor	room 356	U-Bend Fluorescent - T8	U T8 (32W) - 3L	Electronic	92			1		0.0		92
94	Samsel Upper ES		Education – Primary School	3rd floor	room 355	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0		1,116
95	Samsel Upper ES		Education – Primary School	3rd floor	room 354	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0		1,116
96	Samsel Upper ES		Education – Primary School	3rd floor	room 353	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0		1,116
97	Samsel Upper ES		Education – Primary School	3rd floor	room 351 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0		372
98	Samsel Upper ES		Education – Primary School	3rd floor	room 352 (sotrage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0		372
99	Samsel Upper ES		Education – Primary School	3rd floor	room 349	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			15		0.0		1,395
100	Samsel Upper ES		Education – Primary School	3rd floor	room 350	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			15		0.0		1,395
101	Samsel Upper ES		Education – Primary School	3rd floor	room 348	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			15		0.0		1,395
102	Samsel Upper ES		Education – Primary School	3rd floor	room 347	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			15		0.0		1,395
103	Samsel Upper ES		Education – Primary School	3rd floor	room 346	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			15		0.0		1,395
104	Samsel Upper ES		Education – Primary School	3rd floor	room 345	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			15		0.0		1,395
105	Samsel Upper ES		Education – Primary School	3rd floor	room 344 (mech room)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			5		0.0		310
106	Samsel Upper ES		Education – Primary School	3rd floor	room 343	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			6		0.0		684
107	Samsel Upper ES		Education – Primary School	3rd floor	room 341	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			9		0.0		837
108	Samsel Upper ES		Education – Primary School	3rd floor	room 342	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			9		0.0		1,026
109	Samsel Upper ES		Education – Primary School	3rd floor	room 340	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			9		0.0		837
110	Samsel Upper ES		Education – Primary School	3rd floor	womens room A	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0		124
111	Samsel Upper ES		Education – Primary School	3rd floor	womens room A	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0		62
112	Samsel Upper ES		Education – Primary School	3rd floor	storage A	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0		62
113	Samsel Upper ES		Education – Primary School	3rd floor	janitor closet C	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0		62
114	Samsel Upper ES		Education – Primary School	3rd floor	childrens restroom A	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0		124
115	Samsel Upper ES		Education – Primary School	3rd floor	childrens restroom A	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0		62
116	Samsel Upper ES		Education – Primary School	3rd floor	hallway	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			93		0.0		5,766
117	Samsel Upper ES		Education – Primary School	3rd floor	hallway	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			3		0.0		186
118	Samsel Upper ES		Education – Primary School	2nd floor	room 237A	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			8		0.0		496
119	Samsel Upper ES		Education – Primary School	2nd floor	room 237B	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0		744
120	Samsel Upper ES		Education – Primary School	2nd floor	room 235 (restroom)	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0		62
121	Samsel Upper ES		Education – Primary School	2nd floor	room 235	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0		62
122	Samsel Upper ES		Education – Primary School	2nd floor	room 235	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			13		0.0		1,482
123	Samsel Upper ES		Education – Primary School	2nd floor	room 236	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			13		0.0		1,482
124	Samsel Upper ES		Education – Primary School	2nd floor	room 236	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0		62
125	Samsel Upper ES		Education – Primary School	2nd floor	room 236 (restroom)	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0		62
126	Samsel Upper ES		Education – Primary School	2nd floor	room 233 closet	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0		62
127	Samsel Upper ES		Education – Primary School	2nd floor	room 233 (restroom)	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0		62
128	Samsel Upper ES		Education – Primary School	2nd floor	room 233	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0		62
129	Samsel Upper ES		Education – Primary School	2nd floor	room 233	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			13		0.0		1,482
130	Samsel Upper ES		Education – Primary School	2nd floor	room 234 (electrical room)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0		124
131	Samsel Upper ES		Education – Primary School	2nd floor	room 234 (restroom)	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0		62
132	Samsel Upper ES		Education – Primary School	2nd floor	room 234	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0		62
133	Samsel Upper ES		Education – Primary School	2nd floor	room 234	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			11		0.0		1,254
134	Samsel Upper ES		Education – Primary School	2nd floor	room 237 (security)	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			2		0.0		228
135	Samsel Upper ES		Education – Primary School	2nd floor	principal	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			4		0.0		456
136	Samsel Upper ES		Education – Primary School	2nd floor	vice principal	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			4		0.0		372
137	Samsel Upper ES		Education – Primary School	2nd floor	main office (restroom)	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0		62
138	Samsel Upper ES		Education – Primary School	2nd floor	main office conference	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			4		0.0		372
139	Samsel Upper ES		Education – Primary School	2nd floor	main office - office A	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			4		0.0		372
140	Samsel Upper ES		Education – Primary School	2nd floor	main office (hallway)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			4		0.0		248
141	Samsel Upper ES		Education – Primary School	2nd floor	main office copy room	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			4		0.0		372
142	Samsel Upper ES		Education – Primary School	2nd floor	main office	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0		558
143	Samsel Upper ES		Education – Primary School	2nd floor	main office	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			5		0.0		310
144	Samsel Upper ES		Education – Primary School	2nd floor	main office	Compact Fluorescent	Screw-In	Electronic	N/A	52	e	5		0.0		260
145	Samsel Upper ES		Education – Primary School	2nd floor	front vestibule	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0		372
146	Samsel Upper ES		Education – Primary School	2nd floor	nurse restroom	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0		62
147	Samsel Upper ES		Education – Primary School	2nd floor	nurse	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			11		0.0		1,023
148	Samsel Upper ES		Education – Primary School	2nd floor	room 230	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			9		0.0		837
149	Samsel Upper ES		Education – Primary School	2nd floor	room 229 (womens room)	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0		62
150	Samsel Upper ES		Education – Primary School	2nd floor	room 229 (mens room)	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0		62
151	Samsel Upper ES		Education – Primary School	2nd floor	room 229	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			9		0.0		837
152	Samsel Upper ES		Education – Primary School	2nd floor	room 228	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			8		0.0		744
153	Samsel Upper ES		Education – Primary School	2nd floor	girls room A	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			3		0.0		186
154	Samsel Upper ES		Education – Primary School	2nd floor	girls room A	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0		62
155	Samsel Upper ES		Education – Primary School	2nd floor	room 227 (office A)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0		124
156	Samsel Upper ES		Education – Primary School	2nd floor	room 227 (office B)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0		124
157	Samsel Upper ES		Education – Primary School	2nd floor	room 227	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			3		0.0		186
158	Samsel Upper ES		Education – Primary School	2nd floor	room 226 (computer room)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			19		0.0		1,767
159	Samsel Upper ES		Education – Primary School	2nd floor	room 225	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			15		0.0		1,395
160	Samsel Upper ES		Education – Primary School	2nd floor	room 225	U-Bend Fluorescent - T8	U T8 (32W) - 3L	Electronic	92			1		0.0		92
161	Samsel Upper ES		Education – Primary School	2nd floor	janitors closet A	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0		62
162	Samsel Upper ES		Education – Primary School	2nd floor	boys room A	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			3		0.0		186
163	Samsel Upper ES		Education – Primary School	2nd floor	boys room A	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0		62
164	Samsel Upper ES		Education – Primary School	2nd floor	room 224	U-Bend Fluorescent - T8	U T8 (32W) - 3L	Electronic	92			1		0.0		92
165	Samsel Upper ES		Education – Primary School	2nd floor	room 224	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			15		0.0		1,395
166	Samsel Upper ES		Education – Primary School	2nd floor	room 222	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			15		0.0		1,395
167	Samsel Upper ES		Education – Primary School	2nd floor	room 222	U-Bend Fluorescent - T8	U T8 (32W) - 3L	Electronic	92			1		0.0		92
168	Samsel Upper ES		Education – Primary School	2nd floor	room 223	U-Bend Fluorescent - T8	U T8 (32W) - 3L	Electronic	92			1		0.0		92
169	Samsel Upper ES		Education – Primary School	2nd floor	room 223	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			15		0.0		1,395
170	Samsel Upper ES		Education – Primary School	2nd floor	room 221	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			7		0.0		651
171	Samsel Upper ES		Education – Primary School	2nd floor	room 221	U-Bend Fluorescent - T8	U T8 (32W) - 3L	Electronic	92			1		0.0		92
172	Samsel Upper ES		Education – Primary School	2nd floor	room 220	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			8		0.0		744
173	Samsel Upper ES		Education – Primary School	2nd floor	court access vestibule	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			3		0.0		279
174	Samsel Upper ES		Education – Primary School	2nd floor	room 218	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			15		0.0		1,395
175	Samsel Upper ES		Education – Primary School	2nd floor	room 218	U-Bend Fluorescent - T8	U T8 (32W) - 3L	Electronic	92			1		0.0		92
176	Samsel Upper ES		Education – Primary School	2nd floor	room 217	U-Bend Fluorescent - T8	U T8 (32W) - 3L	Electronic	92			1		0.0		92
177	Samsel Upper ES		Education – Primary School	2nd floor	room 217	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			7		0.0		651
178	Samsel Upper ES		Education – Primary School	2nd floor	room 219	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			8		0.0		744
179	Samsel Upper ES		Education – Primary School	2nd floor	room 216	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			8		0.0		744
180	Samsel Upper ES		Education – Primary School	2nd floor	room 215	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			15		0.0		1,395
181	Samsel Upper ES		Education – Primary School	2nd floor	room 215	U-Bend Fluorescent - T8	U T8 (32W) - 3L	Electronic	92			1		0.0		92
182	Samsel Upper ES		Education – Primary School	2nd floor	room 214 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			6		0.0		558
183	Samsel Upper ES		Education – Primary School	2nd floor	room 214	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			20		0.0		1,860

184	Samsel Upper ES		Education – Primary School	2nd floor	room 213	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			15		0.0			1,395
185	Samsel Upper ES		Education – Primary School	2nd floor	room 213	U-Bend Fluorescent - T8	U T8 (32W) - 3L	Electronic	92			1		0.0			92
186	Samsel Upper ES		Education – Primary School	2nd floor	room 239 (server room)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
187	Samsel Upper ES		Education – Primary School	2nd floor	girls room B	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			3		0.0			186
188	Samsel Upper ES		Education – Primary School	2nd floor	girls room B	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0			62
189	Samsel Upper ES		Education – Primary School	2nd floor	room 238	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
190	Samsel Upper ES		Education – Primary School	2nd floor	janitor closet B	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
191	Samsel Upper ES		Education – Primary School	2nd floor	boys room B	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			3		0.0			186
192	Samsel Upper ES		Education – Primary School	2nd floor	boys room B	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0			62
193	Samsel Upper ES		Education – Primary School	2nd floor	room 240	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
194	Samsel Upper ES		Education – Primary School	2nd floor	room 203 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			3		0.0			186
195	Samsel Upper ES		Education – Primary School	2nd floor	room 201	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			8		0.0			744
196	Samsel Upper ES		Education – Primary School	2nd floor	room 202	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			7		0.0			651
197	Samsel Upper ES		Education – Primary School	2nd floor	room 202	U-Bend Fluorescent - T8	U T8 (32W) - 3L	Electronic	92			1		0.0			92
198	Samsel Upper ES		Education – Primary School	2nd floor	room 204	U-Bend Fluorescent - T8	U T8 (32W) - 3L	Electronic	92			1		0.0			92
199	Samsel Upper ES		Education – Primary School	2nd floor	room 204	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			15		0.0			1,395
200	Samsel Upper ES		Education – Primary School	2nd floor	room 206	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			15		0.0			1,395
201	Samsel Upper ES		Education – Primary School	2nd floor	room 206	U-Bend Fluorescent - T8	U T8 (32W) - 3L	Electronic	92			1		0.0			92
202	Samsel Upper ES		Education – Primary School	2nd floor	room 205	U-Bend Fluorescent - T8	U T8 (32W) - 3L	Electronic	92			2		0.0			184
203	Samsel Upper ES		Education – Primary School	2nd floor	room 205	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			10		0.0			930
204	Samsel Upper ES		Education – Primary School	2nd floor	room 207	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			10		0.0			930
205	Samsel Upper ES		Education – Primary School	2nd floor	room 210 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			12		0.0			744
206	Samsel Upper ES		Education – Primary School	2nd floor	room 208	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			15		0.0			1,395
207	Samsel Upper ES		Education – Primary School	2nd floor	room 208	U-Bend Fluorescent - T8	U T8 (32W) - 3L	Electronic	92			1		0.0			92
208	Samsel Upper ES		Education – Primary School	2nd floor	room 209	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			18		0.0			1,674
209	Samsel Upper ES		Education – Primary School	2nd floor	room 209	U-Bend Fluorescent - T8	U T8 (32W) - 3L	Electronic	92			2		0.0			184
210	Samsel Upper ES		Education – Primary School	2nd floor	room 211	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			18		0.0			1,674
211	Samsel Upper ES		Education – Primary School	2nd floor	room 211	U-Bend Fluorescent - T8	U T8 (32W) - 3L	Electronic	92			2		0.0			184
212	Samsel Upper ES		Education – Primary School	2nd floor	hallway	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			55		0.0			3,410
213	Samsel Upper ES		Education – Primary School	2nd floor	hallway	U-Bend Fluorescent - T8	U T8 (32W) - 3L	Electronic	92			1		0.0			92
214	Samsel Upper ES		Education – Primary School	1st floor	room 121 (mech room)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			29		0.0			1,798
215	Samsel Upper ES		Education – Primary School	1st floor	girls room A	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			3		0.0			186
216	Samsel Upper ES		Education – Primary School	1st floor	girls room A	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			4		0.0			248
217	Samsel Upper ES		Education – Primary School	1st floor	room 120 (cafeteria)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			79		0.0			7,347
218	Samsel Upper ES		Education – Primary School	1st floor	room 120 (cafeteria)	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			5		0.0			310
219	Samsel Upper ES		Education – Primary School	1st floor	room 120A (faculty dining)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			9		0.0			837
220	Samsel Upper ES		Education – Primary School	1st floor	room 120A (womens room)	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0			62
221	Samsel Upper ES		Education – Primary School	1st floor	room 120A (mens room)	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0			62
222	Samsel Upper ES		Education – Primary School	1st floor	room 120 (kitchen)	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			13		0.0			1,482
223	Samsel Upper ES		Education – Primary School	1st floor	room 120 (janitor closet)	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0			62
224	Samsel Upper ES		Education – Primary School	1st floor	room 120 (walk in 1)	Incandescent	Standard	N/A	N/A	60	e	1		0.0			60
225	Samsel Upper ES		Education – Primary School	1st floor	room 120 (walk in 2)	Incandescent	Standard	N/A	N/A	60	e	1		0.0			60
226	Samsel Upper ES		Education – Primary School	1st floor	room 120 (restroom)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			1		0.0			93
227	Samsel Upper ES		Education – Primary School	1st floor	room 120 (office)	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			1		0.0			114
228	Samsel Upper ES		Education – Primary School	1st floor	room120 (vestibule)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
229	Samsel Upper ES		Education – Primary School	1st floor	room 120 (dish room)	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			2		0.0			228
230	Samsel Upper ES		Education – Primary School	1st floor	room 120 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			8		0.0			496
231	Samsel Upper ES		Education – Primary School	1st floor	room 119 (elevator room)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
232	Samsel Upper ES		Education – Primary School	1st floor	boys room A	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			3		0.0			186
233	Samsel Upper ES		Education – Primary School	1st floor	boys room A	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0			62
234	Samsel Upper ES		Education – Primary School	1st floor	room 118	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			8		0.0			496
235	Samsel Upper ES		Education – Primary School	1st floor	room 117	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			8		0.0			744
236	Samsel Upper ES		Education – Primary School	1st floor	room 116	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			8		0.0			744
237	Samsel Upper ES		Education – Primary School	1st floor	room 114	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
238	Samsel Upper ES		Education – Primary School	1st floor	room 115	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
239	Samsel Upper ES		Education – Primary School	1st floor	room 113	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			8		0.0			744
240	Samsel Upper ES		Education – Primary School	1st floor	room 112	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			8		0.0			744
241	Samsel Upper ES		Education – Primary School	1st floor	room 110	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
242	Samsel Upper ES		Education – Primary School	1st floor	room 111	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
243	Samsel Upper ES		Education – Primary School	1st floor	room 109	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
244	Samsel Upper ES		Education – Primary School	1st floor	room 101 (GYM)	Compact Fluorescent	Screw-In	Electronic	N/A	160	e	1		0.0			160
245	Samsel Upper ES		Education – Primary School	1st floor	room 101 (office A)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
246	Samsel Upper ES		Education – Primary School	1st floor	room 101 (office B)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
247	Samsel Upper ES		Education – Primary School	1st floor	room 101 (stage)	Incandescent	Standard	Electronic	N/A	90	e	8		0.0			720
248	Samsel Upper ES		Education – Primary School	1st floor	room 101 (stage access A & B)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			2		0.0			186
249	Samsel Upper ES		Education – Primary School	1st floor	room 101 (stage back hallway)	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			3		0.0			279
250	Samsel Upper ES		Education – Primary School	1st floor	room 101 (GYM)	Compact Fluorescent	Screw-In	Electronic	N/A	60		34		0.0			2,040
251	Samsel Upper ES		Education – Primary School	1st floor	room 101 (GYM storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
252	Samsel Upper ES		Education – Primary School	1st floor	room 108	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			12		0.0			1,116
253	Samsel Upper ES		Education – Primary School	1st floor	room 107 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
254	Samsel Upper ES		Education – Primary School	1st floor	womens room A	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			3		0.0			186
255	Samsel Upper ES		Education – Primary School	1st floor	womens room A	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0			62
256	Samsel Upper ES		Education – Primary School	1st floor	janitor closet A	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
257	Samsel Upper ES		Education – Primary School	1st floor	mens room A	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			1		0.0			62
258	Samsel Upper ES		Education – Primary School	1st floor	mens room A	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			3		0.0			279
259	Samsel Upper ES		Education – Primary School	1st floor	room 101 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
260	Samsel Upper ES		Education – Primary School	1st floor	room 102 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			6		0.0			372
261	Samsel Upper ES		Education – Primary School	1st floor	music vestibule	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
262	Samsel Upper ES		Education – Primary School	1st floor	room 103 (practice room A)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			11		0.0			682
263	Samsel Upper ES		Education – Primary School	1st floor	room 103	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			18		0.0			1,674
264	Samsel Upper ES		Education – Primary School	1st floor	room 103 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
265	Samsel Upper ES		Education – Primary School	1st floor	room 103 (practice room B)	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			1		0.0			114
266	Samsel Upper ES		Education – Primary School	1st floor	room 103/105 (office)	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			6		0.0			684
267	Samsel Upper ES		Education – Primary School	1st floor	room 105	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			18		0.0			1,674
268	Samsel Upper ES		Education – Primary School	1st floor	room 105 (practice roomA)	Linear Fluorescent - T8	4' T8 (32W) - 4L	Electronic	114			1		0.0			114
269	Samsel Upper ES		Education – Primary School	1st floor	room 105 (storage)	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			2		0.0			124
270	Samsel Upper ES		Education – Primary School	1st floor	hallway	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			36		0.0			2,232
271	Samsel Upper ES		Education – Primary School	1st floor	hallway	U-Bend Fluorescent - T8	U T8 (32W) - 2L	Electronic	62			2		0.0			124
272	Samsel Upper ES		Education – Primary School		stairs A	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62

273	Samsel Upper ES		Education – Primary School		stairs A	Linear Fluorescent - T8	3' T8 (25W) - 2L	Electronic	48			1		0.0			48
274	Samsel Upper ES		Education – Primary School		stairs A	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			4		0.0			372
275	Samsel Upper ES		Education – Primary School		stairs A	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			1		0.0			93
276	Samsel Upper ES		Education – Primary School		stairs b	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			3		0.0			279
277	Samsel Upper ES		Education – Primary School		stairs C	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			4		0.0			372
278	Samsel Upper ES		Education – Primary School		stairs C	Linear Fluorescent - T8	4' T8 (32W) - 3L	Electronic	93			1		0.0			93
279	Samsel Upper ES		Education – Primary School		stairs C	Linear Fluorescent - T8	4' T8 (32W) - 2L	Electronic	62			1		0.0			62
280	Samsel Upper ES		Education – Primary School		stairs C	Linear Fluorescent - T8	3' T8 (25W) - 2L	Electronic	48			1		0.0			48

HARRY TRUMAN ELEMENTARY SCHOOL

	Facility Type	Default Annual Hours	Fixture Location	Located in Conditioned Space?		Fixtures Con-trolled?	Lighting Fixture Description	# of Fixtures	Default Watts per Fixture	Actual Watts per Fixture	Install Height >12 ft?
1	Education – Primary School	2,575	1-library	Y	Existing	N	Fluorescent, (3) 48", T12 lamp	32	151.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**32**	**37.5**		
2	Education – Primary School	2,575	1-library	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	5	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**5**	**25.0**		
3	Education – Primary School	2,575	1-library	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	8	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**8**	**27.0**		
5	Education – Primary School	2,575	1-D13-1	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
6	Education – Primary School	2,575	1-D13-2	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
7	Education – Primary School	2,575	1-D15	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	9	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**9**	**25.0**		
8	Education – Primary School	2,575	1-D15	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	1	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**1**	**27.0**		
9	Education – Primary School	2,575	1-D10	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	9	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**9**	**25.0**		
10	Education – Primary School	2,575	1-D10	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	1	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**1**	**27.0**		
11	Education – Primary School	2,575	1-D17	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	9	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**9**	**25.0**		

12	Education – Primary School	2,575	1-D17	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	1	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**1**	**27.0**		
13	Education – Primary School	2,575	1-D12	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	9	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**9**	**25.0**		
14	Education – Primary School	2,575	1-D12	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	1	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**1**	**27.0**		
15	Education – Primary School	2,575	1-D19	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	9	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**9**	**25.0**		
16	Education – Primary School	2,575	1-D19	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	1	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**1**	**27.0**		
17	Education – Primary School	2,575	1-D14	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	9	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**9**	**25.0**		
18	Education – Primary School	2,575	1-D14	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	1	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**1**	**27.0**		
19	Education – Primary School	2,575	1-D21	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	9	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**9**	**25.0**		
20	Education – Primary School	2,575	1-D21	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	1	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**1**	**27.0**		
21	Education – Primary School	2,575	1-D16	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	9	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**9**	**25.0**		
22	Education – Primary School	2,575	1-D16	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	1	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**1**	**27.0**		

23	Education – Primary School	2,575	1-boys restroom	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
24	Education – Primary School	2,575	1-boys restroom	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
25	Education – Primary School	2,575	1-D6	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
26	Education – Primary School	2,575	1-girls restroom	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
27	Education – Primary School	2,575	1-girls restroom	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
28	Education – Primary School	2,575	1-D11	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	5	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**5**	**25.0**		
29	Education – Primary School	2,575	1-D9	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	5	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**5**	**25.0**		
30	Education – Primary School	2,575	1-faculty	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
31	Education – Primary School	2,575	1-faculty	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	4	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**4**	**25.0**		
32	Education – Primary School	2,575	1-restroom #1	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
33	Education – Primary School	2,575	1-restroom #2	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		

34	Education – Primary School	2,575	1-health	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	1	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**25.0**		
35	Education – Primary School	2,575	1-conference room	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
36	Education – Primary School	2,575	1-restroom A	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
37	Education – Primary School	2,575	1-main office	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	6	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**25.0**		
38	Education – Primary School	2,575	1-office	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	1	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**25.0**		
39	Education – Primary School	2,575	1-A2	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
40	Education – Primary School	2,575	1-A4	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
41	Education – Primary School	2,575	1-A1	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	4	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**4**	**25.0**		
42	Education – Primary School	2,575	1-A6	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	1	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**25.0**		
43	Education – Primary School	2,575	1-A3	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	9	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**9**	**25.0**		
45	Education – Primary School	2,575	1-A8	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	6	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**25.0**		

46	Education – Primary School	2,575	1-A10	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	9	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**9**	**25.0**		
47	Education – Primary School	2,575	1-A5	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	15	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**15**	**25.0**		
48	Education – Primary School	2,575	1-A5	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	1	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**1**	**27.0**		
49	Education – Primary School	2,575	1-A12	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
50	Education – Primary School	2,575	1-A7	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	6	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**25.0**		
51	Education – Primary School	2,575	1-A7	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	2	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**2**	**27.0**		
52	Education – Primary School	2,575	1-A7	Y	Existing	N	Fluorescent, (2) U-Tube, T8 lamp	1	59.0		N
					Proposed	**N**	**Relamp/Reballast: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W**	**1**	**28.0**		
53	Education – Primary School	2,575	1-A7 restroom	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
54	Education – Primary School	2,575	1-A14	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	6	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**25.0**		
55	Education – Primary School	2,575	1-A14	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	2	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**2**	**27.0**		
56	Education – Primary School	2,575	1-A14	Y	Existing	N	Fluorescent, (2) U-Tube, T8 lamp	1	59.0		N
					Proposed	**N**	**Relamp/Reballast: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W**	**1**	**28.0**		

57	Education – Primary School	2,575	1-A14 restroom	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
58	Education – Primary School	2,575	1-A9	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	8	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**8**	**25.0**		
59	Education – Primary School	2,575	1-A9	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	2	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**2**	**27.0**		
60	Education – Primary School	2,575	1-A9	Y	Existing	N	Fluorescent, (2) U-Tube, T8 lamp	1	59.0		N
					Proposed	**N**	**Relamp/Reballast: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W**	**1**	**28.0**		
61	Education – Primary School	2,575	1-A16	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	8	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**8**	**25.0**		
62	Education – Primary School	2,575	1-A16	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	2	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**2**	**27.0**		
63	Education – Primary School	2,575	1-A16	Y	Existing	N	Fluorescent, (2) U-Tube, T8 lamp	1	59.0		N
					Proposed	**N**	**Relamp/Reballast: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W**	**1**	**28.0**		
64	Education – Primary School	2,575	1-A18	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	9	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**9**	**25.0**		
65	Education – Primary School	2,575	1-A18	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	2	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**2**	**27.0**		
66	Education – Primary School	2,575	1-A18	Y	Existing	N	Fluorescent, (2) U-Tube, T8 lamp	1	59.0		N
					Proposed	**N**	**Relamp/Reballast: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W**	**1**	**28.0**		
67	Education – Primary School	2,575	1-restroom B	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		

68	Education – Primary School	2,575	1-A11	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	9	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**9**	**25.0**		
69	Education – Primary School	2,575	1-A11	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	2	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**2**	**27.0**		
70	Education – Primary School	2,575	1-A11	Y	Existing	N	Fluorescent, (2) U-Tube, T8 lamp	1	59.0		N
					Proposed	**N**	**Relamp/Reballast: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W**	**1**	**28.0**		
71	Education – Primary School	2,575	1-restroom C	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
72	Education – Primary School	2,575	1-restroom D	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
73	Education – Primary School	2,575	1-B1	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	1	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**25.0**		
74	Education – Primary School	2,575	1-boys restroom	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
75	Education – Primary School	2,575	1-boys restroom	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
77	Education – Primary School	2,575	1-B3	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	1	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**25.0**		
78	Education – Primary School	2,575	1-girls restroom	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
79	Education – Primary School	2,575	1-girls restroom	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		

80	Education – Primary School	2,575	1-B5	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	7	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**7**	**25.0**		
81	Education – Primary School	2,575	1-B5	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	2	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**2**	**27.0**		
82	Education – Primary School	2,575	1-B5	Y	Existing	N	Fluorescent, (2) U-Tube, T8 lamp	1	59.0		N
					Proposed	**N**	**Relamp/Reballast: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W**	**1**	**28.0**		
83	Education – Primary School	2,575	1-B5	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	1	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**12.5**		
84	Education – Primary School	2,575	1-B8	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	10	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**10**	**25.0**		
85	Education – Primary School	2,575	1-B8	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	2	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**2**	**27.0**		
86	Education – Primary School	2,575	1-B8	Y	Existing	N	Fluorescent, (2) U-Tube, T8 lamp	1	59.0		N
					Proposed	**N**	**Relamp/Reballast: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W**	**1**	**28.0**		
87	Education – Primary School	2,575	1-IT closet	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	1	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**12.5**		
88	Education – Primary School	2,575	1-B7	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	10	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**10**	**25.0**		
89	Education – Primary School	2,575	1-B7	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	2	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**2**	**27.0**		
90	Education – Primary School	2,575	1-B7	Y	Existing	N	Fluorescent, (2) U-Tube, T8 lamp	1	59.0		N
					Proposed	**N**	**Relamp/Reballast: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W**	**1**	**28.0**		

91	Education – Primary School	2,575	1-B7	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	1	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**12.5**		
92	Education – Primary School	2,575	1-B10	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	7	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**7**	**25.0**		
93	Education – Primary School	2,575	1-B10	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	2	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**2**	**27.0**		
94	Education – Primary School	2,575	1-B10	Y	Existing	N	Fluorescent, (2) U-Tube, T8 lamp	1	59.0		N
					Proposed	**N**	**Relamp/Reballast: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W**	**1**	**28.0**		
95	Education – Primary School	2,575	1-B10	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	1	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**12.5**		
96	Education – Primary School	2,575	1-C21	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	13	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**13**	**25.0**		
97	Education – Primary School	2,575	1-restroom E	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	3	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**3**	**25.0**		
98	Education – Primary School	2,575	1-C2-2	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	13	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**13**	**25.0**		
99	Education – Primary School	2,575	1-boiler room	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	15	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**15**	**12.5**		
100	Education – Primary School	2,575	1-boiler room	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	1	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**25.0**		
101	Education – Primary School	2,575	1-C5	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	11	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**11**	**25.0**		

102	Education – Primary School	2,575	1-C5	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
103	Education – Primary School	2,575	1-C5 restroom	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
104	Education – Primary School	2,575	1-C7	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	11	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**11**	**25.0**		
105	Education – Primary School	2,575	1-C7	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
106	Education – Primary School	2,575	1-C7 restroom	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
107	Education – Primary School	2,575	1-C9	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	20	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**20**	**25.0**		
108	Education – Primary School	2,575	1-C9	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	2	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**2**	**27.0**		
109	Education – Primary School	2,575	1-C9	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	1	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**12.5**		
110	Education – Primary School	2,575	1-C9 restroom	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
111	Education – Primary School	2,575	1-storage	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	4	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**4**	**25.0**		
112	Education – Primary School	2,575	1-C6	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	15	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**15**	**25.0**		

113	Education – Primary School	2,575	1-C6	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
114	Education – Primary School	2,575	1-C6	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	1	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**12.5**		
115	Education – Primary School	2,575	1-C6 restroom	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
116	Education – Primary School	2,575	1-C8	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	14	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**14**	**25.0**		
117	Education – Primary School	2,575	1-C8	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	1	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**1**	**27.0**		
118	Education – Primary School	2,575	1-restroom F	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
119	Education – Primary School	2,575	1-C11	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	19	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**19**	**25.0**		
120	Education – Primary School	2,575	1-C11	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	1	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**1**	**27.0**		
121	Education – Primary School	2,575	1-restroom G	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
123	Education – Primary School	2,575	1-closet	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	1	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**25.0**		
124	Education – Primary School	2,575	1-A1-3	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	1	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**25.0**		

125	Education – Primary School	2,575	1-A1-3	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	1	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**25.0**		
126	Education – Primary School	2,575	1-vestibule	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
128	Education – Primary School	2,575	1-stage	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	8	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**8**	**25.0**		
130	Education – Primary School	2,575	1-kitchen	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	10	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**10**	**25.0**		
131	Education – Primary School	2,575	1-kitchen	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
132	Education – Primary School	2,575	1-locker	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	1	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**25.0**		
133	Education – Primary School	2,575	1-freezers	Y	Existing	N	Incandescent, (1) 60W lamp	2	60.0		N
					Proposed	**N**	**Relamp: LED - A-Lamp (3 - 25W): 10 W**	**2**	**10.0**		
135	Education – Primary School	2,575	1-closets	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	6	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**12.5**		
136	Education – Primary School	2,575	1-hallway	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	80	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**80**	**25.0**		
138	Education – Primary School	2,575	1-hallway	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	2	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**2**	**18.0**		
139	Education – Primary School	2,575	1-hallway	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	11	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**11**	**18.0**		

140	Education – Primary School	2,575	1-hallway	Y	Existing	N	CFL: 23W	6	23.0		N
					Proposed	**N**	**Relamp: LED - A-Lamp (3 - 25W): 10 W**	**6**	**10.0**		
141	Education – Primary School	2,575	exterior	N	Existing	N	Metal Halide, (1) 70W lamp	2	95.0		N
					Proposed	**N**	**Fixture Replacement: LED Architectural Flood/Spot (25 - 150W): 31 W**	**2**	**31.0**		
142	Education – Primary School	2,575	exterior	N	Existing	N	Mercury Vapor, (1) 75W lamp	31	93.0		N
					Proposed	**N**		**31**	**93.0**		
143	Education – Primary School	2,575	exterior	N	Existing	N	Metal Halide, (1) 175W lamp	3	215.0		N
TOTALS											

DWIGHT EISENHOWER ELEMENTARY SCHOOL

	Facility Type	Default Annual Hours	Fixture Location	Located in Conditioned Space?		Fixtures Controlled?	Lighting Fixture Description	# of Fixtures	Default Watts per Fixture	Actual Watts per Fixture	Install Height >12 ft?
1	Education – Primary School	2,575	Cafeteria	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	14	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**14**	**25.0**		
3	Education – Primary School	2,575	Teachers Lounge	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	6	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**25.0**		
4	Education – Primary School	2,575	Gym	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	5	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**5**	**25.0**		
5	Education – Primary School	2,575	Gym	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	32	83.0		Y
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**32**	**37.5**		
6	Education – Primary School	2,575	Gym	Y	Existing	N	EXIT Incandescent, (1) 25W lamp	4	25.0		N
					Proposed	**N**	**Fixture Replacement: LED Exit Sign: 2.3 W**	**4**	**2.3**		
7	Education – Primary School	2,575	Music Room 37	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	13	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**13**	**25.0**		
8	Education – Primary School	2,575	Room	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	2	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**2**	**27.0**		
9	Education – Primary School	2,575	Girls Room	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	2	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**2**	**27.0**		
10	Education – Primary School	2,575	Girls Room	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
11	Education – Primary School	2,575	Boys Room	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	2	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**2**	**27.0**		
12	Education – Primary School	2,575	Boys Room	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
13	Education – Primary School	2,575	Art Room	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	15	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**15**	**25.0**		
14	Education – Primary School	2,575	Supply Room	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	2	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**2**	**27.0**		
15	Education – Primary School	2,575	Classroom 35	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
16	Education – Primary School	2,575	Classroom 35	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	1	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**37.5**		
17	Education – Primary School	2,575	Closet	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
18	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	2	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**2**	**9.0**		
20	Education – Primary School	2,575	Vestibule	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	1	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**1**	**27.0**		
21	Education – Primary School	2,575	Main Office	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	7	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**7**	**25.0**		
22	Education – Primary School	2,575	Main Office	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
23	Education – Primary School	2,575	Fax Room	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	1	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**25.0**		
24	Education – Primary School	2,575	Closet	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	1	47.0		N

24	Education – Primary School	2,575	Closet	Y	**Proposed**	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**1**	**27.0**		N
25	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	1	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**1**	**27.0**		
26	Education – Primary School	2,575	Confrence Room	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
27	Education – Primary School	2,575	34A	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
28	Education – Primary School	2,575	34A	Y	Existing	N	Fluorescent, (2) U-Tube, T8 lamp	1	59.0		N
					Proposed	**N**	**Relamp/Reballast: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W**	**1**	**28.0**		
29	Education – Primary School	2,575	Nurses Office	Y	Existing	N	Fluorescent, (3) 24", T8 lamp	7	47.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 2-Foot T8**	**7**	**27.0**		
30	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	2	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**2**	**9.0**		
31	Education – Primary School	2,575	Classroom 14	Y	Existing	N	Fluorescent, (4) 48", T8 lamp	6	108.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**50.0**		
32	Education – Primary School	2,575	Classroom 14	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
33	Education – Primary School	2,575	Classroom 32	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	12	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**12**	**12.5**		
34	Education – Primary School	2,575	Classroom 15	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	43	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**43**	**12.5**		
35	Education – Primary School	2,575	Room 1	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	4	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**4**	**12.5**		
36	Education – Primary School	2,575	Closet	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	1	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**12.5**		
37	Education – Primary School	2,575	Classroom 31	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	12	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**12**	**12.5**		
38	Education – Primary School	2,575	Classroom 30	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	18	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**18**	**12.5**		
39	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
40	Education – Primary School	2,575	Classroom 16	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	18	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**18**	**12.5**		
41	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
42	Education – Primary School	2,575	Classroom 29	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	17	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**17**	**12.5**		
43	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
44	Education – Primary School	2,575	C2	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	1	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**12.5**		
45	Education – Primary School	2,575	Classroom 28	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	17	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**17**	**12.5**		
46	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
47	Education – Primary School	2,575	Classroom 27	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	17	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**17**	**12.5**		
48	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		

49	Education – Primary School	2,575	Classroom 26	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	17	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Standard - 12.5W)**	**17**	**12.5**		
50	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
52	Education – Primary School	2,575	Classroom 17	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	7	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Standard - 12.5W)**	**7**	**12.5**		
53	Education – Primary School	2,575	Classroom 25	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	17	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Standard - 12.5W)**	**17**	**12.5**		
54	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
55	Education – Primary School	2,575	Classroom 18	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	17	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Standard - 12.5W)**	**17**	**12.5**		
56	Education – Primary School	2,575	Classroom 18	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
57	Education – Primary School	2,575	Classroom 22	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	17	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Standard - 12.5W)**	**17**	**12.5**		
58	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
59	Education – Primary School	2,575	Classroom 24	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	17	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Standard - 12.5W)**	**17**	**12.5**		
60	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
61	Education – Primary School	2,575	Classroom 23	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	17	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Standard - 12.5W)**	**17**	**12.5**		
62	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
63	Education – Primary School	2,575	Classroom 20	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	17	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Standard - 12.5W)**	**17**	**12.5**		
64	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
65	Education – Primary School	2,575	Classroom 22	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	25	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Standard - 12.5W)**	**25**	**12.5**		
66	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
67	Education – Primary School	2,575	S7	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	6	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Standard - 12.5W)**	**6**	**12.5**		
68	Education – Primary School	2,575	S7	Y	Existing	N	EXIT Compact Fluorescent, (1) 9W lamp	1	12.0		N
					Proposed	**N**	**Fixture Replacement: LED Exit Sign: 2.3 W**	**1**	**2.3**		
69	Education – Primary School	2,575	Classroom 21	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	25	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Standard - 12.5W)**	**25**	**12.5**		
70	Education – Primary School	2,575	Mid Room	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
71	Education – Primary School	2,575	Mid Room	Y	Existing	N	EXIT Compact Fluorescent, (1) 9W lamp	1	12.0		N
					Proposed	**N**	**Fixture Replacement: LED Exit Sign: 2.3 W**	**1**	**2.3**		
72	Education – Primary School	2,575	Boys Room	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	3	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Standard - 12.5W)**	**3**	**25.0**		
73	Education – Primary School	2,575	Mens Room	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	1	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Standard - 12.5W)**	**1**	**25.0**		
74	Education – Primary School	2,575	Womens	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	1	54.0		N

74	– Primary School	2,575	Room		**Proposed**	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**25.0**		N
75	Education – Primary School	2,575	Girls Room	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	3	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**3**	**25.0**		
76	Education – Primary School	2,575	C1	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	3	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**3**	**12.5**		
78	Education – Primary School	2,575	Classroom 4	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	12	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**12**	**25.0**		
79	Education – Primary School	2,575	Classroom 3	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	1	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**25.0**		
80	Education – Primary School	2,575	Classroom 3	Y	Existing	N	Fluorescent, (4) 48", T8 lamp	1	108.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**50.0**		
81	Education – Primary School	2,575	Restroom	Y	Existing	N	Incandescent, (1) 60W lamp	2	60.0		N
					Proposed	**N**	**Relamp: LED - A-Lamp (3 - 25W): 10 W**	**2**	**10.0**		
83	Education – Primary School	2,575	Tech Room	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	1	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**25.0**		
84	Education – Primary School	2,575	Classroom 1	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	13	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**13**	**25.0**		
85	Education – Primary School	2,575	Classroom 13	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	18	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**18**	**12.5**		
86	Education – Primary School	2,575	Classroom 12	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	18	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**18**	**12.5**		
87	Education – Primary School	2,575	Classroom 11	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	18	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**18**	**12.5**		
88	Education – Primary School	2,575	Classroom 5	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	18	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**18**	**12.5**		
89	Education – Primary School	2,575	Classroom 6	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	18	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**18**	**12.5**		
90	Education – Primary School	2,575	Classroom 10	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	24	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**24**	**12.5**		
91	Education – Primary School	2,575	Classroom 9A	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	6	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**12.5**		
92	Education – Primary School	2,575	Classroom 7	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	18	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**18**	**12.5**		
93	Education – Primary School	2,575	Classroom 9	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	24	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**24**	**12.5**		
94	Education – Primary School	2,575	Classroom 8	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	18	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**18**	**12.5**		
95	Education – Primary School	2,575	Hallway	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	108	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**108**	**25.0**		
96	Education – Primary School	2,575	Hallway	Y	Existing	N	EXIT Compact Fluorescent, (1) 9W lamp	12	12.0		N
					Proposed	**N**	**Fixture Replacement: LED Exit Sign: 2.3 W**	**12**	**2.3**		
97	Education – Primary School	2,575	Hallway	Y	Existing	N	Incandescent, (1) 90W lamp	4	90.0		N
					Proposed	**N**	**Relamp: LED - PAR38 (13 - 23W): 17 W**	**4**	**17.0**		
TOTALS											

EMMA L ARLETH ELEMENTARY SCHOOL

	Facility Type	Default Annual Hours	Fixture Location	Located in Conditioned Space?		Fixtures Controlled?	Lighting Fixture Description	# of Fixtures	Default Watts per Fixture	Actual Watts per Fixture	Install Height >12 ft?
1	Education – Primary School	2,575	Girls Room	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
2	Education – Primary School	2,575	Gym/Café	Y	Existing	N	Fluorescent, (4) 48", T5HO lamp	8	234.0		Y
					Proposed	**N**	**Relamp/ReBallast: Plug & Play LED - 4-Lamp - 4-Foot T5HO**	**8**	**112.0**		
3	Education – Primary School	2,575	Gym/Café	Y	Existing	N	EXIT Incandescent, (2) 50W lamp	2	100.0		N
					Proposed	**N**	**Fixture Replacement: LED Exit Sign: 2.3 W**	**2**	**2.3**		
4	Education – Primary School	2,575	Kitchen	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	4	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**4**	**25.0**		
6	Education – Primary School	2,575	Stage	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	6	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**12.5**		
8	Education – Primary School	2,575	Storage	N	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
9	Education – Primary School	2,575	Teachers Room	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	2	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**2**	**9.0**		
10	Education – Primary School	2,575	Teachers Room	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
11	Education – Primary School	2,575	Restrooms	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	2	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**2**	**9.0**		
12	Education – Primary School	2,575	Classroom 16	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	12	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**12**	**25.0**		
13	Education – Primary School	2,575	Supply Room	N	Existing	N	Fluorescent, (2) 48", T8 lamp	1	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**25.0**		
14	Education – Primary School	2,575	Classroom 15	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	12	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**12**	**25.0**		
15	Education – Primary School	2,575	Classroom 14	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	12	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**12**	**25.0**		
16	Education – Primary School	2,575	Classroom 13	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	12	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**12**	**25.0**		
17	Education – Primary School	2,575	Classroom 12	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	12	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**12**	**25.0**		
18	Education – Primary School	2,575	Classroom 11	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	12	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**12**	**25.0**		
19	Education – Primary School	2,575	Classroom 10	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	12	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**12**	**25.0**		
20	Education – Primary School	2,575	Speech	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	3	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**3**	**25.0**		
21	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
22	Education – Primary School	2,575	Classroom 9	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	12	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**12**	**25.0**		
23	Education – Primary School	2,575	Girls Room	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
24	Education – Primary School	2,575	Janitors Closet	N	Existing	N	Fluorescent, (1) 48", T8 lamp	1	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**12.5**		

25	Education – Primary School	2,575	Boys Room	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	1	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**25.0**		
26	Education – Primary School	2,575	Classrrom 7	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	12	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**12**	**25.0**		
27	Education – Primary School	2,575	Classrrom 8	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	12	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**12**	**25.0**		
28	Education – Primary School	2,575	Classrrom 5	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	12	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**12**	**25.0**		
29	Education – Primary School	2,575	Classrrom 6	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	12	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**12**	**25.0**		
30	Education – Primary School	2,575	Classrrom 3	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	14	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**14**	**25.0**		
31	Education – Primary School	2,575	Classrrom 4	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	14	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**14**	**25.0**		
32	Education – Primary School	2,575	Music Room 2	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	18	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**18**	**25.0**		
33	Education – Primary School	2,575	Music Room 2	Y	Existing	N	Fluorescent, (4) 48", T8 lamp	1	108.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**50.0**		
34	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
35	Education – Primary School	2,575	Restroom	Y	Existing	N	EXIT Incandescent, (2) 50W lamp	1	100.0		N
					Proposed	**N**	**Fixture Replacement: LED Exit Sign: 2.3 W**	**1**	**2.3**		
36	Education – Primary School	2,575	Art Room	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	17	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**17**	**25.0**		
37	Education – Primary School	2,575	Art Room	Y	Existing	N	EXIT Incandescent, (2) 50W lamp	1	100.0		N
					Proposed	**N**	**Fixture Replacement: LED Exit Sign: 2.3 W**	**1**	**2.3**		
39	Education – Primary School	2,575	Classrrom 44-2	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	6	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**37.5**		
40	Education – Primary School	2,575	Classrrom 42	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	6	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**37.5**		
41	Education – Primary School	2,575	Classrrom 44-1	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	6	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**37.5**		
42	Education – Primary School	2,575	Media Center	Y	Existing	N	CFL: 105W	35	105.0		N
					Proposed	**N**	**Fixture Replacement: LED Interior Ambient Luminaire - 2x2: 30 W**	**35**	**28.7**		
43	Education – Primary School	2,575	Media Center	Y	Existing	N	CFL: 42W	4	42.0		N
					Proposed	**N**	**Relamp/Reballast: LED 2-Lamp PL 4-Pin**	**4**	**28.0**		
45	Education – Primary School	2,575	Media Center	Y	Existing	N	EXIT Incandescent, (2) 50W lamp	2	100.0		N
					Proposed	**N**	**Fixture Replacement: LED Exit Sign: 2.3 W**	**2**	**2.3**		
46	Education – Primary School	2,575	Office	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	4	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**4**	**37.5**		
47	Education – Primary School	2,575	Computer Lab	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	12	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**12**	**37.5**		
48	Education – Primary School	2,575	Classrrom 42-1	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	6	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**37.5**		
49	Education – Primary School	2,575	Classrrom 40-2	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	6	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**37.5**		
50	Education – Primary School	2,575	Classrrom 39-2	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	6	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**37.5**		
51	Education – Primary	2,575	Classrrom 40-1	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	6	83.0		N

51	Education – Primary School	2,575	Classrrom 40-1	Y	**Proposed**	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**37.5**		N
52	Education – Primary School	2,575	Classrrom 38	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	3	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**3**	**37.5**		
53	Education – Primary School	2,575	Closet	N	Existing	N	Fluorescent, (2) 48", T8 lamp	1	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**25.0**		
54	Education – Primary School	2,575	Classrrom 39-1	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	6	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**37.5**		
55	Education – Primary School	2,575	Classrrom 37-2	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	6	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**37.5**		
56	Education – Primary School	2,575	Boys Room	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	3	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**3**	**37.5**		
57	Education – Primary School	2,575	Girls Room	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	3	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**3**	**37.5**		
58	Education – Primary School	2,575	Between Boys & Girls Room	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	2	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**2**	**18.0**		
59	Education – Primary School	2,575	Janitors	N	Existing	N	Fluorescent, (2) 48", T8 lamp	1	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**25.0**		
60	Education – Primary School	2,575	Stage Room	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	8	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**8**	**37.5**		
62	Education – Primary School	2,575	Stage	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	2	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**37.5**		
63	Education – Primary School	2,575	Gym	Y	Existing	N	Fluorescent, (4) 48", T5HO lamp	18	234.0		Y
					Proposed	**N**	**Relamp/ReBallast: Plug & Play LED - 4-Lamp - 4-Foot T5HO**	**18**	**112.0**		
64	Education – Primary School	2,575	Gym	Y	Existing	N	EXIT Incandescent, (2) 50W lamp	3	100.0		N
					Proposed	**N**	**Fixture Replacement: LED Exit Sign: 2.3 W**	**3**	**2.3**		
65	Education – Primary School	2,575	Sprinkler Room	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	5	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**5**	**25.0**		
66	Education – Primary School	2,575	37-1	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	6	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**37.5**		
67	Education – Primary School	2,575	Computer Hub	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	1	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**37.5**		
68	Education – Primary School	2,575	36-2	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	12	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**12**	**37.5**		
69	Education – Primary School	2,575	35-2	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	12	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**12**	**37.5**		
70	Education – Primary School	2,575	34-2	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	12	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**12**	**37.5**		
71	Education – Primary School	2,575	33-2	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	12	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**12**	**37.5**		
72	Education – Primary School	2,575	Classroom 25	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	15	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**15**	**37.5**		
73	Education – Primary School	2,575	Classroom 25	Y	Existing	N	EXIT Incandescent, (2) 50W lamp	1	100.0		N
					Proposed	**N**	**Fixture Replacement: LED Exit Sign: 2.3 W**	**1**	**2.3**		
74	Education – Primary School	2,575	Classroom 26	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	15	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**15**	**37.5**		
75	Education – Primary School	2,575	Classroom 26	Y	Existing	N	EXIT Incandescent, (2) 50W lamp	1	100.0		N
					Proposed	**N**	**Fixture Replacement: LED Exit Sign: 2.3 W**	**1**	**2.3**		
76	Education – Primary School	2,575	Classroom 26	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		

77	Education – Primary School	2,575	Classroom 24	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	15	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**15**	**37.5**		
78	Education – Primary School	2,575	Classroom 24	Y	Existing	N	EXIT Incandescent, (2) 50W lamp	1	100.0		N
					Proposed	**N**	**Fixture Replacement: LED Exit Sign: 2.3 W**	**1**	**2.3**		
79	Education – Primary School	2,575	Classroom 24	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
80	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
81	Education – Primary School	2,575	Classroom 23	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	15	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**15**	**37.5**		
82	Education – Primary School	2,575	Classroom 23	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	2	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**2**	**18.0**		
83	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
84	Education – Primary School	2,575	Classroom 21	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	15	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**15**	**37.5**		
85	Education – Primary School	2,575	Classroom 21	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
86	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
87	Education – Primary School	2,575	Classroom 22	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	16	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**16**	**37.5**		
88	Education – Primary School	2,575	Classroom 22	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
89	Education – Primary School	2,575	Classroom 22	Y	Existing	N	EXIT Incandescent, (2) 50W lamp	1	100.0		N
					Proposed	**N**	**Fixture Replacement: LED Exit Sign: 2.3 W**	**1**	**2.3**		
90	Education – Primary School	2,575	Classroom 20	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	15	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**15**	**37.5**		
91	Education – Primary School	2,575	Classroom 19	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	15	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**15**	**37.5**		
92	Education – Primary School	2,575	Classroom 18	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	15	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**15**	**37.5**		
93	Education – Primary School	2,575	Classroom 17	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	17	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**17**	**37.5**		
94	Education – Primary School	2,575	Classroom 32	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	4	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**4**	**37.5**		
95	Education – Primary School	2,575	Machine Room	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	4	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**4**	**37.5**		
96	Education – Primary School	2,575	General Office	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	6	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**25.0**		
97	Education – Primary School	2,575	Nurses	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	3	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**3**	**25.0**		
98	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
99	Education – Primary School	2,575	Principals Office	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	4	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**4**	**25.0**		
100	Education – Primary School	2,575	Boys Room	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	1	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**25.0**		
101	Education – Primary	2,575	Janitors room	N	Existing	N	Fluorescent, (1) 48", T8 lamp	1	28.0		N

101	School	2,575	Janitors room	N	**Proposed**	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**12.5**		N
102	Education – Primary School	2,575	Boiler Room	N	Existing	N	Fluorescent, (2) 48", T8 lamp	5	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**5**	**25.0**		
103	Education – Primary School	2,575	Boiler Room	N	Existing	N	Fluorescent, (4) 48", T8 lamp	1	108.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**50.0**		
104	Education – Primary School	2,575	Boiler Room	N	Existing	N	EXIT Incandescent, (2) 50W lamp	1	100.0		N
					Proposed	**N**	**Fixture Replacement: LED Exit Sign: 2.3 W**	**1**	**2.3**		
105	Education – Primary School	2,575	Hallway Open Space	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	26	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**26**	**25.0**		
106	Education – Primary School	2,575	Hallway Open Space	Y	Existing	N	EXIT Incandescent, (2) 50W lamp	15	100.0		N
					Proposed	**N**	**Fixture Replacement: LED Exit Sign: 2.3 W**	**15**	**2.3**		
107	Education – Primary School	2,575	Hallway Open Space	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	45	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**45**	**25.0**		
108	Education – Primary School	2,575	Hallway Open Space	Y	Existing	N	CFL: 42W	14	42.0		N
					Proposed	**N**	**Relamp/Reballast: LED 2-Lamp PL 4-Pin**	**14**	**28.0**		
109	Education – Primary School	2,575	Rear Entrance Lobby	Y	Existing	N	CFL: 42W	16	42.0		N
					Proposed	**N**	**Fixture Replacement: LED Recessed Downlight - 6" - 18 W**	**16**	**18.0**		
110	Education – Primary School	2,575	Rear Entrance Lobby	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
111	Education – Primary School	2,575	Rear Entrance Lobby	Y	Existing	N	EXIT Incandescent, (2) 50W lamp	2	100.0		N
					Proposed	**N**	**Fixture Replacement: LED Exit Sign: 2.3 W**	**2**	**2.3**		
112	Education – Primary School	2,575	Rear Entrance Lobby	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	6	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**6**	**18.0**		
TOTALS											

SELOVER SCHOOL

	Facility Type	Default Annual Hours	Fixture Location	Located in Conditioned Space?		Fixtures Con-trolled?	Lighting Fixture Description	# of Fixtures	Default Watts per Fixture	Actual Watts per Fixture	Install Height >12 ft?
1	Education – Primary School	2,575	Class #17	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	9	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**9**	**37.5**		
2	Education – Primary School	2,575	Class #19	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	9	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**9**	**37.5**		
3	Education – Primary School	2,575	Class #20	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	9	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**9**	**37.5**		
4	Education – Primary School	2,575	Class #18	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	9	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**9**	**37.5**		
5	Education – Primary School	2,575	Boiler Room	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	4	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**4**	**25.0**		
6	Education – Primary School	2,575	Class #16	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	9	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**9**	**37.5**		
7	Education – Primary School	2,575	Mens	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	2	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**12.5**		
8	Education – Primary School	2,575	Womens	Y	Existing	N	Fluorescent, (4) 48", T8 lamp	3	108.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**3**	**50.0**		
9	Education – Primary School	2,575	Class #15	Y	Existing	N	Fluorescent, (4) 48", T8 lamp	14	108.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**14**	**50.0**		
10	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
11	Education – Primary School	2,575	Closet	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
12	Education – Primary School	2,575	Class #22	Y	Existing	N	Fluorescent, (4) 48", T8 lamp	14	108.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**14**	**50.0**		
13	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
14	Education – Primary School	2,575	Closet	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
15	Education –	2,575	Class #14	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	14	83.0		N

15	Education – Primary School	2,575	Class #14	Y	**Proposed**	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**14**	**37.5**		N
16	Education – Primary School	2,575	Closet	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
17	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
18	Education – Primary School	2,575	Class #23	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	14	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**14**	**37.5**		
19	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
20	Education – Primary School	2,575	Closet	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
21	Education – Primary School	2,575	Main Office	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	10	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**10**	**25.0**		
22	Education – Primary School	2,575	Vestibule	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	1	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**12.5**		
23	Education – Primary School	2,575	Closet	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
24	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
25	Education – Primary School	2,575	Security Office	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	4	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**4**	**37.5**		
26	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
27	Education – Primary School	2,575	IT/ Telephone Room	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	1	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**12.5**		
28	Education – Primary School	2,575	IT/ Telephone Room	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
30	Education – Primary School	2,575	Office	Y	Existing	N	Fluorescent, (4) 48", T8 lamp	4	108.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**4**	**50.0**		
31	Education – Primary School	2,575	Confrence Room	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	16	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**16**	**25.0**		
32	Education –	2,575	Closet	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N

32	Education – Primary School	2,575	Closet	Y	**Proposed**	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		N
34	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
35	Education – Primary School	2,575	Spot Lights	Y	Existing	N	CFL: 32W	3	32.0		N
					Proposed	**N**	**Relamp/Reballast: LED 1-Lamp PL 4-Pin**	**3**	**14.0**		
36	Education – Primary School	2,575	Exit Signs	Y	Existing	N	EXIT Incandescent, (2) 50W lamp	1	100.0		N
					Proposed	**N**	**Fixture Replacement: LED Exit Sign: 2.3 W**	**1**	**2.3**		
37	Education – Primary School	2,575	Classroom 2	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	8	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**8**	**25.0**		
38	Education – Primary School	2,575	Office	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	2	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**37.5**		
39	Education – Primary School	2,575	Classroom 10	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	12	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**12**	**25.0**		
40	Education – Primary School	2,575	Classroom 3	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	3	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**3**	**25.0**		
41	Education – Primary School	2,575	Classroom 9	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	12	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**12**	**25.0**		
42	Education – Primary School	2,575	Classroom 4	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	7	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**7**	**25.0**		
43	Education – Primary School	2,575	Classroom 8	Y	Existing	N	Fluorescent, (4) 48", T8 lamp	8	108.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**8**	**50.0**		
44	Education – Primary School	2,575	Womens	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	2	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**37.5**		
45	Education – Primary School	2,575	Closet	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
46	Education – Primary School	2,575	Custodian	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
47	Education – Primary School	2,575	1st Aid	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
48	Education – Primary School	2,575	Mens	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	2	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**37.5**		
49	Education –	2,575	Staff Room	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N

49	Education – Primary School	2,575	Staff Room	Y	**Proposed**	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		N
50	Education – Primary School	2,575	Staff Room	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	4	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**4**	**25.0**		
51	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	2	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**2**	**18.0**		
52	Education – Primary School	2,575	Vestibule	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
53	Education – Primary School	2,575	Closet	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
54	Education – Primary School	2,575	Lobby Entrance	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
55	Education – Primary School	2,575	Classroom 5	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	12	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**12**	**25.0**		
56	Education – Primary School	2,575	Classroom 6	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	12	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**12**	**37.5**		
57	Education – Primary School	2,575	Exit Lobby	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
58	Education – Primary School	2,575	Exit Lobby	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	1	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**12.5**		
59	Education – Primary School	2,575	Basement Storage Room	Y	Existing	N	Fluorescent, (4) 48", T8 lamp	4	108.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**4**	**50.0**		
60	Education – Primary School	2,575	Custodial	Y	Existing	N	Fluorescent, (4) 48", T8 lamp	2	108.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**50.0**		
61	Education – Primary School	2,575	Restroom Storage	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	1	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**25.0**		
62	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	2	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**2**	**18.0**		
63	Education – Primary School	2,575	Maintenance	Y	Existing	N	Fluorescent, (4) 48", T8 lamp	4	108.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**4**	**50.0**		
64	Education – Primary School	2,575	Boys Room	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	1	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**25.0**		
65	Education –	2,575	Boys Room	Y	Existing	N	Fluorescent, (4) 48", T8 lamp	1	108.0		N

65	Education – Primary School	2,575	Boys Room	Y	**Proposed**	**N**	**Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**50.0**		N
66	Education – Primary School	2,575	Storage	Y	Existing	N	Fluorescent, (4) 48", T8 lamp	4	108.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**4**	**50.0**		
67	Education – Primary School	2,575	Storage	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
68	Education – Primary School	2,575	Electrical Panel	Y	Existing	N	Fluorescent, (4) 48", T8 lamp	3	108.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**3**	**50.0**		
69	Education – Primary School	2,575	Storage	Y	Existing	N	Fluorescent, (6) 48", T8 lamp	6	175.0		Y
					Proposed	**N**	**Relamp: Direct Line LED - 6-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**75.0**		
70	Education – Primary School	2,575	Storage	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	3	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**3**	**25.0**		
71	Education – Primary School	2,575	Storage	Y	Existing	N	EXIT Incandescent, (2) 50W lamp	1	100.0		N
					Proposed	**N**	**Fixture Replacement: LED Exit Sign: 2.3 W**	**1**	**2.3**		
72	Education – Primary School	2,575	Storage	Y	Existing	N	Incandescent, (1) 65W lamp	1	65.0		N
					Proposed	**N**	**Relamp: LED - BR40 (9 - 30W): 14 W**	**1**	**14.0**		
73	Education – Primary School	2,575	Hallway	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	9	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**9**	**12.5**		
74	Education – Primary School	2,575	Hallway	Y	Existing	N	EXIT Incandescent, (2) 50W lamp	1	100.0		N
					Proposed	**N**	**Fixture Replacement: LED Exit Sign: 2.3 W**	**1**	**2.3**		
75	Education – Primary School	2,575	1st Fl Hallway	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	35	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**35**	**12.5**		
76	Education – Primary School	2,575	1st Fl Hallway	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	9	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**9**	**37.5**		
77	Education – Primary School	2,575	1st Fl Hallway	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	15	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**15**	**25.0**		
78	Education – Primary School	2,575	1st Fl Hallway	Y	Existing	N	EXIT Incandescent, (2) 50W lamp	5	100.0		N
					Proposed	**N**	**Fixture Replacement: LED Exit Sign: 2.3 W**	**5**	**2.3**		
79	Education – Primary School	2,575	1st Fl Hallway	Y	Existing	N	EXIT Incandescent, (2) 50W lamp	1	100.0		N
					Proposed	**N**	**Fixture Replacement: LED Exit Sign: 2.3 W**	**1**	**2.3**		
81	Education – Primary School	2,575	Exterior	N	Existing	N	Metal Halide, (1) 70W lamp	14	95.0		N
					Proposed	**N**	**Fixture Replacement: LED Architectural Flood/Spot (25 - 150W): 20 W**	**14**	**19.8**		
82	Education –	2,575	Exterior	N	Existing	N	Metal Halide, (1) 70W lamp	1	95.0		N

82	Primary School	2,575	Exterior	N	**Proposed**	**N**	**Fixture Replacement: LED Outdoor Wall Mount (14 - 60W): 17 W**	**1**	**17.0**		N
83	Education – Primary School	2,575	Exterior	N	Existing	N	Metal Halide, (1) 70W lamp	1	95.0		N
					Proposed	**N**	**Fixture Replacement: LED Outdoor Wall Mount (14 - 60W): 17 W**	**1**	**17.0**		
84	Education – Primary School	2,575	Exterior	N	Existing	N	Metal Halide, (1) 250W lamp	1	295.0		N
					Proposed	**N**	**Fixture Replacement: LED Architectural Flood/Spot (25 - 150W): 148 W**	**1**	**148.2**		
TOTALS												

WOODROW WILSON ELEMENTARY SCHOOL

	Facility Type	Default Annual Hours	Fixture Location	Located in Conditioned Space?		Fixtures Con-trolled?	Lighting Fixture Description	# of Fixtures	Default Watts per Fixture	Actual Watts per Fixture	Install Height >12 ft?
1	Education – Primary School	2,575	2nd Fl Principals Office	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
2	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (2) 24", T8 lamp	1	33.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 2-Foot T8**	**1**	**18.0**		
3	Education – Primary School	2,575	Classroom 27	Y	Existing	N	Fluorescent, (4) 48", T8 lamp	6	108.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**50.0**		
4	Education – Primary School	2,575	Classroom 28	Y	Existing	N	Fluorescent, (4) 48", T8 lamp	6	108.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**50.0**		
5	Education – Primary School	2,575	Girls Room	Y	Existing	N	Fluorescent, (4) 48", T8 lamp	2	108.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**50.0**		
7	Education – Primary School	2,575	Classroom 29	Y	Existing	N	Fluorescent, (4) 48", T8 lamp	6	108.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**50.0**		
8	Education – Primary School	2,575	Classroom 30	Y	Existing	N	Fluorescent, (4) 48", T8 lamp	6	108.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**50.0**		
9	Education – Primary School	2,575	Classroom 31	Y	Existing	N	Fluorescent, (4) 48", T8 lamp	6	108.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**50.0**		
10	Education – Primary School	2,575	Closet	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
11	Education – Primary School	2,575	Office	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
12	Education – Primary School	2,575	Restroom	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		
13	Education – Primary School	2,575	Classroom 26	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	10	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**10**	**25.0**		
14	Education – Primary School	2,575	Classroom 25	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	10	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**10**	**25.0**		
15	Education – Primary School	2,575	Boys Room	Y	Existing	N	Fluorescent, (4) 48", T8 lamp	2	108.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**50.0**		
16	Education – Primary School	2,575	Classroom 24	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	10	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**10**	**25.0**		
17	Education – Primary School	2,575	Classroom 23	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	10	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**10**	**25.0**		
18	Education – Primary School	2,575	Art Room	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	12	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**12**	**25.0**		
19	Education – Primary School	2,575	Closets	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	2	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**2**	**9.0**		
20	Education – Primary School	2,575	Classroom 21	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	12	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**12**	**25.0**		
21	Education – Primary School	2,575	Closets	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	2	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**2**	**9.0**		
22	Education – Primary School	2,575	Library	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	20	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**20**	**25.0**		
23	Education – Primary School	2,575	Closet	Y	Existing	N	Fluorescent, (1) 24", T8 lamp	1	20.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 2-Foot T8**	**1**	**9.0**		

24	Education – Primary School	2,575	Hallway	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	26	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**26**	**25.0**		
25	Education – Primary School	2,575	Hallway	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
26	Education – Primary School	2,575	Hallway	Y	Existing	N	EXIT Incandescent, (2) 50W lamp	1	100.0		N
					Proposed	**N**	**Fixture Replacement: LED Exit Sign: 2.3 W**	**1**	**2.3**		
27	Education – Primary School	2,575	1st Fl Boys	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
28	Education – Primary School	2,575	1st Fl Boys	Y	Existing	N	Fluorescent, (2) U-Tube, T8 lamp	1	59.0		N
					Proposed	**N**	**Relamp/Reballast: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W**	**1**	**28.0**		
29	Education – Primary School	2,575	Classroom 8	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	4	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**4**	**25.0**		
30	Education – Primary School	2,575	Classroom 7	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	6	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**25.0**		
32	Education – Primary School	2,575	Classroom 6	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	15	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**15**	**25.0**		
33	Education – Primary School	2,575	Mens	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
34	Education – Primary School	2,575	Classroom 5	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	12	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**12**	**25.0**		
35	Education – Primary School	2,575	Slop Sink	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	1	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**12.5**		
36	Education – Primary School	2,575	Classroom 4	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	4	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**4**	**25.0**		
37	Education – Primary School	2,575	Classroom 3	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	10	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**10**	**25.0**		
38	Education – Primary School	2,575	Classroom 2	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	10	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**10**	**25.0**		
39	Education – Primary School	2,575	Classroom 1	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	8	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**8**	**25.0**		
40	Education – Primary School	2,575	Gym	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	32	83.0		Y
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**32**	**37.5**		
41	Education – Primary School	2,575	Gym	Y	Existing	N	EXIT Incandescent, (2) 50W lamp	2	100.0		N
					Proposed	**N**	**Fixture Replacement: LED Exit Sign: 2.3 W**	**2**	**2.3**		
42	Education – Primary School	2,575	Speech	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	1	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**12.5**		
43	Education – Primary School	2,575	Office	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
44	Education – Primary School	2,575	Nurse	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	1	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**12.5**		
45	Education – Primary School	2,575	Storage	Y	Existing	N	Fluorescent, (4) 48", T8 lamp	1	108.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**50.0**		
46	Education – Primary School	2,575	Classroom	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	6	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**25.0**		
47	Education – Primary School	2,575	Vestibule	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	1	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**12.5**		
48	Education – Primary School	2,575	Girls Room	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
49	Education – Primary	2,575	Girls Room	Y	Existing	N	Fluorescent, (4) 48", T8 lamp	6	108.0		N

49	Education – Primary School	2,575	Girls Room	Y	**Proposed**	**N**	**Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**50.0**		N
50	Education – Primary School	2,575	Boys Room	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
51	Education – Primary School	2,575	Cafeteria	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	10	83.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**10**	**37.5**		
52	Education – Primary School	2,575	Kitchen	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	4	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**4**	**25.0**		
53	Education – Primary School	2,575	Exit Signs	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	1	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**25.0**		
54	Education – Primary School	2,575	Teachers Lounge	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	9	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**9**	**25.0**		
55	Education – Primary School	2,575	Classroom 9	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	8	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**8**	**25.0**		
56	Education – Primary School	2,575	Girls Room	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
57	Education – Primary School	2,575	Girls Room	Y	Existing	N	Fluorescent, (2) U-Tube, T8 lamp	1	59.0		N
					Proposed	**N**	**Relamp/Reballast: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W**	**1**	**28.0**		
58	Education – Primary School	2,575	Auditorium	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	8	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**8**	**25.0**		
59	Education – Primary School	2,575	Auditorium	Y	Existing	N	Fluorescent, (3) 48", T8 lamp	8	83.0		Y
					Proposed	**N**	**Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**8**	**37.5**		
60	Education – Primary School	2,575	Stage	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
61	Education – Primary School	2,575	Stage	Y	Existing	N	EXIT Incandescent, (2) 50W lamp	2	100.0		N
					Proposed	**N**	**Fixture Replacement: LED Exit Sign: 2.3 W**	**2**	**2.3**		
62	Education – Primary School	2,575	Stage	Y	Existing	N	EXIT Incandescent, (2) 50W lamp	4	100.0		N
					Proposed	**N**	**Fixture Replacement: LED Exit Sign: 2.3 W**	**4**	**2.3**		
63	Education – Primary School	2,575	Hallway	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	25	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**25**	**12.5**		
64	Education – Primary School	2,575	Hallway	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	22	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**22**	**25.0**		
65	Education – Primary School	2,575	Hallway	Y	Existing	N	EXIT Incandescent, (2) 50W lamp	8	100.0		N
					Proposed	**N**	**Fixture Replacement: LED Exit Sign: 2.3 W**	**8**	**2.3**		
66	Education – Primary School	2,575	Exit Signs	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	1	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**25.0**		
67	Education – Primary School	2,575	Stairwell	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
68	Education – Primary School	2,575	Stairwell	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	1	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**25.0**		
69	Education – Primary School	2,575	Stairwell	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	3	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**3**	**25.0**		
70	Education – Primary School	2,575	Stairwell	Y	Existing	N	EXIT Incandescent, (2) 50W lamp	1	100.0		N
					Proposed	**N**	**Fixture Replacement: LED Exit Sign: 2.3 W**	**1**	**2.3**		
71	Education – Primary School	2,575	Basement Storage	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	6	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**6**	**25.0**		
72	Education – Primary School	2,575	Elec Room	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	1	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**12.5**		
73	Education – Primary School	2,575	Boiler Room	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	1	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**25.0**		

74	Education – Primary School	2,575	Boiler Room	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	1	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**12.5**		
75	Education – Primary School	2,575	Boiler Room	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	1	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**1**	**25.0**		
76	Education – Primary School	2,575	Boiler Room	Y	Existing	N	Incandescent, (1) 65W lamp	1	65.0		N
					Proposed	**N**	**Relamp: LED - BR40 (9 - 30W): 17 W**	**1**	**17.0**		
77	Education – Primary School	2,575	Boiler Room	Y	Existing	N	EXIT Incandescent, (2) 50W lamp	1	100.0		N
					Proposed	**N**	**Fixture Replacement: LED Exit Sign: 2.3 W**	**1**	**2.3**		
78	Education – Primary School	2,575	Boiler Room	Y	Existing	N	Fluorescent, (1) 48", T8 lamp	2	28.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**12.5**		
79	Education – Primary School	2,575	Boiler Room	Y	Existing	N	EXIT Incandescent, (2) 50W lamp	1	100.0		N
					Proposed	**N**	**Fixture Replacement: LED Exit Sign: 2.3 W**	**1**	**2.3**		
80	Education – Primary School	2,575	Stairwell	Y	Existing	N	Fluorescent, (2) 48", T8 lamp	2	54.0		N
					Proposed	**N**	**Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W)**	**2**	**25.0**		
81	Education – Primary School	2,575	Exterior	N	Existing	N	Metal Halide, (1) 70W lamp	3	95.0		Y
					Proposed	**N**	**Fixture Replacement: LED Architectural Flood/Spot (25 - 150W): 20 W**	**3**	**19.8**		
82	Education – Primary School	2,575	Exterior	N	Existing	N	Metal Halide, (1) 70W lamp	1	95.0		N
					Proposed	**N**	**Fixture Replacement: LED Outdoor Wall Mount (14 - 60W): 22 W**	**1**	**22.0**		
83	Education – Primary School	2,575	Exterior	N	Existing	N	Metal Halide, (1) 250W lamp	1	295.0		Y
					Proposed	**N**	**Fixture Replacement: LED Architectural Flood/Spot (25 - 150W): 148 W**	**1**	**148.2**		
TOTALS											

Appendix C
Solar PV

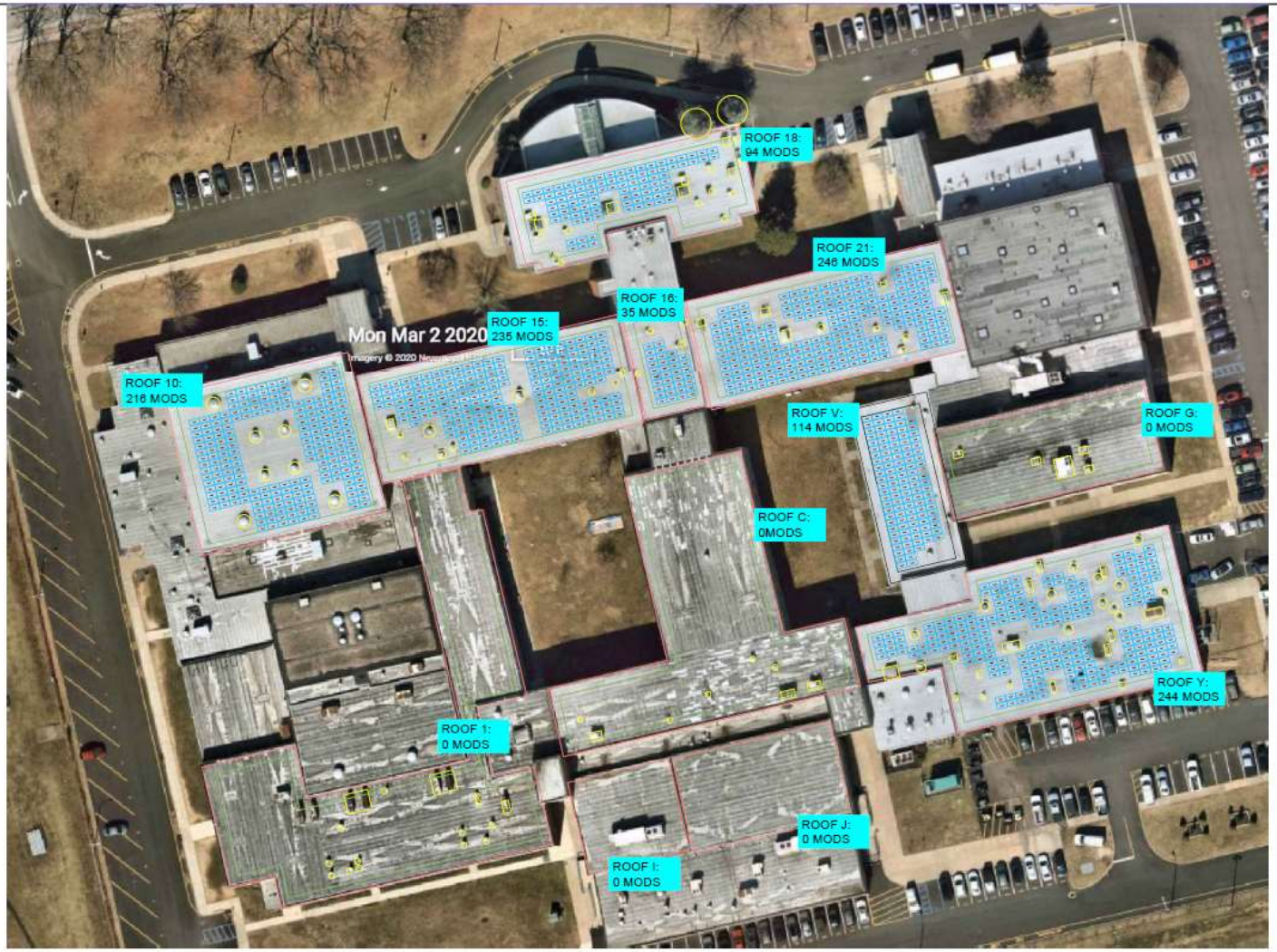
Solar

$317,166 3.125 MW

	Sayreville HS	Sayreville MS	EL Arleth ES	HS Truman ES	Samsel Upper ES	Dwight Eisenhower ES	Wilson ES	Selover BOE Offices
Roof (kW)	468	597	228	240	0	135	102	72
Carport (kW)	822	0	0	0	461	0	0	0
Implementation Cost (Included in ESIP)	$14,000	$20,000	$10,000	$15,000	$0	$15,000	$520,000	$0
Yearly $ Savings	$125,902	$64,739	$23,244	$28,701	$41,652	$14,248	$10,452	$8,228
15 Year $ Savings	$1,888,531	$971,085	$348,660	$430,515	$624,780	$213,720	$156,780	$123,425

WILLDAN

High School Solar Plan



SAYERVILLE WAR MEMORIAL HIGH SCHOOL

820 WASHINGTON ROAD
PARLIN, NJ 08859

TOTAL SYSTEM SIZE:
467.68 kW-DC

TOTAL MODULES:
1,184 @ 395 WATTS EACH

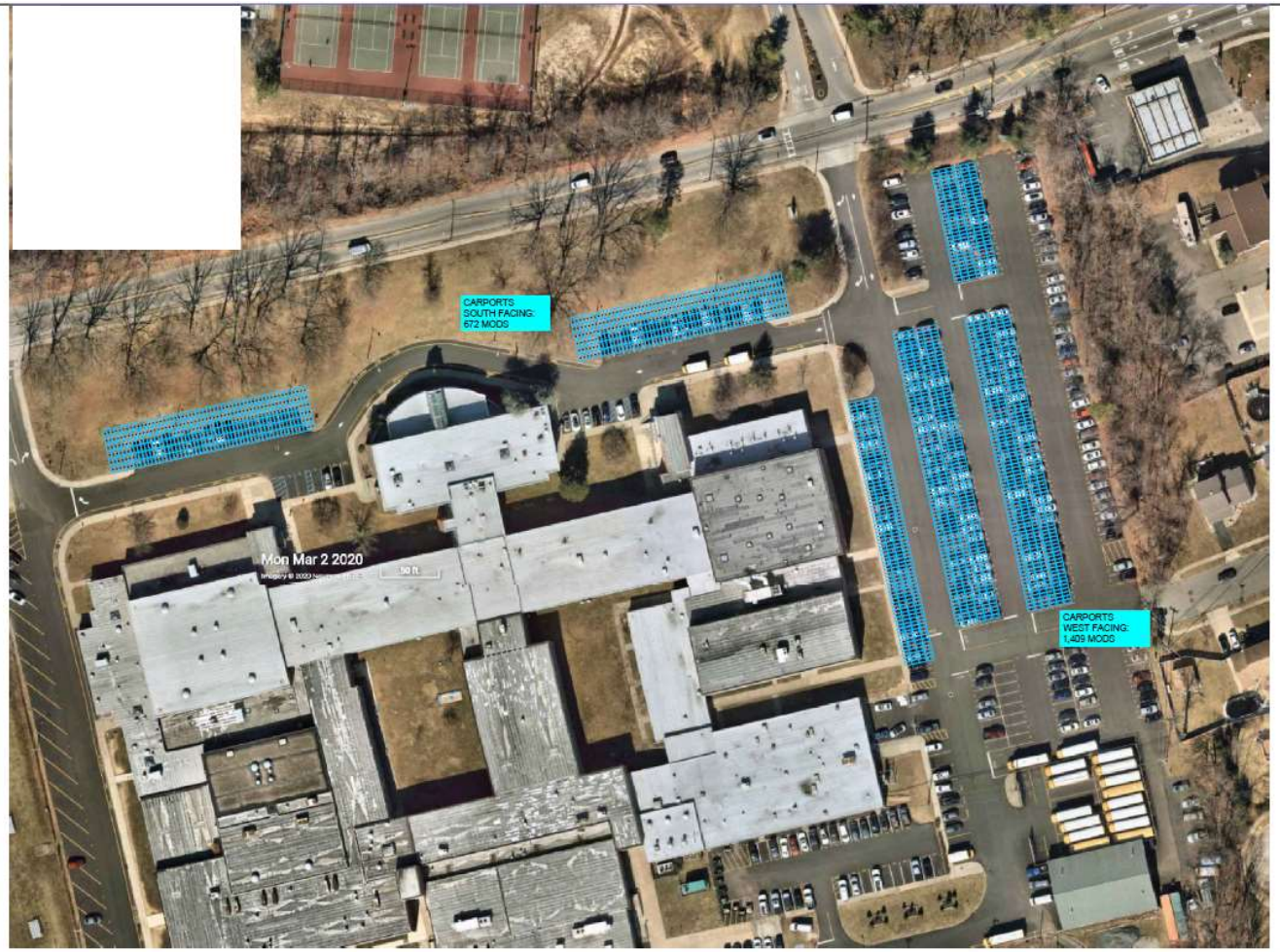
ALL LAYOUTS SUBJECT TO FINAL ENGINEERING

ARRAY LAYOUT

SCALE: 1/32" = 1'-0"

EZNERGY
Solar Energy Solutions

High School Solar Plan - Carport



SAYERVILLE WAR MEMORIAL HIGH SCHOOL
CARPORT OPTION

820 WASHINGTON ROAD
PARLIN, NJ 08859

TOTAL SYSTEM SIZE:
821.995 kW-DC

TOTAL MODULES:
2,081 @ 395 WATTS EACH

ALL LAYOUTS SUBJECT TO FINAL ENGINEERING

ARRAY LAYOUT

SCALE: Custom

EZNERGY
Solar Energy Solutions

Middle School Solar Plan



SAYERVILLE MIDDLE SCHOOL

800 WASHINGTON ROAD
PARLIN, NJ 08859

TOTAL SYSTEM SIZE:
596.845 kW-DC

TOTAL MODULES:
1,511 @ 395 WATTS EACH

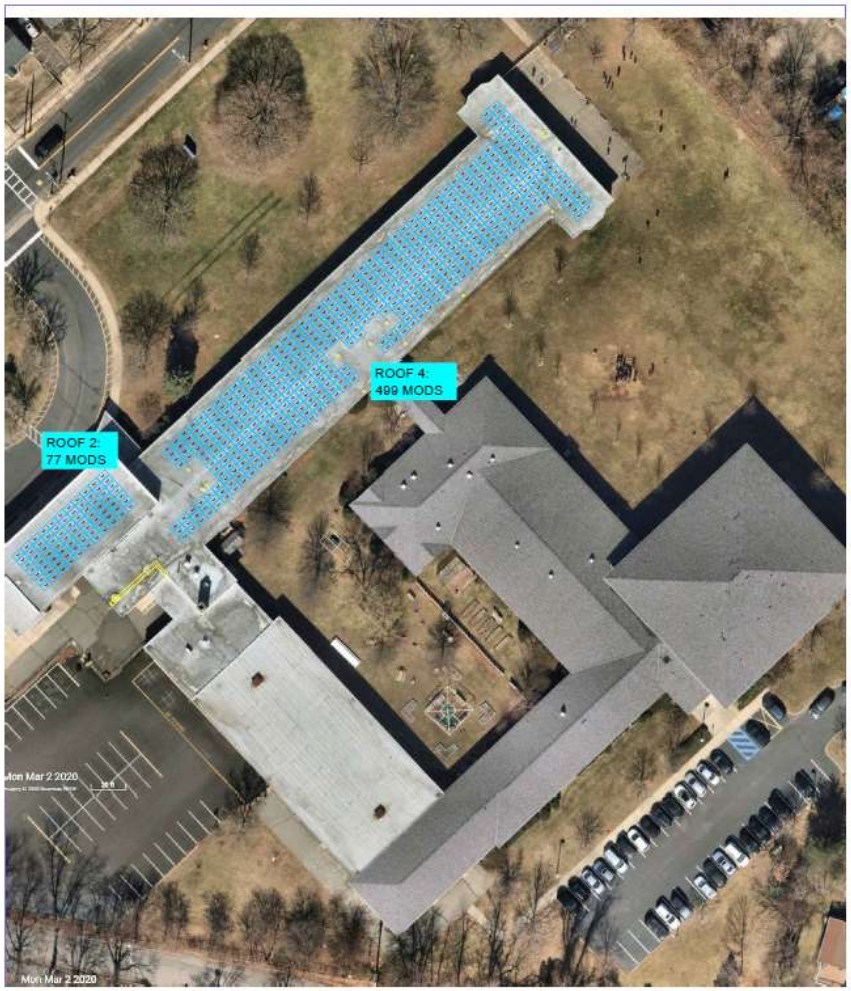
ALL LAYOUTS SUBJECT TO FINAL ENGINEERING

ARRAY LAYOUT

SCALE: 1/32" = 1'-0"

EZNERGY
Solar Energy Solutions

Arleth ES Solar Plan



ARLETH ELEMENTARY

3198 WASHINGTON ROAD
PARLIN, NJ 08859

TOTAL SYSTEM SIZE:
227.52 kW-DC

TOTAL MODULES:
576 @ 395 WATTS EACH

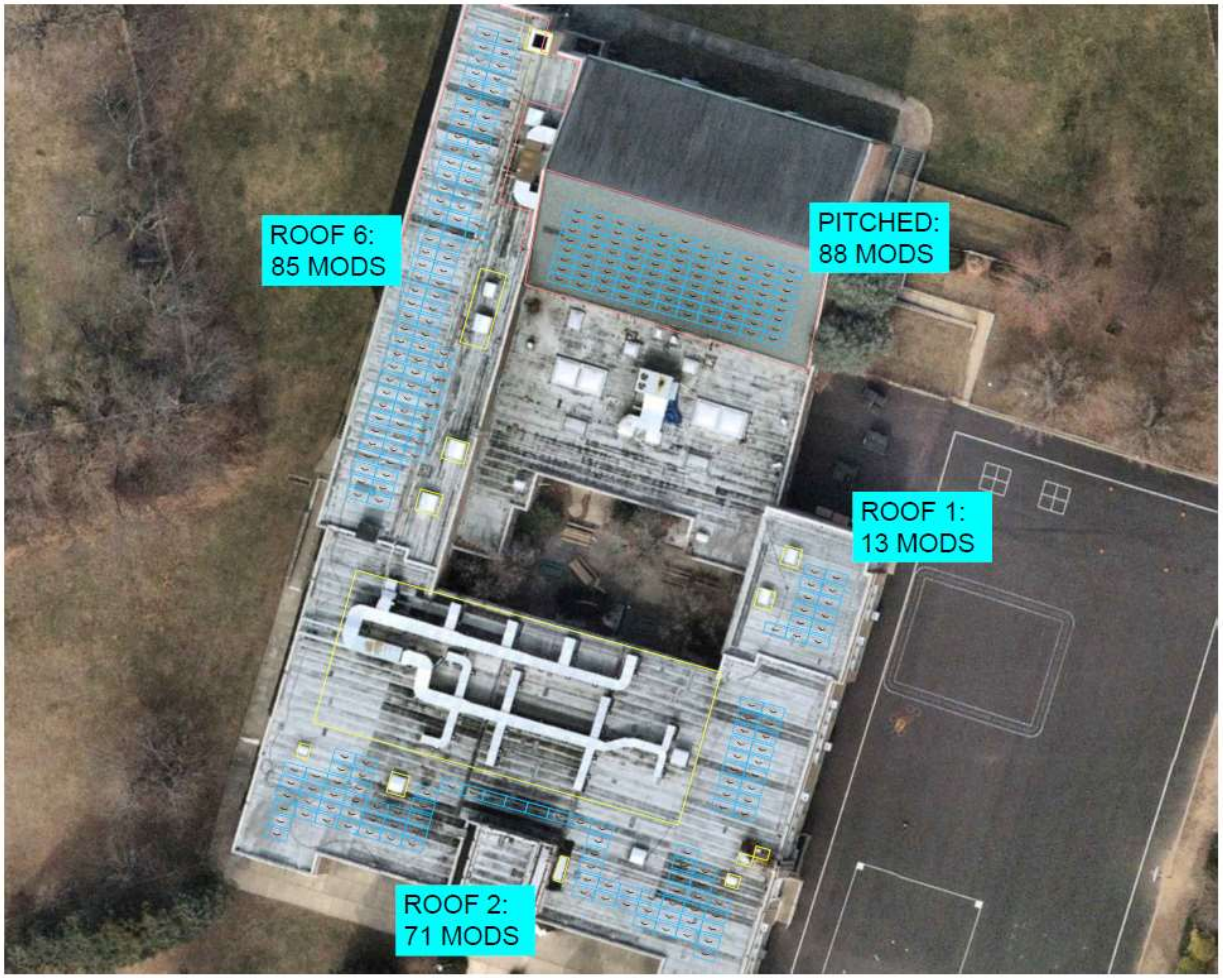
ALL LAYOUTS SUBJECT
TO FINAL ENGINEERING

ARRAY LAYOUT

SCALE: 1/32" = 1'-0"

EZNERGY
Solar Energy Solutions

Wilson ES Solar Plan



WILSON ELEMENTARY

65 DANE STREET
SAYREVILLE, NJ 08872

TOTAL SYSTEM SIZE:
101.52 kW-DC

TOTAL MODULES:
257 @ 395 WATTS EACH

ALL LAYOUTS SUBJECT
TO FINAL ENGINEERING

ARRAY LAYOUT

SCALE: 1/16" = 1'-0"

EZNERGY
Solar Energy Solutions

Samsel Upper Solar Plan - Carport



SAMSEL UPPER ELEMENTARY SCHOOL CARPORT OPTION

298 ERNSTON ROAD,
PARLIN, NJ 08859

TOTAL SYSTEM SIZE:
461.36 kW-DC

TOTAL MODULES:
1,168 @ 395 WATTS EACH

ALL LAYOUTS SUBJECT TO FINAL ENGINEERING

ARRAY LAYOUT

SCALE: 1/32" = 1'-0"

EZNERGY
Solar Energy Solutions

Truman Solar Plan



HARRY S. TRUMAN ELEMENTARY SCHOOL

1 TAFT PLACE
PARLIN, NJ 08859

TOTAL SYSTEM SIZE:
239.765 kW-DC

TOTAL MODULES:
607 @ 395 WATTS EACH

ALL LAYOUTS SUBJECT TO FINAL ENGINEERING

ARRAY LAYOUT

SCALE: 1/16" = 1'-0"

EZNERGY
Solar Energy Solutions

Eisenhower Solar Plan



DWIGHT D. EISENHOWER ELEMENTARY SCHOOL

601 ERNSTON RD.
PARLIN, NJ 08859

TOTAL SYSTEM SIZE:
134.695 kW-DC

TOTAL MODULES:
341 @ 395 WATTS EACH

ALL LAYOUTS SUBJECT TO FINAL ENGINEERING

ARRAY LAYOUT

SCALE: 1/32" = 1'-0"

EZNERGY
Solar Energy Solutions

Selover Solar Plan



SELVER BOARD OF EDUCATION OFFICES

150 LINCOLN STREET
SOUTH AMBOY, NJ 08879

TOTAL SYSTEM SIZE:
71.89 kW-DC

TOTAL MODULES:
182 @ 395 WATTS EACH

ALL LAYOUTS SUBJECT TO FINAL ENGINEERING

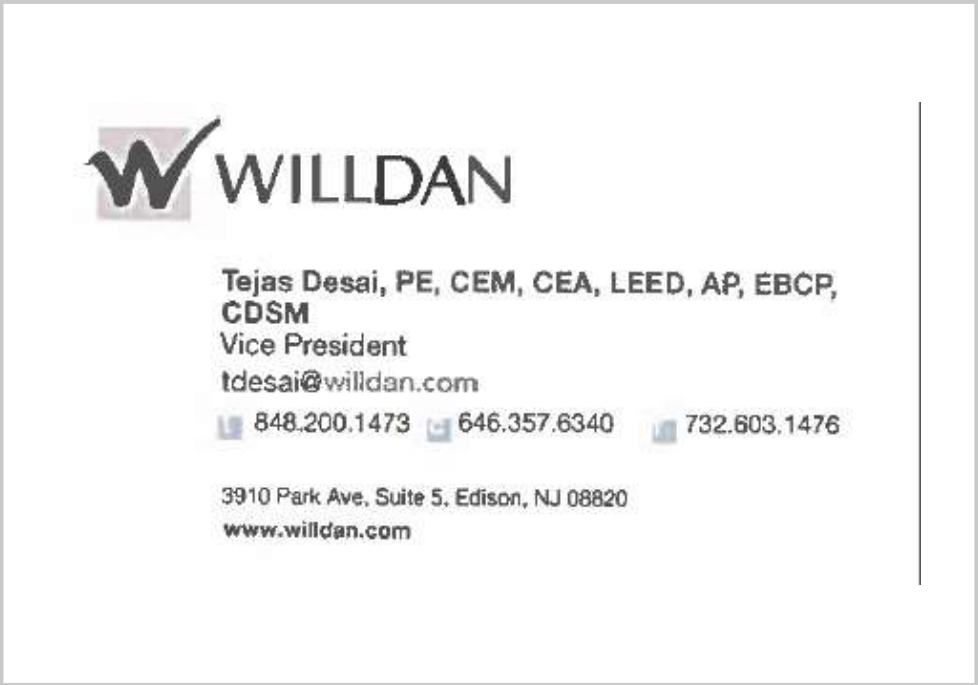
ARRAY LAYOUT

SCALE: 1/16" = 1'-0"

EZNERGY
Solar Energy Solutions

Thank you


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Appendix D
Direct Install Proposal

Facility Name	Total Project Cost	Incentives	Customer cost	Extras	Equipment included		
					Lighting	Mechanical	
Dwight D Eisenhower	$ 342,736.98	$ 148,663.55	$ 194,073.43	$ 54,330.00	100% Lighting is included	Qty, 4, 1500MBH Boilers Series - Pipe Wrap, Aerators, T-Stats	
Emma L Arleth	$ 294,341.98	$ 160,281.53	$ 134,060.45	$ 42,877.50	100% Lighting is included	Qty, 1, 6 Ton Split - Qty, 3, 1500MBH Boilers Series - Pipe Wrap, Aerators, T-Stats	
Harry S Truman	$ 154,776.27	$ 67,218.04	$ 87,558.23	$ 117,400.73	100% Lighting is included	Qty, 3, 600MBH Boilers Series - Water Heater 75G - Pipe Wrap, Aerators, T-Stats	
Selover School	$ 102,426.25	$ 73,116.40	$ 29,309.85	$ 17,940.00	100% Lighting is included	Qty, 1, 1250MBH - Pipe Wrap, Aerators, T-Stats - Qty, 1, Steam Economizer	
Wilson School	$ 202,949.62	$ 104,399.10	$ 98,550.52	$ 56,605.00	100% Lighting is included	Qty, 1, 15 Ton Package - Qty, 2, 1500MBH Boilers Series - Pipe Wrap, Aerators, T-Stats - Qty, 1 Dual Enthalpy Economizer - Qty, 1, AC Economizer	
Direct Install Proposal Total	$ 1,097,231.10	$ 553,678.62	$ 543,552.48	$ 289,153.23			

Direct Install Proposal Total	$ 1,386,384.33	
Customer Contribution	$ 832,705.71	60%
NJOCE Incentives	$ 553,678.62	40%

Program	Dwight D Eisenhower	Emma L Arleth	Harry S Truman	Selover School	Wilson School
NJOCE Direct Install	x	X	x	X	x
NJOCE SmartStart					
NJOCE Pay for Performance					
NJOCE Benchmarking					
SREC Registration Program					

New Jersey Office of Clean Energy
Direct Install Program
Energy Assessment Tool (V4.0C)

General Project Information

Participating Customer:	Sayreville Boro BD of Ed		**Facility Type:**	Education – Primary School
Contractor / Project #:	Lime	LM126366	**HVAC Type:**	No AC, Gas Heat
Facility Name:	Dwight D. Eisenhower Elementary Schoo		**Total Facility Square Footage:**	59,000
Street Address:	601 Ernston Rd		**Avg Weekly Hrs of Operation:**	40
City / Zip Code:	Parlin	08859	**# of Full-Time Employees:**	50
Is this facility publicly owned?:		Y	**Year Constructed:**	1960
BOE, MUA or other public entity property?		Y	**Tax Exempt?:**	Y
			Project Permitting Costs:	$500.00

Enhanced Incentive Eligibility

Project in UEZ?	N	**K-12 School?**	Y
Project in OZ?	N	**Municipality?**	N
		County Facility?	N

Electric Utility Information

Electric Provider:	Jersey Central Power & Light
Service Class:	GSS
Account #:	100 013 954 480
Billing Period Start Date:	09/17/19
Billing Period End Date:	10/15/19
Billing Period kWh Consumption:	15,600
Billing Period Total Cost:	$1,231.99
Total Taxes + Fees on Bill:	$11.13
Electric - Average Cost ($/kWh):	**$0.078**

Gas Utility Information

Gas Provider:	PSE&G
Service Class:	LVG
Account #:	73 376 945 04
Billing Period Start Date:	11/06/19
Billing Period End Date:	12/06/19
Billing Period Therm Consumption:	4,061
Billing Period Total Cost:	$3,423.52
Total Taxes + Fees on Bill:	$137.29
Gas - Average Cost ($/Therm):	**$0.809**

Oil Information

Annual Consumption (Gallons):	
Annual Cost:	
Annual Taxes + Fees on Bill:	
Oil - Average Cost ($/Gallon):	**$0.000**

Propane Information

Annual Consumption (Gallons):	
Annual Cost:	
Annual Taxes + Fees on Bill:	
Propane - Average Cost ($/Gallon):	**$0.000**

Project Summary

	Annual Energy Savings	Energy Units	Annual Cost Savings	Total Measure Cost	Estimated Incentive Amount	Total Cost to Customer
Lighting Measures Total:	46,453	kWh	$3,635.40	$49,781.10	$21,592.75	$28,188.35
Motors & VFD Measures Total:	0	kWh	$0.00	$0.00	$0.00	$0.00
HVAC Electric Measures Total:	0	kWh	$0.00	$0.00	$0.00	$0.00
Refrigeration Measures Total:	0	kWh	$0.00	$0.00	$0.00	$0.00
ELECTRIC MEASURES:	**46,453**	**kWh**	**$3,635.40**	**$49,781.10**	**$21,592.75**	**$28,188.35**
GAS MEASURES:	**27,448**	**Therms**	**$22,211.74**	**$292,955.88**	**$127,070.80**	**$165,885.08**
OIL MEASURES:	**0**	**Gallons**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
TOTAL PROPANE MEASURES:	**0**	**Gallons**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
CONVERSION MEASURES (OIL):	**0**	**Gallons**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
CONVERSION MEASURES GAS:	**0**	**Therms**				
COMBINED PROJECT TOTALS:			**$25,847.14**	**$342,736.98**	**$148,663.55**	**$194,073.43**

SIMPLE PAYBACK (YEARS): **7.51**

PROJECT TRC TEST: **2.56**

Projected Dollar Savings Per Measure Category



Direct Install Energy Assessment Tool (ver. 4.0C)
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DIRECT INSTALL PROGRAM

PARTICIPATION AGREEMENT

SCOPE OF WORK ATTACHMENT

LMLM126366

"Parties":				
Participating Customer*:	**Sayreville Boro BD of Ed**			
Participating Contractor*:	**Lime**			
Facility Name*:	**Dwight D. Eisenhower Elementary School**			
Facility Address:	**601 Ernston Rd**	**Parlin,**	**NJ**	**08859**
	Street	City		Zip

*as listed on Application

When fully signed, this Scope of Work Attachment ("Attachment") shall become part of the Direct Install Program Participation Agreement ("Participation Agreement") previously executed by the Parties in connection with the installation of energy efficiency retrofit Measures to be performed by the Participating Contractor (or "Contractor") at the above listed Facility. This Attachment, together with the Participation Agreement shall constitute the full Agreement between the Parties. Terms capitalized herein are defined in the Participation Agreement.

The Participating Customer (or "Customer") agrees to have Contractor perform retrofit work in connection with the Measures listed on page 2 of this form (attached). In consideration of the Contractor's performance of such work, Customer agrees to pay Contractor based on the measure costs listed below under Customer Unit Cost for the number of completed units for each Measure upon receipt of invoice; provided the Contractor may collect a deposit from Customer prior to performing such work, in which case the final invoice shall be net of such deposit. Customer and Contractor understand that conditions discovered during installation may require that some measures identified in the energy assessment cannot be installed, or some areas may require additional measures/quantities to be installed. Should conditions in the field dictate that the Estimated Program Total Cost shown on page 2 increase by more than 10%, Contractor must obtain both Program Administrator and Customer written approval in the form of an amended Scope of Work Attachment before proceeding with such additional work.

By signing below, the Parties agree the above listed Measures shall be installed by the Contractor. The Customer shall pay the Contractor as described herein following Completion and Acceptance of Measures. Customer certifies that he/she has the authority to contract for retrofit work in the Facility in connection with the Measures listed and, if the Customer does not own the Facility, the Owner has granted permission to Customer for performance of such work.

Participating Customer	Date	Participating Contractor	Date

Page 2
Scope of Work

The work to be performed by the Participating Contractor in connection with the Project shall be comprised of the below listed Measures in the estimated quantities listed:

Measure Description / Location	Quantity To Be Installed	Total Measure Cost	Estimated Customer Total Cost	Estimated Incentive Amount
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Cafeteria	14	$ 864.92	$ 489.76	$ 375.16
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Teachers Lounge	6	$ 370.68	$ 209.90	$ 160.78
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Gym	5	$ 308.90	$ 174.91	$ 133.99
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Gym	32	$ 2,966.40	$ 1,679.71	$ 1,286.69
Fixture Replacement: LED Exit Sign: 2.3 W / Gym	4	$ 291.60	$ 165.12	$ 126.48
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Music Room 37	13	$ 803.14	$ 454.77	$ 348.37
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / Room	2	$ 164.18	$ 92.97	$ 71.21
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / Girls Room	2	$ 164.18	$ 92.97	$ 71.21
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / Girls Room	1	$ 56.29	$ 31.87	$ 24.42
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / Boys Room	2	$ 164.18	$ 92.97	$ 71.21
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / Boys Room	1	$ 56.29	$ 31.87	$ 24.42
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Art Room	15	$ 926.70	$ 524.74	$ 401.96
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / Supply Room	2	$ 164.18	$ 92.97	$ 71.21
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 35	2	$ 123.56	$ 69.97	$ 53.59
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 35	1	$ 77.15	$ 43.69	$ 33.46
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / Closet	1	$ 56.29	$ 31.87	$ 24.42
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / Restroom	2	$ 112.58	$ 63.75	$ 48.83
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / Vestibule	1	$ 82.09	$ 46.48	$ 35.61
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Main Office	7	$ 432.46	$ 244.88	$ 187.58
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Main Office	2	$ 123.56	$ 69.97	$ 53.59
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Fax Room	1	$ 61.78	$ 34.98	$ 26.80
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / Closet	1	$ 82.09	$ 46.48	$ 35.61
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / Restroom	1	$ 82.09	$ 46.48	$ 35.61
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Confrence Room	2	$ 123.56	$ 69.97	$ 53.59
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 34A	2	$ 123.56	$ 69.97	$ 53.59
Relamp/Reballast: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W / 34A	1	$ 85.18	$ 48.23	$ 36.95
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / Nurses Office	7	$ 574.63	$ 325.38	$ 249.25
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / Restroom	2	$ 112.58	$ 63.75	$ 48.83
Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 14	6	$ 505.74	$ 286.37	$ 219.37
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 14	2	$ 123.56	$ 69.97	$ 53.59
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 32	12	$ 655.80	$ 371.34	$ 284.46
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 15	43	$ 2,349.95	$ 1,330.65	$ 1,019.30
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Room 1	4	$ 218.60	$ 123.78	$ 94.82
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Closet	1	$ 54.65	$ 30.95	$ 23.70
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 31	12	$ 655.80	$ 371.34	$ 284.46
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 30	18	$ 983.70	$ 557.02	$ 426.68
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / Restroom	1	$ 56.29	$ 31.87	$ 24.42
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 16	18	$ 983.70	$ 557.02	$ 426.68
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / Restroom	1	$ 56.29	$ 31.87	$ 24.42
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 29	17	$ 929.05	$ 526.07	$ 402.98
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / Restroom	1	$ 56.29	$ 31.87	$ 24.42
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / C2	1	$ 54.65	$ 30.95	$ 23.70
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 28	17	$ 929.05	$ 526.07	$ 402.98

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Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / Restroom	1	$ 56.29	$ 31.87	$ 24.42
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 27	17	$ 929.05	$ 526.07	$ 402.98
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / Restroom	1	$ 56.29	$ 31.87	$ 24.42
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 26	17	$ 929.05	$ 526.07	$ 402.98
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / Restroom	1	$ 56.29	$ 31.87	$ 24.42
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 17	7	$ 382.55	$ 216.62	$ 165.93
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 25	17	$ 929.05	$ 526.07	$ 402.98
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / Restroom	1	$ 56.29	$ 31.87	$ 24.42
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 18	17	$ 929.05	$ 526.07	$ 402.98
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / Classroom 18	1	$ 56.29	$ 31.87	$ 24.42
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 22	17	$ 929.05	$ 526.07	$ 402.98
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / Restroom	1	$ 56.29	$ 31.87	$ 24.42
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 24	17	$ 929.05	$ 526.07	$ 402.98
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / Restroom	1	$ 56.29	$ 31.87	$ 24.42
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 23	17	$ 929.05	$ 526.07	$ 402.98
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / Restroom	1	$ 56.29	$ 31.87	$ 24.42
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 20	17	$ 929.05	$ 526.07	$ 402.98
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / Restroom	1	$ 56.29	$ 31.87	$ 24.42
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 22	25	$ 1,366.25	$ 773.63	$ 592.62
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / Restroom	1	$ 56.29	$ 31.87	$ 24.42
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / S7	6	$ 327.90	$ 185.67	$ 142.23
Fixture Replacement: LED Exit Sign: 2.3 W / S7	1	$ 72.90	$ 41.28	$ 31.62
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 21	25	$ 1,366.25	$ 773.63	$ 592.62
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Mid Room	1	$ 65.07	$ 36.85	$ 28.22
Fixture Replacement: LED Exit Sign: 2.3 W / Mid Room	1	$ 72.90	$ 41.28	$ 31.62
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Boys Room	3	$ 185.34	$ 104.95	$ 80.39
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Mens Room	1	$ 61.78	$ 34.98	$ 26.80
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Womens Room	1	$ 61.78	$ 34.98	$ 26.80
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Girls Room	3	$ 185.34	$ 104.95	$ 80.39
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / C1	3	$ 163.95	$ 92.84	$ 71.11
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 4	12	$ 741.36	$ 419.79	$ 321.57
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 3	1	$ 61.78	$ 34.98	$ 26.80
Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 3	1	$ 84.29	$ 47.73	$ 36.56
Relamp: LED - A-Lamp (3 - 25W): 10 W / Restroom	2	$ 41.20	$ 23.33	$ 17.87
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Tech Room	1	$ 61.78	$ 34.98	$ 26.80
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 1	13	$ 803.14	$ 454.77	$ 348.37
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 13	18	$ 983.70	$ 557.02	$ 426.68
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 12	18	$ 983.70	$ 557.02	$ 426.68
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 11	18	$ 983.70	$ 557.02	$ 426.68
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 5	18	$ 983.70	$ 557.02	$ 426.68
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 6	18	$ 983.70	$ 557.02	$ 426.68
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 10	24	$ 1,311.60	$ 742.69	$ 568.91
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 9A	6	$ 327.90	$ 185.67	$ 142.23
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 7	18	$ 983.70	$ 557.02	$ 426.68
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 9	24	$ 1,311.60	$ 742.69	$ 568.91
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 8	18	$ 983.70	$ 557.02	$ 426.68
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Hallway	108	$ 6,672.24	$ 3,778.13	$ 2,894.11
Fixture Replacement: LED Exit Sign: 2.3 W / Hallway	12	$ 874.80	$ 495.35	$ 379.45
Relamp: LED - PAR38 (13 - 23W): 17 W / Hallway	4	$ 128.28	$ 72.64	$ 55.64
Gas-Fired Boiler / boiler room	2	$ 286,927.98	$ 162,471.81	$ 124,456.17
Programmable Thermostats / Wall	4	$ 884.00	$ 500.56	$ 383.44

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Savings values are estimates. Actual savings will vary.
Incentives and participation subject to program rules and Participation Agreement.

Low-Flow Aerators (Lavatory) / Classrooms, Restrooms	29	$ 345.10	$ 195.41	$ 149.69
Low-Flow Aerators (Kitchen) / Cafeteria	2	$ 24.80	$ 14.04	$ 10.76
Pre-Rinse Spray Valves / Cafeteria	1	$ 95.75	$ 54.22	$ 41.53
Pipe Wrap Insulation / Boiler Room	1	$ 1,024.25	$ 579.98	$ 444.27
Pipe Wrap Insulation / Boiler Room	1	$ 1,211.00	$ 685.72	$ 525.28
Pipe Wrap Insulation / Boiler Room	1	$ 1,288.00	$ 729.32	$ 558.68
Pipe Wrap Insulation / Boiler Room	1	$ 1,155.00	$ 654.01	$ 500.99
TOTALS**		$ 342,736.98	$ 194,073.43	$ 148,663.55

**Maximum incentive amount per project is $125,000. Measures that would qualify the project for funding through the State Energy Program (SEP) are identified above with an 'S'. If any "SEP measures" are included then the total incentive amount for all measures will be paid with SEP funds, otherwise the total incentive amount will come from NJ Clean Energy funds.

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NEW JERSEY'S CLEAN ENERGY PROGRAM
DIRECT Install
PARTICIPATING CONTRACTOR

How did you learn about this Energy Efficiency Program?
☐ Advertisement ☐ Internet Search ☐ Mailer ☐ Video
☐ Tradeshow/Event ☐ Word of Mouth ☐ Radio ☐ Contractor
☐ Other _____

Direct Install Application and Participation Agreement
July 1, 2019 – June 30, 2020

Utility(ies) Serving Customer:

☐ Atlantic City Electric ☒ Jersey Central Power & Light ☒ PSE&G ☐ New Jersey Natural Gas
☐ Elizabethtown Gas ☐ Rockland Electric Co. ☐ South Jersey Gas ☐ Other Utility

Instructions

1. Fill out all applicable sections below.
2. Provide a completed Application and signed Participation Agreement to the Participating Contractor serving your area, along with copies of utility billing demonstrating average electric demand does not exceed 200 kW in the preceding 12 months.
3. Your Contractor or Program Manager will confirm program participation eligibility, perform the Energy Assessment, and arrange for final approval by the Program Manager prior to installing eligible measures.

Customer Information

Legal Name	Tax ID	NAICS Code
Sayreville Boro BD of Ed		

Company Address	City	State	Zip
150 Lincoln St	South Amboy	NJ	08879

Project Contact	Phone	E-Mail
Barbara Malewicz	609-659-7400	bmalewicz@spiezle.com

Customer to provide: a) Copies of required gas and electric billing ☒ Check if attached

Facility Information (Facility on which Energy Assessment is to be conducted and measures provided)

Facility Address	City	State	Zip
150 Lincoln St	South Amboy	NJ	08879

County	Utility Account Number(s):	Electric	Gas
Middlesex		100 011 664 024	73 376 948 06

Facility Name and Brief Type/Occupancy Description
Selover School/School/50

For Participating Contractor Use Only

Company Name	Contact
Lime Energy	Christopher Fornicola

Contact Phone	Contact E-mail	Contractor Assigned Project Number
732-427-7278	chris.fornicola@lime-energy.com	LM126367

Average Electric Demand	Project Name
32.08 kW (based on preceding 12 months)	Selover School

Enhanced Incentives – if applicable, check appropriate box

☒ K-12 Public School ☐ Municipality ☐ County Entity ☐ Facilities located in an NJ Urban Enterprise Zone
☐ Facilities located in an NJ Opportunity Zone

DIRECT INSTALL PARTICIPATION AGREEMENT

DEFINITIONS:

ADMINISTRATOR - The New Jersey Board of Public Utilities (NJBPU).

APPLICATION - Page 1 of this Application and Participation Agreement.

APPLICATION PACKAGE - Consists of the entirety of: an executed Application and Participation Agreement, utility billing demonstrating, if required, average electric demand not exceeding 200 kW in the preceding 12 months and completed Energy Assessment with Scope of Work Attachment. Measures may not be installed, and Incentives shall not be paid until after the Application Package is approved by the Program Manager.

COMPLETION AND ACCEPTANCE OF MEASURES - Work performed by Participating Contractor shall be deemed completed and accepted upon the signing of a Measure Acceptance Form by the Participating Customer and Program Manager.

ENERGY ASSESSMENT - An inventory of existing energy consuming equipment and analysis of possible replacement Measures generated by the Program-approved energy assessment tool to determine estimated energy savings, in addition to costs and Incentives eligible under the Program.

ENERGY-EFFICIENT MEASURES (or "Measures") - Any device or grouping of devices eligible to receive an Incentive through the Program.

INCENTIVE - An amount paid by the Direct Install component of New Jersey's Clean Energy Program through the Program Manager to the Participating Contractor in connection with the installation of a Measure. Incentives are available to cover up to 70% of the cost of installed Measures, and entities owned or operated by Municipalities, Counties, K-12 public schools, and customers located in UEZs or OZs may be eligible for incentives up to 80% of the cost of installed Measures. Incentives are subject to change without notice prior to the Program Manager approving the Application Package.

MEASURE ACCEPTANCE FORM – A document providing the means by which the Contractor and Customer confirm and accept the installation of Measures.

NEW JERSEY UTILITIES - The regulated electric and/or gas utilities in the State of New Jersey. They are: Atlantic City Electric, Jersey Central Power & Light, Rockland Electric Company, New Jersey Natural Gas, Elizabethtown Gas, PSE&G, and South Jersey Gas.

PARTICIPATING CONTRACTOR (or "Contractor") - An entity under contract to the Program Manager which performs Energy Assessments and installation of Measures in connection with the Program.

PARTICIPATING VENDOR (or "Vendor") - An entity under contract to the Program Manager which provides/supplies equipment directly to the program's contractors for project implementation.

PARTICIPATING CUSTOMER (or "Customer") - Those non-residential electric and/or gas service customers of the New Jersey utilities, municipal utilities or rural electric cooperatives who participate in the Program.

PRE-INSTALLED MEASURES - Measures installed before the application approval date shall not be included in the work scope and will not receive Program Incentives.

PROGRAM - New Jersey's Clean Energy Direct Install Program offered herein by the New Jersey Board of Public Utilities pursuant to state regulatory approval under the New Jersey Electric Discount and Energy Competition Act, NJSA 48:3-49, et seq, and subject to change without notice and subject to funding availability.

PROGRAM MANAGER - TRC

PROGRAM SCOPE - Services to be provided under the Program are limited to those directly associated with the evaluation and installation of Measures and shall in no way include work by the Contractor in connection with the correction of apparent or hidden safety issues or code violations. Contractor shall not perform work where, in its sole discretion, it is determined such safety issues or code violations exist. All work shall be performed during normal business hours, Monday through Friday unless the Customer and Contractor agree otherwise, in which case the Contractor shall not receive additional compensation for work performed outside of such normal business hours.

PROJECT - The Measure(s) to be installed in the facility listed under the Facility Information section of the application.

SCOPE OF WORK ATTACHMENT - A document generated by the Energy Assessment tool which lists the Measures eligible for installation, their Incentive Amounts and costs to be paid by the Customer. Once countersigned by the Customer and Contractor indicating the Measures to be installed in the Project and approval by the Program Manager, the Scope of Work Attachment shall be part of this Participation Agreement.

PARTICIPATION PROCESS:

1. Customer completes Application and provides necessary utility usage and demand data.
2. Contractor or Program Manager performs the Energy Assessment using the program-approved energy assessment tool. The Energy Assessment generates a Scope of Work Attachment for countersignature by the Customer to indicate which eligible Measures are to be included in the Project.
3. Contractor countersigns the Scope of Work Attachment and submits a full Application Package to the Program Manager for approval.
4. Upon Program Manager's approval, Contractor performs retrofit work to remove existing equipment and install Measures, and submits documentation of Project completion in the form of a Measure Acceptance Form signed by the Customer. Contractor invoices the Program Manager for the Incentive portion and the Customer for the balance.
5. Customer pays outstanding balance of costs, less any prior payment or deposit, to Contractor according to amounts listed on the Scope of Work Attachment.

The Program, or agent thereof, reserves the right to conduct inspections of the Project prior to or after the installation of Measures. To be eligible for Incentives, the Application Package must be approved by the Program Manager prior to Measure installation.

CHANGES TO THE PROGRAM - The Program and/or Participation Agreements may be changed by the Program Manager or Administrator at any time without notice, however, approved Application Packages will be processed to completion under the terms in effect at the time of approval.

ELIGIBILITY - Program services and Incentives are available to existing non-residential, commercial and industrial buildings with an average electric demand that did not exceed 200 kW in the preceding 12 months and served by at least one of the New Jersey utilities, municipal utilities or rural electric cooperatives who participate in the Program. If the Participant is a municipal electric company customer, and a customer of a regulated gas New Jersey utility, only gas Measures will be eligible under the Program.

Participating projects with a contract at or above current prevailing wage contract threshold amount set pursuant to the New Jersey Prevailing Wage Act (N.J.S.A. 34:11-56.25 et seq.) are required to pay no less than prevailing wage rate to workers employed in the performance of any construction undertaken in connection with Board of Public Utilities financial assistance, or undertaken to fulfill any condition of receiving Board of Public Utilities financial assistance, including the performance of any contract to construct, renovate or otherwise prepare a facility, the operations of which are necessary for the receipt of Board of Public Utilities financial assistance. By signing this application, the signatories agree to comply with the provisions of the New Jersey Prevailing Wage Act, N.J.S.A. 34: 11-56.25 et seq., (Act), if and to the extent that Act may apply to the work covered by this application. By submitting an application, or accepting program incentives, applicant agrees to adhere to New Jersey Prevailing Wage requirements, as applicable.

Customers of New Jersey utilities who have not contributed to the Societal Benefits Charge during the calendar year in which the Application Package is received by the Program Manager may not be eligible for Incentives offered through the Program.

NO ENDORSEMENT - The Program Manager and Administrator do not endorse, support or recommend any particular manufacturer, product or system design.

INCENTIVE AMOUNTS - Incentive amounts will be listed in the Scope of Work Attachment which, when completed and countersigned by the Customer and approved by the Program Manager, will be part of this Participation Agreement. The Customer will be responsible for paying the remaining balance of costs listed in the Scope of Work Attachment upon receipt of Contractor's invoice.

Incentives will be offered for eligible and qualifying Measures as determined from the Energy Assessment and listed on a separate Scope of Work Attachment. The Scope of Work Attachment shall be countersigned by the Customer to indicate eligible and qualifying Measures to be included in the Project. All Incentive payments shall be paid by the Program Manager directly to the Contractor. The Program is not bound to pay any Incentive unless the Application Package associated with the Incentive payment is approved by the Program Manager prior to Measure installation.

INCENTIVE CAP - Program Manager reserves the right to limit the amount of Incentives on a per-Project or Program basis. Any such caps on individual projects will be disclosed to Customers on the Scope of Work Attachment.

INSTALLATION AGREEMENT - Following completion of the Energy Assessment, but prior to commencement of any installation work, the Customer will be presented a separate Installation Agreement in the form of

DIRECT INSTALL PARTICIPATION AGREEMENT

a Scope of Work Attachment which shall become part of this Agreement. By executing the Scope of Work Attachment, the Customer agrees to allow the Contractor to install the eligible Measures identified in the Scope of Work Attachment.

WARRANTIES - THE PROGRAM MANAGER AND ADMINISTRATOR DO NOT EXPRESSLY OR IMPLIEDLY WARRANTY THE PERFORMANCE OF INSTALLED EQUIPMENT, AND/OR SERVICES RENDERED AS PART OF THIS PROGRAM. NO WARRANTIES OR REPRESENTATIONS OF ANY KIND, WHETHER STATUTORY, EXPRESS, OR IMPLIED, INCLUDING, WITHOUT LIMITATIONS, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE REGARDING EQUIPMENT OR SERVICES ARE PROVIDED BY ANY PARTY, INCLUDING THE PROGRAM MANAGER UNDER THE PROGRAM. CONTRACTOR SHALL EXTEND TO CUSTOMER FULL EQUIPMENT, MATERIALS AND LABOR WARRANTIES WITH AN EXPIRATION DATE OF THE LATER OF EITHER ONE YEAR FROM THE DATE OF INSTALLATION OR THE MANUFACTURER'S STANDARD WARRANTY EXPIRATION. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL WARRANTY ISSUES RELATING TO EQUIPMENT AND MATERIALS INSTALLED UNDER THE PROGRAM FOR A PERIOD OF ONE YEAR.

In no way shall the reviews, inspections, approvals and all other actions performed by the Program Manager under the Program be construed as a determination or acceptance of performance, applicability, dollar savings, or energy savings. The Program Manager and Administrator offer no guarantee or warranty of performance for equipment or labor provided in connection with the Program. The Contractors assume full responsibility and liability for the removal and installation of all equipment, including but not limited to design, specification, all permits, installation, maintenance, performance, and proper disposal of equipment removed, including lamps and ballasts.

LIMITATION OF LIABILITY – By virtue of participating in the Program, Participating Customer agrees to waive any and all claims or damages against the Program Manager, and the Administrator. Participating Customers agree that the Program Manager's and Administrator's liability, in connection with the Program, is limited to paying the Program Incentives specified directly to the Participating Contractor, for the value of the work performed/Measures installed, as identified in the Installation Agreement. Under no circumstances shall the Program Manager, its representatives, or subcontractors, or the Administrator be liable for any lost profits, special, punitive, consequential or incidental damages or for any other damages or claims connected with or resulting from participation in this Program. Further, any liability attributed to the Program Manager or its subcontractors under this Program shall be individual, and not joint and/or several.

IDEMNIFICATION – As part of agreeing to participate in the Program, which includes financial incentives to reduce the customer's net project costs, the Participating Customer agrees to indemnify and hold harmless the Program Manager and Administrator and their respective staffs with respect to the Project.

INSPECTION – Customer agrees to grant the Program reasonable access to Customer's Facility to inspect both pre-existing equipment (if applicable) and the Measures installed under this Program, either prior to issuing Incentives or at a later time.

PROGRAM OFFER – The Program covers services rendered on or after July 1, 2019. Program Incentives are available to non-residential retail electric and/or gas service customers of the New Jersey Utilities.

TAX LIABILITY – Neither the Program Manager nor Contractor shall be responsible for any tax liability that may be imposed on any Customer as a result of the payment of Program Incentives.

TERMINATION – The Administrator reserves the right to extend, modify (this includes modification of Program Incentive levels) or terminate this program without prior or further notice.

CUSTOMER ACKNOWLEDGEMENT – I have read, understood and am in compliance with all rules and regulations concerning this incentive Program. I certify that all information provided is correct to the best of my knowledge, and I give the Program Manager permission to share my records with the New Jersey Board of Public Utilities, and contractors it selects to manage, coordinate or evaluate New Jersey's Clean Energy Programs, including the release of electric and natural gas utility billing information. I allow reasonable access to my property to inspect the installation and performance of the technologies and installations that are eligible for Incentives under the guidelines of New Jersey's Clean Energy Program. This Participation Agreement supersedes all other communications and representations. I agree that this document and all notices and disclosures made or given relating to this document may be created, executed, delivered and retained electronically and that the electronic signatures appearing on this document and any related documents shall have the same legal effect for all purposes as a handwritten signature. The information, statements, and documents I have provided in and with this document are true and accurate to the best of my knowledge. I am aware that if any of them are willfully false, I am subject to punishment.

Other Funding Sources

☐ Check the box if an Energy Savings Improvement Program (ESIP) will be a source of funding. ESIP allows government agencies to pay for energy related improvements using the value of the resulting energy savings.

The Parties signing below certify they are duly authorized to enter into this agreement and hereby accept the above terms:

PARTICIPATING CUSTOMER

Name of Participating Customer

Authorized Signature | Date

CONTRACTOR'S COUNTERSIGNATURE

By signing, below, I certify that I have received the Customer's Application Package and will, in connection with the Project, perform my obligations as Participating Contractor as outlined in the separate Program Contractor Agreement executed between the Contractor below and the Program Manager.

PARTICIPATING CONTRACTOR

Name of Participating Contractor

Authorized Signature | Date

PAYMENT TERMS

This Contract is entered by and between

Lime Energy of 4 Gateway Center, 100 Mulberry St, Newark, NJ 07102

	MAIN OFFICE	PROJECT LOCATION
Customer	Sayreville Board of Education	Dwight D. Eisenhower Elementary School
Address	601 Ernston Rd.	- Same -
City, ST, Zip:	Parlin NJ 08859	- Same -
Contact:	Barbara Malewicz	- Same -
Telephone:	609-659-7400	- Same -

("Customer") relative to the work described below:

Total Project Cost	**Customer Contribution**
$342,736.98	$194,073.43
Additional Cost Outside of Program	**Total Customer Contribution**
$54,330.00	**$248,403.43**

1. The **Customer** shall pay to **Lime** 1/2 of the net customer cost at Scope of Work (SOW) TRC approval. The **Customer** shall pay **Lime** the final balance of the net customer cost upon project completion, Net 30.
2. Change in SOW resulting in an increase/decrease in customer co-pay will be executed only upon receipt of written approval by **Customer** and will be reflected in final invoice.
3. Accepted payment methods are: Money Order, Bank Check, Personal Check, Credit Card (Visa, Mastercard, Discover Card).

1st Payment **$124,201.72**
2nd & Final Payment **$124,201.71**

Accepted this_____ Day of_____, ____2020_____.
(Day) (month) (year)

Lime Signature:	Customer Signature Duly Authorized:
Printed Name:	Printed Name:

Acceptance of Contract: The above prices, specifications, and conditions are satisfactory and are here-by accepted. Willdan authorized to perform the work as specified based on TRC approval. Payments will be made as outlined above.

Lime Energy

Company Name:	Sayreville BOE - Dwight D. Eisenhower Elementary School
Address:	601 Ernston Rd, Parlin NJ 08859
Contact:	Barbara Malewicz
Phone:	609-659-7400
Work order #:	LM126366

Project Description: The following list defines extra work required for a proper and "up-to-code" mechanical installation for this project. The costs associated with this extra work is NOT covered by the Direct Install program.

Materials & Labor is as follows:

Description	Unit Cost	Qty	Sub-Total
Requires Boilers Repiping - Reconfiguration	$4,600.00	4	**$18,400.00**
Boilers Water Treatment : Over 2000MBH	$2,300.00	1	**$2,300.00**
Hydronic Heating Filter For Iron Oxide Sludge	$1,840.00	1	**$1,840.00**
Requires New Venting System : 1500 MBH	$3,450.00	4	**$13,800.00**
Requires Condensate Piping : Level 2	$300.00	4	**$1,200.00**
Requires Acid Neutralizer : Upto 1500MBH	$690.00	4	**$2,760.00**
Reuse Expansion Tank	$230.00	4	**$920.00**
Requires Rigging : Level 3	$2,300.00	4	**$9,200.00**
Requires System Commissioining	$2,760.00	1	**$2,760.00**
Prepare Manual J/N & S : Level 2	$920.00	1	**$920.00**
Requires On-Site Building Dept. Inspection	$230.00	1	**$230.00**

Unforeseen Costs will be handled on a case by case basis

Unforeseen Costs will be handled on a case by case basis

Total Cost = **$54,330.00**

If you have any questions please feel free to contact me at (732) 427-7278
Willdan Energy Solutions welcomes the opportunity to work with you.
Regrards,
Lime Energy

Christopher Fornicola
Christopher Fornicola
Program Manager

Acknowledged, accepted, and agreed, this _____ day of, _____, 2020 by the duly authorized representative of the undersigned:

Signature: _____

Name(please print): _____

Title: _____

Direct Install Contractor Checklist

Application # LM126366

Applicant Company Name: _Dwight D Eisenhower Elementary School

[x] - Lighting assessed and included in the EAT

[x] - Explored possibilities of adding lighting controls

[N/A] - Motors assessed and included in the EAT

[x] - Explored possibilities of adding Variable Frequency Drives

[x] - HVAC (electric cooling) assessed and included in the EAT

[x] - HVAC (gas heating) assessed and included in the EAT

[x] - Explored option of adding duel enthalpy or fuel use economizers to existing non qualifying units

[x] - Explored possibilities of adding faucet aerators, low flow showerheads or pre-rinse spray valves

[x] - Explored possibilities of adding thermostats to HVAC equipment

[x] - Explored possibilities of adding refrigeration equipment

All qualified lighting included. Sensors are not a good fit for the space. There is no motor opportunity. Explored and found no possibility of adding Variable Frequency Drives. Aerators and pipe wrap are included. This area is cooled by multiple Mini Split AC condenser's which are not qualified to be replaced through DI. This area is heated by two gas-fired boiler which we are proposing to replace. Refrigeration controls are not required as lunches are brought in by outside vendor.

Comments:

_____ _____

Contractor signature Applicant signature

_____

NJ DIRECT INSTALL LIGHTING NOTES & EXCLUSIONS

In some cases, existing light levels in your facility may be higher than necessary when compared to current recommended lighting standards. To maximize your savings *and* provide a comfortable work environment, upgrades included in your Scope of Work may reduce lighting levels in your building. Please speak with your Direct Install account representative if you have any questions.

1) This Scope of Work assumes that all lighting equipment operates on voltages between 120V and 277V. If any lighting fixtures included in this scope operate at 480 volts, there will be additional costs that are not covered by the Direct Install program.

2) There are no allowances in this Scope of Work for battery backup systems that are integrated into existing luminaires. If these systems exist in your facility, there will be additional costs that are not covered by the Direct Install program to include battery backups in the retrofits or fixture replacements that are included in this Scope of Work. The unit price for this work is $150/each and shall be reviewed at the conclusion of the project, if applicable.

3) Mounting hardware for the exterior fixtures and high bay fixtures is not included in the program pricing. These measures are contingent upon the customer's acceptance of the Mounting Hardware proposal included herewith. Shielding requirements for exterior fixtures to prevent light trespass, where applicable, are also excluded from the program pricing.

4) There are no allowances for the correction of code violations, or additional on-incidental work required to meet changes in code requirements since the installation of the existing equipment. Conditions hidden from sight prior to removal of existing equipment are also excluded.

5) Lighting color temperature will be matched with existing color temperature unless otherwise directed at this time.

6) All projects will be done on 1st shift. Any work outside of the hours of 7am to 3pm will be an additional cost charged to the customer.

NJ DIRECT INSTALL HVAC NOTES & EXCLUSIONS

Air Distribution

The NJ Direct Install Program is a one for one equipment replacement and does not address pre-existing ductwork conditions. Some items that would be excluded are as follows:

1) Undersized, oversized and or damaged ductwork (Hard or Flex)

NJ DIRECT INSTALL HVAC NOTES & EXCLUSIONS (Cont'd)

2) Faulty VAV Boxes
3) Faulty Re-Heat Coils
4) Faulty or incorrect Supply Diffusers or Return Diffusers
5) Humidifiers, De-Humidifiers or Air Cleaners
6) Air Balancing of the system

BAS Systems
This proposal does not include the cost of special factory installed control boards or tying and programming into the existing system.

Code Violations
There are no allowances for the correction of code violations, or additional nonincidental work required to meet changes in code requirements since the installation of the existing equipment. Conditions hidden from sight prior to removal of existing equipment are also excluded.

Crane Costs
This proposal covers crane costs for installation and removal of items up to 20 feet vertical and 30 feet horizontal. There may be additional charges, if the required lift is greater in either dimension.

Duct Work
This proposal covers up to 2 linear feet of transition ductwork to tie the new unit into the existing duct system.

Fire Alarm
This proposal excludes wiring of HVAC smoke detectors to a building's fire alarm system. This must be completed by a certified fire alarm contractor. There are also no provisions within the program to install new smoke detectors, or to replace existing smoke detectors that are not in working condition.

Gas Piping & Condensate Lines
This proposal covers up to 10 linear feet of new piping to tie the new unit into the existing gas and condensate lines on packaged units, where required.

Railings
This proposal excludes safety railings or seismic strapping if required by code. Code requires HVAC equipment to be at least 10 feet away from the edge of the roof. If less than 10 feet, local building codes may require the installation of a safety railing.

Structural
This proposal excludes structural engineering, structural drawings, and structural steel work. Due to the nature of this project, you may be responsible for supplying a set of structural drawings to include with the permit package for approval. This proposal does not include the cost for any service needed above.

The pricing & scope provided herewith, does not include asbestos testing or remediation of any kind.

Signature: _____

Name: _____

Title: _____

Date: _____



To Whom It May Concern:

Due to our past relationship with Lime Energy, Dwight D. Eisenhower Elementary School would prefer to continue to work with Lime outside of their assigned New Jersey Direct Install territory at our facility located at ***601 Ernston RD, Sayreville, NJ 08859***

Thank you,

New Jersey Office of Clean Energy
Direct Install Program
Energy Assessment Tool (V4.0C)

General Project Information

Participating Customer:	Sayreville Boro BD of Ed		**Facility Type:**	Education – Primary School	
Contractor / Project #:	Lime	LM126368	**HVAC Type:**	AC & Gas Heat	
Facility Name:	Emma L. Arleth Elementary School		**Total Facility Square Footage:**	74,000	
Street Address:	3198 Washington Rd		**Avg Weekly Hrs of Operation:**	40	
City / Zip Code:	Parlin	08859	**# of Full-Time Employees:**	20	
Is this facility publicly owned?:	Y		**Year Constructed:**	1960	
BOE, MUA or other public entity property?	Y		**Tax Exempt?:**	Y	
			Project Permitting Costs:	$500.00	

Enhanced Incentive Eligibility

Project in UEZ?	N	**K-12 School?**	Y
Project in OZ?	N	**Municipality?**	N
		County Facility?	N

Electric Utility Information

Electric Provider:	Jersey Central Power & Light
Service Class:	GSS
Account #:	100 013 951 908
Billing Period Start Date:	09/17/19
Billing Period End Date:	10/16/19
Billing Period kWh Consumption:	29,760
Billing Period Total Cost:	$2,349.64
Total Taxes + Fees on Bill:	$11.13
Electric - Average Cost ($/kWh):	**$0.079**

Gas Utility Information

Gas Provider:	PSE&G
Service Class:	LVG
Account #:	73 376 946 01
Billing Period Start Date:	01/03/19
Billing Period End Date:	02/01/19
Billing Period Therm Consumption:	9,394
Billing Period Total Cost:	$3,138.27
Total Taxes + Fees on Bill:	$106.75
Gas - Average Cost ($/Therm):	**$0.323**

Oil Information

Annual Consumption (Gallons):	
Annual Cost:	
Annual Taxes + Fees on Bill:	
Oil - Average Cost ($/Gallon):	**$0.000**

Propane Information

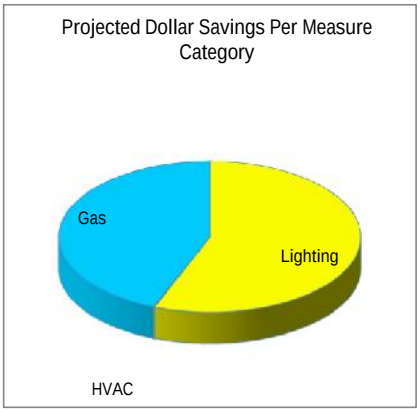
Annual Consumption (Gallons):	
Annual Cost:	
Annual Taxes + Fees on Bill:	
Propane - Average Cost ($/Gallon):	**$0.000**

Project Summary

	Annual Energy Savings	Energy Units	Annual Cost Savings	Total Measure Cost	Estimated Incentive Amount	Total Cost to Customer
Lighting Measures Total:	114,196	kWh	$8,973.43	$60,806.59	$33,111.73	$27,694.86
Motors & VFD Measures Total:	0	kWh	$0.00	$0.00	$0.00	$0.00
HVAC Electric Measures Total:	215	kWh	$16.89	$13,146.15	$7,158.63	$5,987.52
Refrigeration Measures Total:	0	kWh	$0.00	$0.00	$0.00	$0.00
ELECTRIC MEASURES:	**114,411**	**kWh**	**$8,990.32**	**$73,952.74**	**$40,270.36**	**$33,682.38**
GAS MEASURES:	**21,823**	**Therms**	**$7,042.59**	**$220,389.24**	**$120,011.17**	**$100,378.07**
OIL MEASURES:	**0**	**Gallons**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
TOTAL PROPANE MEASURES:	**0**	**Gallons**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
CONVERSION MEASURES (OIL):	**0**	**Gallons**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
CONVERSION MEASURES GAS:	**0**	**Therms**				
COMBINED PROJECT TOTALS:			**$16,032.91**	**$294,341.98**	**$160,281.53**	**$134,060.45**

SIMPLE PAYBACK (YEARS): **8.36**

PROJECT TRC TEST: **2.51**



Direct Install Energy Assessment Tool (ver. 4.0C)
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DIRECT INSTALL PROGRAM

PARTICIPATION AGREEMENT

SCOPE OF WORK ATTACHMENT

LMLM126368

"Parties":				
Participating Customer*:	**Sayreville Boro BD of Ed**			
Participating Contractor*:	**Lime**			
Facility Name*:	**Emma L. Arleth Elementary School**			
Facility Address:	**3198 Washington Rd**	**Parlin,**	**NJ**	**08859**
	Street	City		Zip

*as listed on Application

When fully signed, this Scope of Work Attachment ("Attachment") shall become part of the Direct Install Program Participation Agreement ("Participation Agreement") previously executed by the Parties in connection with the installation of energy efficiency retrofit Measures to be performed by the Participating Contractor (or "Contractor") at the above listed Facility. This Attachment, together with the Participation Agreement shall constitute the full Agreement between the Parties. Terms capitalized herein are defined in the Participation Agreement.

The Participating Customer (or "Customer") agrees to have Contractor perform retrofit work in connection with the Measures listed on page 2 of this form (attached). In consideration of the Contractor's performance of such work, Customer agrees to pay Contractor based on the measure costs listed below under Customer Unit Cost for the number of completed units for each Measure upon receipt of invoice; provided the Contractor may collect a deposit from Customer prior to performing such work, in which case the final invoice shall be net of such deposit. Customer and Contractor understand that conditions discovered during installation may require that some measures identified in the energy assessment cannot be installed, or some areas may require additional measures/quantities to be installed. Should conditions in the field dictate that the Estimated Program Total Cost shown on page 2 increase by more than 10%, Contractor must obtain both Program Administrator and Customer written approval in the form of an amended Scope of Work Attachment before proceeding with such additional work.

By signing below, the Parties agree the above listed Measures shall be installed by the Contractor. The Customer shall pay the Contractor as described herein following Completion and Acceptance of Measures. Customer certifies that he/she has the authority to contract for retrofit work in the Facility in connection with the Measures listed and, if the Customer does not own the Facility, the Owner has granted permission to Customer for performance of such work.

Participating Customer Date

Participating Contractor Date

Page 2
Scope of Work

The work to be performed by the Participating Contractor in connection with the Project shall be comprised of the below listed Measures in the estimated quantities listed:

Measure Description / Location	Quantity To Be Installed	Total Measure Cost	Estimated Customer Total Cost	Estimated Incentive Amount
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Girls Room	2	$ 123.56	$ 56.28	$ 67.28
Relamp/Reballast: Plug & Play LED - 4-Lamp - 4-Foot T5HO / Gym/Café	8	$ 1,159.28	$ 528.00	$ 631.28
Fixture Replacement: LED Exit Sign: 2.3 W / Gym/Café	2	$ 145.80	$ 66.41	$ 79.39
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Kitchen	4	$ 247.12	$ 112.55	$ 134.57
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Stage	6	$ 327.90	$ 149.34	$ 178.56
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Storage	2	$ 123.56	$ 56.28	$ 67.28
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / Teachers Room	2	$ 112.58	$ 51.28	$ 61.30
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Teachers Room	2	$ 123.56	$ 56.28	$ 67.28
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / Restrooms	2	$ 112.58	$ 51.28	$ 61.30
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 16	12	$ 741.36	$ 337.66	$ 403.70
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Supply Room	1	$ 61.78	$ 28.14	$ 33.64
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 15	12	$ 741.36	$ 337.66	$ 403.70
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 14	12	$ 741.36	$ 337.66	$ 403.70
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 13	12	$ 741.36	$ 337.66	$ 403.70
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 12	12	$ 741.36	$ 337.66	$ 403.70
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 11	12	$ 741.36	$ 337.66	$ 403.70
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 10	12	$ 741.36	$ 337.66	$ 403.70
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Speech	3	$ 185.34	$ 84.41	$ 100.93
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / Restroom	1	$ 56.29	$ 25.64	$ 30.65
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 9	12	$ 741.36	$ 337.66	$ 403.70
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Girls Room	2	$ 123.56	$ 56.28	$ 67.28
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Janitors Closet	1	$ 54.65	$ 24.89	$ 29.76
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Boys Room	1	$ 61.78	$ 28.14	$ 33.64
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classrrom 7	12	$ 741.36	$ 337.66	$ 403.70
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classrrom 8	12	$ 741.36	$ 337.66	$ 403.70
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classrrom 5	12	$ 741.36	$ 337.66	$ 403.70
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classrrom 6	12	$ 741.36	$ 337.66	$ 403.70
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classrrom 3	14	$ 864.92	$ 393.93	$ 470.99
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classrrom 4	14	$ 864.92	$ 393.93	$ 470.99
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Music Room 2	18	$ 1,112.04	$ 506.49	$ 605.55
Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / Music Room 2	1	$ 84.29	$ 38.39	$ 45.90
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / Restroom	1	$ 56.29	$ 25.64	$ 30.65
Fixture Replacement: LED Exit Sign: 2.3 W / Restroom	1	$ 72.90	$ 33.20	$ 39.70
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Art Room	17	$ 1,050.26	$ 478.35	$ 571.91
Fixture Replacement: LED Exit Sign: 2.3 W / Art Room	1	$ 72.90	$ 33.20	$ 39.70
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classrrom 44-2	6	$ 462.90	$ 210.83	$ 252.07
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classrrom 42	6	$ 462.90	$ 210.83	$ 252.07
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classrrom 44-1	6	$ 462.90	$ 210.83	$ 252.07
Fixture Replacement: LED Interior Ambient Luminaire - 2x2: 30 W / Media Center	35	$ 5,463.50	$ 2,488.40	$ 2,975.10
Relamp/Reballast: LED 2-Lamp PL 4-Pin / Media Center	4	$ 266.84	$ 121.53	$ 145.31
Fixture Replacement: LED Exit Sign: 2.3 W / Media Center	2	$ 145.80	$ 66.41	$ 79.39
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Office	4	$ 308.60	$ 140.55	$ 168.05
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Computer Lab	12	$ 925.80	$ 421.66	$ 504.14

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Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classrrom 42-1	6	$ 462.90	$ 210.83	$ 252.07
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classrrom 40-2	6	$ 462.90	$ 210.83	$ 252.07
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classrrom 39-2	6	$ 462.90	$ 210.83	$ 252.07
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classrrom 40-1	6	$ 462.90	$ 210.83	$ 252.07
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classrrom 38	3	$ 231.45	$ 105.42	$ 126.03
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Closet	1	$ 61.78	$ 28.14	$ 33.64
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classrrom 39-1	6	$ 462.90	$ 210.83	$ 252.07
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classrrom 37-2	6	$ 462.90	$ 210.83	$ 252.07
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Boys Room	3	$ 231.45	$ 105.42	$ 126.03
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Girls Room	3	$ 231.45	$ 105.42	$ 126.03
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Between Boys & Girls Room	2	$ 130.14	$ 59.27	$ 70.87
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Janitors	1	$ 61.78	$ 28.14	$ 33.64
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Stage Room	8	$ 617.20	$ 281.11	$ 336.09
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Stage	2	$ 154.30	$ 70.28	$ 84.02
Relamp/Reballast: Plug & Play LED - 4-Lamp - 4-Foot T5HO / Gym	18	$ 2,608.38	$ 1,188.01	$ 1,420.37
Fixture Replacement: LED Exit Sign: 2.3 W / Gym	3	$ 218.70	$ 99.61	$ 119.09
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Sprinkler Room	5	$ 308.90	$ 140.69	$ 168.21
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / 37-1	6	$ 462.90	$ 210.83	$ 252.07
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Computer Hub	1	$ 77.15	$ 35.14	$ 42.01
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / 36-2	12	$ 925.80	$ 421.66	$ 504.14
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / 35-2	12	$ 925.80	$ 421.66	$ 504.14
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / 34-2	12	$ 925.80	$ 421.66	$ 504.14
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / 33-2	12	$ 925.80	$ 421.66	$ 504.14
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 25	15	$ 1,157.25	$ 527.08	$ 630.17
Fixture Replacement: LED Exit Sign: 2.3 W / Classroom 25	1	$ 72.90	$ 33.20	$ 39.70
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 26	15	$ 1,157.25	$ 527.08	$ 630.17
Fixture Replacement: LED Exit Sign: 2.3 W / Classroom 26	1	$ 72.90	$ 33.20	$ 39.70
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / Classroom 26	1	$ 56.29	$ 25.64	$ 30.65
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 24	15	$ 1,157.25	$ 527.08	$ 630.17
Fixture Replacement: LED Exit Sign: 2.3 W / Classroom 24	1	$ 72.90	$ 33.20	$ 39.70
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / Classroom 24	1	$ 56.29	$ 25.64	$ 30.65
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Restroom	1	$ 65.07	$ 29.64	$ 35.43
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 23	15	$ 1,157.25	$ 527.08	$ 630.17
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Classroom 23	2	$ 130.14	$ 59.27	$ 70.87
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Restroom	1	$ 65.07	$ 29.64	$ 35.43
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 21	15	$ 1,157.25	$ 527.08	$ 630.17
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Classroom 21	1	$ 65.07	$ 29.64	$ 35.43
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Restroom	1	$ 65.07	$ 29.64	$ 35.43
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 22	16	$ 1,234.40	$ 562.22	$ 672.18
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Classroom 22	1	$ 65.07	$ 29.64	$ 35.43
Fixture Replacement: LED Exit Sign: 2.3 W / Classroom 22	1	$ 72.90	$ 33.20	$ 39.70
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 20	15	$ 1,157.25	$ 527.08	$ 630.17
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 19	15	$ 1,157.25	$ 527.08	$ 630.17
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 18	15	$ 1,157.25	$ 527.08	$ 630.17
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 17	17	$ 1,311.55	$ 597.36	$ 714.19
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 32	4	$ 308.60	$ 140.55	$ 168.05
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Machine Room	4	$ 308.60	$ 140.55	$ 168.05
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / General Office	6	$ 370.68	$ 168.83	$ 201.85
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Nurses	3	$ 185.34	$ 84.41	$ 100.93
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Restroom	1	$ 65.07	$ 29.64	$ 35.43
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Principals Office	4	$ 247.12	$ 112.55	$ 134.57
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Boys Room	1	$ 61.78	$ 28.14	$ 33.64

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Savings values are estimates. Actual savings will vary.
Incentives and participation subject to program rules and Participation Agreement.

Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Janitors room	1	$ 54.65	$ 24.89	$ 29.76
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Boiler Room	5	$ 308.90	$ 140.69	$ 168.21
Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / Boiler Room	1	$ 84.29	$ 38.39	$ 45.90
Fixture Replacement: LED Exit Sign: 2.3 W / Boiler Room	1	$ 72.90	$ 33.20	$ 39.70
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Hallway Open Space	26	$ 1,606.28	$ 731.59	$ 874.69
Fixture Replacement: LED Exit Sign: 2.3 W / Hallway Open Space	15	$ 1,093.50	$ 498.04	$ 595.46
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Hallway Open Space	45	$ 2,780.10	$ 1,266.22	$ 1,513.88
Relamp/Reballast: LED 2-Lamp PL 4-Pin / Hallway Open Space	14	$ 933.94	$ 425.37	$ 508.57
Fixture Replacement: LED Recessed Downlight - 6": 18 W / Rear Entrance Lobby	16	$ 2,531.84	$ 1,153.15	$ 1,378.69
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Rear Entrance Lobby	2	$ 123.56	$ 56.28	$ 67.28
Fixture Replacement: LED Exit Sign: 2.3 W / Rear Entrance Lobby	2	$ 145.80	$ 66.41	$ 79.39
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Rear Entrance Lobby	6	$ 390.42	$ 177.82	$ 212.60
Electric Split System A/C: 6-Tons / Ground	1	$ 13,146.15	$ 5,987.52	$ 7,158.63
Gas-Fired Boiler / boiler room	2	$ 215,195.99	$ 98,012.76	$ 117,183.23
Programmable Thermostats / Wall	4	$ 884.00	$ 402.62	$ 481.38
Low-Flow Aerators (Lavatory) / Classrooms & Restrooms	26	$ 309.40	$ 140.92	$ 168.48
Low-Flow Aerators (Kitchen) / Kitchen	4	$ 49.60	$ 22.59	$ 27.01
Pipe Wrap Insulation / boiler room	1	$ 1,205.00	$ 548.83	$ 656.17
Pipe Wrap Insulation / boiler room	1	$ 1,406.25	$ 640.49	$ 765.76
Pipe Wrap Insulation / boiler room	1	$ 603.75	$ 274.98	$ 328.77
Pipe Wrap Insulation / boiler room	1	$ 735.25	$ 334.88	$ 400.37
TOTALS**		$ 294,341.98	$ 134,060.45	$ 160,281.53

**Maximum incentive amount per project is $125,000. Measures that would qualify the project for funding through the State Energy Program (SEP) are identified above with an 'S'. If any "SEP measures" are included then the total incentive amount for all measures will be paid with SEP funds, otherwise the total incentive amount will come from NJ Clean Energy funds.

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New Jersey's cleanenergy program njcleanenergy.com

NEW JERSEY'S CLEAN ENERGY PROGRAM
DIRECT Install
PARTICIPATING CONTRACTOR

How did you learn about this Energy Efficiency Program?
☐ Advertisement ☐ Internet Search ☐ Mailer ☐ Video
☐ Tradeshow/Event ☐ Word of Mouth ☐ Radio ☐ Contractor
☐ Other _____

Direct Install Application and Participation Agreement
July 1, 2019 – June 30, 2020

Utility(ies) Serving Customer:

☐ Atlantic City Electric ☒ Jersey Central Power & Light ☐ PSE&G ☐ New Jersey Natural Gas
☐ Elizabethtown Gas ☐ Rockland Electric Co. ☐ South Jersey Gas ☐ Other Utility

Instructions

1. Fill out all applicable sections below.
2. Provide a completed Application and signed Participation Agreement to the Participating Contractor serving your area, along with copies of utility billing demonstrating average electric demand does not exceed 200 kW in the preceding 12 months.
3. Your Contractor or Program Manager will confirm program participation eligibility, perform the Energy Assessment, and arrange for final approval by the Program Manager prior to installing eligible measures.

Customer Information

Legal Name		Tax ID	NAICS Code
Company Address	City	State	Zip
Project Contact	Phone	E-Mail	
Customer to provide: a) Copies of required gas and electric billing ☐ Check if attached			

Facility Information (Facility on which Energy Assessment is to be conducted and measures provided)

Facility Address	City	State NJ	Zip
County	Utility Account Number(s): Electric _____ Gas _____		
Facility Name and Brief Type/Occupancy Description			

For Participating Contractor Use Only

Company Name		Contact
Contact Phone	Contact E-mail	Contractor Assigned Project Number
Average Electric Demand _____ kW (based on preceding 12 months)		Project Name

Enhanced Incentives – if applicable, check appropriate box

☐ K-12 Public School ☐ Municipality ☐ County Entity ☐ Facilities located in an NJ Urban Enterprise Zone
☐ Facilities located in an NJ Opportunity Zone

DIRECT INSTALL PARTICIPATION AGREEMENT

DEFINITIONS:

ADMINISTRATOR - The New Jersey Board of Public Utilities (NJBPU).

APPLICATION - Page 1 of this Application and Participation Agreement.

APPLICATION PACKAGE - Consists of the entirety of: an executed Application and Participation Agreement, utility billing demonstrating, if required, average electric demand not exceeding 200 kW in the preceding 12 months and completed Energy Assessment with Scope of Work Attachment. Measures may not be installed, and Incentives shall not be paid until after the Application Package is approved by the Program Manager.

COMPLETION AND ACCEPTANCE OF MEASURES - Work performed by Participating Contractor shall be deemed completed and accepted upon the signing of a Measure Acceptance Form by the Participating Customer and Program Manager.

ENERGY ASSESSMENT - An inventory of existing energy consuming equipment and analysis of possible replacement Measures generated by the Program-approved energy assessment tool to determine estimated energy savings, in addition to costs and Incentives eligible under the Program.

ENERGY-EFFICIENT MEASURES (or "Measures") - Any device or grouping of devices eligible to receive an Incentive through the Program.

INCENTIVE - An amount paid by the Direct Install component of New Jersey's Clean Energy Program through the Program Manager to the Participating Contractor in connection with the installation of a Measure. Incentives are available to cover up to 70% of the cost of installed Measures, and entities owned or operated by Municipalities, Counties, K-12 public schools, and customers located in UEZs or OZs may be eligible for incentives up to 80% of the cost of installed Measures. Incentives are subject to change without notice prior to the Program Manager approving the Application Package.

MEASURE ACCEPTANCE FORM – A document providing the means by which the Contractor and Customer confirm and accept the installation of Measures.

NEW JERSEY UTILITIES - The regulated electric and/or gas utilities in the State of New Jersey. They are: Atlantic City Electric, Jersey Central Power & Light, Rockland Electric Company, New Jersey Natural Gas, Elizabethtown Gas, PSE&G, and South Jersey Gas.

PARTICIPATING CONTRACTOR (or "Contractor") - An entity under contract to the Program Manager which performs Energy Assessments and installation of Measures in connection with the Program.

PARTICIPATING VENDOR (or "Vendor") - An entity under contract to the Program Manager which provides/supplies equipment directly to the program's contractors for project implementation.

PARTICIPATING CUSTOMER (or "Customer") - Those non-residential electric and/or gas service customers of the New Jersey utilities, municipal utilities or rural electric cooperatives who participate in the Program.

PRE-INSTALLED MEASURES - Measures installed before the application approval date shall not be included in the work scope and will not receive Program Incentives.

PROGRAM - New Jersey's Clean Energy Direct Install Program offered herein by the New Jersey Board of Public Utilities pursuant to state regulatory approval under the New Jersey Electric Discount and Energy Competition Act, NJSA 48:3-49, et seq, and subject to change without notice and subject to funding availability.

PROGRAM MANAGER - TRC

PROGRAM SCOPE - Services to be provided under the Program are limited to those directly associated with the evaluation and installation of Measures and shall in no way include work by the Contractor in connection with the correction of apparent or hidden safety issues or code violations. Contractor shall not perform work where, in its sole discretion, it is determined such safety issues or code violations exist. All work shall be performed during normal business hours, Monday through Friday unless the Customer and Contractor agree otherwise, in which case the Contractor shall not receive additional compensation for work performed outside of such normal business hours.

PROJECT - The Measure(s) to be installed in the facility listed under the Facility Information section of the application.

SCOPE OF WORK ATTACHMENT - A document generated by the Energy Assessment tool which lists the Measures eligible for installation, their Incentive Amounts and costs to be paid by the Customer. Once countersigned by the Customer and Contractor indicating the Measures to be installed in the Project and approval by the Program Manager, the Scope of Work Attachment shall be part of this Participation Agreement.

PARTICIPATION PROCESS:

1. Customer completes Application and provides necessary utility usage and demand data.
2. Contractor or Program Manager performs the Energy Assessment using the program-approved energy assessment tool. The Energy Assessment generates a Scope of Work Attachment for countersignature by the Customer to indicate which eligible Measures are to be included in the Project.
3. Contractor countersigns the Scope of Work Attachment and submits a full Application Package to the Program Manager for approval.
4. Upon Program Manager's approval, Contractor performs retrofit work to remove existing equipment and install Measures, and submits documentation of Project completion in the form of a Measure Acceptance Form signed by the Customer. Contractor invoices the Program Manager for the Incentive portion and the Customer for the balance.
5. Customer pays outstanding balance of costs, less any prior payment or deposit, to Contractor according to amounts listed on the Scope of Work Attachment.

The Program, or agent thereof, reserves the right to conduct inspections of the Project prior to or after the installation of Measures. To be eligible for Incentives, the Application Package must be approved by the Program Manager prior to Measure installation.

CHANGES TO THE PROGRAM - The Program and/or Participation Agreements may be changed by the Program Manager or Administrator at any time without notice, however, approved Application Packages will be processed to completion under the terms in effect at the time of approval.

ELIGIBILITY - Program services and Incentives are available to existing non-residential, commercial and industrial buildings with an average electric demand that did not exceed 200 kW in the preceding 12 months and served by at least one of the New Jersey utilities, municipal utilities or rural electric cooperatives who participate in the Program. If the Participant is a municipal electric company customer, and a customer of a regulated gas New Jersey utility, only gas Measures will be eligible under the Program.

Participating projects with a contract at or above current prevailing wage contract threshold amount set pursuant to the New Jersey Prevailing Wage Act (N.J.S.A. 34:11-56.25 et seq.) are required to pay no less than prevailing wage rate to workers employed in the performance of any construction undertaken in connection with Board of Public Utilities financial assistance, or undertaken to fulfill any condition of receiving Board of Public Utilities financial assistance, including the performance of any contract to construct, renovate or otherwise prepare a facility, the operations of which are necessary for the receipt of Board of Public Utilities financial assistance. By signing this application, the signatories agree to comply with the provisions of the New Jersey Prevailing Wage Act, N.J.S.A. 34: 11-56.25 et seq., (Act), if and to the extent that Act may apply to the work covered by this application. By submitting an application, or accepting program incentives, applicant agrees to adhere to New Jersey Prevailing Wage requirements, as applicable.

Customers of New Jersey utilities who have not contributed to the Societal Benefits Charge during the calendar year in which the Application Package is received by the Program Manager may not be eligible for Incentives offered through the Program.

NO ENDORSEMENT - The Program Manager and Administrator do not endorse, support or recommend any particular manufacturer, product or system design.

INCENTIVE AMOUNTS - Incentive amounts will be listed in the Scope of Work Attachment which, when completed and countersigned by the Customer and approved by the Program Manager, will be part of this Participation Agreement. The Customer will be responsible for paying the remaining balance of costs listed in the Scope of Work Attachment upon receipt of Contractor's invoice.

Incentives will be offered for eligible and qualifying Measures as determined from the Energy Assessment and listed on a separate Scope of Work Attachment. The Scope of Work Attachment shall be countersigned by the Customer to indicate eligible and qualifying Measures to be included in the Project. All Incentive payments shall be paid by the Program Manager directly to the Contractor. The Program is not bound to pay any Incentive unless the Application Package associated with the Incentive payment is approved by the Program Manager prior to Measure installation.

INCENTIVE CAP - Program Manager reserves the right to limit the amount of Incentives on a per-Project or Program basis. Any such caps on individual projects will be disclosed to Customers on the Scope of Work Attachment.

INSTALLATION AGREEMENT - Following completion of the Energy Assessment, but prior to commencement of any installation work, the Customer will be presented a separate Installation Agreement in the form of

DIRECT INSTALL PARTICIPATION AGREEMENT

a Scope of Work Attachment which shall become part of this Agreement. By executing the Scope of Work Attachment, the Customer agrees to allow the Contractor to install the eligible Measures identified in the Scope of Work Attachment.

WARRANTIES - THE PROGRAM MANAGER AND ADMINISTRATOR DO NOT EXPRESSLY OR IMPLIEDLY WARRANTY THE PERFORMANCE OF INSTALLED EQUIPMENT, AND/OR SERVICES RENDERED AS PART OF THIS PROGRAM. NO WARRANTIES OR REPRESENTATIONS OF ANY KIND, WHETHER STATUTORY, EXPRESS, OR IMPLIED, INCLUDING, WITHOUT LIMITATIONS, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE REGARDING EQUIPMENT OR SERVICES ARE PROVIDED BY ANY PARTY, INCLUDING THE PROGRAM MANAGER UNDER THE PROGRAM. CONTRACTOR SHALL EXTEND TO CUSTOMER FULL EQUIPMENT, MATERIALS AND LABOR WARRANTIES WITH AN EXPIRATION DATE OF THE LATER OF EITHER ONE YEAR FROM THE DATE OF INSTALLATION OR THE MANUFACTURER'S STANDARD WARRANTY EXPIRATION. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL WARRANTY ISSUES RELATING TO EQUIPMENT AND MATERIALS INSTALLED UNDER THE PROGRAM FOR A PERIOD OF ONE YEAR.

In no way shall the reviews, inspections, approvals and all other actions performed by the Program Manager under the Program be construed as a determination or acceptance of performance, applicability, dollar savings, or energy savings. The Program Manager and Administrator offer no guarantee or warranty of performance for equipment or labor provided in connection with the Program. The Contractors assume full responsibility and liability for the removal and installation of all equipment, including but not limited to design, specification, all permits, installation, maintenance, performance, and proper disposal of equipment removed, including lamps and ballasts.

LIMITATION OF LIABILITY – By virtue of participating in the Program, Participating Customer agrees to waive any and all claims or damages against the Program Manager, and the Administrator. Participating Customers agree that the Program Manager's and Administrator's liability, in connection with the Program, is limited to paying the Program Incentives specified directly to the Participating Contractor, for the value of the work performed/Measures installed, as identified in the Installation Agreement. Under no circumstances shall the Program Manager, its representatives, or subcontractors, or the Administrator be liable for any lost profits, special, punitive, consequential or incidental damages or for any other damages or claims connected with or resulting from participation in this Program. Further, any liability attributed to the Program Manager or its subcontractors under this Program shall be individual, and not joint and/or several.

IDEMNIFICATION – As part of agreeing to participate in the Program, which includes financial incentives to reduce the customer's net project costs, the Participating Customer agrees to indemnify and hold harmless the Program Manager and Administrator and their respective staffs with respect to the Project.

INSPECTION – Customer agrees to grant the Program reasonable access to Customer's Facility to inspect both pre-existing equipment (if applicable) and the Measures installed under this Program, either prior to issuing Incentives or at a later time.

PROGRAM OFFER – The Program covers services rendered on or after July 1, 2019. Program Incentives are available to non-residential retail electric and/or gas service customers of the New Jersey Utilities.

TAX LIABILITY – Neither the Program Manager nor Contractor shall be responsible for any tax liability that may be imposed on any Customer as a result of the payment of Program Incentives.

TERMINATION – The Administrator reserves the right to extend, modify (this includes modification of Program Incentive levels) or terminate this program without prior or further notice.

CUSTOMER ACKNOWLEDGEMENT – I have read, understood and am in compliance with all rules and regulations concerning this incentive Program. I certify that all information provided is correct to the best of my knowledge, and I give the Program Manager permission to share my records with the New Jersey Board of Public Utilities, and contractors it selects to manage, coordinate or evaluate New Jersey's Clean Energy Programs, including the release of electric and natural gas utility billing information. I allow reasonable access to my property to inspect the installation and performance of the technologies and installations that are eligible for Incentives under the guidelines of New Jersey's Clean Energy Program. This Participation Agreement supersedes all other communications and representations. I agree that this document and all notices and disclosures made or given relating to this document may be created, executed, delivered and retained electronically and that the electronic signatures appearing on this document and any related documents shall have the same legal effect for all purposes as a handwritten signature. The information, statements, and documents I have provided in and with this document are true and accurate to the best of my knowledge. I am aware that if any of them are willfully false, I am subject to punishment.

Other Funding Sources

☐ Check the box if an Energy Savings Improvement Program (ESIP) will be a source of funding. ESIP allows government agencies to pay for energy related improvements using the value of the resulting energy savings.

The Parties signing below certify they are duly authorized to enter into this agreement and hereby accept the above terms:

PARTICIPATING CUSTOMER

Name of Participating Customer

Authorized Signature | Date

CONTRACTOR'S COUNTERSIGNATURE

By signing, below, I certify that I have received the Customer's Application Package and will, in connection with the Project, perform my obligations as Participating Contractor as outlined in the separate Program Contractor Agreement executed between the Contractor below and the Program Manager.

PARTICIPATING CONTRACTOR

Name of Participating Contractor

Authorized Signature | Date

PAYMENT TERMS

This Contract is entered by and between

Lime Energy of 4 Gateway Center, 100 Mulberry St, Newark, NJ 07102

	MAIN OFFICE	PROJECT LOCATION
Customer	Sayreville Board of Education	Emma L Arleth
Address	3198 Washington Rd	- Same -
City, ST, Zip:	Sayreville, NJ 08859	- Same -
Contact:	Barbara Malewicz	- Same -
Telephone:	609-659-7400	- Same -

("Customer") relative to the work described below:

Total Project Cost	**Customer Contribution**
$294,341.98	$134,060.45
Additional Cost Outside of Program	**Total Customer Contribution**
$42,877.50	**$176,937.95**

1. The **Customer** shall pay to **Lime** 1/2 of the net customer cost at Scope of Work (SOW) TRC approval. The **Customer** shall pay **Lime** the final balance of the net customer cost upon project completion, Net 30.
2. Change in SOW resulting in an increase/decrease in customer co-pay will be executed only upon receipt of written approval by **Customer** and will be reflected in final invoice.
3. Accepted payment methods are: Money Order, Bank Check, Personal Check, Credit Card (Visa, Mastercard, Discover Card).

1st Payment **$88,468.98**
2nd & Final Payment **$88,468.98**

Accepted this_____ Day of_____, ____2020_____.
(Day) (month) (year)

Lime Signature:	Customer Signature Duly Authorized:
Printed Name:	Printed Name:

Acceptance of Contract: The above prices, specifications, and conditions are satisfactory and are here-by accepted. Willdan authorized to perform the work as specified based on TRC approval. Payments will be made as outlined above.

Lime Energy

Company Name: Sayreville BOE - Emma L Arleth
Address: 3198 Washington Rd, Sayreville, NJ 08859
Contact: Barbara Malewicz
Phone: 609-659-7400
Work order #:

Project Description: The following list defines extra work required for a proper and "up-to-code" mechanical installation for this project. The costs associated with this extra work is NOT covered by the Direct Install program.

Materials & Labor is as follows:

Description	Unit Cost	Qty	Sub-Total
Boilers			
Requires Boiler Repiping (Reconfiguration to Primary Secondary)	$3,400.00	3	**$10,200.00**
Requires Boiler Water-Treatment: Over 2,000 MBH	$2,000.00	1	**$2,000.00**
Requires Hydronic-Heating Filter for Iron Oxide Sludge	$1,600.00	1	**$1,600.00**
Requires New Venting System: Up to 1,500 MBH	$2,400.00	3	**$7,200.00**
Requires Condensate Piping: Level 2	$200.00	3	**$600.00**
Requires Acid Neutralizer: Up to 1500 MBH	$800.00	3	**$2,400.00**
Reuse Existing Expansion Tank	$400.00	3	**$1,200.00**
Requires Rigging: Level 6	$2,200.00	3	**$6,600.00**
Requires System Commissioning	$2,400.00	1	**$2,400.00**
Prepare Manual J/N & S: Level 2 $	$800.00	1	**$800.00**
Trane 6Ton			
Requires Excavation, Gravel Base, Stone Perimeter: Up to 10 Ton	$ 690.00	1	**$690.00**
Requires Rehanging of Indoor Equipment: Level 3	$ 1,840.00	1	**$1,840.00**
Requires Supply/Return Duct Modification: Up to 10 Tons	$ 1,380.00	1	**$1,380.00**
Requires Smoke Detector w/Central Station (wiring by others)	$ 460.00	1	**$460.00**
Requires Lineset Re-Insulation: Up to 10 Feet	$ 230.00	1	**$230.00**
Requires Refrigerant Flush Kit: Up to 10 Tons	$ 460.00	1	**$460.00**
Requires Condensate Piping: Level 3	$ 345.00	1	**$345.00**
Requires Secondary Drain Pan: Up to 10 Ton	$ 920.00	1	**$920.00**
Requires Disconnect: Up to 10 Ton $	$ 345.00	1	**$345.00**
Requires Rigging: Level 3 $	$ 920.00	1	**$920.00**
Requires System Commissioning: Up to 10 Tons $	$ 287.50	1	**$287.50**

Total Cost = **$42,877.50**

If you have any questions please feel free to contact me at (732) 427-7278
Willdan Energy Solutions welcomes the opportunity to work with you.
Regrards,
Lime Energy
Christopher Fornicola
Christopher Fornicola
Program Manager

Acknowledged, accepted, and agreed, this _____ day of, _____, 2020 by the duly authorized representative of the undersigned:

Signature: _____

Name(please print): _____

Title: _____

Direct Install Contractor Checklist

Application # LM126368

Applicant Company Name: Emma L. Arleth Elementary School Sayreville

[x] - Lighting assessed and included in the EAT

[x] - Explored possibilities of adding lighting controls

[N/A] - Motors assessed and included in the EAT

[x] - Explored possibilities of adding Variable Frequency Drives

[x] - HVAC (electric cooling) assessed and included in the EAT

[x] - HVAC (gas heating) assessed and included in the EAT

[x] - Explored option of adding duel enthalpy or fuel use economizers to existing non qualifying units

[x] - Explored possibilities of adding faucet aerators, low flow showerheads or pre-rinse spray valves

[x] - Explored possibilities of adding thermostats to HVAC equipment

[x] - Explored possibilities of adding refrigeration equipment

All qualified lighting included. Sensors are not a good fit for the space. There is no motor opportunity. Explored and found no possibility of adding Variable Frequency Drives. Aerators and pipe wrap are included. This area is cooled by a 6-ton electric split system. This area is heated with two gas-fired boilers which have an existing MBH of 6300. We are proposing to replace both boilers. Refrigeration controls are not required as lunches are brought in by outside vendor.

Comments:

_____ _____

Contractor signature Applicant signature

_____

NJ DIRECT INSTALL LIGHTING NOTES & EXCLUSIONS

In some cases, existing light levels in your facility may be higher than necessary when compared to current recommended lighting standards. To maximize your savings *and* provide a comfortable work environment, upgrades included in your Scope of Work may reduce lighting levels in your building. Please speak with your Direct Install account representative if you have any questions.

1) This Scope of Work assumes that all lighting equipment operates on voltages between 120V and 277V. If any lighting fixtures included in this scope operate at 480 volts, there will be additional costs that are not covered by the Direct Install program.

2) There are no allowances in this Scope of Work for battery backup systems that are integrated into existing luminaires. If these systems exist in your facility, there will be additional costs that are not covered by the Direct Install program to include battery backups in the retrofits or fixture replacements that are included in this Scope of Work. The unit price for this work is $150/each and shall be reviewed at the conclusion of the project, if applicable.

3) Mounting hardware for the exterior fixtures and high bay fixtures is not included in the program pricing. These measures are contingent upon the customer's acceptance of the Mounting Hardware proposal included herewith. Shielding requirements for exterior fixtures to prevent light trespass, where applicable, are also excluded from the program pricing.

4) There are no allowances for the correction of code violations, or additional on-incidental work required to meet changes in code requirements since the installation of the existing equipment. Conditions hidden from sight prior to removal of existing equipment are also excluded.

5) Lighting color temperature will be matched with existing color temperature unless otherwise directed at this time.

6) All projects will be done on 1st shift. Any work outside of the hours of 7am to 3pm will be an additional cost charged to the customer.

NJ DIRECT INSTALL HVAC NOTES & EXCLUSIONS

Air Distribution

The NJ Direct Install Program is a one for one equipment replacement and does not address pre-existing ductwork conditions. Some items that would be excluded are as follows:

1) Undersized, oversized and or damaged ductwork (Hard or Flex)

NJ DIRECT INSTALL HVAC NOTES & EXCLUSIONS (Cont'd)

2) Faulty VAV Boxes
3) Faulty Re-Heat Coils
4) Faulty or incorrect Supply Diffusers or Return Diffusers
5) Humidifiers, De-Humidifiers or Air Cleaners
6) Air Balancing of the system

BAS Systems
This proposal does not include the cost of special factory installed control boards or tying and programming into the existing system.

Code Violations
There are no allowances for the correction of code violations, or additional nonincidental work required to meet changes in code requirements since the installation of the existing equipment. Conditions hidden from sight prior to removal of existing equipment are also excluded.

Crane Costs
This proposal covers crane costs for installation and removal of items up to 20 feet vertical and 30 feet horizontal. There may be additional charges, if the required lift is greater in either dimension.

Duct Work
This proposal covers up to 2 linear feet of transition ductwork to tie the new unit into the existing duct system.

Fire Alarm
This proposal excludes wiring of HVAC smoke detectors to a building's fire alarm system. This must be completed by a certified fire alarm contractor. There are also no provisions within the program to install new smoke detectors, or to replace existing smoke detectors that are not in working condition.

Gas Piping & Condensate Lines
This proposal covers up to 10 linear feet of new piping to tie the new unit into the existing gas and condensate lines on packaged units, where required.

Railings
This proposal excludes safety railings or seismic strapping if required by code. Code requires HVAC equipment to be at least 10 feet away from the edge of the roof. If less than 10 feet, local building codes may require the installation of a safety railing.

Structural
This proposal excludes structural engineering, structural drawings, and structural steel work. Due to the nature of this project, you may be responsible for supplying a set of structural drawings to include with the permit package for approval. This proposal does not include the cost for any service needed above.

The pricing & scope provided herewith, does not include asbestos testing or remediation of any kind.

Signature: _____

Name: _____

Title: _____

Date: _____



To Whom It May Concern:

Due to our past relationship with Lime Energy, Emma L Arleth Elementary School would prefer to continue to work with Lime outside of their assigned New Jersey Direct Install territory at our facility located at ***3198 Washington Road, Sayreville, NJ 08859***

Thank you,

New Jersey Office of Clean Energy
Direct Install Program
Energy Assessment Tool (V4.0C)

General Project Information

Participating Customer:	Sayreville Boro of Ed		**Facility Type:**	Education – Primary School	
Contractor / Project #:	Lime	LM126376	**HVAC Type:**	AC & Gas Heat	
Facility Name:	Harry S. Truman Elementary School		**Total Facility Square Footage:**	53,000	
Street Address:	1 Taft Place		**Avg Weekly Hrs of Operation:**	70	
City / Zip Code:	Parlin	08859	**# of Full-Time Employees:**	20	
Is this facility publicly owned?:	Y		**Year Constructed:**	1975	
BOE, MUA or other public entity property?	Y		**Tax Exempt?:**	Y	
			Project Permitting Costs:	$500.00	

Enhanced Incentive Eligibility

Project in UEZ?	N	**K-12 School?**	Y
Project in OZ?	N	**Municipality?**	N
		County Facility?	N

Electric Utility Information

Electric Provider:	Jersey Central Power & Light
Service Class:	GSS
Account #:	100 013 754 021
Billing Period Start Date:	10/17/19
Billing Period End Date:	11/13/19
Billing Period kWh Consumption:	22,400
Billing Period Total Cost:	$1,780.00
Total Taxes + Fees on Bill:	$11.13
Electric - Average Cost ($/kWh):	**$0.079**

Gas Utility Information

Gas Provider:	PSE&G
Service Class:	LVG
Account #:	73 376 952 09
Billing Period Start Date:	02/05/20
Billing Period End Date:	03/06/20
Billing Period Therm Consumption:	3,080
Billing Period Total Cost:	$1,089.07
Total Taxes + Fees on Bill:	$143.78
Gas - Average Cost ($/Therm):	**$0.307**

Oil Information

Annual Consumption (Gallons):	
Annual Cost:	
Annual Taxes + Fees on Bill:	
Oil - Average Cost ($/Gallon):	**$0.000**

Propane Information

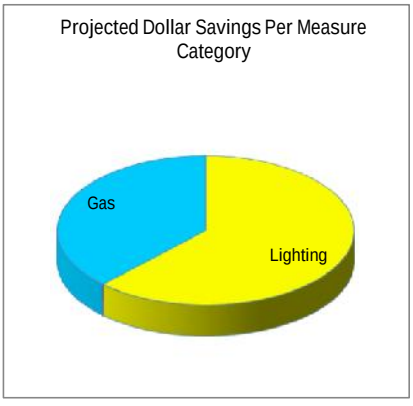
Annual Consumption (Gallons):	
Annual Cost:	
Annual Taxes + Fees on Bill:	
Propane - Average Cost ($/Gallon):	**$0.000**

Project Summary

	Annual Energy Savings	Energy Units	Annual Cost Savings	Total Measure Cost	Estimated Incentive Amount	Total Cost to Customer
Lighting Measures Total:	55,748	kWh	$4,402.31	$40,159.70	$17,441.02	$22,718.68
Motors & VFD Measures Total:	0	kWh	$0.00	$0.00	$0.00	$0.00
HVAC Electric Measures Total:	0	kWh	$0.00	$0.00	$0.00	$0.00
Refrigeration Measures Total:	0	kWh	$0.00	$0.00	$0.00	$0.00
ELECTRIC MEASURES:	**55,748**	**kWh**	**$4,402.31**	**$40,159.70**	**$17,441.02**	**$22,718.68**
GAS MEASURES:	**8,740**	**Therms**	**$2,682.46**	**$114,616.57**	**$49,777.02**	**$64,839.55**
OIL MEASURES:	**0**	**Gallons**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
TOTAL PROPANE MEASURES:	**0**	**Gallons**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
CONVERSION MEASURES (OIL):	**0**	**Gallons**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
CONVERSION MEASURES GAS:	**0**	**Therms**				
COMBINED PROJECT TOTALS:			**$7,084.77**	**$154,776.27**	**$67,218.04**	**$87,558.23**

SIMPLE PAYBACK (YEARS): **12.36**

PROJECT TRC TEST: **1.69**



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DIRECT INSTALL PROGRAM

PARTICIPATION AGREEMENT

SCOPE OF WORK ATTACHMENT

LMLM126376

"Parties":

Participating Customer*:	**Sayreville Boro of Ed**			
Participating Contractor*:	**Lime**			
Facility Name*:	**Harry S. Truman Elementary School**			
Facility Address:	**1 Taft Place**	**Parlin,**	**NJ**	**08859**
	Street	City		Zip

*as listed on Application

When fully signed, this Scope of Work Attachment ("Attachment") shall become part of the Direct Install Program Participation Agreement ("Participation Agreement") previously executed by the Parties in connection with the installation of energy efficiency retrofit Measures to be performed by the Participating Contractor (or "Contractor") at the above listed Facility. This Attachment, together with the Participation Agreement shall constitute the full Agreement between the Parties. Terms capitalized herein are defined in the Participation Agreement.

The Participating Customer (or "Customer") agrees to have Contractor perform retrofit work in connection with the Measures listed on page 2 of this form (attached). In consideration of the Contractor's performance of such work, Customer agrees to pay Contractor based on the measure costs listed below under Customer Unit Cost for the number of completed units for each Measure upon receipt of invoice; provided the Contractor may collect a deposit from Customer prior to performing such work, in which case the final invoice shall be net of such deposit. Customer and Contractor understand that conditions discovered during installation may require that some measures identified in the energy assessment cannot be installed, or some areas may require additional measures/quantities to be installed. Should conditions in the field dictate that the Estimated Program Total Cost shown on page 2 increase by more than 10%, Contractor must obtain both Program Administrator and Customer written approval in the form of an amended Scope of Work Attachment before proceeding with such additional work.

By signing below, the Parties agree the above listed Measures shall be installed by the Contractor. The Customer shall pay the Contractor as described herein following Completion and Acceptance of Measures. Customer certifies that he/she has the authority to contract for retrofit work in the Facility in connection with the Measures listed and, if the Customer does not own the Facility, the Owner has granted permission to Customer for performance of such work.

Participating Customer Date

Participating Contractor Date

Page 2
Scope of Work

The work to be performed by the Participating Contractor in connection with the Project shall be comprised of the below listed Measures in the estimated quantities listed:

Measure Description / Location	Quantity To Be Installed	Total Measure Cost	Estimated Customer Total Cost	Estimated Incentive Amount
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-library	32	$ 2,468.80	$ 1,396.62	$ 1,072.18
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-library	5	$ 308.90	$ 174.75	$ 134.15
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / 1-library	8	$ 656.72	$ 371.51	$ 285.21
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-D13-1	2	$ 123.56	$ 69.90	$ 53.66
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-D13-2	2	$ 123.56	$ 69.90	$ 53.66
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-D15	9	$ 556.02	$ 314.55	$ 241.47
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / 1-D15	1	$ 82.09	$ 46.44	$ 35.65
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-D10	9	$ 556.02	$ 314.55	$ 241.47
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / 1-D10	1	$ 82.09	$ 46.44	$ 35.65
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-D17	9	$ 556.02	$ 314.55	$ 241.47
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / 1-D17	1	$ 82.09	$ 46.44	$ 35.65
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-D12	9	$ 556.02	$ 314.55	$ 241.47
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / 1-D12	1	$ 82.09	$ 46.44	$ 35.65
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-D19	9	$ 556.02	$ 314.55	$ 241.47
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / 1-D19	1	$ 82.09	$ 46.44	$ 35.65
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-D14	9	$ 556.02	$ 314.55	$ 241.47
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / 1-D14	1	$ 82.09	$ 46.44	$ 35.65
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-D21	9	$ 556.02	$ 314.55	$ 241.47
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / 1-D21	1	$ 82.09	$ 46.44	$ 35.65
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-D16	9	$ 556.02	$ 314.55	$ 241.47
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / 1-D16	1	$ 82.09	$ 46.44	$ 35.65
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-boys restroom	2	$ 123.56	$ 69.90	$ 53.66
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / 1-boys restroom	1	$ 56.29	$ 31.84	$ 24.45
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / 1-D6	1	$ 65.07	$ 36.81	$ 28.26
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-girls restroom	2	$ 123.56	$ 69.90	$ 53.66
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / 1-girls restroom	1	$ 56.29	$ 31.84	$ 24.45
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-D11	5	$ 308.90	$ 174.75	$ 134.15
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-D9	5	$ 308.90	$ 174.75	$ 134.15
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / 1-faculty	1	$ 65.07	$ 36.81	$ 28.26
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-faculty	4	$ 247.12	$ 139.80	$ 107.32
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / 1-restroom #1	1	$ 56.29	$ 31.84	$ 24.45
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / 1-restroom #2	1	$ 56.29	$ 31.84	$ 24.45
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-health	1	$ 61.78	$ 34.95	$ 26.83
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-conference room	2	$ 123.56	$ 69.90	$ 53.66
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / 1-restroom A	1	$ 56.29	$ 31.84	$ 24.45
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-main office	6	$ 370.68	$ 209.70	$ 160.98
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-office	1	$ 61.78	$ 34.95	$ 26.83
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-A2	2	$ 123.56	$ 69.90	$ 53.66
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-A4	2	$ 123.56	$ 69.90	$ 53.66
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-A1	4	$ 247.12	$ 139.80	$ 107.32
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-A6	1	$ 61.78	$ 34.95	$ 26.83
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-A3	9	$ 556.02	$ 314.55	$ 241.47
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-A8	6	$ 370.68	$ 209.70	$ 160.98

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Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-A10	9	$ 556.02	$ 314.55	$ 241.47
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-A5	15	$ 926.70	$ 524.24	$ 402.46
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / 1-A5	1	$ 82.09	$ 46.44	$ 35.65
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / 1-A12	1	$ 56.29	$ 31.84	$ 24.45
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-A7	6	$ 370.68	$ 209.70	$ 160.98
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / 1-A7	2	$ 164.18	$ 92.88	$ 71.30
Relamp/Reballast: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W / 1-A7	1	$ 85.18	$ 48.19	$ 36.99
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / 1-A7 restroom	1	$ 56.29	$ 31.84	$ 24.45
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-A14	6	$ 370.68	$ 209.70	$ 160.98
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / 1-A14	2	$ 164.18	$ 92.88	$ 71.30
Relamp/Reballast: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W / 1-A14	1	$ 85.18	$ 48.19	$ 36.99
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / 1-A14 restroom	1	$ 56.29	$ 31.84	$ 24.45
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-A9	8	$ 494.24	$ 279.60	$ 214.64
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / 1-A9	2	$ 164.18	$ 92.88	$ 71.30
Relamp/Reballast: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W / 1-A9	1	$ 85.18	$ 48.19	$ 36.99
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-A16	8	$ 494.24	$ 279.60	$ 214.64
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / 1-A16	2	$ 164.18	$ 92.88	$ 71.30
Relamp/Reballast: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W / 1-A16	1	$ 85.18	$ 48.19	$ 36.99
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-A18	9	$ 556.02	$ 314.55	$ 241.47
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / 1-A18	2	$ 164.18	$ 92.88	$ 71.30
Relamp/Reballast: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W / 1-A18	1	$ 85.18	$ 48.19	$ 36.99
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / 1-restroom B	1	$ 56.29	$ 31.84	$ 24.45
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-A11	9	$ 556.02	$ 314.55	$ 241.47
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / 1-A11	2	$ 164.18	$ 92.88	$ 71.30
Relamp/Reballast: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W / 1-A11	1	$ 85.18	$ 48.19	$ 36.99
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / 1-restroom C	1	$ 56.29	$ 31.84	$ 24.45
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / 1-restroom D	1	$ 56.29	$ 31.84	$ 24.45
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-B1	1	$ 61.78	$ 34.95	$ 26.83
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-boys restroom	2	$ 123.56	$ 69.90	$ 53.66
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / 1-boys restroom	1	$ 56.29	$ 31.84	$ 24.45
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-B3	1	$ 61.78	$ 34.95	$ 26.83
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-girls restroom	2	$ 123.56	$ 69.90	$ 53.66
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / 1-girls restroom	1	$ 56.29	$ 31.84	$ 24.45
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-B5	7	$ 432.46	$ 244.65	$ 187.81
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / 1-B5	2	$ 164.18	$ 92.88	$ 71.30
Relamp/Reballast: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W / 1-B5	1	$ 85.18	$ 48.19	$ 36.99
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-B5	1	$ 54.65	$ 30.92	$ 23.73
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-B8	10	$ 617.80	$ 349.49	$ 268.31
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / 1-B8	2	$ 164.18	$ 92.88	$ 71.30
Relamp/Reballast: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W / 1-B8	1	$ 85.18	$ 48.19	$ 36.99
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-IT closet	1	$ 54.65	$ 30.92	$ 23.73
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-B7	10	$ 617.80	$ 349.49	$ 268.31
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / 1-B7	2	$ 164.18	$ 92.88	$ 71.30
Relamp/Reballast: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W / 1-B7	1	$ 85.18	$ 48.19	$ 36.99
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-B7	1	$ 54.65	$ 30.92	$ 23.73
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-B10	7	$ 432.46	$ 244.65	$ 187.81
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / 1-B10	2	$ 164.18	$ 92.88	$ 71.30
Relamp/Reballast: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W / 1-B10	1	$ 85.18	$ 48.19	$ 36.99
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-B10	1	$ 54.65	$ 30.92	$ 23.73
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-C21	13	$ 803.14	$ 454.34	$ 348.80
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-restroom E	3	$ 185.34	$ 104.85	$ 80.49
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-C2-2	13	$ 803.14	$ 454.34	$ 348.80

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Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-boiler room	15	$ 819.75	$ 463.74	$ 356.01
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-boiler room	1	$ 61.78	$ 34.95	$ 26.83
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-C5	11	$ 679.58	$ 384.44	$ 295.14
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / 1-C5	1	$ 65.07	$ 36.81	$ 28.26
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / 1-C5 restroom	1	$ 56.29	$ 31.84	$ 24.45
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-C7	11	$ 679.58	$ 384.44	$ 295.14
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / 1-C7	1	$ 65.07	$ 36.81	$ 28.26
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / 1-C7 restroom	1	$ 56.29	$ 31.84	$ 24.45
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-C9	20	$ 1,235.60	$ 698.99	$ 536.61
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / 1-C9	2	$ 164.18	$ 92.88	$ 71.30
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-C9	1	$ 54.65	$ 30.92	$ 23.73
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / 1-C9 restroom	1	$ 56.29	$ 31.84	$ 24.45
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-storage	4	$ 247.12	$ 139.80	$ 107.32
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-C6	15	$ 926.70	$ 524.24	$ 402.46
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / 1-C6	1	$ 65.07	$ 36.81	$ 28.26
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-C6	1	$ 54.65	$ 30.92	$ 23.73
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / 1-C6 restroom	1	$ 56.29	$ 31.84	$ 24.45
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-C8	14	$ 864.92	$ 489.29	$ 375.63
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / 1-C8	1	$ 82.09	$ 46.44	$ 35.65
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / 1-restroom F	1	$ 56.29	$ 31.84	$ 24.45
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-C11	19	$ 1,173.82	$ 664.04	$ 509.78
Relamp: Direct Line LED - 3-Lamp - 2-Foot T8 / 1-C11	1	$ 82.09	$ 46.44	$ 35.65
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / 1-restroom G	1	$ 56.29	$ 31.84	$ 24.45
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-closet	1	$ 61.78	$ 34.95	$ 26.83
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-A1-3	1	$ 61.78	$ 34.95	$ 26.83
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-A1-3	1	$ 61.78	$ 34.95	$ 26.83
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-vestibule	2	$ 123.56	$ 69.90	$ 53.66
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-stage	8	$ 494.24	$ 279.60	$ 214.64
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-kitchen	10	$ 617.80	$ 349.49	$ 268.31
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / 1-kitchen	1	$ 56.29	$ 31.84	$ 24.45
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-locker	1	$ 61.78	$ 34.95	$ 26.83
Relamp: LED - A-Lamp (3 - 25W): 10 W / 1-freezers	2	$ 41.20	$ 23.31	$ 17.89
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-closets	6	$ 327.90	$ 185.50	$ 142.40
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1-hallway	80	$ 4,942.40	$ 2,795.96	$ 2,146.44
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / 1-hallway	2	$ 130.14	$ 73.62	$ 56.52
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / 1-hallway	11	$ 715.77	$ 404.92	$ 310.85
Relamp: LED - A-Lamp (3 - 25W): 10 W / 1-hallway	6	$ 123.60	$ 69.92	$ 53.68
Fixture Replacement: LED Architectural Flood/Spot (25 - 150W): 31 W / exterior	2	$ 437.62	$ 247.57	$ 190.05
Gas-Fired Boiler / Boiler	2	$ 104,608.08	$ 59,177.66	$ 45,430.42
Gas-Fired Storage Water Heater / Boiler Room	1	$ 5,021.54	$ 2,840.73	$ 2,180.81
Programmable Thermostats / Wall	3	$ 663.00	$ 375.06	$ 287.94
Low-Flow Aerators (Lavatory) / Sinks	8	$ 95.20	$ 53.86	$ 41.34
Pipe Wrap Insulation / Boiler Room	1	$ 1,116.25	$ 631.47	$ 484.78
Pipe Wrap Insulation / Boiler Room	1	$ 913.75	$ 516.92	$ 396.83
Pipe Wrap Insulation / Boiler Room	1	$ 1,181.25	$ 668.24	$ 513.01
Pipe Wrap Insulation / Boiler Room	1	$ 1,017.50	$ 575.61	$ 441.89
TOTALS**		$ 154,776.27	$ 87,558.23	$ 67,218.04

**Maximum incentive amount per project is $125,000. Measures that would qualify the project for funding through the State Energy Program (SEP) are identified above with an 'S'. If any "SEP measures" are included then the total incentive amount for all measures will be paid with SEP funds, otherwise the total incentive amount will come from NJ Clean Energy funds.

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New Jersey's cleanenergy program™ njcleanenergy.com

NEW JERSEY'S CLEAN ENERGY PROGRAM
DIRECT Install
PARTICIPATING CONTRACTOR

How did you learn about this Energy Efficiency Program?
☐ Advertisement ☐ Internet Search ☐ Mailer ☐ Video
☐ Tradeshow/Event ☐ Word of Mouth ☐ Radio ☐ Contractor
☐ Other _____

Direct Install Application and Participation Agreement

July 1, 2019 – June 30, 2020

Utility(ies) Serving Customer:

☐ Atlantic City Electric ☐ Jersey Central Power & Light ☐ PSE&G ☐ New Jersey Natural Gas
☐ Elizabethtown Gas ☐ Rockland Electric Co. ☐ South Jersey Gas ☐ Other Utility

Instructions

1. Fill out all applicable sections below.
2. Provide a completed Application and signed Participation Agreement to the Participating Contractor serving your area, along with copies of utility billing demonstrating average electric demand does not exceed 200 kW in the preceding 12 months.
3. Your Contractor or Program Manager will confirm program participation eligibility, perform the Energy Assessment, and arrange for final approval by the Program Manager prior to installing eligible measures.

Customer Information

Legal Name		Tax ID	NAICS Code
Company Address	City	State	Zip
Project Contact	Phone	E-Mail	
Customer to provide: a) Copies of required gas and electric billing ☐ Check if attached			

Facility Information (Facility on which Energy Assessment is to be conducted and measures provided)

Facility Address	City	State NJ	Zip
County	Utility Account Number(s): Electric _____ Gas _____		
Facility Name and Brief Type/Occupancy Description			

For Participating Contractor Use Only

Company Name	Contact	
Contact Phone	Contact E-mail	Contractor Assigned Project Number
Average Electric Demand _____ kW (based on preceding 12 months)	Project Name	

Enhanced Incentives – if applicable, check appropriate box

☐ K-12 Public School ☐ Municipality ☐ County Entity ☐ Facilities located in an NJ Urban Enterprise Zone
☐ Facilities located in an NJ Opportunity Zone

DIRECT INSTALL PARTICIPATION AGREEMENT

DEFINITIONS:

ADMINISTRATOR - The New Jersey Board of Public Utilities (NJBPU).

APPLICATION - Page 1 of this Application and Participation Agreement.

APPLICATION PACKAGE - Consists of the entirety of: an executed Application and Participation Agreement, utility billing demonstrating, if required, average electric demand not exceeding 200 kW in the preceding 12 months and completed Energy Assessment with Scope of Work Attachment. Measures may not be installed, and Incentives shall not be paid until after the Application Package is approved by the Program Manager.

COMPLETION AND ACCEPTANCE OF MEASURES - Work performed by Participating Contractor shall be deemed completed and accepted upon the signing of a Measure Acceptance Form by the Participating Customer and Program Manager.

ENERGY ASSESSMENT - An inventory of existing energy consuming equipment and analysis of possible replacement Measures generated by the Program-approved energy assessment tool to determine estimated energy savings, in addition to costs and Incentives eligible under the Program.

ENERGY-EFFICIENT MEASURES (or "Measures") - Any device or grouping of devices eligible to receive an Incentive through the Program.

INCENTIVE - An amount paid by the Direct Install component of New Jersey's Clean Energy Program through the Program Manager to the Participating Contractor in connection with the installation of a Measure. Incentives are available to cover up to 70% of the cost of installed Measures, and entities owned or operated by Municipalities, Counties, K-12 public schools, and customers located in UEZs or OZs may be eligible for incentives up to 80% of the cost of installed Measures. Incentives are subject to change without notice prior to the Program Manager approving the Application Package.

MEASURE ACCEPTANCE FORM – A document providing the means by which the Contractor and Customer confirm and accept the installation of Measures.

NEW JERSEY UTILITIES - The regulated electric and/or gas utilities in the State of New Jersey. They are: Atlantic City Electric, Jersey Central Power & Light, Rockland Electric Company, New Jersey Natural Gas, Elizabethtown Gas, PSE&G, and South Jersey Gas.

PARTICIPATING CONTRACTOR (or "Contractor") - An entity under contract to the Program Manager which performs Energy Assessments and installation of Measures in connection with the Program.

PARTICIPATING VENDOR (or "Vendor") - An entity under contract to the Program Manager which provides/supplies equipment directly to the program's contractors for project implementation.

PARTICIPATING CUSTOMER (or "Customer") - Those non-residential electric and/or gas service customers of the New Jersey utilities, municipal utilities or rural electric cooperatives who participate in the Program.

PRE-INSTALLED MEASURES - Measures installed before the application approval date shall not be included in the work scope and will not receive Program Incentives.

PROGRAM - New Jersey's Clean Energy Direct Install Program offered herein by the New Jersey Board of Public Utilities pursuant to state regulatory approval under the New Jersey Electric Discount and Energy Competition Act, NJSA 48:3-49, et seq, and subject to change without notice and subject to funding availability.

PROGRAM MANAGER - TRC

PROGRAM SCOPE - Services to be provided under the Program are limited to those directly associated with the evaluation and installation of Measures and shall in no way include work by the Contractor in connection with the correction of apparent or hidden safety issues or code violations. Contractor shall not perform work where, in its sole discretion, it is determined such safety issues or code violations exist. All work shall be performed during normal business hours, Monday through Friday unless the Customer and Contractor agree otherwise, in which case the Contractor shall not receive additional compensation for work performed outside of such normal business hours.

PROJECT - The Measure(s) to be installed in the facility listed under the Facility Information section of the application.

SCOPE OF WORK ATTACHMENT - A document generated by the Energy Assessment tool which lists the Measures eligible for installation, their Incentive Amounts and costs to be paid by the Customer. Once countersigned by the Customer and Contractor indicating the Measures to be installed in the Project and approval by the Program Manager, the Scope of Work Attachment shall be part of this Participation Agreement.

PARTICIPATION PROCESS:

1. Customer completes Application and provides necessary utility usage and demand data.
2. Contractor or Program Manager performs the Energy Assessment using the program-approved energy assessment tool. The Energy Assessment generates a Scope of Work Attachment for countersignature by the Customer to indicate which eligible Measures are to be included in the Project.
3. Contractor countersigns the Scope of Work Attachment and submits a full Application Package to the Program Manager for approval.
4. Upon Program Manager's approval, Contractor performs retrofit work to remove existing equipment and install Measures, and submits documentation of Project completion in the form of a Measure Acceptance Form signed by the Customer. Contractor invoices the Program Manager for the Incentive portion and the Customer for the balance.
5. Customer pays outstanding balance of costs, less any prior payment or deposit, to Contractor according to amounts listed on the Scope of Work Attachment.

The Program, or agent thereof, reserves the right to conduct inspections of the Project prior to or after the installation of Measures. To be eligible for Incentives, the Application Package must be approved by the Program Manager prior to Measure installation.

CHANGES TO THE PROGRAM - The Program and/or Participation Agreements may be changed by the Program Manager or Administrator at any time without notice, however, approved Application Packages will be processed to completion under the terms in effect at the time of approval.

ELIGIBILITY - Program services and Incentives are available to existing non-residential, commercial and industrial buildings with an average electric demand that did not exceed 200 kW in the preceding 12 months and served by at least one of the New Jersey utilities, municipal utilities or rural electric cooperatives who participate in the Program. If the Participant is a municipal electric company customer, and a customer of a regulated gas New Jersey utility, only gas Measures will be eligible under the Program.

Participating projects with a contract at or above current prevailing wage contract threshold amount set pursuant to the New Jersey Prevailing Wage Act (N.J.S.A. 34:11-56.25 et seq.) are required to pay no less than prevailing wage rate to workers employed in the performance of any construction undertaken in connection with Board of Public Utilities financial assistance, or undertaken to fulfill any condition of receiving Board of Public Utilities financial assistance, including the performance of any contract to construct, renovate or otherwise prepare a facility, the operations of which are necessary for the receipt of Board of Public Utilities financial assistance. By signing this application, the signatories agree to comply with the provisions of the New Jersey Prevailing Wage Act, N.J.S.A. 34: 11-56.25 et seq., (Act), if and to the extent that Act may apply to the work covered by this application. By submitting an application, or accepting program incentives, applicant agrees to adhere to New Jersey Prevailing Wage requirements, as applicable.

Customers of New Jersey utilities who have not contributed to the Societal Benefits Charge during the calendar year in which the Application Package is received by the Program Manager may not be eligible for Incentives offered through the Program.

NO ENDORSEMENT - The Program Manager and Administrator do not endorse, support or recommend any particular manufacturer, product or system design.

INCENTIVE AMOUNTS - Incentive amounts will be listed in the Scope of Work Attachment which, when completed and countersigned by the Customer and approved by the Program Manager, will be part of this Participation Agreement. The Customer will be responsible for paying the remaining balance of costs listed in the Scope of Work Attachment upon receipt of Contractor's invoice.

Incentives will be offered for eligible and qualifying Measures as determined from the Energy Assessment and listed on a separate Scope of Work Attachment. The Scope of Work Attachment shall be countersigned by the Customer to indicate eligible and qualifying Measures to be included in the Project. All Incentive payments shall be paid by the Program Manager directly to the Contractor. The Program is not bound to pay any Incentive unless the Application Package associated with the Incentive payment is approved by the Program Manager prior to Measure installation.

INCENTIVE CAP - Program Manager reserves the right to limit the amount of Incentives on a per-Project or Program basis. Any such caps on individual projects will be disclosed to Customers on the Scope of Work Attachment.

INSTALLATION AGREEMENT - Following completion of the Energy Assessment, but prior to commencement of any installation work, the Customer will be presented a separate Installation Agreement in the form of

DIRECT INSTALL PARTICIPATION AGREEMENT

a Scope of Work Attachment which shall become part of this Agreement. By executing the Scope of Work Attachment, the Customer agrees to allow the Contractor to install the eligible Measures identified in the Scope of Work Attachment.

WARRANTIES - THE PROGRAM MANAGER AND ADMINISTRATOR DO NOT EXPRESSLY OR IMPLIEDLY WARRANTY THE PERFORMANCE OF INSTALLED EQUIPMENT, AND/OR SERVICES RENDERED AS PART OF THIS PROGRAM. NO WARRANTIES OR REPRESENTATIONS OF ANY KIND, WHETHER STATUTORY, EXPRESS, OR IMPLIED, INCLUDING, WITHOUT LIMITATIONS, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE REGARDING EQUIPMENT OR SERVICES ARE PROVIDED BY ANY PARTY, INCLUDING THE PROGRAM MANAGER UNDER THE PROGRAM. CONTRACTOR SHALL EXTEND TO CUSTOMER FULL EQUIPMENT, MATERIALS AND LABOR WARRANTIES WITH AN EXPIRATION DATE OF THE LATER OF EITHER ONE YEAR FROM THE DATE OF INSTALLATION OR THE MANUFACTURER'S STANDARD WARRANTY EXPIRATION. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL WARRANTY ISSUES RELATING TO EQUIPMENT AND MATERIALS INSTALLED UNDER THE PROGRAM FOR A PERIOD OF ONE YEAR.

In no way shall the reviews, inspections, approvals and all other actions performed by the Program Manager under the Program be construed as a determination or acceptance of performance, applicability, dollar savings, or energy savings. The Program Manager and Administrator offer no guarantee or warranty of performance for equipment or labor provided in connection with the Program. The Contractors assume full responsibility and liability for the removal and installation of all equipment, including but not limited to design, specification, all permits, installation, maintenance, performance, and proper disposal of equipment removed, including lamps and ballasts.

LIMITATION OF LIABILITY – By virtue of participating in the Program, Participating Customer agrees to waive any and all claims or damages against the Program Manager, and the Administrator. Participating Customers agree that the Program Manager's and Administrator's liability, in connection with the Program, is limited to paying the Program Incentives specified directly to the Participating Contractor, for the value of the work performed/Measures installed, as identified in the Installation Agreement. Under no circumstances shall the Program Manager, its representatives, or subcontractors, or the Administrator be liable for any lost profits, special, punitive, consequential or incidental damages or for any other damages or claims connected with or resulting from participation in this Program. Further, any liability attributed to the Program Manager or its subcontractors under this Program shall be individual, and not joint and/or several.

IDEMNIFICATION – As part of agreeing to participate in the Program, which includes financial incentives to reduce the customer's net project costs, the Participating Customer agrees to indemnify and hold harmless the Program Manager and Administrator and their respective staffs with respect to the Project.

INSPECTION – Customer agrees to grant the Program reasonable access to Customer's Facility to inspect both pre-existing equipment (if applicable) and the Measures installed under this Program, either prior to issuing Incentives or at a later time.

PROGRAM OFFER – The Program covers services rendered on or after July 1, 2019. Program Incentives are available to non-residential retail electric and/or gas service customers of the New Jersey Utilities.

TAX LIABILITY – Neither the Program Manager nor Contractor shall be responsible for any tax liability that may be imposed on any Customer as a result of the payment of Program Incentives.

TERMINATION – The Administrator reserves the right to extend, modify (this includes modification of Program Incentive levels) or terminate this program without prior or further notice.

CUSTOMER ACKNOWLEDGEMENT – I have read, understood and am in compliance with all rules and regulations concerning this incentive Program. I certify that all information provided is correct to the best of my knowledge, and I give the Program Manager permission to share my records with the New Jersey Board of Public Utilities, and contractors it selects to manage, coordinate or evaluate New Jersey's Clean Energy Programs, including the release of electric and natural gas utility billing information. I allow reasonable access to my property to inspect the installation and performance of the technologies and installations that are eligible for Incentives under the guidelines of New Jersey's Clean Energy Program. This Participation Agreement supersedes all other communications and representations. I agree that this document and all notices and disclosures made or given relating to this document may be created, executed, delivered and retained electronically and that the electronic signatures appearing on this document and any related documents shall have the same legal effect for all purposes as a handwritten signature. The information, statements, and documents I have provided in and with this document are true and accurate to the best of my knowledge. I am aware that if any of them are willfully false, I am subject to punishment.

Other Funding Sources

☐ Check the box if an Energy Savings Improvement Program (ESIP) will be a source of funding. ESIP allows government agencies to pay for energy related improvements using the value of the resulting energy savings.

The Parties signing below certify they are duly authorized to enter into this agreement and hereby accept the above terms:

PARTICIPATING CUSTOMER

Name of Participating Customer

Authorized Signature | Date

CONTRACTOR'S COUNTERSIGNATURE

By signing, below, I certify that I have received the Customer's Application Package and will, in connection with the Project, perform my obligations as Participating Contractor as outlined in the separate Program Contractor Agreement executed between the Contractor below and the Program Manager.

PARTICIPATING CONTRACTOR

Name of Participating Contractor

Authorized Signature | Date

PAYMENT TERMS

This Contract is entered by and between

Lime Energy of 4 Gateway Center, 100 Mulberry St, Newark, NJ 07102

	MAIN OFFICE	PROJECT LOCATION
Customer	Sayreville Board of Education	Harry Truman
Address	1 Taft Place	- Same -
City, ST, Zip:	Parlin, NJ 08859	- Same -
Contact:	Barbara Malewicz	- Same -
Telephone:	609-659-7400	- Same -

("Customer") relative to the work described below:

Total Project Cost	**Customer Contribution**
$154,776.27	$87,558.23
Additional Cost Outside of Program	**Total Customer Contribution**
$29,842.50	**$117,400.73**

1. The **Customer** shall pay to **Lime** 1/2 of the net customer cost at Scope of Work (SOW) TRC approval. The **Customer** shall pay **Lime** the final balance of the net customer cost upon project completion, Net 30.
2. Change in SOW resulting in an increase/decrease in customer co-pay will be executed only upon receipt of written approval by **Customer** and will be reflected in final invoice.
3. Accepted payment methods are: Money Order, Bank Check, Personal Check, Credit Card (Visa, Mastercard, Discover Card).

1st Payment **$58,700.37**
2nd & Final Payment **$58,700.37**

Accepted this_____ Day of_____, ____2020_____.
(Day) (month) (year)

Lime Signature:	Customer Signature Duly Authorized:
Printed Name:	Printed Name:

Acceptance of Contract: The above prices, specifications, and conditions are satisfactory and are here-by accepted. Willdan authorized to perform the work as specified based on TRC approval. Payments will be made as outlined above.

Lime Energy

Company Name: Sayreville BOE - Harry Truman
Address: 1 Taft Place, Parlin, NJ 08859
Contact: Barbara Malewicz
Phone: 609-659-7400
Work order #:

Project Description: The following list defines extra work required for a proper and "up-to-code" mechanical installation for this project. The costs associated with this extra work is NOT covered by the Direct Install program.

Materials & Labor is as follows:

Description	Unit Cost	Qty	Sub-Total
Requires Boiler Repiping (Reconfiguration to Primary Secondary):	$2,896.56	3	**$8,689.69**
Requires Boiler Water-Treatment: Up to 1,000 MBH	$826.56	3	**$2,479.69**
Requires Hydronic-Heating Filter for Iron Oxide Sludge: Medium	$826.56	3	**$2,479.69**
Requires New Venting System: Up to 1,000 MBH	$2,206.56	3	**$6,619.69**
Requires Condensate Pump (and/or Piping): Level 3	$1,056.56	3	**$3,169.69**
Requires Acid Neutralizer: Up to 1000 MBH	$711.56	3	**$2,134.69**
Reuse Existing Expansion Tank	$366.56	3	**$1,099.69**
Requires System Commissioning: Up to 1,000 MBH	$1,056.56	3	**$3,169.69**

Unforeseen Costs will be handled on a case by case basis

Total Cost = **$29,842.50**

If you have any questions please feel free to contact me at (732) 427-7278
Willdan Energy Solutions welcomes the opportunity to work with you.
Regrards,
Lime Energy
Christopher Fornicola
Christopher Fornicola
Program Manager

Acknowledged, accepted, and agreed, this _____ day of, _____, 2020 by the duly authorized representative of the undersigned:

Signature: _____

Name(please print): _____

Title: _____

Direct Install Contractor Checklist

Application # LM126376

Applicant Company Name: Harry S Truman Elementary

[x] - Lighting assessed and included in the EAT

[x] - Explored possibilities of adding lighting controls

[N/A] - Motors assessed and included in the EAT

[x] - Explored possibilities of adding Variable Frequency Drives

[x] - HVAC (electric cooling) assessed and included in the EAT

[x] - HVAC (gas heating) assessed and included in the EAT

[x] - Explored option of adding duel enthalpy or fuel use economizers to existing non qualifying units

[x] - Explored possibilities of adding faucet aerators, low flow showerheads or pre-rinse spray valves

[x] - Explored possibilities of adding thermostats to HVAC equipment

[x] - Explored possibilities of adding refrigeration equipment

All qualified lighting included. Sensors are not a good fit for the space. There is no motor opportunity. Explored and found no possibility of adding Variable Frequency Drives. Aerators and pipe wrap are included. This area is cooled by system type air cooled chillers which are not applicable to the DI program. This area is heated by two gas fired boilers and one gas fired storage water, and we are proposing to replace all three. Refrigeration controls are not required as lunches are brought in by outside vendor.

Comments:

_____ _____

Contractor signature Applicant signature

_____

NJ DIRECT INSTALL LIGHTING NOTES & EXCLUSIONS

In some cases, existing light levels in your facility may be higher than necessary when compared to current recommended lighting standards. To maximize your savings *and* provide a comfortable work environment, upgrades included in your Scope of Work may reduce lighting levels in your building. Please speak with your Direct Install account representative if you have any questions.

1) This Scope of Work assumes that all lighting equipment operates on voltages between 120V and 277V. If any lighting fixtures included in this scope operate at 480 volts, there will be additional costs that are not covered by the Direct Install program.

2) There are no allowances in this Scope of Work for battery backup systems that are integrated into existing luminaires. If these systems exist in your facility, there will be additional costs that are not covered by the Direct Install program to include battery backups in the retrofits or fixture replacements that are included in this Scope of Work. The unit price for this work is $150/each and shall be reviewed at the conclusion of the project, if applicable.

3) Mounting hardware for the exterior fixtures and high bay fixtures is not included in the program pricing. These measures are contingent upon the customer's acceptance of the Mounting Hardware proposal included herewith. Shielding requirements for exterior fixtures to prevent light trespass, where applicable, are also excluded from the program pricing.

4) There are no allowances for the correction of code violations, or additional on-incidental work required to meet changes in code requirements since the installation of the existing equipment. Conditions hidden from sight prior to removal of existing equipment are also excluded.

5) Lighting color temperature will be matched with existing color temperature unless otherwise directed at this time.

6) All projects will be done on 1st shift. Any work outside of the hours of 7am to 3pm will be an additional cost charged to the customer.

NJ DIRECT INSTALL HVAC NOTES & EXCLUSIONS

Air Distribution

The NJ Direct Install Program is a one for one equipment replacement and does not address pre-existing ductwork conditions. Some items that would be excluded are as follows:

1) Undersized, oversized and or damaged ductwork (Hard or Flex)

NJ DIRECT INSTALL HVAC NOTES & EXCLUSIONS (Cont'd)

2) Faulty VAV Boxes
3) Faulty Re-Heat Coils
4) Faulty or incorrect Supply Diffusers or Return Diffusers
5) Humidifiers, De-Humidifiers or Air Cleaners
6) Air Balancing of the system

BAS Systems
This proposal does not include the cost of special factory installed control boards or tying and programming into the existing system.

Code Violations
There are no allowances for the correction of code violations, or additional nonincidental work required to meet changes in code requirements since the installation of the existing equipment. Conditions hidden from sight prior to removal of existing equipment are also excluded.

Crane Costs
This proposal covers crane costs for installation and removal of items up to 20 feet vertical and 30 feet horizontal. There may be additional charges, if the required lift is greater in either dimension.

Duct Work
This proposal covers up to 2 linear feet of transition ductwork to tie the new unit into the existing duct system.

Fire Alarm
This proposal excludes wiring of HVAC smoke detectors to a building's fire alarm system. This must be completed by a certified fire alarm contractor. There are also no provisions within the program to install new smoke detectors, or to replace existing smoke detectors that are not in working condition.

Gas Piping & Condensate Lines
This proposal covers up to 10 linear feet of new piping to tie the new unit into the existing gas and condensate lines on packaged units, where required.

Railings
This proposal excludes safety railings or seismic strapping if required by code. Code requires HVAC equipment to be at least 10 feet away from the edge of the roof. If less than 10 feet, local building codes may require the installation of a safety railing.

Structural
This proposal excludes structural engineering, structural drawings, and structural steel work. Due to the nature of this project, you may be responsible for supplying a set of structural drawings to include with the permit package for approval. This proposal does not include the cost for any service needed above.

The pricing & scope provided herewith, does not include asbestos testing or remediation of any kind.

Signature: _____

Name: _____

Title: _____

Date: _____

HARRY S. TRUMAN
ELEMENTARY SCHOOL

To Whom It May Concern:

Due to our past relationship with Lime Energy, Harry S Truman Elementary would prefer to continue to work with Lime outside of their assigned New Jersey Direct Install territory at our facility located at ***1 Taft Pl, Parlin, NJ 08859***

Thank you,

New Jersey Office of Clean Energy
Direct Install Program
Energy Assessment Tool (V4.0C)

General Project Information

Participating Customer:	Sayreville Boro BD of Ed		**Facility Type:**	Education – Primary School	
Contractor / Project #:	Lime	LM126367	**HVAC Type:**	AC & Gas Heat	
Facility Name:	Jesse Selover School (BOE Office)		**Total Facility Square Footage:**	36,000	
Street Address:	150 Lincoln St		**Avg Weekly Hrs of Operation:**	40	
City / Zip Code:	South Amboy	08879	**# of Full-Time Employees:**	20	
Is this facility publicly owned?:	Y		**Year Constructed:**	1960	
BOE, MUA or other public entity property?	Y		**Tax Exempt?:**	Y	
			Project Permitting Costs:	$500.00	

Enhanced Incentive Eligibility

Project in UEZ?	N	**K-12 School?**	Y
Project in OZ?	N	**Municipality?**	N
		County Facility?	N

Electric Utility Information

Electric Provider:	PSE&G
Service Class:	GSS
Account #:	100 011 664 024
Billing Period Start Date:	10/19/19
Billing Period End Date:	11/18/19
Billing Period kWh Consumption:	11,745
Billing Period Total Cost:	$1,371.71
Total Taxes + Fees on Bill:	$11.13
Electric - Average Cost ($/kWh):	**$0.116**

Gas Utility Information

Gas Provider:	PSE&G
Service Class:	LVG
Account #:	73 376 953 06
Billing Period Start Date:	05/09/19
Billing Period End Date:	06/10/19
Billing Period Therm Consumption:	296
Billing Period Total Cost:	$154.98
Total Taxes + Fees on Bill:	$137.29
Gas - Average Cost ($/Therm):	**$0.060**

Oil Information

Annual Consumption (Gallons):	
Annual Cost:	
Annual Taxes + Fees on Bill:	
Oil - Average Cost ($/Gallon):	**$0.000**

Propane Information

Annual Consumption (Gallons):	
Annual Cost:	
Annual Taxes + Fees on Bill:	
Propane - Average Cost ($/Gallon):	**$0.000**

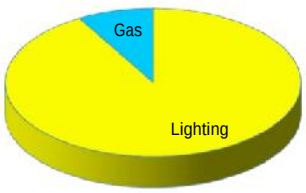
Project Summary

	Annual Energy Savings	Energy Units	Annual Cost Savings	Total Measure Cost	Estimated Incentive Amount	Total Cost to Customer
Lighting Measures Total:	52,489	kWh	$6,080.52	$29,690.15	$21,194.15	$8,496.00
Motors & VFD Measures Total:	0	kWh	$0.00	$0.00	$0.00	$0.00
HVAC Electric Measures Total:	0	kWh	$0.00	$0.00	$0.00	$0.00
Refrigeration Measures Total:	0	kWh	$0.00	$0.00	$0.00	$0.00
ELECTRIC MEASURES:	**52,489**	**kWh**	**$6,080.52**	**$29,690.15**	**$21,194.15**	**$8,496.00**
GAS MEASURES:	**9,230**	**Therms**	**$551.62**	**$72,736.10**	**$51,922.25**	**$20,813.85**
OIL MEASURES:	**0**	**Gallons**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
TOTAL PROPANE MEASURES:	**0**	**Gallons**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
CONVERSION MEASURES (OIL):	**0**	**Gallons**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
CONVERSION MEASURES GAS:	**0**	**Therms**				
COMBINED PROJECT TOTALS:			**$6,632.14**	**$102,426.25**	**$73,116.40**	**$29,309.85**

SIMPLE PAYBACK (YEARS): **4.42**

PROJECT TRC TEST: **2.26**

Projected Dollar Savings Per Measure Category



Direct Install Energy Assessment Tool (ver. 4.0C)
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DIRECT INSTALL PROGRAM

PARTICIPATION AGREEMENT

SCOPE OF WORK ATTACHMENT

LMLM126367

"Parties":				
Participating Customer*:	**Sayreville Boro BD of Ed**			
Participating Contractor*:	**Lime**			
Facility Name*:	**Jesse Selover School (BOE Office)**			
Facility Address:	**150 Lincoln St**	**South Amboy,**	**NJ**	**08879**
	Street	City		Zip

*as listed on Application

When fully signed, this Scope of Work Attachment ("Attachment") shall become part of the Direct Install Program Participation Agreement ("Participation Agreement") previously executed by the Parties in connection with the installation of energy efficiency retrofit Measures to be performed by the Participating Contractor (or "Contractor") at the above listed Facility. This Attachment, together with the Participation Agreement shall constitute the full Agreement between the Parties. Terms capitalized herein are defined in the Participation Agreement.

The Participating Customer (or "Customer") agrees to have Contractor perform retrofit work in connection with the Measures listed on page 2 of this form (attached). In consideration of the Contractor's performance of such work, Customer agrees to pay Contractor based on the measure costs listed below under Customer Unit Cost for the number of completed units for each Measure upon receipt of invoice; provided the Contractor may collect a deposit from Customer prior to performing such work, in which case the final invoice shall be net of such deposit. Customer and Contractor understand that conditions discovered during installation may require that some measures identified in the energy assessment cannot be installed, or some areas may require additional measures/quantities to be installed. Should conditions in the field dictate that the Estimated Program Total Cost shown on page 2 increase by more than 10%, Contractor must obtain both Program Administrator and Customer written approval in the form of an amended Scope of Work Attachment before proceeding with such additional work.

By signing below, the Parties agree the above listed Measures shall be installed by the Contractor. The Customer shall pay the Contractor as described herein following Completion and Acceptance of Measures. Customer certifies that he/she has the authority to contract for retrofit work in the Facility in connection with the Measures listed and, if the Customer does not own the Facility, the Owner has granted permission to Customer for performance of such work.

Participating Customer Date

Participating Contractor Date

Page 2
Scope of Work

The work to be performed by the Participating Contractor in connection with the Project shall be comprised of the below listed Measures in the estimated quantities listed:

Measure Description / Location	Quantity To Be Installed	Total Measure Cost	Estimated Customer Total Cost	Estimated Incentive Amount
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Class #17	9	$ 694.35	$ 198.69	$ 495.66
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Class #19	9	$ 694.35	$ 198.69	$ 495.66
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Class #20	9	$ 694.35	$ 198.69	$ 495.66
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Class #18	9	$ 694.35	$ 198.69	$ 495.66
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Boiler Room	4	$ 247.12	$ 70.71	$ 176.41
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Class #16	9	$ 694.35	$ 198.69	$ 495.66
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Mens	2	$ 109.30	$ 31.28	$ 78.02
Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / Womens	3	$ 252.87	$ 72.36	$ 180.51
Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / Class #15	14	$ 1,180.06	$ 337.68	$ 842.38
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Restroom	1	$ 65.07	$ 18.62	$ 46.45
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Closet	1	$ 65.07	$ 18.62	$ 46.45
Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / Class #22	14	$ 1,180.06	$ 337.68	$ 842.38
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Restroom	1	$ 65.07	$ 18.62	$ 46.45
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Closet	1	$ 65.07	$ 18.62	$ 46.45
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Class #14	14	$ 1,080.10	$ 309.08	$ 771.02
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Closet	1	$ 65.07	$ 18.62	$ 46.45
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Restroom	1	$ 65.07	$ 18.62	$ 46.45
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Class #23	14	$ 1,080.10	$ 309.08	$ 771.02
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Restroom	1	$ 65.07	$ 18.62	$ 46.45
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Closet	1	$ 65.07	$ 18.62	$ 46.45
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Main Office	10	$ 617.80	$ 176.79	$ 441.01
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Vestibule	1	$ 54.65	$ 15.64	$ 39.01
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Closet	1	$ 65.07	$ 18.62	$ 46.45
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Restroom	1	$ 65.07	$ 18.62	$ 46.45
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Security Office	4	$ 308.60	$ 88.31	$ 220.29
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Restroom	1	$ 65.07	$ 18.62	$ 46.45
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / IT/ Telephone Room	1	$ 54.65	$ 15.64	$ 39.01
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / IT/ Telephone Room	2	$ 123.56	$ 35.36	$ 88.20
Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / Office	4	$ 337.16	$ 96.48	$ 240.68
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Confrence Room	16	$ 988.48	$ 282.86	$ 705.62
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Closet	1	$ 65.07	$ 18.62	$ 46.45
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Restroom	1	$ 65.07	$ 18.62	$ 46.45
Relamp/Reballast: LED 1-Lamp PL 4-Pin / Spot Lights	3	$ 160.38	$ 45.89	$ 114.49
Fixture Replacement: LED Exit Sign: 2.3 W / Exit Signs	1	$ 72.90	$ 20.86	$ 52.04
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 2	8	$ 494.24	$ 141.43	$ 352.81
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Office	2	$ 154.30	$ 44.15	$ 110.15
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 10	12	$ 741.36	$ 212.14	$ 529.22
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 3	3	$ 185.34	$ 53.04	$ 132.30
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 9	12	$ 741.36	$ 212.14	$ 529.22
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 4	7	$ 432.46	$ 123.75	$ 308.71
Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 8	8	$ 674.32	$ 192.96	$ 481.36
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Womens	2	$ 154.30	$ 44.15	$ 110.15
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Closet	1	$ 65.07	$ 18.62	$ 46.45

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Savings values are estimates. Actual savings will vary.
Incentives and participation subject to program rules and Participation Agreement.

Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Custodian	1	$ 65.07	$ 18.62	$ 46.45
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / 1st Aid	1	$ 65.07	$ 18.62	$ 46.45
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Mens	2	$ 154.30	$ 44.15	$ 110.15
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Staff Room	1	$ 65.07	$ 18.62	$ 46.45
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Staff Room	4	$ 247.12	$ 70.71	$ 176.41
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Restroom	2	$ 130.14	$ 37.24	$ 92.90
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Vestibule	1	$ 65.07	$ 18.62	$ 46.45
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Closet	1	$ 65.07	$ 18.62	$ 46.45
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Lobby Entrance	2	$ 123.56	$ 35.36	$ 88.20
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 5	12	$ 741.36	$ 212.14	$ 529.22
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 6	12	$ 925.80	$ 264.92	$ 660.88
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Exit Lobby	2	$ 123.56	$ 35.36	$ 88.20
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Exit Lobby	1	$ 54.65	$ 15.64	$ 39.01
Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / Basement Storage Room	4	$ 337.16	$ 96.48	$ 240.68
Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / Custodial	2	$ 168.58	$ 48.24	$ 120.34
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Restroom Storage	1	$ 61.78	$ 17.68	$ 44.10
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Restroom	2	$ 130.14	$ 37.24	$ 92.90
Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / Maintenance	4	$ 337.16	$ 96.48	$ 240.68
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Boys Room	1	$ 61.78	$ 17.68	$ 44.10
Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / Boys Room	1	$ 84.29	$ 24.12	$ 60.17
Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / Storage	4	$ 337.16	$ 96.48	$ 240.68
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Storage	2	$ 123.56	$ 35.36	$ 88.20
Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / Electrical Panel	3	$ 252.87	$ 72.36	$ 180.51
Relamp: Direct Line LED - 6-Lamp - 4-Foot T8 (Stand. - 12.5W) / Storage	6	$ 731.52	$ 209.33	$ 522.19
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Storage	3	$ 185.34	$ 53.04	$ 132.30
Fixture Replacement: LED Exit Sign: 2.3 W / Storage	1	$ 72.90	$ 20.86	$ 52.04
Relamp: LED - BR40 (9 - 30W): 14 W / Storage	1	$ 26.04	$ 7.45	$ 18.59
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Hallway	9	$ 491.85	$ 140.75	$ 351.10
Fixture Replacement: LED Exit Sign: 2.3 W / Hallway	1	$ 72.90	$ 20.86	$ 52.04
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1st Fl Hallway	35	$ 1,912.75	$ 547.34	$ 1,365.41
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1st Fl Hallway	9	$ 694.35	$ 198.69	$ 495.66
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1st Fl Hallway	15	$ 926.70	$ 265.18	$ 661.52
Fixture Replacement: LED Exit Sign: 2.3 W / 1st Fl Hallway	5	$ 364.50	$ 104.30	$ 260.20
Fixture Replacement: LED Exit Sign: 2.3 W / 1st Fl Hallway	1	$ 72.90	$ 20.86	$ 52.04
Fixture Replacement: LED Architectural Flood/Spot (25 - 150W): 20 W / Exterior	14	$ 2,755.90	$ 788.62	$ 1,967.28
Fixture Replacement: LED Outdoor Wall Mount (14 - 60W): 17 W / Exterior	1	$ 190.76	$ 54.59	$ 136.17
Fixture Replacement: LED Outdoor Wall Mount (14 - 60W): 17 W / Exterior	1	$ 190.76	$ 54.59	$ 136.17
Fixture Replacement: LED Architectural Flood/Spot (25 - 150W): 148 W / Exterior	1	$ 472.46	$ 135.20	$ 337.26
Gas-Fired Boiler / Boiler Room	1	$ 65,142.00	$ 18,640.75	$ 46,501.25
Electronic Fuel-Use Economizers (for Steam Heat) / Steam Boiler	1	$ 2,466.50	$ 705.80	$ 1,760.70
Programmable Thermostats / Wall	1	$ 221.00	$ 63.24	$ 157.76
Low-Flow Aerators (Lavatory) / Classrooms, Restrooms,	19	$ 226.10	$ 64.70	$ 161.40
Pipe Wrap Insulation / boiler room	1	$ 1,084.50	$ 310.34	$ 774.16
Pipe Wrap Insulation / boiler room	1	$ 900.00	$ 257.54	$ 642.46
Pipe Wrap Insulation / boiler room	1	$ 1,408.00	$ 402.91	$ 1,005.09
Pipe Wrap Insulation / boiler room	1	$ 1,288.00	$ 368.57	$ 919.43
TOTALS**		$ 102,426.25	$ 29,309.85	$ 73,116.40

**Maximum incentive amount per project is $125,000. Measures that would qualify the project for funding through the State Energy Program (SEP) are identified above with an 'S'. If any "SEP measures" are included then the total incentive amount for all measures will be paid with SEP funds, otherwise the total incentive amount will come from NJ Clean Energy funds.

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New Jersey's cleanenergy program njcleanenergy.com

NEW JERSEY'S CLEAN ENERGY PROGRAM
DIRECT Install
PARTICIPATING CONTRACTOR

How did you learn about this Energy Efficiency Program?
☐ Advertisement ☐ Internet Search ☐ Mailer ☐ Video
☐ Tradeshow/Event ☐ Word of Mouth ☐ Radio ☐ Contractor
☐ Other _____

Direct Install Application and Participation Agreement
July 1, 2019 – June 30, 2020

Utility(ies) Serving Customer:

☐ Atlantic City Electric ☒ Jersey Central Power & Light ☐ PSE&G ☐ New Jersey Natural Gas
☐ Elizabethtown Gas ☐ Rockland Electric Co. ☐ South Jersey Gas ☐ Other Utility

Instructions

1. Fill out all applicable sections below.
2. Provide a completed Application and signed Participation Agreement to the Participating Contractor serving your area, along with copies of utility billing demonstrating average electric demand does not exceed 200 kW in the preceding 12 months.
3. Your Contractor or Program Manager will confirm program participation eligibility, perform the Energy Assessment, and arrange for final approval by the Program Manager prior to installing eligible measures.

Customer Information

Legal Name		Tax ID	NAICS Code
Company Address	City	State	Zip
Project Contact	Phone	E-Mail	
Customer to provide: a) Copies of required gas and electric billing ☐ Check if attached			

Facility Information (Facility on which Energy Assessment is to be conducted and measures provided)

Facility Address	City	State NJ	Zip
County	Utility Account Number(s): Electric _____ Gas _____		
Facility Name and Brief Type/Occupancy Description			

For Participating Contractor Use Only

Company Name		Contact
Contact Phone	Contact E-mail	Contractor Assigned Project Number
Average Electric Demand _____ kW (based on preceding 12 months)		Project Name

Enhanced Incentives – if applicable, check appropriate box

☐ K-12 Public School ☐ Municipality ☐ County Entity ☐ Facilities located in an NJ Urban Enterprise Zone
☐ Facilities located in an NJ Opportunity Zone

DIRECT INSTALL PARTICIPATION AGREEMENT

DEFINITIONS:

ADMINISTRATOR - The New Jersey Board of Public Utilities (NJBPU).

APPLICATION - Page 1 of this Application and Participation Agreement.

APPLICATION PACKAGE - Consists of the entirety of: an executed Application and Participation Agreement, utility billing demonstrating, if required, average electric demand not exceeding 200 kW in the preceding 12 months and completed Energy Assessment with Scope of Work Attachment. Measures may not be installed, and Incentives shall not be paid until after the Application Package is approved by the Program Manager.

COMPLETION AND ACCEPTANCE OF MEASURES - Work performed by Participating Contractor shall be deemed completed and accepted upon the signing of a Measure Acceptance Form by the Participating Customer and Program Manager.

ENERGY ASSESSMENT - An inventory of existing energy consuming equipment and analysis of possible replacement Measures generated by the Program-approved energy assessment tool to determine estimated energy savings, in addition to costs and Incentives eligible under the Program.

ENERGY-EFFICIENT MEASURES (or "Measures") - Any device or grouping of devices eligible to receive an Incentive through the Program.

INCENTIVE - An amount paid by the Direct Install component of New Jersey's Clean Energy Program through the Program Manager to the Participating Contractor in connection with the installation of a Measure. Incentives are available to cover up to 70% of the cost of installed Measures, and entities owned or operated by Municipalities, Counties, K-12 public schools, and customers located in UEZs or OZs may be eligible for incentives up to 80% of the cost of installed Measures. Incentives are subject to change without notice prior to the Program Manager approving the Application Package.

MEASURE ACCEPTANCE FORM – A document providing the means by which the Contractor and Customer confirm and accept the installation of Measures.

NEW JERSEY UTILITIES - The regulated electric and/or gas utilities in the State of New Jersey. They are: Atlantic City Electric, Jersey Central Power & Light, Rockland Electric Company, New Jersey Natural Gas, Elizabethtown Gas, PSE&G, and South Jersey Gas.

PARTICIPATING CONTRACTOR (or "Contractor") - An entity under contract to the Program Manager which performs Energy Assessments and installation of Measures in connection with the Program.

PARTICIPATING VENDOR (or "Vendor") - An entity under contract to the Program Manager which provides/supplies equipment directly to the program's contractors for project implementation.

PARTICIPATING CUSTOMER (or "Customer") - Those non-residential electric and/or gas service customers of the New Jersey utilities, municipal utilities or rural electric cooperatives who participate in the Program.

PRE-INSTALLED MEASURES - Measures installed before the application approval date shall not be included in the work scope and will not receive Program Incentives.

PROGRAM - New Jersey's Clean Energy Direct Install Program offered herein by the New Jersey Board of Public Utilities pursuant to state regulatory approval under the New Jersey Electric Discount and Energy Competition Act, NJSA 48:3-49, et seq, and subject to change without notice and subject to funding availability.

PROGRAM MANAGER - TRC

PROGRAM SCOPE - Services to be provided under the Program are limited to those directly associated with the evaluation and installation of Measures and shall in no way include work by the Contractor in connection with the correction of apparent or hidden safety issues or code violations. Contractor shall not perform work where, in its sole discretion, it is determined such safety issues or code violations exist. All work shall be performed during normal business hours, Monday through Friday unless the Customer and Contractor agree otherwise, in which case the Contractor shall not receive additional compensation for work performed outside of such normal business hours.

PROJECT - The Measure(s) to be installed in the facility listed under the Facility Information section of the application.

SCOPE OF WORK ATTACHMENT - A document generated by the Energy Assessment tool which lists the Measures eligible for installation, their Incentive Amounts and costs to be paid by the Customer. Once countersigned by the Customer and Contractor indicating the Measures to be installed in the Project and approval by the Program Manager, the Scope of Work Attachment shall be part of this Participation Agreement.

PARTICIPATION PROCESS:

1. Customer completes Application and provides necessary utility usage and demand data.
2. Contractor or Program Manager performs the Energy Assessment using the program-approved energy assessment tool. The Energy Assessment generates a Scope of Work Attachment for countersignature by the Customer to indicate which eligible Measures are to be included in the Project.
3. Contractor countersigns the Scope of Work Attachment and submits a full Application Package to the Program Manager for approval.
4. Upon Program Manager's approval, Contractor performs retrofit work to remove existing equipment and install Measures, and submits documentation of Project completion in the form of a Measure Acceptance Form signed by the Customer. Contractor invoices the Program Manager for the Incentive portion and the Customer for the balance.
5. Customer pays outstanding balance of costs, less any prior payment or deposit, to Contractor according to amounts listed on the Scope of Work Attachment.

The Program, or agent thereof, reserves the right to conduct inspections of the Project prior to or after the installation of Measures. To be eligible for Incentives, the Application Package must be approved by the Program Manager prior to Measure installation.

CHANGES TO THE PROGRAM - The Program and/or Participation Agreements may be changed by the Program Manager or Administrator at any time without notice, however, approved Application Packages will be processed to completion under the terms in effect at the time of approval.

ELIGIBILITY - Program services and Incentives are available to existing non-residential, commercial and industrial buildings with an average electric demand that did not exceed 200 kW in the preceding 12 months and served by at least one of the New Jersey utilities, municipal utilities or rural electric cooperatives who participate in the Program. If the Participant is a municipal electric company customer, and a customer of a regulated gas New Jersey utility, only gas Measures will be eligible under the Program.

Participating projects with a contract at or above current prevailing wage contract threshold amount set pursuant to the New Jersey Prevailing Wage Act (N.J.S.A. 34:11-56.25 et seq.) are required to pay no less than prevailing wage rate to workers employed in the performance of any construction undertaken in connection with Board of Public Utilities financial assistance, or undertaken to fulfill any condition of receiving Board of Public Utilities financial assistance, including the performance of any contract to construct, renovate or otherwise prepare a facility, the operations of which are necessary for the receipt of Board of Public Utilities financial assistance. By signing this application, the signatories agree to comply with the provisions of the New Jersey Prevailing Wage Act, N.J.S.A. 34: 11-56.25 et seq., (Act), if and to the extent that Act may apply to the work covered by this application. By submitting an application, or accepting program incentives, applicant agrees to adhere to New Jersey Prevailing Wage requirements, as applicable.

Customers of New Jersey utilities who have not contributed to the Societal Benefits Charge during the calendar year in which the Application Package is received by the Program Manager may not be eligible for Incentives offered through the Program.

NO ENDORSEMENT - The Program Manager and Administrator do not endorse, support or recommend any particular manufacturer, product or system design.

INCENTIVE AMOUNTS - Incentive amounts will be listed in the Scope of Work Attachment which, when completed and countersigned by the Customer and approved by the Program Manager, will be part of this Participation Agreement. The Customer will be responsible for paying the remaining balance of costs listed in the Scope of Work Attachment upon receipt of Contractor's invoice.

Incentives will be offered for eligible and qualifying Measures as determined from the Energy Assessment and listed on a separate Scope of Work Attachment. The Scope of Work Attachment shall be countersigned by the Customer to indicate eligible and qualifying Measures to be included in the Project. All Incentive payments shall be paid by the Program Manager directly to the Contractor. The Program is not bound to pay any Incentive unless the Application Package associated with the Incentive payment is approved by the Program Manager prior to Measure installation.

INCENTIVE CAP - Program Manager reserves the right to limit the amount of Incentives on a per-Project or Program basis. Any such caps on individual projects will be disclosed to Customers on the Scope of Work Attachment.

INSTALLATION AGREEMENT - Following completion of the Energy Assessment, but prior to commencement of any installation work, the Customer will be presented a separate Installation Agreement in the form of

DIRECT INSTALL PARTICIPATION AGREEMENT

a Scope of Work Attachment which shall become part of this Agreement. By executing the Scope of Work Attachment, the Customer agrees to allow the Contractor to install the eligible Measures identified in the Scope of Work Attachment.

WARRANTIES - THE PROGRAM MANAGER AND ADMINISTRATOR DO NOT EXPRESSLY OR IMPLIEDLY WARRANTY THE PERFORMANCE OF INSTALLED EQUIPMENT, AND/OR SERVICES RENDERED AS PART OF THIS PROGRAM. NO WARRANTIES OR REPRESENTATIONS OF ANY KIND, WHETHER STATUTORY, EXPRESS, OR IMPLIED, INCLUDING, WITHOUT LIMITATIONS, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE REGARDING EQUIPMENT OR SERVICES ARE PROVIDED BY ANY PARTY, INCLUDING THE PROGRAM MANAGER UNDER THE PROGRAM. CONTRACTOR SHALL EXTEND TO CUSTOMER FULL EQUIPMENT, MATERIALS AND LABOR WARRANTIES WITH AN EXPIRATION DATE OF THE LATER OF EITHER ONE YEAR FROM THE DATE OF INSTALLATION OR THE MANUFACTURER'S STANDARD WARRANTY EXPIRATION. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL WARRANTY ISSUES RELATING TO EQUIPMENT AND MATERIALS INSTALLED UNDER THE PROGRAM FOR A PERIOD OF ONE YEAR.

In no way shall the reviews, inspections, approvals and all other actions performed by the Program Manager under the Program be construed as a determination or acceptance of performance, applicability, dollar savings, or energy savings. The Program Manager and Administrator offer no guarantee or warranty of performance for equipment or labor provided in connection with the Program. The Contractors assume full responsibility and liability for the removal and installation of all equipment, including but not limited to design, specification, all permits, installation, maintenance, performance, and proper disposal of equipment removed, including lamps and ballasts.

LIMITATION OF LIABILITY – By virtue of participating in the Program, Participating Customer agrees to waive any and all claims or damages against the Program Manager, and the Administrator. Participating Customers agree that the Program Manager's and Administrator's liability, in connection with the Program, is limited to paying the Program Incentives specified directly to the Participating Contractor, for the value of the work performed/Measures installed, as identified in the Installation Agreement. Under no circumstances shall the Program Manager, its representatives, or subcontractors, or the Administrator be liable for any lost profits, special, punitive, consequential or incidental damages or for any other damages or claims connected with or resulting from participation in this Program. Further, any liability attributed to the Program Manager or its subcontractors under this Program shall be individual, and not joint and/or several.

IDEMNIFICATION – As part of agreeing to participate in the Program, which includes financial incentives to reduce the customer's net project costs, the Participating Customer agrees to indemnify and hold harmless the Program Manager and Administrator and their respective staffs with respect to the Project.

INSPECTION – Customer agrees to grant the Program reasonable access to Customer's Facility to inspect both pre-existing equipment (if applicable) and the Measures installed under this Program, either prior to issuing Incentives or at a later time.

PROGRAM OFFER – The Program covers services rendered on or after July 1, 2019. Program Incentives are available to non-residential retail electric and/or gas service customers of the New Jersey Utilities.

TAX LIABILITY – Neither the Program Manager nor Contractor shall be responsible for any tax liability that may be imposed on any Customer as a result of the payment of Program Incentives.

TERMINATION – The Administrator reserves the right to extend, modify (this includes modification of Program Incentive levels) or terminate this program without prior or further notice.

CUSTOMER ACKNOWLEDGEMENT – I have read, understood and am in compliance with all rules and regulations concerning this incentive Program. I certify that all information provided is correct to the best of my knowledge, and I give the Program Manager permission to share my records with the New Jersey Board of Public Utilities, and contractors it selects to manage, coordinate or evaluate New Jersey's Clean Energy Programs, including the release of electric and natural gas utility billing information. I allow reasonable access to my property to inspect the installation and performance of the technologies and installations that are eligible for Incentives under the guidelines of New Jersey's Clean Energy Program. This Participation Agreement supersedes all other communications and representations. I agree that this document and all notices and disclosures made or given relating to this document may be created, executed, delivered and retained electronically and that the electronic signatures appearing on this document and any related documents shall have the same legal effect for all purposes as a handwritten signature. The information, statements, and documents I have provided in and with this document are true and accurate to the best of my knowledge. I am aware that if any of them are willfully false, I am subject to punishment.

Other Funding Sources

☐ Check the box if an Energy Savings Improvement Program (ESIP) will be a source of funding. ESIP allows government agencies to pay for energy related improvements using the value of the resulting energy savings.

The Parties signing below certify they are duly authorized to enter into this agreement and hereby accept the above terms:

PARTICIPATING CUSTOMER

Name of Participating Customer

Authorized Signature | Date

CONTRACTOR'S COUNTERSIGNATURE

By signing, below, I certify that I have received the Customer's Application Package and will, in connection with the Project, perform my obligations as Participating Contractor as outlined in the separate Program Contractor Agreement executed between the Contractor below and the Program Manager.

PARTICIPATING CONTRACTOR

Name of Participating Contractor

Authorized Signature | Date

PAYMENT TERMS

This Contract is entered by and between

Lime Energy of 4 Gateway Center, 100 Mulberry St, Newark, NJ 07102

	MAIN OFFICE	PROJECT LOCATION
Customer	Sayreville Board of Education	Selover School
Address	150 Lincoln St	- Same -
City, ST, Zip:	South Amboy	- Same -
Contact:	Barbara Malewicz	- Same -
Telephone:	609-659-7400	- Same -

("Customer") relative to the work described below:

Total Project Cost	**Customer Contribution**
$102,426.25	$29,309.85
Additional Cost Outside of Program	**Total Customer Contribution**
$17,940.00	**$47,249.85**

1. The **Customer** shall pay to **Lime** 1/2 of the net customer cost at Scope of Work (SOW) TRC approval. The **Customer** shall pay **Lime** the final balance of the net customer cost upon project completion, Net 30.
2. Change in SOW resulting in an increase/decrease in customer co-pay will be executed only upon receipt of written approval by **Customer** and will be reflected in final invoice.
3. Accepted payment methods are: Money Order, Bank Check, Personal Check, Credit Card (Visa, Mastercard, Discover Card).

1st Payment **$23,624.93**
2nd & Final Payment **$23,624.93**

Accepted this_____ Day of_____, ____2020_____.
(Day) (month) (year)

Lime Signature:	Customer Signature Duly Authorized:
Printed Name:	Printed Name:

Acceptance of Contract: The above prices, specifications, and conditions are satisfactory and are here-by accepted. Willdan authorized to perform the work as specified based on TRC approval. Payments will be made as outlined above.

Lime Energy

Company Name:	Sayreville BOE - Selover School
Address:	150 Lincoln St
Contact:	Barbara Malewicz
Phone:	609-659-7400
Work order #:	LM126366

Project Description: The following list defines extra work required for a proper and "up-to-code" mechanical installation for this project. The costs associated with this extra work is NOT covered by the Direct Install program.

Materials & Labor is as follows:

Description	Unit Cost	Qty	Sub-Total
Requires Demolition: Level 7	$4,830.00	1	**$4,830.00**
Requires Boiler Repiping (Reconfiguration to Prir	$3,910.00	1	**$3,910.00**
Requires Boiler Water-Treatment	$1,150.00	1	**$1,150.00**
Requires Hydronic-Heating Filter for Iron Oxide S	$1,150.00	1	**$1,150.00**
Requires New Venting System	$2,760.00	1	**$2,760.00**
Requires Condensate Piping: Level 2	$230.00	1	**$230.00**
Requires Acid Neutralizer	$690.00	1	**$690.00**
Reuse Existing Expansion Tank	$230.00	1	**$230.00**
Requires Rigging: Level 4	$1,380.00	1	**$1,380.00**
Requires System Commissioning	$1,380.00	1	**$1,380.00**
Requires On-Site Building Department Inspectior	$230.00	1	**$230.00**

Unforeseen Costs will be handled on a case by case basis

Unforeseen Costs will be handled on a case by case basis

Total Cost = **$17,940.00**

If you have any questions please feel free to contact me at (732) 427-7278
Willdan Energy Solutions welcomes the opportunity to work with you.
Regrards,
Lime Energy

Christopher Fornicola
Christopher Fornicola
Program Manager

Acknowledged, accepted, and agreed, this _____ day of, _____, 2020 by the duly authorized representative of the undersigned:

Signature: _____

Name(please print): _____

Title: _____

Direct Install Contractor Checklist

Application # LM126367

Applicant Company Name: Selover School South Amboy

[x] - Lighting assessed and included in the EAT

[x] - Explored possibilities of adding lighting controls

[N/A] - Motors assessed and included in the EAT

[x] - Explored possibilities of adding Variable Frequency Drives

[N/A] - HVAC (electric cooling) assessed and included in the EAT

[x] - HVAC (gas heating) assessed and included in the EAT

[x] - Explored option of adding duel enthalpy or fuel use economizers to existing non qualifying units

[x] - Explored possibilities of adding faucet aerators, low flow showerheads or pre-rinse spray valves

[x] - Explored possibilities of adding thermostats to HVAC equipment

[x] - Explored possibilities of adding refrigeration equipment

All qualified lighting included. Sensors are not a good fit for the space. There is no motor opportunity. Explored and found no possibility of adding Variable Frequency Drives. Aerators and pipe wrap are included. This area is cooled by multiple Mini Split AC condensers. The area is heated by a gas fired boiler which we are proposing to replace. It is also heated by a gas-fired storage water heater which are not replacing but proposing electronic fuel-use economizer for this unit. Refrigeration controls are not required as lunches are brought in by outside vendor.

Comments:

_____ _____

Contractor signature Applicant signature

_____

NJ DIRECT INSTALL LIGHTING NOTES & EXCLUSIONS

In some cases, existing light levels in your facility may be higher than necessary when compared to current recommended lighting standards. To maximize your savings *and* provide a comfortable work environment, upgrades included in your Scope of Work may reduce lighting levels in your building. Please speak with your Direct Install account representative if you have any questions.

1) This Scope of Work assumes that all lighting equipment operates on voltages between 120V and 277V. If any lighting fixtures included in this scope operate at 480 volts, there will be additional costs that are not covered by the Direct Install program.

2) There are no allowances in this Scope of Work for battery backup systems that are integrated into existing luminaires. If these systems exist in your facility, there will be additional costs that are not covered by the Direct Install program to include battery backups in the retrofits or fixture replacements that are included in this Scope of Work. The unit price for this work is $150/each and shall be reviewed at the conclusion of the project, if applicable.

3) Mounting hardware for the exterior fixtures and high bay fixtures is not included in the program pricing. These measures are contingent upon the customer's acceptance of the Mounting Hardware proposal included herewith. Shielding requirements for exterior fixtures to prevent light trespass, where applicable, are also excluded from the program pricing.

4) There are no allowances for the correction of code violations, or additional on-incidental work required to meet changes in code requirements since the installation of the existing equipment. Conditions hidden from sight prior to removal of existing equipment are also excluded.

5) Lighting color temperature will be matched with existing color temperature unless otherwise directed at this time.

6) All projects will be done on 1st shift. Any work outside of the hours of 7am to 3pm will be an additional cost charged to the customer.

NJ DIRECT INSTALL HVAC NOTES & EXCLUSIONS

Air Distribution

The NJ Direct Install Program is a one for one equipment replacement and does not address pre-existing ductwork conditions. Some items that would be excluded are as follows:

1) Undersized, oversized and or damaged ductwork (Hard or Flex)

NJ DIRECT INSTALL HVAC NOTES & EXCLUSIONS (Cont'd)

2) Faulty VAV Boxes
3) Faulty Re-Heat Coils
4) Faulty or incorrect Supply Diffusers or Return Diffusers
5) Humidifiers, De-Humidifiers or Air Cleaners
6) Air Balancing of the system

BAS Systems
This proposal does not include the cost of special factory installed control boards or tying and programming into the existing system.

Code Violations
There are no allowances for the correction of code violations, or additional nonincidental work required to meet changes in code requirements since the installation of the existing equipment. Conditions hidden from sight prior to removal of existing equipment are also excluded.

Crane Costs
This proposal covers crane costs for installation and removal of items up to 20 feet vertical and 30 feet horizontal. There may be additional charges, if the required lift is greater in either dimension.

Duct Work
This proposal covers up to 2 linear feet of transition ductwork to tie the new unit into the existing duct system.

Fire Alarm
This proposal excludes wiring of HVAC smoke detectors to a building's fire alarm system. This must be completed by a certified fire alarm contractor. There are also no provisions within the program to install new smoke detectors, or to replace existing smoke detectors that are not in working condition.

Gas Piping & Condensate Lines
This proposal covers up to 10 linear feet of new piping to tie the new unit into the existing gas and condensate lines on packaged units, where required.

Railings
This proposal excludes safety railings or seismic strapping if required by code. Code requires HVAC equipment to be at least 10 feet away from the edge of the roof. If less than 10 feet, local building codes may require the installation of a safety railing.

Structural
This proposal excludes structural engineering, structural drawings, and structural steel work. Due to the nature of this project, you may be responsible for supplying a set of structural drawings to include with the permit package for approval. This proposal does not include the cost for any service needed above.

The pricing & scope provided herewith, does not include asbestos testing or remediation of any kind.

Signature: _____

Name: _____

Title: _____

Date: _____



To Whom It May Concern:

Due to our past relationship with Lime Energy, Selover School would prefer to continue to work with Lime outside of their assigned New Jersey Direct Install territory at our facility located at ***150 Lincoln St, South Amboy, NJ 08879***

Thank you,

New Jersey Office of Clean Energy
Direct Install Program
Energy Assessment Tool (V4.0C)

General Project Information

Participating Customer:	Sayreville Boro BD of ED		**Facility Type:**	Education – Primary School
Contractor / Project #:	Lime	LM126365	**HVAC Type:**	AC & Gas Heat
Facility Name:	Wilson School		**Total Facility Square Footage:**	54,150
Street Address:	75 Dane Street		**Avg Weekly Hrs of Operation:**	50
City / Zip Code:	Sayreville	08872	**# of Full-Time Employees:**	20
Is this facility publicly owned?:		Y	**Year Constructed:**	1960
BOE, MUA or other public entity property?		Y	**Tax Exempt?:**	Y
			Project Permitting Costs:	$500.00

Enhanced Incentive Eligibility

Project in UEZ?	N	**K-12 School?**	Y
Project in OZ?	N	**Municipality?**	N
		County Facility?	N

Electric Utility Information

Electric Provider:	Jersey Central Power & Light
Service Class:	GSS
Account #:	100 012 970 107
Billing Period Start Date:	06/19/19
Billing Period End Date:	07/18/19
Billing Period kWh Consumption:	27,000
Billing Period Total Cost:	$2,162.25
Total Taxes + Fees on Bill:	$11.13
Electric - Average Cost ($/kWh):	**$0.080**

Gas Utility Information

Gas Provider:	PSE&G
Service Class:	GSG
Account #:	
Billing Period Start Date:	
Billing Period End Date:	
Billing Period Therm Consumption:	
Billing Period Total Cost:	
Total Taxes + Fees on Bill:	
Gas - Average Cost ($/Therm):	**$0.000**

Oil Information

Annual Consumption (Gallons):	
Annual Cost:	
Annual Taxes + Fees on Bill:	
Oil - Average Cost ($/Gallon):	**$0.000**

Propane Information

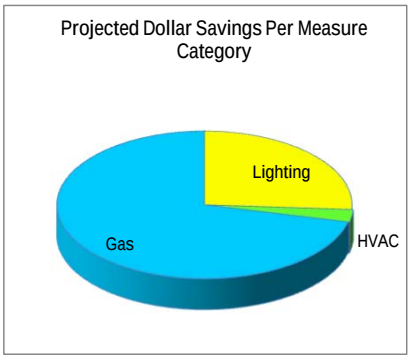
Annual Consumption (Gallons):	
Annual Cost:	
Annual Taxes + Fees on Bill:	
Propane - Average Cost ($/Gallon):	**$0.000**

Project Summary

	Annual Energy Savings	Energy Units	Annual Cost Savings	Total Measure Cost	Estimated Incentive Amount	Total Cost to Customer
Lighting Measures Total:	58,487	kWh	$4,659.74	$30,122.27	$15,495.16	$14,627.11
Motors & VFD Measures Total:	0	kWh	$0.00	$0.00	$0.00	$0.00
HVAC Electric Measures Total:	6,100	kWh	$485.99	$23,590.66	$12,135.25	$11,455.41
Refrigeration Measures Total:	0	kWh	$0.00	$0.00	$0.00	$0.00
ELECTRIC MEASURES:	**64,587**	**kWh**	**$5,145.74**	**$53,712.93**	**$27,630.41**	**$26,082.52**
GAS MEASURES:	**14,184**	**Therms**	**$12,765.82**	**$149,236.69**	**$76,768.69**	**$72,468.00**
OIL MEASURES:	**0**	**Gallons**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
TOTAL PROPANE MEASURES:	**0**	**Gallons**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
CONVERSION MEASURES (OIL):	**0**	**Gallons**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
CONVERSION MEASURES GAS:	**0**	**Therms**				
COMBINED PROJECT TOTALS:			**$17,911.56**	**$202,949.62**	**$104,399.10**	**$98,550.52**

SIMPLE PAYBACK (YEARS): **5.50**

PROJECT TRC TEST: **2.29**



Direct Install Energy Assessment Tool (ver. 4.0C)
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DIRECT INSTALL PROGRAM

PARTICIPATION AGREEMENT

SCOPE OF WORK ATTACHMENT

LMLM126365

"Parties":

Participating Customer*:	**Sayreville Boro BD of ED**			
Participating Contractor*:	**Lime**			
Facility Name*:	**Wilson School**			
Facility Address:	**75 Dane Street**	**Sayreville,**	**NJ**	**08872**
	Street	City		Zip

*as listed on Application

When fully signed, this Scope of Work Attachment ("Attachment") shall become part of the Direct Install Program Participation Agreement ("Participation Agreement") previously executed by the Parties in connection with the installation of energy efficiency retrofit Measures to be performed by the Participating Contractor (or "Contractor") at the above listed Facility. This Attachment, together with the Participation Agreement shall constitute the full Agreement between the Parties. Terms capitalized herein are defined in the Participation Agreement.

The Participating Customer (or "Customer") agrees to have Contractor perform retrofit work in connection with the Measures listed on page 2 of this form (attached). In consideration of the Contractor's performance of such work, Customer agrees to pay Contractor based on the measure costs listed below under Customer Unit Cost for the number of completed units for each Measure upon receipt of invoice; provided the Contractor may collect a deposit from Customer prior to performing such work, in which case the final invoice shall be net of such deposit. Customer and Contractor understand that conditions discovered during installation may require that some measures identified in the energy assessment cannot be installed, or some areas may require additional measures/quantities to be installed. Should conditions in the field dictate that the Estimated Program Total Cost shown on page 2 increase by more than 10%, Contractor must obtain both Program Administrator and Customer written approval in the form of an amended Scope of Work Attachment before proceeding with such additional work.

By signing below, the Parties agree the above listed Measures shall be installed by the Contractor. The Customer shall pay the Contractor as described herein following Completion and Acceptance of Measures. Customer certifies that he/she has the authority to contract for retrofit work in the Facility in connection with the Measures listed and, if the Customer does not own the Facility, the Owner has granted permission to Customer for performance of such work.

Participating Customer Date

Participating Contractor Date

Page 2
Scope of Work

The work to be performed by the Participating Contractor in connection with the Project shall be comprised of the below listed Measures in the estimated quantities listed:

Measure Description / Location	Quantity To Be Installed	Total Measure Cost	Estimated Customer Total Cost	Estimated Incentive Amount
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 2nd Fl Principals Office	2	$ 123.56	$ 60.00	$ 63.56
Relamp: Direct Line LED - 2-Lamp - 2-Foot T8 / Restroom	1	$ 65.07	$ 31.60	$ 33.47
Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 27	6	$ 505.74	$ 245.58	$ 260.16
Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 28	6	$ 505.74	$ 245.58	$ 260.16
Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / Girls Room	2	$ 168.58	$ 81.86	$ 86.72
Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 29	6	$ 505.74	$ 245.58	$ 260.16
Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 30	6	$ 505.74	$ 245.58	$ 260.16
Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 31	6	$ 505.74	$ 245.58	$ 260.16
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / Closet	1	$ 56.29	$ 27.33	$ 28.96
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Office	2	$ 123.56	$ 60.00	$ 63.56
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / Restroom	1	$ 56.29	$ 27.33	$ 28.96
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 26	10	$ 617.80	$ 300.00	$ 317.80
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 25	10	$ 617.80	$ 300.00	$ 317.80
Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / Boys Room	2	$ 168.58	$ 81.86	$ 86.72
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 24	10	$ 617.80	$ 300.00	$ 317.80
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 23	10	$ 617.80	$ 300.00	$ 317.80
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Art Room	12	$ 741.36	$ 360.00	$ 381.36
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / Closets	2	$ 112.58	$ 54.67	$ 57.91
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 21	12	$ 741.36	$ 360.00	$ 381.36
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / Closets	2	$ 112.58	$ 54.67	$ 57.91
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Library	20	$ 1,235.60	$ 600.00	$ 635.60
Relamp: Direct Line LED - 1-Lamp - 2-Foot T8 / Closet	1	$ 56.29	$ 27.33	$ 28.96
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Hallway	26	$ 1,606.28	$ 780.00	$ 826.28
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Hallway	2	$ 123.56	$ 60.00	$ 63.56
Fixture Replacement: LED Exit Sign: 2.3 W / Hallway	1	$ 72.90	$ 35.40	$ 37.50
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / 1st Fl Boys	2	$ 123.56	$ 60.00	$ 63.56
Relamp/Reballast: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W / 1st Fl Boys	1	$ 85.18	$ 41.36	$ 43.82
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 8	4	$ 247.12	$ 120.00	$ 127.12
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 7	6	$ 370.68	$ 180.00	$ 190.68
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 6	15	$ 926.70	$ 450.00	$ 476.70
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Mens	2	$ 123.56	$ 60.00	$ 63.56
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 5	12	$ 741.36	$ 360.00	$ 381.36
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Slop Sink	1	$ 54.65	$ 26.54	$ 28.11
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 4	4	$ 247.12	$ 120.00	$ 127.12
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 3	10	$ 617.80	$ 300.00	$ 317.80
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 2	10	$ 617.80	$ 300.00	$ 317.80
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 1	8	$ 494.24	$ 240.00	$ 254.24
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Gym	32	$ 2,966.40	$ 1,440.46	$ 1,525.94
Fixture Replacement: LED Exit Sign: 2.3 W / Gym	2	$ 145.80	$ 70.80	$ 75.00
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Speech	1	$ 54.65	$ 26.54	$ 28.11
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Office	2	$ 123.56	$ 60.00	$ 63.56
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Nurse	1	$ 54.65	$ 26.54	$ 28.11
Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / Storage	1	$ 84.29	$ 40.93	$ 43.36

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Savings values are estimates. Actual savings will vary.
Incentives and participation subject to program rules and Participation Agreement.

Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom	6	$ 370.68	$ 180.00	$ 190.68
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Vestibule	1	$ 54.65	$ 26.54	$ 28.11
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Girls Room	2	$ 123.56	$ 60.00	$ 63.56
Relamp: Direct Line LED - 4-Lamp - 4-Foot T8 (Stand. - 12.5W) / Girls Room	6	$ 505.74	$ 245.58	$ 260.16
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Boys Room	2	$ 123.56	$ 60.00	$ 63.56
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Cafeteria	10	$ 771.50	$ 374.63	$ 396.87
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Kitchen	4	$ 247.12	$ 120.00	$ 127.12
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Exit Signs	1	$ 61.78	$ 30.00	$ 31.78
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Teachers Lounge	9	$ 556.02	$ 270.00	$ 286.02
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Classroom 9	8	$ 494.24	$ 240.00	$ 254.24
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Girls Room	2	$ 123.56	$ 60.00	$ 63.56
Relamp/Reballast: Plug & Play LED - 2-Lamp - U-Bend (U6): 12W / Girls Room	1	$ 85.18	$ 41.36	$ 43.82
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Auditorium	8	$ 494.24	$ 240.00	$ 254.24
Relamp: Direct Line LED - 3-Lamp - 4-Foot T8 (Stand. - 12.5W) / Auditorium	8	$ 741.60	$ 360.11	$ 381.49
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Stage	2	$ 123.56	$ 60.00	$ 63.56
Fixture Replacement: LED Exit Sign: 2.3 W / Stage	2	$ 145.80	$ 70.80	$ 75.00
Fixture Replacement: LED Exit Sign: 2.3 W / Stage	4	$ 291.60	$ 141.60	$ 150.00
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Hallway	25	$ 1,366.25	$ 663.44	$ 702.81
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Hallway	22	$ 1,359.16	$ 660.00	$ 699.16
Fixture Replacement: LED Exit Sign: 2.3 W / Hallway	8	$ 583.20	$ 283.20	$ 300.00
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Exit Signs	1	$ 61.78	$ 30.00	$ 31.78
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Stairwell	2	$ 123.56	$ 60.00	$ 63.56
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Stairwell	1	$ 61.78	$ 30.00	$ 31.78
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Stairwell	3	$ 185.34	$ 90.00	$ 95.34
Fixture Replacement: LED Exit Sign: 2.3 W / Stairwell	1	$ 72.90	$ 35.40	$ 37.50
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Basement Storage	6	$ 370.68	$ 180.00	$ 190.68
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Elec Room	1	$ 54.65	$ 26.54	$ 28.11
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Boiler Room	1	$ 61.78	$ 30.00	$ 31.78
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Boiler Room	1	$ 54.65	$ 26.54	$ 28.11
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Boiler Room	1	$ 61.78	$ 30.00	$ 31.78
Relamp: LED - BR40 (9 - 30W): 17 W / Boiler Room	1	$ 27.58	$ 13.39	$ 14.19
Fixture Replacement: LED Exit Sign: 2.3 W / Boiler Room	1	$ 72.90	$ 35.40	$ 37.50
Relamp: Direct Line LED - 1-Lamp - 4-Foot T8 (Stand. - 12.5W) / Boiler Room	2	$ 109.30	$ 53.08	$ 56.22
Fixture Replacement: LED Exit Sign: 2.3 W / Boiler Room	1	$ 72.90	$ 35.40	$ 37.50
Relamp: Direct Line LED - 2-Lamp - 4-Foot T8 (Stand. - 12.5W) / Stairwell	2	$ 123.56	$ 60.00	$ 63.56
Fixture Replacement: LED Architectural Flood/Spot (25 - 150W): 20 W / Exterior	3	$ 654.81	$ 317.97	$ 336.84
Fixture Replacement: LED Outdoor Wall Mount (14 - 60W): 22 W / Exterior	1	$ 191.98	$ 93.22	$ 98.76
Fixture Replacement: LED Architectural Flood/Spot (25 - 150W): 148 W / Exterior	1	$ 493.88	$ 239.82	$ 254.06
Packaged RTU (Electric Only): 15-Tons / roof	1	$ 20,915.00	$ 10,156.14	$ 10,758.86
Dual Enthalpy Economizers / RTU	1	$ 1,705.16	$ 828.01	$ 877.15
Electronic Fuel-Use Economizers (for AC) / RTU	1	$ 970.50	$ 471.27	$ 499.23
Gas-Fired Boiler / boiler room	1	$ 143,463.99	$ 69,664.83	$ 73,799.16
Programmable Thermostats / Wall	3	$ 663.00	$ 321.95	$ 341.05
Low-Flow Aerators (Lavatory) / Restrooms	16	$ 190.40	$ 92.46	$ 97.94
Low-Flow Aerators (Kitchen) / Kitchen	2	$ 24.80	$ 12.04	$ 12.76
Pre-Rinse Spray Valves / Kitchen	1	$ 95.75	$ 46.50	$ 49.25
Pipe Wrap Insulation / Boiler Room	1	$ 1,531.25	$ 743.56	$ 787.69
Pipe Wrap Insulation / Boiler Room	1	$ 1,128.75	$ 548.11	$ 580.64
Pipe Wrap Insulation / Boiler Room	1	$ 1,341.25	$ 651.30	$ 689.95
Pipe Wrap Insulation / Boiler Room	1	$ 797.50	$ 387.26	$ 410.24
TOTALS**		$ 202,949.62	$ 98,550.52	$ 104,399.10

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Savings values are estimates. Actual savings will vary.
Incentives and participation subject to program rules and Participation Agreement.

**Maximum incentive amount per project is $125,000. Measures that would qualify the project for funding through the State Energy Program (SEP) are identified above with an 'S'. If any "SEP measures" are included then the total incentive amount for all measures will be paid with SEP funds, otherwise the total incentive amount will come from NJ Clean Energy funds.

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New Jersey's cleanenergy program njcleanenergy.com

NEW JERSEY'S CLEAN ENERGY PROGRAM
DIRECT Install
PARTICIPATING CONTRACTOR

How did you learn about this Energy Efficiency Program?
☐ Advertisement ☐ Internet Search ☐ Mailer ☐ Video
☐ Tradeshow/Event ☐ Word of Mouth ☐ Radio ☐ Contractor
☐ Other _____

Direct Install Application and Participation Agreement
July 1, 2019 – June 30, 2020

Utility(ies) Serving Customer:

☐ Atlantic City Electric ☒ Jersey Central Power & Light ☐ PSE&G ☐ New Jersey Natural Gas
☐ Elizabethtown Gas ☐ Rockland Electric Co. ☐ South Jersey Gas ☐ Other Utility

Instructions

1. Fill out all applicable sections below.
2. Provide a completed Application and signed Participation Agreement to the Participating Contractor serving your area, along with copies of utility billing demonstrating average electric demand does not exceed 200 kW in the preceding 12 months.
3. Your Contractor or Program Manager will confirm program participation eligibility, perform the Energy Assessment, and arrange for final approval by the Program Manager prior to installing eligible measures.

Customer Information

Legal Name		Tax ID	NAICS Code
Company Address	City	State	Zip
Project Contact	Phone	E-Mail	
Customer to provide: a) Copies of required gas and electric billing ☐ Check if attached			

Facility Information (Facility on which Energy Assessment is to be conducted and measures provided)

Facility Address	City	State NJ	Zip
County	Utility Account Number(s): Electric _____ Gas _____		
Facility Name and Brief Type/Occupancy Description			

For Participating Contractor Use Only

Company Name		Contact
Contact Phone	Contact E-mail	Contractor Assigned Project Number
Average Electric Demand _____ kW (based on preceding 12 months)		Project Name

Enhanced Incentives – if applicable, check appropriate box

☐ K-12 Public School ☐ Municipality ☐ County Entity ☐ Facilities located in an NJ Urban Enterprise Zone
☐ Facilities located in an NJ Opportunity Zone

DIRECT INSTALL PARTICIPATION AGREEMENT

DEFINITIONS:

ADMINISTRATOR - The New Jersey Board of Public Utilities (NJBPU).

APPLICATION - Page 1 of this Application and Participation Agreement.

APPLICATION PACKAGE - Consists of the entirety of: an executed Application and Participation Agreement, utility billing demonstrating, if required, average electric demand not exceeding 200 kW in the preceding 12 months and completed Energy Assessment with Scope of Work Attachment. Measures may not be installed, and Incentives shall not be paid until after the Application Package is approved by the Program Manager.

COMPLETION AND ACCEPTANCE OF MEASURES - Work performed by Participating Contractor shall be deemed completed and accepted upon the signing of a Measure Acceptance Form by the Participating Customer and Program Manager.

ENERGY ASSESSMENT - An inventory of existing energy consuming equipment and analysis of possible replacement Measures generated by the Program-approved energy assessment tool to determine estimated energy savings, in addition to costs and Incentives eligible under the Program.

ENERGY-EFFICIENT MEASURES (or "Measures") - Any device or grouping of devices eligible to receive an Incentive through the Program.

INCENTIVE - An amount paid by the Direct Install component of New Jersey's Clean Energy Program through the Program Manager to the Participating Contractor in connection with the installation of a Measure. Incentives are available to cover up to 70% of the cost of installed Measures, and entities owned or operated by Municipalities, Counties, K-12 public schools, and customers located in UEZs or OZs may be eligible for incentives up to 80% of the cost of installed Measures. Incentives are subject to change without notice prior to the Program Manager approving the Application Package.

MEASURE ACCEPTANCE FORM – A document providing the means by which the Contractor and Customer confirm and accept the installation of Measures.

NEW JERSEY UTILITIES - The regulated electric and/or gas utilities in the State of New Jersey. They are: Atlantic City Electric, Jersey Central Power & Light, Rockland Electric Company, New Jersey Natural Gas, Elizabethtown Gas, PSE&G, and South Jersey Gas.

PARTICIPATING CONTRACTOR (or "Contractor") - An entity under contract to the Program Manager which performs Energy Assessments and installation of Measures in connection with the Program.

PARTICIPATING VENDOR (or "Vendor") - An entity under contract to the Program Manager which provides/supplies equipment directly to the program's contractors for project implementation.

PARTICIPATING CUSTOMER (or "Customer") - Those non-residential electric and/or gas service customers of the New Jersey utilities, municipal utilities or rural electric cooperatives who participate in the Program.

PRE-INSTALLED MEASURES - Measures installed before the application approval date shall not be included in the work scope and will not receive Program Incentives.

PROGRAM - New Jersey's Clean Energy Direct Install Program offered herein by the New Jersey Board of Public Utilities pursuant to state regulatory approval under the New Jersey Electric Discount and Energy Competition Act, NJSA 48:3-49, et seq, and subject to change without notice and subject to funding availability.

PROGRAM MANAGER - TRC

PROGRAM SCOPE - Services to be provided under the Program are limited to those directly associated with the evaluation and installation of Measures and shall in no way include work by the Contractor in connection with the correction of apparent or hidden safety issues or code violations. Contractor shall not perform work where, in its sole discretion, it is determined such safety issues or code violations exist. All work shall be performed during normal business hours, Monday through Friday unless the Customer and Contractor agree otherwise, in which case the Contractor shall not receive additional compensation for work performed outside of such normal business hours.

PROJECT - The Measure(s) to be installed in the facility listed under the Facility Information section of the application.

SCOPE OF WORK ATTACHMENT - A document generated by the Energy Assessment tool which lists the Measures eligible for installation, their Incentive Amounts and costs to be paid by the Customer. Once countersigned by the Customer and Contractor indicating the Measures to be installed in the Project and approval by the Program Manager, the Scope of Work Attachment shall be part of this Participation Agreement.

PARTICIPATION PROCESS:

1. Customer completes Application and provides necessary utility usage and demand data.
2. Contractor or Program Manager performs the Energy Assessment using the program-approved energy assessment tool. The Energy Assessment generates a Scope of Work Attachment for countersignature by the Customer to indicate which eligible Measures are to be included in the Project.
3. Contractor countersigns the Scope of Work Attachment and submits a full Application Package to the Program Manager for approval.
4. Upon Program Manager's approval, Contractor performs retrofit work to remove existing equipment and install Measures, and submits documentation of Project completion in the form of a Measure Acceptance Form signed by the Customer. Contractor invoices the Program Manager for the Incentive portion and the Customer for the balance.
5. Customer pays outstanding balance of costs, less any prior payment or deposit, to Contractor according to amounts listed on the Scope of Work Attachment.

The Program, or agent thereof, reserves the right to conduct inspections of the Project prior to or after the installation of Measures. To be eligible for Incentives, the Application Package must be approved by the Program Manager prior to Measure installation.

CHANGES TO THE PROGRAM - The Program and/or Participation Agreements may be changed by the Program Manager or Administrator at any time without notice, however, approved Application Packages will be processed to completion under the terms in effect at the time of approval.

ELIGIBILITY - Program services and Incentives are available to existing non-residential, commercial and industrial buildings with an average electric demand that did not exceed 200 kW in the preceding 12 months and served by at least one of the New Jersey utilities, municipal utilities or rural electric cooperatives who participate in the Program. If the Participant is a municipal electric company customer, and a customer of a regulated gas New Jersey utility, only gas Measures will be eligible under the Program.

Participating projects with a contract at or above current prevailing wage contract threshold amount set pursuant to the New Jersey Prevailing Wage Act (N.J.S.A. 34:11-56.25 et seq.) are required to pay no less than prevailing wage rate to workers employed in the performance of any construction undertaken in connection with Board of Public Utilities financial assistance, or undertaken to fulfill any condition of receiving Board of Public Utilities financial assistance, including the performance of any contract to construct, renovate or otherwise prepare a facility, the operations of which are necessary for the receipt of Board of Public Utilities financial assistance. By signing this application, the signatories agree to comply with the provisions of the New Jersey Prevailing Wage Act, N.J.S.A. 34: 11-56.25 et seq., (Act), if and to the extent that Act may apply to the work covered by this application. By submitting an application, or accepting program incentives, applicant agrees to adhere to New Jersey Prevailing Wage requirements, as applicable.

Customers of New Jersey utilities who have not contributed to the Societal Benefits Charge during the calendar year in which the Application Package is received by the Program Manager may not be eligible for Incentives offered through the Program.

NO ENDORSEMENT - The Program Manager and Administrator do not endorse, support or recommend any particular manufacturer, product or system design.

INCENTIVE AMOUNTS - Incentive amounts will be listed in the Scope of Work Attachment which, when completed and countersigned by the Customer and approved by the Program Manager, will be part of this Participation Agreement. The Customer will be responsible for paying the remaining balance of costs listed in the Scope of Work Attachment upon receipt of Contractor's invoice.

Incentives will be offered for eligible and qualifying Measures as determined from the Energy Assessment and listed on a separate Scope of Work Attachment. The Scope of Work Attachment shall be countersigned by the Customer to indicate eligible and qualifying Measures to be included in the Project. All Incentive payments shall be paid by the Program Manager directly to the Contractor. The Program is not bound to pay any Incentive unless the Application Package associated with the Incentive payment is approved by the Program Manager prior to Measure installation.

INCENTIVE CAP - Program Manager reserves the right to limit the amount of Incentives on a per-Project or Program basis. Any such caps on individual projects will be disclosed to Customers on the Scope of Work Attachment.

INSTALLATION AGREEMENT - Following completion of the Energy Assessment, but prior to commencement of any installation work, the Customer will be presented a separate Installation Agreement in the form of

DIRECT INSTALL PARTICIPATION AGREEMENT

a Scope of Work Attachment which shall become part of this Agreement. By executing the Scope of Work Attachment, the Customer agrees to allow the Contractor to install the eligible Measures identified in the Scope of Work Attachment.

WARRANTIES - THE PROGRAM MANAGER AND ADMINISTRATOR DO NOT EXPRESSLY OR IMPLIEDLY WARRANTY THE PERFORMANCE OF INSTALLED EQUIPMENT, AND/OR SERVICES RENDERED AS PART OF THIS PROGRAM. NO WARRANTIES OR REPRESENTATIONS OF ANY KIND, WHETHER STATUTORY, EXPRESS, OR IMPLIED, INCLUDING, WITHOUT LIMITATIONS, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE REGARDING EQUIPMENT OR SERVICES ARE PROVIDED BY ANY PARTY, INCLUDING THE PROGRAM MANAGER UNDER THE PROGRAM. CONTRACTOR SHALL EXTEND TO CUSTOMER FULL EQUIPMENT, MATERIALS AND LABOR WARRANTIES WITH AN EXPIRATION DATE OF THE LATER OF EITHER ONE YEAR FROM THE DATE OF INSTALLATION OR THE MANUFACTURER'S STANDARD WARRANTY EXPIRATION. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL WARRANTY ISSUES RELATING TO EQUIPMENT AND MATERIALS INSTALLED UNDER THE PROGRAM FOR A PERIOD OF ONE YEAR.

In no way shall the reviews, inspections, approvals and all other actions performed by the Program Manager under the Program be construed as a determination or acceptance of performance, applicability, dollar savings, or energy savings. The Program Manager and Administrator offer no guarantee or warranty of performance for equipment or labor provided in connection with the Program. The Contractors assume full responsibility and liability for the removal and installation of all equipment, including but not limited to design, specification, all permits, installation, maintenance, performance, and proper disposal of equipment removed, including lamps and ballasts.

LIMITATION OF LIABILITY – By virtue of participating in the Program, Participating Customer agrees to waive any and all claims or damages against the Program Manager, and the Administrator. Participating Customers agree that the Program Manager's and Administrator's liability, in connection with the Program, is limited to paying the Program Incentives specified directly to the Participating Contractor, for the value of the work performed/Measures installed, as identified in the Installation Agreement. Under no circumstances shall the Program Manager, its representatives, or subcontractors, or the Administrator be liable for any lost profits, special, punitive, consequential or incidental damages or for any other damages or claims connected with or resulting from participation in this Program. Further, any liability attributed to the Program Manager or its subcontractors under this Program shall be individual, and not joint and/or several.

IDEMNIFICATION – As part of agreeing to participate in the Program, which includes financial incentives to reduce the customer's net project costs, the Participating Customer agrees to indemnify and hold harmless the Program Manager and Administrator and their respective staffs with respect to the Project.

INSPECTION – Customer agrees to grant the Program reasonable access to Customer's Facility to inspect both pre-existing equipment (if applicable) and the Measures installed under this Program, either prior to issuing Incentives or at a later time.

PROGRAM OFFER – The Program covers services rendered on or after July 1, 2019. Program Incentives are available to non-residential retail electric and/or gas service customers of the New Jersey Utilities.

TAX LIABILITY – Neither the Program Manager nor Contractor shall be responsible for any tax liability that may be imposed on any Customer as a result of the payment of Program Incentives.

TERMINATION – The Administrator reserves the right to extend, modify (this includes modification of Program Incentive levels) or terminate this program without prior or further notice.

CUSTOMER ACKNOWLEDGEMENT – I have read, understood and am in compliance with all rules and regulations concerning this incentive Program. I certify that all information provided is correct to the best of my knowledge, and I give the Program Manager permission to share my records with the New Jersey Board of Public Utilities, and contractors it selects to manage, coordinate or evaluate New Jersey's Clean Energy Programs, including the release of electric and natural gas utility billing information. I allow reasonable access to my property to inspect the installation and performance of the technologies and installations that are eligible for Incentives under the guidelines of New Jersey's Clean Energy Program. This Participation Agreement supersedes all other communications and representations. I agree that this document and all notices and disclosures made or given relating to this document may be created, executed, delivered and retained electronically and that the electronic signatures appearing on this document and any related documents shall have the same legal effect for all purposes as a handwritten signature. The information, statements, and documents I have provided in and with this document are true and accurate to the best of my knowledge. I am aware that if any of them are willfully false, I am subject to punishment.

Other Funding Sources

☐ Check the box if an Energy Savings Improvement Program (ESIP) will be a source of funding. ESIP allows government agencies to pay for energy related improvements using the value of the resulting energy savings.

The Parties signing below certify they are duly authorized to enter into this agreement and hereby accept the above terms:

PARTICIPATING CUSTOMER

Name of Participating Customer

Authorized Signature | Date

CONTRACTOR'S COUNTERSIGNATURE

By signing, below, I certify that I have received the Customer's Application Package and will, in connection with the Project, perform my obligations as Participating Contractor as outlined in the separate Program Contractor Agreement executed between the Contractor below and the Program Manager.

PARTICIPATING CONTRACTOR

Name of Participating Contractor

Authorized Signature | Date

PAYMENT TERMS

This Contract is entered by and between

Lime Energy of 4 Gateway Center, 100 Mulberry St, Newark, NJ 07102

	MAIN OFFICE	PROJECT LOCATION
Customer	Sayreville Board of Education	Wilson School
Address	75 Dane Street	- Same -
City, ST, Zip:	Sayreville NJ 08872	- Same -
Contact:	Barbara Malewicz	- Same -
Telephone:	609-659-7400	- Same -

("Customer") relative to the work described below:

Total Project Cost	**Customer Contribution**
$202,949.62	$98,550.52
Additional Cost Outside of Program	**Total Customer Contribution**
$56,605.00	**$155,155.52**

1. The **Customer** shall pay to **Lime** 1/2 of the net customer cost at Scope of Work (SOW) TRC approval. The **Customer** shall pay **Lime** the final balance of the net customer cost upon project completion, Net 30.
2. Change in SOW resulting in an increase/decrease in customer co-pay will be executed only upon receipt of written approval by **Customer** and will be reflected in final invoice.
3. Accepted payment methods are: Money Order, Bank Check, Personal Check, Credit Card (Visa, Mastercard, Discover Card).

1st Payment **$77,577.76**
2nd & Final Payment **$77,577.76**

Accepted this_____ Day of_____, ____2020_____.
(Day) (month) (year)

Lime Signature:	Customer Signature Duly Authorized:
Printed Name:	Printed Name:

Acceptance of Contract: The above prices, specifications, and conditions are satisfactory and are here-by accepted. Willdan authorized to perform the work as specified based on TRC approval. Payments will be made as outlined above.

Lime Energy

Company Name:	Sayreville BOE - Wilson School
Address:	75 Dane Street, Sayreville NJ 08872
Contact:	Barbara Malewicz
Phone:	609-659-7400
Work order #:	LM126365

Project Description: The following list defines extra work required for a proper and "up-to-code" mechanical installation for this project. The costs associated with this extra work is NOT covered by the Direct Install program.

Materials & Labor is as follows:

Description	Unit Cost	Qty	Sub-Total
Requires Demolition : Level 6 RTU	$3,450.00	1	**$3,450.00**
Requires New Curb - Upto 15T RTU	$4,600.00	1	**$4,600.00**
Requires New Custom Curb Adaptor - 15T RTU	$3,220.00	1	**$3,220.00**
Requires Smoke Detector - 15T RTU	$920.00	1	**$920.00**
Requires Local Rewiring - 15T RTU	$920.00	1	**$920.00**
Requires Disconnect - 15T RTU	$460.00	1	**$460.00**
Requires Standard Crane - 15T RTU	$1,610.00	1	**$1,610.00**
Requires Demolition : Level 7	$5,175.00	2	**$10,350.00**
Requires Boilers Repiping - Reconfiguration	$4,370.00	2	**$8,740.00**
Boilers Water Treatment : Over 2000MBH	$2,300.00	1	**$2,300.00**
Hydronic Heating Filter For Iron Oxide Sludge	$1,840.00	1	**$1,840.00**
Requires New Venting System : 1500 MBH	$3,450.00	2	**$6,900.00**
Requires Condensate Piping : Level 2	$300.00	2	**$600.00**
Requires Acid Neutralizer : Upto 1500MBH	$690.00	2	**$1,380.00**
Requires Rigging : Level 3	$2,300.00	2	**$4,600.00**
Requires System Commissioining	$3,565.00	1	**$3,565.00**
Prepare Manual J/N & S : Level 2	$920.00	1	**$920.00**
Requires On-Site Building Dept. Inspection	$230.00	1	**$230.00**

Unforeseen Costs will be handled on a case by case basis

Total Cost = **$56,605.00**

If you have any questions please feel free to contact me at (732) 427-7278
Willdan Energy Solutions welcomes the opportunity to work with you.
Regrards,
Lime Energy

Christopher Fornicola
Christopher Fornicola
Program Manager

Acknowledged, accepted, and agreed, this _____ day of, _____, 2020 by the duly authorized representative of the undersigned:

Signature: _____

Name(please print): _____

Title: _____

Direct Install Contractor Checklist

Application # LM_126365

Applicant Company Name: Wilson School

[x] - Lighting assessed and included in the EAT

[x] - Explored possibilities of adding lighting controls

[N/A] - Motors assessed and included in the EAT

[x] - Explored possibilities of adding Variable Frequency Drives

[x] - HVAC (electric cooling) assessed and included in the EAT

[x] - HVAC (gas heating) assessed and included in the EAT

[x] - Explored option of adding duel enthalpy or fuel use economizers to existing non qualifying units

[x] - Explored possibilities of adding faucet aerators, low flow showerheads or pre-rinse spray valves

[x] - Explored possibilities of adding thermostats to HVAC equipment

[x] - Explored possibilities of adding refrigeration equipment

All qualified lighting included. Sensors are not a good fit for the space. There is no motor opportunity. Explored and found no possibility of adding Variable Frequency Drives. Aerators and pipe wrap are included. This area is cooled by a 15-ton electric only packed unit. Electronic fuel-use economizers are proposed for this unit. This area is heated with a gas-fired boiler with an existing capacity of 4200MBH. Refrigeration controls are not required as lunches are brought in by outside vendor.

Comments:

_____ _____

Contractor signature Applicant signature

_____

NJ DIRECT INSTALL LIGHTING NOTES & EXCLUSIONS

In some cases, existing light levels in your facility may be higher than necessary when compared to current recommended lighting standards. To maximize your savings *and* provide a comfortable work environment, upgrades included in your Scope of Work may reduce lighting levels in your building. Please speak with your Direct Install account representative if you have any questions.

1) This Scope of Work assumes that all lighting equipment operates on voltages between 120V and 277V. If any lighting fixtures included in this scope operate at 480 volts, there will be additional costs that are not covered by the Direct Install program.

2) There are no allowances in this Scope of Work for battery backup systems that are integrated into existing luminaires. If these systems exist in your facility, there will be additional costs that are not covered by the Direct Install program to include battery backups in the retrofits or fixture replacements that are included in this Scope of Work. The unit price for this work is $150/each and shall be reviewed at the conclusion of the project, if applicable.

3) Mounting hardware for the exterior fixtures and high bay fixtures is not included in the program pricing. These measures are contingent upon the customer's acceptance of the Mounting Hardware proposal included herewith. Shielding requirements for exterior fixtures to prevent light trespass, where applicable, are also excluded from the program pricing.

4) There are no allowances for the correction of code violations, or additional on-incidental work required to meet changes in code requirements since the installation of the existing equipment. Conditions hidden from sight prior to removal of existing equipment are also excluded.

5) Lighting color temperature will be matched with existing color temperature unless otherwise directed at this time.

6) All projects will be done on 1st shift. Any work outside of the hours of 7am to 3pm will be an additional cost charged to the customer.

NJ DIRECT INSTALL HVAC NOTES & EXCLUSIONS

Air Distribution

The NJ Direct Install Program is a one for one equipment replacement and does not address pre-existing ductwork conditions. Some items that would be excluded are as follows:

1) Undersized, oversized and or damaged ductwork (Hard or Flex)

NJ DIRECT INSTALL HVAC NOTES & EXCLUSIONS (Cont'd)

2) Faulty VAV Boxes
3) Faulty Re-Heat Coils
4) Faulty or incorrect Supply Diffusers or Return Diffusers
5) Humidifiers, De-Humidifiers or Air Cleaners
6) Air Balancing of the system

BAS Systems
This proposal does not include the cost of special factory installed control boards or tying and programming into the existing system.

Code Violations
There are no allowances for the correction of code violations, or additional nonincidental work required to meet changes in code requirements since the installation of the existing equipment. Conditions hidden from sight prior to removal of existing equipment are also excluded.

Crane Costs
This proposal covers crane costs for installation and removal of items up to 20 feet vertical and 30 feet horizontal. There may be additional charges, if the required lift is greater in either dimension.

Duct Work
This proposal covers up to 2 linear feet of transition ductwork to tie the new unit into the existing duct system.

Fire Alarm
This proposal excludes wiring of HVAC smoke detectors to a building's fire alarm system. This must be completed by a certified fire alarm contractor. There are also no provisions within the program to install new smoke detectors, or to replace existing smoke detectors that are not in working condition.

Gas Piping & Condensate Lines
This proposal covers up to 10 linear feet of new piping to tie the new unit into the existing gas and condensate lines on packaged units, where required.

Railings
This proposal excludes safety railings or seismic strapping if required by code. Code requires HVAC equipment to be at least 10 feet away from the edge of the roof. If less than 10 feet, local building codes may require the installation of a safety railing.

Structural
This proposal excludes structural engineering, structural drawings, and structural steel work. Due to the nature of this project, you may be responsible for supplying a set of structural drawings to include with the permit package for approval. This proposal does not include the cost for any service needed above.

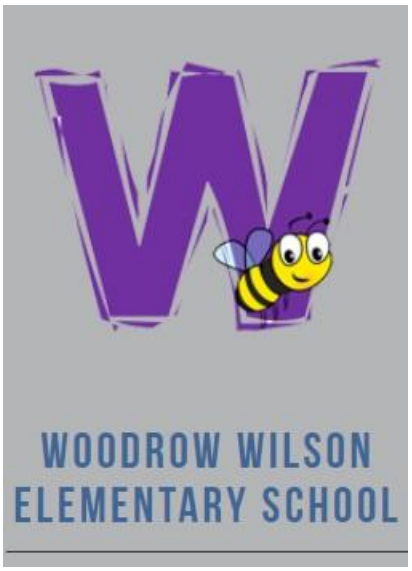
The pricing & scope provided herewith, does not include asbestos testing or remediation of any kind.

Signature: _____

Name: _____

Title: _____

Date: _____



To Whom It May Concern:

Due to our past relationship with Lime Energy, Wilson School School would prefer to continue to work with Lime outside of their assigned New Jersey Direct Install territory at our facility located at ***75 Dane Street, Sayreville, NJ 08872***

Thank you,

Appendix E
Proposed Equipment

Carrier

Turn to the experts

Product Data

AquaSnap®
Air-Cooled Chillers

60 to 300 Nominal Tons

greenspeed AQUASNAP





30RB060-300 Air-Cooled Chillers and
30RB080-300 Air-Cooled Chillers with
Greenspeed® Intelligence

© 2019 Carrier Corporation

Features/Benefits

The AquaSnap® chiller is an effective all-in-one package that is easy to install and easy to own. AquaSnap chillers cost less to purchase and install, and then operate quietly and efficiently. Value-added features include:

- Rotary scroll compression
- Puron® HFC refrigerant (R-410A)
- Quiet AeroAcoustic™ fan system
- Easy to use *Comfort*Link controls
- Optional integrated hydronic pump package, available with variable frequency drive (VFD)
- Novation® heat exchanger technology with microchannel coil
- High-efficiency, variable-speed condenser fans (30RB080-300 with Greenspeed intelligence)

Carrier's superior chiller design provides savings at initial purchase, at installation, and for years afterward.

Cost savings right from the start

Carrier's AquaSnap chillers feature a compact, all-in-one package design that installs quickly and easily on the ground or the rooftop. The optional pump and hydronic components are already built in; this costs less than buying and installing the components individually. The chiller's fully integrated and pre-assembled hydronic system installs in minutes.

No other chiller in this class installs so easily and inexpensively. The preassembled and integrated hydronic module uses reliable top-quality components and pumps. The AquaSnap unit's high efficiency keeps operating costs down.

AquaSnap chillers make noise in the marketplace, not the workplace

The AquaSnap chiller's AeroAcoustic™ fan system is extremely quiet. Much of the noise reduction is in frequencies where noise is most annoying, which makes AquaSnap chillers ideal for sound-sensitive environments. When lower ambient temperatures allow part load operation or during scheduled nighttime operation, the units operate with fewer fans and become even quieter. AquaSnap chillers are quiet during the day and even quieter at night.

The savings will continue to mount

Besides being affordable to buy and install, AquaSnap chillers are also affordable to operate. Carrier's Aqua Series chillers are our most efficient air-cooled models. The 30RB chillers provide full-load EER (Energy Efficiency Ratio) up to 10.3[1]. The 30RB chiller provides an IPLV (integrated part load value) up to 14.3, while the 30RB chiller with Greenspeed® intelligence provides an IPLV up to 17.1.

Aqua-Snap chillers use ultra-quiet, high-efficiency rotary scroll compressors, operated in tandem, trios or quads per independent circuit for greater efficiency at partial loads.

30RB chillers with Greenspeed intelligence feature a high-efficiency, variable-speed condenser fan option along with fine-tuned ComfortLink controls, which together provide premium part load efficiency to facilitate reduced utility costs over the lifespan of the chiller. Additionally, the lower sound levels achieved at part load conditions can be very beneficial for sensitive acoustic applications.

Standard DC link reactor for 30RB units with Greenspeed intelligence is included in all drives for the fans. The use of this component mitigates customer concern over electrical system harmonics, and therefore AC line reactors should not be required for applications employing 30RB chillers with Greenspeed intelligence.

Electronic expansion valve allows for precise control through all operating ranges, resulting in higher efficiencies.

Proven reliability is built in

Thousands of AquaSnap chillers are already in service around the world. This field-proven design is backed by a 12-month warranty that includes the optional hydronic system (U.S.A. and Canada only). The compressors are maintenance-free and protected by an auto-adaptive control that minimizes compressor wear. Year-round operation is standard, from –20°F (–29°C) (with optional cooler heater, low ambient control, and wind baffles) to 125°F (52°C).

Rotary scroll compressors provide smooth, quiet and reliable operation.

Multiple independent circuits are standard on all AquaSnap chillers for redundancy and greater reliability.

All-in-one package

AquaSnap chillers provide the most comprehensive chilled water circuit available for any air-cooled chiller. Included is a shell-in-tube direct expansion cooler that may be remote-mounted. The cooler is also completely drainable with factory-installed vents and drains.

Electronic thermal-dispersion flow switch is included with the cooler. The switch is factory installed and tested and contains no moving parts for high reliability.

Table of contents

Features/Benefits 2
Model Number Nomenclature 5
Physical Data 6
Options and Accessories 14
Dimensions 17
Selection Procedure 29
Typical Piping and Wiring 43
Electrical Data 46
Controls 55
Typical Control Wiring Schematic 58
Application Data 59
Guide Specifications 66

1. Model numbers that reach an EER of up to 10.3 include 090, 120, 160, and 315.

Optional integrated hydronics package is more than just a pump, it is an entire chilled water system, including:

- Single/dual pumps up to 15 hp and 140 ft (42.7 m) head
- Availability at constant speed or VFD configuration
- Strainer
- Start-up strainer (to be removed within 24 hours after chiller start-up)
- Flow regulator
- Freeze protection to –20°F (–29°C) (with freeze protection option)
- Heaters
- Required piping
- Pressure/temperature taps
- Isolation check valves for dual pump systems

The factory-installed and tested hydronics package provides faster, simpler and less expensive installation.

Environmentally balanced

Carrier's Puron® refrigerant (R-410A) enables one to make a responsible decision in the protection of the earth's ozone layer. Puron refrigerant is an HFC refrigerant that does not contain chlorine that is damaging to the ozone layer. This refrigerant is a safe, efficient, and environmentally balanced refrigerant.

Structurally sound

The base rail is industrial-quality 7 ga for maximum structural integrity. The zinc-dipped galvanized frame (with Magni-coated screws) provides the best protection on the market for corrosion resistance. With such a structurally sound base, no perimeter base rail is needed.

*Comfort*Link controls speak your language

The *Comfort*Link controls communicate in plain English, making it as easy as possible to monitor and control each AquaSnap chiller while accurately maintaining fluid temperatures. The large scrolling marquee display acts as a window into the unit's operation, providing easy-to-read information about chiller performance and over 15 diagnostic functions. Carrier's 30 Series chillers' *Comfort*Link controls provide features such as chilled water temperature reset, demand limiting, compressor wear minimization and protection, temperature and pressure displays and diagnostic functions. These controls result in higher chiller reliability, simplified training and more productive service calls with correspondingly lower operational and maintenance costs.

Carrier's exclusive handheld Navigator™ display provides convenience and powerful information in the palm of your hand. The Navigator display helps technicians to quickly diagnose problems and even prevent them from occurring.

All AquaSnap units are ready to be used with the Carrier Comfort Network® (CCN) system.

A BACnet[1] communication option is also available for the i-Vu® Open control system or a third-party BACnet building automation system.

Seismic certification

A seismic kit is available which will result in a unit SDS (seismic design acceleration parameter) level of 2.0.

Novation® heat exchanger technology

The Novation heat exchanger design with microchannel (MCHX) condenser coil is a robust, cost effective alternative to traditional coil design. These coils are offered coated or uncoated to match coil protection to site conditions. The e-coated version of this coil can withstand an 8000-hour salt spray test in accordance with ASTM B-117 Standard. The Carrier Electronic Catalog (E-Cat) can be used to determine whether or not corrosion protection is recommended for particular applications in coastal/marine environments. Following the input of the requested data, the E-Cat program output will advise the appropriate coil to be used.

Other factors described in "Selection Guide: Environmental Corrosion Protection," catalog number 04-581061-01, must also be considered to determine if corrosion protection is required.

Microchannel coils are sturdier than other coil types; thus, easier to clean without causing damage to the coil.

Due to the compact all-aluminum design, microchannel coils will reduce overall unit operating weight by 6 to 7%. The streamlined MCHX coil design reduces refrigerant charge by up to 30%.

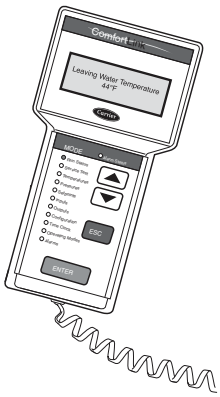
The coil is designed with rubber isolation around the powder painted coil frame to eliminate galvanic couples, which can cause corrosion due to dissimilar metals.

Optional desuperheater

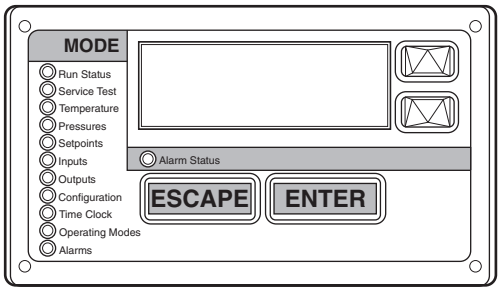
For applications with a simultaneous requirement for chilled water and tempered hot water, the use of a desuperheater is an ideal solution. The production of useful hot water in conjunction with useful chilled water can lead to greatly improved COP (coefficient of performance).

1. BACnet is a registered trademark of ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers).

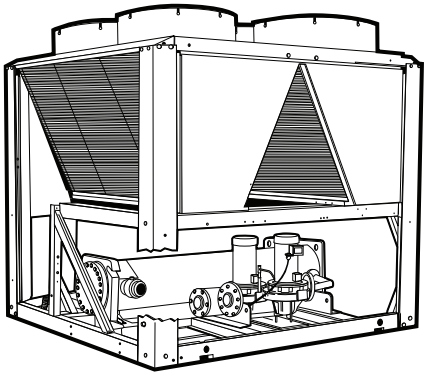
Features/Benefits (cont)



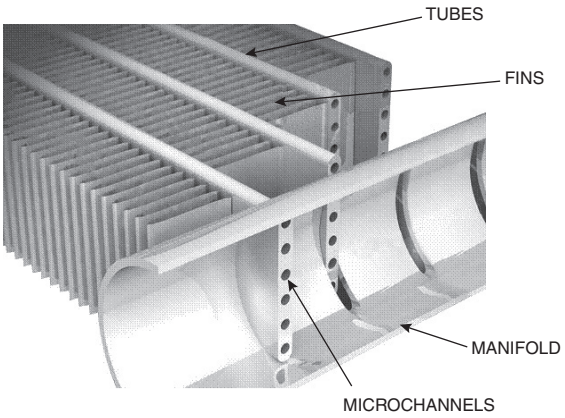
NAVIGATOR™ DISPLAY



SCROLLING MARQUEE DISPLAY



OPTIONAL HYDRONIC PACKAGE



NOVATION® HEAT EXCHANGER TECHNOLOGY WITH MICROCHANNEL CONDENSER COILS

Model number nomenclature

30RB F 190 6 4 - L - - - L

30RB – Air-Cooled AquaSnap® Chiller

Design Series

Nominal Sizes

060	110	170	275
070	120	190	300
080	130	210	
090	150	225	
100	160	250	

Voltage
1 – 575-3-60
2 – 380-3-60
5 – 208/230-3-60
6 – 460-3-60

Condenser Coil Options
- – Aluminum Fin/Copper Tube
0 – Copper Fin/Copper Tube
1 – Aluminum Pre-Coat Fin/Copper Tube
2 – Aluminum E-Coat Fin/Copper Tube
3 – Copper E-Coat Fin/Copper Tube
4 – Microchannel (MCHX)
5 – E-Coat, Microchannel (MCHX)

Hydronics Option*
- – No Pump Installed
0 – Single Pump, 3 HP
1 – Single Pump, 5 HP
2 – Single Pump, 7.5 HP
3 – Single Pump, 10 HP
4 – Single Pump, 15 HP
6 – Dual Pump, 3 HP
7 – Dual Pump, 5 HP
8 – Dual Pump, 7.5 HP, Low Head
9 – Dual Pump, 7.5 HP, High Head
B – Dual Pump, 10 HP
C – Dual Pump, 15 HP
F – Single Pump, 3 HP w/ VFD
G – Single Pump, 5 HP w/ VFD
H – Single Pump, 7.5 HP w/ VFD
J – Single Pump, 10 HP w/ VFD
K – Single Pump, 15 HP w/ VFD
M – Dual Pump, 3 HP w/ VFD
N – Dual Pump, 5 HP w/ VFD
P – Dual Pump, 7.5 HP, Low Head w/ VFD
T – Dual Pump, 7.5 HP, High Head w/ VFD
Q – Dual Pump, 10 HP w/ VFD
R – Dual Pump, 15 HP w/ VFD
Z – Special order designation

Cooler Options
– – Integral Cooler, CRN (Canada)
0 – Integral Cooler, Cooler Heater, CRN (Canada)
4 – Integral Cooler, Microchannel (MCHX), CRN (Canada)
5 – Integral Cooler, Cooler Heater, Microchannel (MCHX), CRN (Canada)
G – Integral Cooler, no CRN
H – Integral Cooler, Cooler Heater, no CRN
K – Integral Cooler, Microchannel (MCHX), no CRN
L – Integral Cooler, Cooler Heater, Microchannel (MCHX), no CRN

Packaging/Security Options
L – No Packaging
0 – Skid
1 – Skid, Top Crate, Bag
3 – Coil Trim Panels
4 – Skid, Coil Trim Panels
5 – Skid, Top Crate, Bag, Coil Trim Panels
7 – Coil Trim Panels, Upper and Lower Grilles
8 – Skid, Coil Trim Panels, Upper and Lower Grilles
9 – Skid, Top Crate, Bag, Coil Trim Panels, Upper and Lower Grilles
C – Trim Panels, Upper and Lower Grilles, Upper Hail Guards
D – Skid, Trim Panels, Upper and Lower Grilles, Upper Hail Guards
F – Skid, Top Crate, Bag, Trim Panels, Upper and Lower Grilles, Upper Hail Guards
H – Skid, Full End Covers
J – Skid, Top Crate, Bag, Full End Covers
K – Full End Covers

Controls/Communication Options
- – None
0 – EMM
1 – Remote Service Point, GFI-CO
2 – EMM, Remote Service Point, GFI-CO
3 – BACnet Communication
4 – BACnet Communication, EMM
5 – BACnet Communication, Remote Service Port, GFI-CO
6 – BACnet Communication, EMM, Remote Service Port, GFI-CO
7 – BACnet Translator
8 – BACnet Translator, EMM
9 – BACnet Translator, Remote Service Port, GFI-CO
B – BACnet Translator, EMM, Remote Service Port, GFI-CO
H – LON Translator
J – LON Translator, EMM
K – LON Translator, Remote Service Port, GFI-CO
L – LON Translator, EMM, Remote Service Port, GFI-CO

Electrical/Low Sound/High SCCR Options
- – Single Point Power Connections, XL, Terminal Block
3 – Dual Point Power Connections, XL, Terminal Block
7 – Single Point Power Connections, XL, Non-Fused Disconnect
8 – Single Point Power Connections, XL, Non-Fused Disconnect, High SCCR
C – Dual Point Power, XL, Non-Fused Disconnect
D – Dual Point Power, XL, Non-Fused Disconnect, High SCCR
G – Single Point Power Connections, XL, Terminal Block, Cmpr Blankets
J – Dual Point Power Connections, XL, Terminal Block, Cmpr Blankets
L – Single Point Power Connections, XL, Non-Fused Disconnect, Cmpr Blankets
M – Single Point Power Connections, XL, Non-Fused Disconnect, Cmpr Blankets, High SCCR
N – Dual Point Power, XL, Non-Fused Disconnect, Cmpr Blankets
P – Dual Point Power, XL, Non-Fused Disconnect, Cmpr Blankets, High SCCR
Q – Single Point Power Connections, XL, Terminal Block, Cmpr Blankets, Cmpr Enclosures
S – Dual Point Power Connections, XL, Terminal Block, Cmpr Blankets, Cmpr Enclosures
V – Single Point Power Connections, XL, Non-Fused Disconnect, Cmpr Blankets, Cmpr Enclosures
W – Single Point Power Connections, XL, Non-Fused Disconnect, Cmpr Blankets, Cmpr Enclosures, High SCCR
X – Dual Power Point, XL, Non-Fused Disconnect, Cmpr Blankets, Cmpr Enclosures
Y – Dual Power Point, XL, Non-Fused Disconnect, Cmpr Blankets, Cmpr Enclosures, High SCCR

Refrigeration Circuit Options
- – None
0 – Suction Line Insulation
1 – Suction Service Valves
3 – Suction Line Insulation, Suction Service Valves
4 – Suction Line Insulation, Low Ambient Head Pressure Control Operation
5 – Suction Service Valves, Low Ambient Head Pressure Control Operation
6 – Suction Line Insulation, Suction Service Valves, Head Pressure Control
7 – Minimum Load Control
8 – Suction Line Insulation, Minimum Load Control
9 – Suction Service Valves, Minimum Load Control
B – Low Ambient Head Pressure Control Operation, Minimum Load Control
C – Suction Line Insulation, Suction Service Valves, Minimum Load Control
D – Suction Line Insulation, Head Pressure Control, Minimum Load Control
F – Suction Service Valves, Head Pressure Control, Minimum Load Control
G – Suction Line Insulation, Suction Service Valves, Low Ambient Head Pressure Control, Operation, Minimum Load Control Operation
H – Suction Service Valves, High-Efficiency Variable Condenser Fans
J – Suction Line Insulation, Suction Service Valve, High-Efficiency Variable Condenser Fans
K – High-Efficiency Variable Condenser Fans
L – Suction Line Insulation, High-Efficiency Variable Condenser Fans
M – Suction Service Valves, High-Efficiency Variable Condenser Fans, Minimum Load Control Operation
N – Suction Line Insulation, Suction Service Valve, High-Efficiency Variable Condenser Fans, Minimum Load Control Operation
P – High-Efficiency Variable Condenser Fans, Minimum Load Control Operation
Q – Suction Line Insulation, High-Efficiency Variable Condenser Fans, Minimum Load Control Operation

LEGEND

CRN	—	Canadian Registration Number
ETO	—	Engineered to Order
MCHX	—	Microchannel Condenser Coil
SCCR	—	Short Circuit Current Rating
XL	—	Across-the-Line Start

*Hydronic pumps not available on units 30RB060-190 with high SCCR option.

NOTE: A “Z” in position 11 indicates a special order machine. Digits following do not correspond to tables.

Quality Assurance

ISO 9001: 2015-certified processes

Physical data

30RB060-300 — ENGLISH

UNIT 30RB	060	070	080	090	100	110	120	130	150
OPERATING WEIGHT (lb)*									
Al-Cu Condenser Coil	4,111	4,317	4,600	5,932	6,155	6,519	7,690	8,045	9,174
Cu-Cu Condenser Coil	4,593	4,799	5,082	6,656	6,879	7,243	8,534	9,010	10,139
MCHX Condenser Coil	3,783	3,978	4,267	5,449	5,663	6,027	7,119	7,402	8,517
REFRIGERANT TYPE†	R-410A, EXV Controlled System								
Refrigerant Charge (lb)									
RTPF Coil, Ckt A/Ckt B/Ckt C	89.5/34/—	94/34/—	68.5/68.5/—	94/76/—	94/96/—	94/106/—	94/133/—	133/106/—	133/133/—
MCHX Coil, Ckt A/Ckt B/Ckt C	40/20/—	40/20/—	33/33/—	40/40/—	40/42/—	40/53/—	43/57/—	54/43/—	56/62/—
COMPRESSORS	Scroll, Hermetic								
Quantity	3	3	4	4	4	5	5	6	6
Speed (rpm)	3500								
(Qty) Compressor Model Number Ckt A	(2) SH240	(2) SH295	(2) SH240	(2) SH295	(2) SH295	(2) SH295	(2) SH295	(3) SH295	(3) SH295
(Qty) Compressor Model Number Ckt B	(1) SH240	(1) SH240	(2) SH240	(2) SH240	(2) SH295	(3) SH240	(3) SH295	(3) SH240	(3) SH295
(Qty) Compressor Model Number Ckt C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Oil Charge (Pt, Ckt A/Ckt B/Ckt C)	26.2/13.1/—	29.2/13.1/—	26.2/26.2/—	29.2/26.2/—	29.2/29.2/—	29.2/39.4/—	29.2/43.8/—	43.8/39.4/—	43.8/43.8/—
No. Capacity Steps									
Standard	3	3	4	4	4	5	5	6	6
Optional (Maximum)	4	4	5	5	5	6	6	7	7
Minimum Capacity Step (%)									
Standard	33	29	25	22	25	18	20	15	17
Optional	22	19	16	14	18	12	14	10	12
Capacity (%)									
Ckt A	67	71	50	56	50	45	40	56	50
Ckt B	33	29	50	44	50	55	60	44	50
Ckt C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
COOLER	Direct Expansion, Shell and Tube Type								
Weight (empty, lb)	715	715	856	856	856	970	970	970	1518
Net Fluid Volume (gal)	28.2	28.2	31.3	31.3	31.3	45.8	45.8	45.8	73.5
Maximum Refrigerant Pressure (psig)	445	445	445	445	445	445	445	445	445
Maximum Water-Side Pressure without Pumps (psig)	300	300	300	300	300	300	300	300	300
Maximum Water-Side Pressure with Pumps (psig)	150	150	150	150	150	150	150	150	150
COOLER WATER CONNECTIONS (in.)									
Inlet and Outlet, Victaulic	4	4	4	4	4	6	6	6	6
Drain (NPT)	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4
CONDENSER FANS	Shrouded Axial Type, Vertical Discharge								
Standard Low Noise Type									
Fan Speed (rpm) Standard	1140	1140	1140	1140	1140	1140	1140	1140	1140
No. Blades...Diameter (in.)	9...30	9…30	9…30	9…30	9…30	9…30	9…30	9…30	9…30
No. Fans (Ckt A/Ckt B/Ckt C)	3/1/—	3/1/—	2/2/—	3/3/—	3/3/—	3/3/—	3/4/—	4/4/—	4/4/—
CONDENSER COILS									
No. Coils (Ckt A/Ckt B/Ckt C)	3/1/—	3/1/—	2/2/—	3/3/—	3/3/—	3/3/—	3/4/—	4/4/—	4/4/—
Total Face Area (sq ft)	94	94	94	141	141	141	164	188	188
Max Working Refrigerant Pressure (psig)	656	656	656	656	656	656	656	656	656
HYDRONIC MODULE (Optional)	Pump(s) with pressure/temperature taps and combination valve.								
Pump	Single or Dual, 1800 or 3600 rpm								
CHASSIS DIMENSIONS (in.)									
Length		94			141			188	
Width					88				
Height					90				

LEGEND

Al-Cu — Aluminum Fin/Copper Tube Condenser Coil
Cu-Cu — Copper Fin/Copper Tube Condenser Coil
EXV — Electronic Expansion Valve
MCHX — Microchannel Condenser Coil
N/A — Not Applicable
RTPF — Round Tube Plate Fin

* Operating weight does not include any options.

† RTPF (Round Tube Plate Fin) includes both Al-Cu and Cu-Cu coils.

NOTES:
1. 30RB chillers with Greenspeed® intelligence are not available in unit sizes 060 and 070.
2. No pumps are available for unit sizes 210-300 or 060-190 with high SCCR option.

30RB060-300 — ENGLISH (cont)

UNIT 30RB	160	170	190	210	225	250	275	300
OPERATING WEIGHT (lb)*								
Al-Cu Condenser Coil	10,266	10,601	12,013	13,734	14,067	15,468	16,915	18,306
Cu-Cu Condenser Coil	11,472	11,807	13,460	15,181	15,514	17,157	18,845	20,477
MCHX Condenser Coil	9,475	9,799	11,064	12,772	13,093	14,349	15,647	16,893
REFRIGERANT TYPE†	R-410A, EXV Controlled System							
Refrigerant Charge (lb)								
RTPF Coil, Ckt A/Ckt B/Ckt C	162/125/—	162/133/—	162/162/—	125/125/125	125/125/125	125/125/162	162/162/125	162/162/162
MCHX Coil, Ckt A/Ckt B/Ckt C	79/63/—	79/64/—	79/87/—	59/53/64	59/59/64	59/59/89	83/87/68	83/87/94
COMPRESSORS	Scroll, Hermetic							
Quantity	7	7	8	9	9	10	11	12
Speed (rpm)	3500							
(Qty) Compressor Model Number Ckt A	(4) SH295	(4) SH295	(4) SH295	(3) SH295	(3) SH295	(3) SH295	(4) SH295	(4) SH295
(Qty) Compressor Model Number Ckt B	(3) SH240	(3) SH295	(4) SH295	(3) SH240	(3) SH295	(3) SH295	(4) SH295	(4) SH295
(Qty) Compressor Model Number Ckt C	N/A	N/A	N/A	(3) SH295	(3) SH295	(4) SH295	(3) SH295	(4) SH295
Oil Charge (Pt, Ckt A/Ckt B/Ckt C)	58.4/39.4/—	58.4/43.8/—	58.4/58.4/—	43.8/39.4/ 43.8	43.8/43.8/ 43.8	43.8/43.8/ 58.4	58.4/58.4/ 43.8	58.4/58.4/ 58.4
No. Capacity Steps								
Standard	7	7	8	9	9	10	11	12
Optional (Maximum)	8	8	9	10	10	11	12	13
Minimum Capacity Step (%)								
Standard	13	14	13	10	11	10	9	8
Optional	8	10	9	6	8	7	7	6
Capacity (%)								
Ckt A	62	57	50	36	33	30	36	33
Ckt B	38	43	50	28	33	30	36	33
Ckt C	N/A	N/A	N/A	36	33	40	28	33
COOLER	Direct Expansion, Shell and Tube Type							
Weight (empty, lb)	1518	1518	1518	2382	2382	2382	2382	2382
Net Fluid Volume (gal)	73.5	73.5	73.5	86.6	86.6	86.6	86.6	86.6
Maximum Refrigerant Pressure (psig)	445	445	445	445	445	445	445	445
Maximum Water-Side Pressure without Pumps (psig)	300	300	300	300	300	300	300	300
Maximum Water-Side Pressure with Pumps (psig)	150	150	150	150	150	150	150	150
COOLER WATER CONNECTIONS (in.)								
Inlet and Outlet, Victaulic	6	6	6	6	6	6	6	6
Drain (NPT)	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4
CONDENSER FANS	Shrouded Axial Type, Vertical Discharge							
Standard Low Noise Type								
Fan Speed (rpm) Standard	1140	1140	1140	1140	1140	1140	1140	1140
No. Blades...Diameter (in.)	9…30	9…30	9…30	9…30	9…30	9…30	9…30	9…30
No. Fans (Ckt A/Ckt B/Ckt C)	6/4/—	6/4/—	6/6/—	4/4/4	4/4/4	4/4/6	6/6/4	6/6/6
CONDENSER COILS								
No. Coils (Ckt A/Ckt B/Ckt C)	6/4/—	6/4/—	6/6/—	4/4/4	4/4/4	4/4/6	6/6/4	6/6/6
Total Face Area (sq ft)	235	235	282	282	282	328	375	422
Max Working Refrigerant Pressure (psig)	656	656	656	656	656	656	656	656
HYDRONIC MODULE (Optional)	Pump(s) with pressure/temperature taps and combination valve.							
Pump	Single or Dual, 1800 or 3600 rpm			Not available				
CHASSIS DIMENSIONS (in.)								
Length	235			282		329	376	423
Width	88							
Height	90							

LEGEND

Al-Cu — Aluminum Fin/Copper Tube Condenser Coil
Cu-Cu — Copper Fin/Copper Tube Condenser Coil
EXV — Electronic Expansion Valve
MCHX — Microchannel Condenser Coil
N/A — Not Applicable
RTPF — Round Tube Plate Fin

* Operating weight does not include any options.

† RTPF (Round Tube Plate Fin) includes both Al-Cu and Cu-Cu coils.

NOTES:
1. 30RB chillers with Greenspeed® intelligence are not available in unit sizes 060 and 070.
2. No pumps are available for unit sizes 210-300 or 060-190 with high SCCR option.

Physical data (cont)

30RB060-300 — SI

UNIT 30RB	060	070	080	090	100	110	120	130	150
OPERATING WEIGHT (kg)*									
Al-Cu Condenser Coil	1869	1962	2091	2697	2798	2963	3488	3649	4161
Cu-Cu Condenser Coil	2088	2181	2310	3026	3127	3292	3871	4087	4599
MCHX Condenser Coil	1716	1804	1934	2472	2569	2734	3229	3358	3863
REFRIGERANT TYPE†	R-410A, EXV Controlled System								
Refrigerant Charge (kg)									
RTPF Coil, Ckt A/Ckt B/Ckt C	40.7/15.5/—	42.7/15.5/—	31.1/31.1/—	42.6/34.5/—	42.6/43.6/—	42.6/48.1/—	42.6/60.3/—	60.3/48.1/—	60.3/60.3/—
MCHX Coil, Ckt A/Ckt B/Ckt C	18.1/9.1/—	18.1/9.1/—	14.9/14.9/—	18.1/18.1/—	18.1/19.1/—	18.1/24.0/—	19.5/25.9/—	24.5/19.5/—	25.4/28.1/—
COMPRESSORS	Scroll, Hermetic								
Quantity	3	3	4	4	4	5	5	6	6
Speed (r/s)	58.3								
(Qty) Compressor Model Number Ckt A	(2) SH240	(2) SH295	(2) SH240	(2) SH295	(2) SH295	(2) SH295	(2) SH295	(3) SH295	(3) SH295
(Qty) Compressor Model Number Ckt B	(1) SH240	(1) SH240	(2) SH240	(2) SH240	(2) SH295	(3) SH240	(3) SH295	(3) SH240	(3) SH295
(Qty) Compressor Model Number Ckt C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Oil Charge (L, Ckt A/Ckt B/Ckt C)	12.4/6.2/—	13.8/6.2/—	12.4/12.4/—	13.8/12.4/—	13.8/13.8/—	13.8/18.6/—	13.8/20.7/—	20.7/18.6/—	20.7/20.7/—
No. Capacity Steps									
Standard	3	3	4	4	4	5	5	6	6
Optional (Maximum)	4	4	5	5	5	6	6	7	7
Minimum Capacity Step (%)									
Standard	33	29	25	22	25	18	20	15	17
Optional	22	19	16	14	18	12	14	10	12
Capacity (%)									
Ckt A	67	71	50	56	50	45	40	56	50
Ckt B	33	29	50	44	50	55	60	44	50
Ckt C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
COOLER	Direct Expansion, Shell and Tube Type								
Weight (empty, kg)	324	324	388	388	388	440	440	440	689
Net Fluid Volume (L)	106	106	118	118	118	173	173	173	278
Maximum Refrigerant Pressure (kPa)	3068	3068	3068	3068	3068	3068	3068	3068	3068
Maximum Water-Side Pressure without Pumps (kPa)	2068	2068	2068	2068	2068	2068	2068	2068	2068
Maximum Water-Side Pressure with Pumps (kPa)	1034	1034	1034	1034	1034	1034	1034	1034	1034
WATER CONNECTIONS (in.)									
Inlet and Outlet, Victaulic	4	4	4	4	4	6	6	6	6
Drain (NPT)	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4
CONDENSER FANS	Shrouded Axial Type, Vertical Discharge								
Standard Low Noise Type									
Fan Speed (r/s) Standard	19	19	19	19	19	19	19	19	19
No. Blades...Diameter (mm)	9…762	9…762	9…762	9…762	9…762	9…762	9…762	9…762	9…762
No. Fans (Ckt A/Ckt B/Ckt C)	3/1/—	3/1/—	2/2/—	3/3/—	3/3/—	3/3/—	3/4/—	4/4/—	4/4/—
CONDENSER COILS									
No. Coils (Ckt A/Ckt B/Ckt C)	3/1/—	3/1/—	2/2/—	3/3/—	3/3/—	3/3/—	3/4/—	4/4/—	4/4/—
Total Face Area (sq m)	8.73	8.73	8.73	13.1	13.1	13.1	15.24	17.47	17.47
Max Working Refrigeration Pressure (kPa)	4522	4522	4522	4522	4522	4522	4522	4522	4522
HYDRONIC MODULE (Optional)	Pump(s) with pressure/temperature taps and combination valve.								
Pump	Single or Dual, 29.2 or 58.3 r/s								
CHASSIS DIMENSIONS (mm)									
Length		2393			3587			4781	
Width					2236				
Height					2281				

LEGEND

Al-Cu — Aluminum Fin/Copper Tube Condenser Coil
Cu-Cu — Copper Fin/Copper Tube Condenser Coil
EXV — Electronic Expansion Valve
MCHX — Microchannel Condenser Coil
N/A — Not Applicable
RTPF — Round Tube Plate Fin

* Operating weight does not include any options.

† RTPF (Round Tube Plate Fin) includes both Al-Cu and Cu-Cu coils.

NOTES:
1. 30RB chillers with Greenspeed® intelligence are not available in unit sizes 060 and 070.
2. No pumps are available for unit sizes 210-300 or 060-190 with high SCCR option.

30RB060-300 — SI (cont)

UNIT 30RB	160	170	190	210	225	250	275	300
OPERATING WEIGHT (kg)*								
Al-Cu Condenser Coil	4666	4819	5461	6243	6394	7031	7686	8321
Cu-Cu Condenser Coil	5215	5367	6118	6901	7052	7799	8566	9308
MCHX Condenser Coil	4297	4443	5019	5793	5937	6509	7096	7659
REFRIGERANT TYPE†	R-410A, EXV Controlled System							
Refrigerant Charge (kg)								
Std Coil, Ckt A/Ckt B/Ckt C	73.6/56.8/—	73.6/60.5/—	73.6/73.6/—	56.8/56.8/56.8	56.8/56.8/56.8	56.8/56.8/ 73.6	73.6/73.6/ 56.8	73.5/73.5/ 73.5
MCHX Coil, Ckt A/Ckt B/Ckt C	35.9/28.6—	35.9/29.1/—	35.9/35.9/—	26.8/24.1/29.1	26.8/26.8/29.1	26.8/26.8/ 40.5	37.7/39.5/ 30.9	37.6/39.5/ 42.6
COMPRESSORS	Scroll, Hermetic							
Quantity	7	7	8	9	9	10	11	12
Speed (r/s)	58.3							
(Qty) Compressor Model Number Ckt A	(4) SH295	(4) SH295	(4) SH295	(3) SH295	(3) SH295	(3) SH295	(4) SH295	(4) SH295
(Qty) Compressor Model Number Ckt B	(3) SH240	(3) SH295	(4) SH295	(3) SH240	(3) SH295	(3) SH295	(4) SH295	(4) SH295
(Qty) Compressor Model Number Ckt C	N/A	N/A	N/A	(3) SH295	(3) SH295	(4) SH295	(3) SH295	(4) SH295
Oil Charge (L, Ckt A/Ckt B/Ckt C)	27.6/18.6/—	27.6/20.7/—	27.6/27.6/—	20.7/18.6/20.7	20.7/20.7/20.7	20.7/20.7/ 27.6	27.6/27.6/ 20.7	27.6/27.6/ 27.6
No. Capacity Steps								
Standard	7	7	8	9	9	10	11	12
Optional (Maximum)	8	8	9	10	10	11	12	13
Minimum Capacity Step (%)								
Standard	13	14	13	10	11	10	9	8
Optional	8	10	9	6	8	7	7	6
Capacity (%)								
Ckt A	62	57	50	38	33	30	36	33
Ckt B	38	43	50	28	33	30	36	33
Ckt C	N/A	N/A	N/A	36	33	40	28	33
COOLER	Direct Expansion, Shell and Tube Type							
Weight (empty, kg)	689	689	689	1080	1080	1080	1080	1080
Net Fluid Volume (L)	278	278	278	327	327	327	327	327
Maximum Refrigerant Pressure (kPa)	3068	3068	3068	3068	3068	3068	3068	3068
Maximum Water-Side Pressure without Pumps (kPa)	2068	2068	2068	2068	2068	2068	2068	2068
Maximum Water-Side Pressure with Pumps (kPa)	1034	1034	1034	1034	1034	1034	1034	1034
WATER CONNECTIONS (in.)								
Inlet and Outlet, Victaulic	6	6	6	6	6	6	6	6
Drain (NPT)	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4
CONDENSER FANS	Shrouded Axial Type, Vertical Discharge							
Standard Low Noise Type								
Fan Speed (r/s) Standard	19	19	19	19	19	19	19	19
No. Blades...Diameter (mm)	9…762	9…762	9…762	9…762	9…762	9…762	9…762	9…762
No. Fans (Ckt A/Ckt B/Ckt C)	6/4/—	6/4/—	6/6/—	4/4/4	4/4/4	4/4/6	6/6/4	6/6/6
CONDENSER COILS								
No. Coils (Ckt A/Ckt B/Ckt C)	6/4/—	6/4/—	6/6/—	4/4/4	4/4/4	4/4/6	6/6/4	6/6/6
Total Face Area (sq m)	21.83	21.83	26.2	26.2	26.2	30.47	34.84	39.21
Max Working Refrigeration Pressure (kPa)	4522	4522	4522	4522	4522	4522	4522	4522
HYDRONIC MODULE (Optional)	Pump(s) with pressure/temperature taps and combination valve.			Not available				
Pump	Single or Dual, 29.2 or 58.3 r/s							
CHASSIS DIMENSIONS (mm)								
Length	5975			7169		8363	9557	10,751
Width	2236							
Height	2281							

LEGEND

Al-Cu — Aluminum Fin/Copper Tube Condenser Coil
Cu-Cu — Copper Fin/Copper Tube Condenser Coil
EXV — Electronic Expansion Valve
MCHX — Microchannel Condenser Coil
N/A — Not Applicable
RTPF — Round Tube Plate Fin

* Operating weight does not include any options.

† RTPF (Round Tube Plate Fin) includes both Al-Cu and Cu-Cu coils.

NOTES:
1. 30RB chillers with Greenspeed® intelligence are not available in unit sizes 060 and 070.
2. No pumps are available for unit sizes 210-300 or 060-190 with high SCCR option.

Physical data (cont)

UNIT WEIGHTS — STANDARD UNITS

AL/CU COIL UNITS WITHOUT PUMP — ENGLISH

UNIT 30RB	MOUNTING WEIGHT (lb) No Pump Al/Cu*				
	A	B	C	D	Total
060	869	913	1193	1136	4111
070	891	936	1275	1215	4317
080	982	958	1313	1346	4600
090	1159	1397	1845	1531	5932
100	1173	1431	1952	1600	6155
110	1319	1448	1964	1788	6519

UNIT 30RB	MOUNTING WEIGHT (lb) No Pump Al/Cu*						
	A	B	C	D	E	F	Total
120	731	1762	809	985	2347	1056	7,690
130	728	1850	818	1168	2531	949	8,045
150	893	2085	888	1228	2864	1217	9,174
160	1106	2189	1104	1483	2923	1463	10,266
170	1142	2220	1108	1487	3039	1606	10,601

UNIT 30RB	MOUNTING WEIGHT (lb) No Pump Al/Cu*								
	A	B	C	D	E	F	G	H	Total
190	1094	1388	1484	1101	1479	2004	1938	1526	12,013
210	916	1804	2139	853	1311	3044	2440	1228	13,734
225	947	1836	2144	855	1313	3049	2569	1354	14,067
250	1122	2271	2133	850	1307	3035	3166	1584	15,468
275	627	2269	2805	1292	1866	3808	3169	1080	16,915
300	899	2602	2792	1284	1859	3795	3640	1435	18,306

AL/CU COIL UNITS WITHOUT PUMP — SI

UNIT 30RB	MOUNTING WEIGHT (kg) No Pump Al/Cu*				
	A	B	C	D	Total
060	395	415	542	516	1869
070	405	425	580	552	1962
080	447	436	597	612	2091
090	527	635	839	696	2697
100	533	650	887	727	2798
110	600	658	893	813	2963

UNIT 30RB	MOUNTING WEIGHT (kg) No Pump Al/Cu*						
	A	B	C	D	E	F	Total
120	332	799	367	447	1065	479	3488
130	330	839	371	530	1148	431	3649
150	405	946	403	557	1299	552	4161
160	503	995	502	674	1328	665	4666
170	519	1009	503	676	1381	730	4819

UNIT 30RB	MOUNTING WEIGHT (kg) No Pump Al/Cu*								
	A	B	C	D	E	F	G	H	Total
190	497	631	674	500	672	911	881	694	5461
210	416	820	972	388	596	1384	1109	558	6243
225	431	835	975	389	597	1386	1168	615	6394
250	510	1032	970	386	594	1380	1439	720	7031
275	285	1032	1275	587	848	1731	1440	491	7689
300	409	1183	1269	584	845	1725	1654	652	8321

CU/CU COIL UNITS WITHOUT PUMP — ENGLISH

UNIT 30RB	MOUNTING WEIGHT (lb) No Pump Cu/Cu†				
	A	B	C	D	Total
060	992	1037	1311	1254	4,593
070	1014	1059	1393	1333	4,799
080	1106	1081	1431	1464	5,082
090	1342	1584	2020	1711	6,656
100	1355	1619	2126	1780	6,879
110	1503	1635	2139	1967	7,243

UNIT 30RB	MOUNTING WEIGHT (lb) No Pump Cu/Cu†						
	A	B	C	D	E	F	Total
120	837	1980	917	1088	2551	1161	8,534
130	850	2100	940	1288	2764	1069	9,010
150	1015	2334	1009	1348	3097	1336	10,139
160	1252	2497	1266	1642	3218	1599	11,472
170	1289	2528	1270	1645	3334	1742	11,807

UNIT 30RB	MOUNTING WEIGHT (lb) No Pump Cu/Cu†								
	A	B	C	D	E	F	G	H	Total
190	1257	1595	1691	1263	1638	2199	2133	1684	13,460
210	1018	2045	2410	978	1427	3297	2681	1326	15,181
225	1049	2078	2415	981	1429	3301	2810	1452	15,514
250	1283	2577	2404	976	1423	3288	3463	1744	17,157
275	732	2554	3193	1501	2059	4185	3446	1175	18,845
300	1064	2950	3179	1494	2053	4172	3974	1591	20,477

CU/CU COIL UNITS WITHOUT PUMP — SI

UNIT 30RB	MOUNTING WEIGHT (kg) No Pump Cu/Cu†				
	A	B	C	D	Total
060	451	471	596	570	2088
070	461	481	633	606	2181
080	503	491	651	665	2310
090	610	720	918	778	3026
100	616	736	966	809	3127
110	683	743	972	894	3292

UNIT 30RB	MOUNTING WEIGHT (kg) No Pump Cu/Cu†						
	A	B	C	D	E	F	Total
120	380	898	416	494	1157	527	3871
130	386	952	426	584	1254	485	4087
150	461	1059	458	611	1405	606	4599
160	569	1135	575	746	1463	727	5215
170	586	1149	577	748	1516	792	5367

UNIT 30RB	MOUNTING WEIGHT (kg) No Pump Cu/Cu†								
	A	B	C	D	E	F	G	H	Total
190	571	725	769	574	744	1000	970	765	6118
210	463	930	1095	445	649	1498	1219	603	6901
225	477	944	1098	446	650	1501	1277	660	7052
250	583	1171	1093	444	647	1494	1574	793	7799
275	333	1161	1451	682	936	1902	1566	534	8566
300	484	1341	1445	679	933	1896	1807	723	9308

MCHX COIL UNITS WITHOUT PUMP — ENGLISH**

UNIT 30RB	MOUNTING WEIGHT (lb) No Pump MCHX				
	A	B	C	D	Total
060	800	840	1098	1045	3,783
070	821	862	1175	1120	3,978
080	911	889	1218	1249	4,267
090	1065	1283	1695	1406	5,449
100	1079	1316	1796	1472	5,663
110	1219	1339	1816	1653	6,027

UNIT 30RB	MOUNTING WEIGHT (lb) No Pump MCHX††						
	A	B	C	D	E	F	Total
120	660	1614	737	915	2210	985	7,119
130	648	1683	738	1088	2377	870	7,402
150	810	1914	805	1146	2706	1136	8,517
160	1020	2020	1019	1368	2698	1350	9,475
170	1055	2052	1024	1374	2809	1485	9,799

UNIT 30RB	MOUNTING WEIGHT (lb) No Pump MCHX††								
	A	B	C	D	E	F	G	H	Total
190	1007	1278	1367	1014	1362	1846	1785	1405	11,064
210	852	1677	1989	793	1219	2831	2269	1142	12,772
225	881	1709	1996	796	1222	2838	2391	1260	13,093
250	1041	2107	1979	789	1212	2815	2937	1469	14,349
275	580	2099	2594	1195	1726	3523	2931	999	15,647
300	830	2401	2576	1185	1716	3502	3359	1324	16,893

MCHX COIL UNITS WITHOUT PUMP — SI**

UNIT 30RB	MOUNTING WEIGHT (kg) No Pump MCHX				
	A	B	C	D	Total
060	363	381	498	474	1716
070	372	391	533	508	1804
080	413	403	552	566	1934
090	483	582	769	638	2472
100	489	597	815	668	2569
110	553	607	824	750	2734

UNIT 30RB	MOUNTING WEIGHT (kg) No Pump MCHX						
	A	B	C	D	E	F	Total
120	299	732	334	415	1002	447	3229
130	294	763	335	493	1078	394	3358
150	367	868	365	520	1227	515	3863
160	463	916	492	620	1224	612	4297
170	478	931	464	623	1274	673	4443

UNIT 30RB	MOUNTING WEIGHT (kg) No Pump MCHX								
	A	B	C	D	E	F	G	H	Total
190	457	580	620	460	618	837	810	637	5019
210	386	761	902	360	553	1284	1029	518	5793
225	400	775	905	361	554	1287	1084	571	5937
250	472	956	898	358	550	1277	1332	666	6509
275	263	952	1176	542	783	1598	1329	453	7096
300	376	1089	1168	537	778	1588	1523	600	7659

*Condenser Coil: Aluminum Fins/Copper Tubing.

†Condenser Coil: Copper Fins/Copper Tubing.

** Condenser Coil: Microchannel Design.

NOTE: 30RB chillers with Greenspeed® intelligence are not available in size 060 and 070.

UNIT WEIGHTS — SINGLE PUMP UNITS

AL/CU COIL UNITS WITH SINGLE PUMP — ENGLISH

UNIT 30RB	MOUNTING WEIGHT (lb) Single Pump Al/Cu*								
	A	B	C	D	Total				
060	1085	1127	1230	1184	4626				
070	1107	1150	1312	1263	4832				
080	1193	1164	1354	1388	5100				
090	1353	1620	1885	1575	6432				
100	1366	1655	1991	1644	6655				
110	1565	1653	1974	1868	7059				
UNIT 30RB	MOUNTING WEIGHT (lb) Single Pump Al/Cu*								
	A	B	C	D	E	F	Total		
120	731	2062	960	961	2460	1056	8,230		
130	728	2149	969	1144	2645	949	8,585		
150	893	2486	1031	1165	3035	1217	9,827		
160	1238	2583	1104	1483	3155	1357	10,919		
170	1279	2609	1108	1487	3276	1495	11,254		
UNIT 30RB	MOUNTING WEIGHT (lb) Single Pump Al/Cu*								
	A	B	C	D	E	F	G	H	Total
190	1094	1510	1889	1101	1479	2178	1890	1526	12,666

AL/CU COIL UNITS WITH SINGLE PUMP — SI

UNIT 30RB	MOUNTING WEIGHT (kg) Single Pump Al/Cu*								
	A	B	C	D	Total				
060	493	512	559	538	2103				
070	503	523	597	574	2196				
080	542	529	616	631	2318				
090	615	736	857	716	2924				
100	621	752	905	747	3025				
110	711	751	897	849	3209				
UNIT 30RB	MOUNTING WEIGHT (kg) Single Pump Al/Cu*								
	A	B	C	D	E	F	Total		
120	332	935	435	436	1116	479	3733		
130	330	975	440	519	1200	431	3894		
150	405	1128	468	528	1377	552	4458		
160	563	1174	502	674	1434	617	4963		
170	582	1186	503	676	1489	679	5116		
UNIT 30RB	MOUNTING WEIGHT (kg) Single Pump Al/Cu*								
	A	B	C	D	E	F	G	H	Total
190	497	686	858	500	672	990	859	694	5757

CU/CU COIL UNITS WITH SINGLE PUMP — ENGLISH

UNIT 30RB	MOUNTING WEIGHT (lb) Single Pump Cu/Cu†								
	A	B	C	D	Total				
060	1208	1250	1348	1302	5,108				
070	1230	1273	1430	1381	5,314				
080	1317	1287	1472	1506	5,582				
090	1537	1806	2060	1753	7,156				
100	1549	1841	2166	1823	7,379				
110	1749	1839	2150	2045	7,783				
UNIT 30RB	MOUNTING WEIGHT (lb) Single Pump Cu/Cu†								
	A	B	C	D	E	F	Total		
120	837	2280	1068	1065	2664	1161	9,074		
130	850	2399	1091	1264	2877	1069	9,550		
150	1015	2735	1153	1284	3269	1336	10,792		
160	1382	2894	1266	1642	3447	1495	12,125		
170	1424	2920	1270	1645	3569	1633	12,460		
UNIT 30RB	MOUNTING WEIGHT (lb) Single Pump Cu/Cu†								
	A	B	C	D	E	F	G	H	Total
190	1257	1718	2095	1263	1638	2374	2084	1684	14,113

CU/CU COIL UNITS WITH SINGLE PUMP — ENGLISH

UNIT 30RB	MOUNTING WEIGHT (kg) Single Pump Cu/Cu†								
	A	B	C	D	Total				
060	549	568	613	592	2322				
070	559	579	650	628	2415				
080	599	585	669	684	2537				
090	699	821	937	797	3253				
100	704	837	985	828	3354				
110	795	836	977	930	3538				
UNIT 30RB	MOUNTING WEIGHT (kg) Single Pump Cu/Cu†								
	A	B	C	D	E	F	Total		
120	380	1034	484	483	1209	527	4116		
130	386	1088	495	573	1305	485	4332		
150	461	1241	523	583	1483	606	4895		
160	628	1315	575	746	1567	680	5511		
170	647	1327	577	748	1622	742	5664		
UNIT 30RB	MOUNTING WEIGHT (kg) Single Pump Cu/Cu†								
	A	B	C	D	E	F	G	H	Total
190	571	781	952	574	744	1079	947	765	6415

MCHX COIL UNITS WITH SINGLE PUMP — ENGLISH

UNIT 30RB	MOUNTING WEIGHT (lb) Single Pump MCHX**								
	A	B	C	D	Total				
060	1008	1047	1143	1100	4298				
070	1030	1069	1220	1174	4493				
080	1115	1088	1266	1298	4767				
090	1251	1498	1743	1457	5949				
100	1265	1532	1844	1522	6163				
110	1456	1537	1836	1738	6567				
UNIT 30RB	MOUNTING WEIGHT (lb) Single Pump MCHX**								
	A	B	C	D	E	F	Total		
120	660	1914	887	891	2322	985	7,659		
130	648	1982	888	1064	2490	870	7,942		
150	810	2316	948	1083	2877	1136	9,170		
160	1148	2395	1024	1376	2926	1259	10,128		
170	1188	2423	1029	1381	3043	1388	10,452		
UNIT 30RB	MOUNTING WEIGHT (lb) Single Pump MCHX**								
	A	B	C	D	E	F	G	H	Total
190	1012	1396	1747	1019	1368	2015	1748	1412	11,717

* Condenser Coil: Aluminum Fins/Copper Tubing.
† Condenser Coil: Copper Fins/Copper Tubing.
** Condenser Coil: Microchannel Design.

MCHX COIL UNITS WITH SINGLE PUMP — SI

UNIT 30RB	MOUNTING WEIGHT (kg) Single Pump MCHX**								
	A	B	C	D	Total				
060	457	475	518	499	1949				
070	467	485	553	532	2037				
080	506	493	574	589	2162				
090	567	679	790	661	2697				
100	574	695	836	690	2795				
110	660	697	833	788	2978				
UNIT 30RB	MOUNTING WEIGHT (kg) Single Pump MCHX**								
	A	B	C	D	E	F	Total		
120	299	868	402	404	1053	447	3474		
130	294	899	403	483	1129	394	3603		
150	367	1051	430	491	1305	515	4160		
160	521	1086	464	624	1327	571	4593		
170	539	1099	467	626	1380	629	4740		
UNIT 30RB	MOUNTING WEIGHT (kg) Single Pump MCHX**								
	A	B	C	D	E	F	G	H	Total
190	459	633	792	462	620	914	763	640	5313

NOTE: 30RB chillers with Greenspeed intelligence are not available in size 060 and 070.

Physical data (cont)

UNIT WEIGHTS — DUAL PUMP UNITS

AL/CU COIL UNITS WITH DUAL PUMP — ENGLISH

UNIT 30RB	MOUNTING WEIGHT (lb) Dual Pump Al/Cu*				
	A	B	C	D	Total
060	1218	1259	1254	1213	4,944
070	1240	1281	1336	1293	5,150
080	1372	1339	1389	1424	5,523
090	1518	1808	1919	1611	6,855
100	1530	1843	2025	1680	7,078
110	1741	1796	1983	1922	7,442

UNIT 30RB	MOUNTING WEIGHT (lb) Dual Pump Al/Cu*						
	A	B	C	D	E	F	Total
120	731	2281	1061	951	2534	1056	8,613
130	728	2367	1071	1133	2719	949	8,968
150	893	2864	1147	1122	3177	1217	10,419
160	1336	2962	1104	1483	3344	1282	11,511
170	1383	2983	1108	1487	3471	1415	11,846

UNIT 30RB	MOUNTING WEIGHT (lb) Dual Pump Al/Cu*								
	A	B	C	D	E	F	G	H	Total
190	1094	1588	2288	1101	1479	2303	1879	1526	13,258

AL/CU COIL UNITS WITH DUAL PUMP — SI

UNIT 30RB	MOUNTING WEIGHT (kg) Dual Pump Al/Cu*				
	A	B	C	D	Total
060	554	572	570	552	2247
070	564	582	607	588	2341
080	624	609	631	647	2511
090	690	822	872	732	3116
100	695	838	920	764	3217
110	791	817	901	874	3383

UNIT 30RB	MOUNTING WEIGHT (kg) Dual Pump Al/Cu*						
	A	B	C	D	E	F	Total
120	332	1035	481	431	1149	479	3907
130	330	1074	486	514	1233	431	4068
150	405	1299	520	509	1441	552	4726
160	607	1347	502	674	1520	583	5232
170	629	1356	503	676	1578	643	5385

UNIT 30RB	MOUNTING WEIGHT (kg) Dual Pump Al/Cu*								
	A	B	C	D	E	F	G	H	Total
190	497	722	1040	500	672	1047	854	1526	6014

CU/CU COIL UNITS WITH DUAL PUMP — ENGLISH

UNIT 30RB	MOUNTING WEIGHT (lb) Dual Pump Cu/Cu†				
	A	B	C	D	Total
060	1341	1382	1371	1331	5,426
070	1363	1405	1453	1411	5,632
080	1495	1462	1507	1541	6,005
090	1702	1994	2095	1788	7,579
100	1714	2030	2201	1858	7,802
110	1926	1982	2160	2099	8,166

UNIT 30RB	MOUNTING WEIGHT (lb) Dual Pump Cu/Cu†						
	A	B	C	D	E	F	Total
120	837	2498	1169	1054	2739	1161	9,457
130	850	2616	1193	1252	2953	1069	9,933
150	1015	3112	1270	1240	3411	1336	11,384
160	1481	3273	1266	1642	3637	1420	12,717
170	1527	3294	1270	1645	3763	1553	13,052

UNIT 30RB	MOUNTING WEIGHT (lb) Dual Pump Cu/Cu†								
	A	B	C	D	E	F	G	H	Total
190	1257	1799	2492	1263	1638	2502	2071	1684	14,705

CU/CU COIL UNITS WITH DUAL PUMP — SI

UNIT 30RB	MOUNTING WEIGHT (kg) Dual Pump Cu/Cu†				
	A	B	C	D	Total
060	610	628	623	605	2466
070	620	638	661	641	2560
080	680	665	685	701	2730
090	774	906	952	813	3445
100	779	923	1000	845	3547
110	875	901	982	954	3712

UNIT 30RB	MOUNTING WEIGHT (kg) Dual Pump Cu/Cu†						
	A	B	C	D	E	F	Total
120	380	1133	530	478	1242	527	4290
130	386	1187	541	568	1339	485	4506
150	461	1412	576	562	1547	606	5164
160	673	1488	575	746	1653	646	5781
170	694	1497	577	748	1710	706	5933

UNIT 30RB	MOUNTING WEIGHT (kg) Dual Pump Cu/Cu†								
	A	B	C	D	E	F	G	H	Total
190	571	818	1133	574	744	1137	941	1684	6669

MCHX COIL UNITS WITH DUAL PUMP — ENGLISH

UNIT 30RB	MOUNTING WEIGHT (lb) Dual Pump MCHX**				
	A	B	C	D	Total
060	1137	1175	1171	1133	4,616
070	1158	1197	1248	1208	4,811
080	1289	1258	1305	1338	5,190
090	1411	1680	1784	1497	6,372
100	1424	1715	1884	1563	6,586
110	1626	1677	1852	1795	6,950

UNIT 30RB	MOUNTING WEIGHT (lb) Dual Pump MCHX**						
	A	B	C	D	E	F	Total
120	660	2134	987	882	2396	985	8,042
130	648	2201	989	1054	2564	870	8,325
150	810	2695	1063	1041	3017	1136	9,762
160	1244	2759	1028	1381	3114	1194	10,720
170	1289	2781	1033	1386	3236	1319	11,044

UNIT 30RB	MOUNTING WEIGHT (lb) Dual Pump MCHX**								
	A	B	C	D	E	F	G	H	Total
190	1016	1474	2124	1022	1373	2138	1745	1417	12,309

MCHX COIL UNITS WITH DUAL PUMP — SI

UNIT 30RB	MOUNTING WEIGHT (kg) Dual Pump MCHX**				
	A	B	C	D	Total
060	516	533	531	514	2094
070	525	543	566	548	2182
080	585	571	592	607	2355
090	640	762	809	679	2890
100	646	778	854	709	2987
110	737	761	840	814	3152

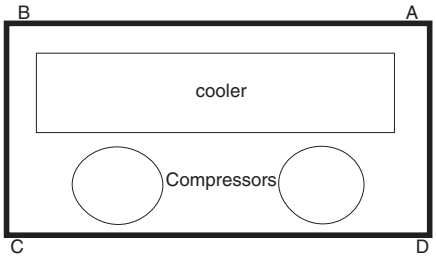
UNIT 30RB	MOUNTING WEIGHT (kg) Dual Pump MCHX**						
	A	B	C	D	E	F	Total
120	299	968	448	400	1087	447	3648
130	294	998	449	478	1163	394	3776
150	367	1223	482	472	1368	515	4428
160	564	1251	466	626	1412	541	4860
170	585	1261	468	629	1468	598	5009

UNIT 30RB	MOUNTING WEIGHT (kg) Dual Pump MCHX**								
	A	B	C	D	E	F	G	H	Total
190	461	668	963	463	623	970	791	643	5582

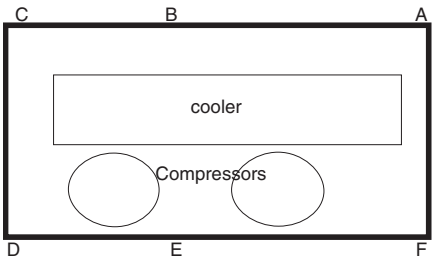
* Condenser Coil: Aluminum Fins/Copper Tubing.
† Condenser Coil: Copper Fins/Copper Tubing.
** Condenser Coil: Microchannel Design.

NOTE: 30RB chillers with Greenspeed intelligence are not available in size 060 and 070.

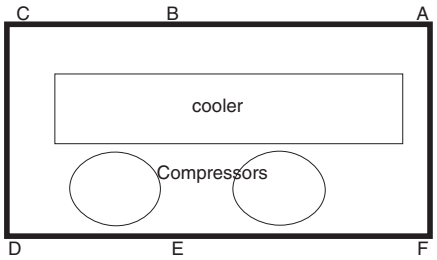
30RB060-110*



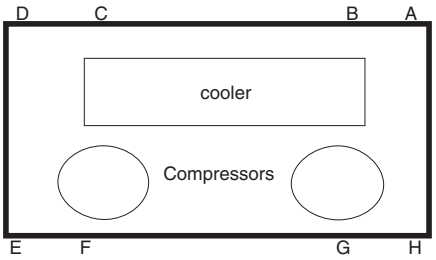
30RB120-150



30RB160, 170



30RB190-300



*30RB chillers with Greenspeed® intelligence are not available in size 060 and 070.

NOTE: Mounting weights are calculated at mounting locations. Refer to certified drawings starting on page 17 for mounting locations.

Options and accessories

ITEM	FACTORY-INSTALLED OPTION	FIELD-INSTALLED ACCESSORY
Condenser Coil Options		
MCHX E-Coated	X	
Aluminum Fin/Copper Tube	X	
Aluminum Fin/Copper Tube, Pre-Coated	X	
Aluminum Fin/Copper Tube, E-Coated	X	
Copper Fin/Copper Tube, E-Coated	X	
Copper Fin/Copper Tube Condenser Coils	X	
Controls/Communication Options		
BACnet Communication	X	
BACnet/Modbus Translator Control	X	X
Chillervisor System Manager III Multi-Unit Control		X
Energy Management Module (EMM)	X	X
LON (Local Operating Network) Translator Control	X	X
Navigator™ Display		X
Remote Service Port		X
Remote Enhanced Display		X
Touch Pilot™ Display		X
Dual Chiller Accessory Kit		X
Cooler Options		
Freeze Protection - Cooler Heaters	X	
Remote Cooler		X
CRN Cooler (Canada Only)	X	
Electrical/Low Sound Options		
Unit-Mounted Main Disconnect, Non-Fused	X	
Convenience Outlet (not available at 380 volt)	X	X
High SCCR (includes non-fused disconnect)(460 v only)	X	
Low Sound - Compressor Sound Reduction Blankets	X	
Ultra Low Sound - Compressor Sound Reduction Enclosures	X	
Hydronics Option		
Hydronic Pump Package (available on unit sizes 060-190 only via ETO, not available with high SCCR)	X	
Refrigeration Circuit Options		
High-Efficiency Variable Condenser Fans (not available on unit sizes 060 and 070)	X	
Compressor Suction Service Valve	X	
Low Ambient Temperature Head Pressure Control (not available with high-efficiency variable condenser fans)	X	X
Minimum Load Control (not available with Leaving Fluid Temperature < 38°F [< 3.3°C])	X	X
Suction Line Insulation	X	
Security/Packaging Options		
Condenser Coil Trim Panels	X	X
Security Grilles	X	X
Full Hail Guard		X
Upper Hail Guard	X	
Full End Screen	X	

LEGEND

E-Coated — Epoxy Coating Applied to Entire Coil Assembly
EMM — Energy Management Module
LON — Local Operating Network
MCHX — Microchannel Heat Exchanger

NOTES:
1. Std SCCR (short circuit current rating) (5 kA).
2. High SCCR 460 v (65 kA).

Factory-installed options

Condenser coil options are available to match coil construction to the site conditions for the best durability. Refer to the Condenser Coil Corrosion Protection Options table on page 16 or the appropriate selection guide for more information.

Compressor suction service valve provides additional isolation of the compressor from the cooler vessel for service. Standard refrigerant discharge isolation and liquid valves enable service personnel to store the refrigerant charge in the cooler or condenser during servicing.

Suction line insulation is tubular, closed-cell insulation. This option is required on applications with leaving fluid temperatures below 30°F (–1.1°C) and recommended for areas of high dewpoints where condensation may be a concern.

Hydronic pump package option adds circulating pumps, a combination valve (isolation, modulation and check), strainer, Victaulic field piping connections, insulation and heaters, and pressure/temperature taps (3). The pumps are available in single or dual (lead/lag controlled) cooler pump versions with total dynamic head external to the chiller from approximately 20 to 140 ft (6.1 m to 42.7 m). Also includes heater and insulation for freeze protection to –20°F (–29°C). The hydronic pump package is available for sizes 060-190 and cannot be used in conjunction with units with high SCCR option.

High-efficiency variable condenser fans control the speed of all fans for improvement in part load efficiency and sound levels. Additionally, high-efficiency variable condenser fans maintain head pressure control down to –20°F (–29°C)

ambient temperature with the use of glycol and wind baffles. Varying the speed of all fans on a circuit to a prescribed speed provides accurate head pressure control to the most efficient point while achieving optimum usage of the coils to accomplish excellent part load efficiency. These fans are the key component of the 30RB chiller with Greenspeed® intelligence. This option is not available on unit sizes 060 and 070.

Low ambient temperature head pressure control permits operation of the 30RB units to –20°F (–29°C) outdoor ambient temperature. The control is also available as a field-installed accessory and requires field-installed wind baffles. (This option or accessory is neither required nor available with the high-efficiency variable condenser fan option.)

CRN cooler (Canada only) provides minor cooler modifications to meet Canadian code.

Unit-mounted non-fused disconnect option provides non-fused disconnect capability for power and control located at the unit. On dual point power applications, this option is not available on 30RB060-120. This option is included with the high SCCR option.

Minimum load control option allows additional capacity reduction for unit operation below the minimum step of unloading (down to 6% of the full load unit capacity, depending on unit size). Minimum load control is also available as a field-installed accessory. This option is not available on applications with leaving fluid temperature less than 38°F (3.3°C).

Security grilles protect the condenser coil from damage with coated wire grilles with openings of 1 by 4 in. (25 mm x 102 mm). The security grille option requires the condenser coil trim panel option. Security grilles are also available as a field-installed accessory.

Condenser coil trim panels provide an aesthetic, finished appearance for the condenser coil ends of the cooler/pump connection side of the unit. Condenser coil trim panels are also available as a field-installed accessory.

Upper hail guard consists of louvered panels on the ends of the machine, which firmly fasten to the machine frame and provide coverage from the top of the unit to the bottom of the coil. A hinged accessory hail guard is also available. The accessory covers the entire unit end (both ends), and, with its hinged design, is not identical to this option.

Full end screen consists of louvered panels on the ends of the machine, providing complete coverage from the top to the bottom of the unit. This option functions as both a privacy screen and a hail guard. For hail protection, an accessory hail guard is also available. The accessory covers the entire unit end (both ends), and, with its hinged design, is not identical to this option.

High SCCR (short circuit current rating) devices allow the chiller to tolerate a 65 kA short circuit current for a brief period of time while protecting downstream components. The high SCCR provides a higher level of protection than the standard chiller components. This option is not available on 30RB250-300. It is available only at 460 v and includes the unit-mounted non-fused disconnect option. The standard SCCR rating for all models is 5 kA.

Low sound - compressor sound blankets reduce unit sound levels by providing an acoustic blanket on each compressor.

Ultra low sound - compressor sound enclosures provide enclosures which encase compressors that are covered with acoustic blankets.

Energy management module provides energy management capabilities to minimize chiller energy consumption. Several features are provided with this module including leaving fluid temperature reset, cooling set point reset or demand limit control from a 4 to 20 mA signal, 2-step demand limit control (from 0 to 100%) activated by a remote contact closure (one-step demand limit does not require the energy management module), and discrete input for "Ice Done" indication for ice stage system interface.

Convenience outlet includes a 4-amp GFI (ground fault interrupt) receptacle with independent fuse protection. Convenience outlet is a 115-v female receptacle.

BACnet communication option provides pre-programmed factory-installed communication capability with a BACnet MS/TP network. Allows integration with i-Vu® Open control system or a third-party BACnet building automation system. No field programming is required.

BACnet/Modbus translator control provides an interface between the chiller and a BACnet Local Area Network (LAN, i.e., MS/TP EIA-485). Field programming is required.

LON translator control provides an interface between the chiller and a Local Operating Network (LON, i.e., LonWorks FT-10A ANSI/EIA-709.1). Field programming is required.

Field-installed accessories

Minimum load control accessory allows additional capacity reduction for unit operation below the minimum step of unloading (down to 6% of the minimum unit capacity, depending on unit size) via hot gas bypass. This accessory is not available on applications with leaving fluid temperature less than 38°F (3.3°C).

Full hail guard consists of hinged, louvered panels, which cover both ends of the unit. This accessory provides complete protection from hail and flying debris. For hail protection, two factory options are also available. These options directly fasten to the end of the chillers (are not hinged), and therefore are not identical to this accessory.

Navigator™ display accessory provides a portable handheld display for convenient access to unit status, operation, configuration and troubleshooting diagnostics capability. The four-line, 80-character LCD display provides clear language information in English, French, Spanish, or Portuguese. The weatherproof enclosure and industrial grade extension cord enables the Navigator display to be ideally suited for outdoor applications. Magnets located on the back of the module allow attachment to any sheet metal component for hands-free operation.

Remote enhanced display accessory kit contains a remotely mounted indoor 40-character per line, 16-line display panel for unit diagnostics.

Touch Pilot™ display used as an accessory is a cost-effective, touch-screen, remote-mount device.

Chillervisor System Manager III multi-unit control accessory allows sequencing of between two and eight chillers in parallel. Pump control is also provided.

Low ambient temperature head pressure control permits operation of the 30RB units to –20°F (–29°C) outdoor ambient temperature. The control is also available as a factory-installed option and requires field-installed wind baffles. (This option or accessory is neither required nor available with the high-efficiency variable speed fan option.)

Options and accessories (cont)

Energy management module provides energy management capabilities to minimize chiller energy consumption. Several features are provided with this module including leaving fluid temperature reset, cooling set point reset or demand limit control from a 4 to 20 mA signal, 2-step demand limit control (from 0 to 100%) activated by a remote contact closure (one-step demand limit does not require the energy management module), and discrete input for "Ice Done" indication for ice stage system interface.

Remote service port consists of a receptacle for Navigator connection. The port is housed in a waterproof enclosure conveniently located for easy access to information during operation and maintenance routines.

Convenience outlet includes a 4-amp GFI (ground fault interrupt) receptacle with independent fuse protection. Convenience outlet is a 115-v female receptacle.

Remote cooler accessory provides the additional hardware required to remotely mount the cooler from the unit. The cooler-unit separation is limited to 75 equivalent feet. The remote cooler accessory cannot be used with MCHX condenser coils or in brine applications. Never bury refrigerant piping on these or any other applications.

BACnet/Modbus translator control provides an interface between the chiller and a BACnet Local Area Network (LAN, i.e., MS/TP EIA-485). Field programming is required.

LON translator control provides an interface between the chiller and a Local Operating Network (LON, i.e., LonWorks FT-10A ANSI/EIA-709.1). Field programming is required.

Security grilles protect the condenser coil from damage with coated wire grilles and openings of 1 by 4 in. (25 mm x 102 mm). The security grille accessory requires the condenser coil trim panel accessory. Security grilles are also available as a factory-installed option.

Condenser coil trim panels provide an aesthetic, finished appearance for the condenser coil ends of the cooler/pump connection side of the unit. Condenser coil trim panels are also available as a factory-installed option.

Dual chiller accessory kit provides the additional hardware (thermistors, wells, connectors) required for applications with 2 chillers running in parallel.

CONDENSER COIL CORROSION PROTECTION OPTIONS

ENVIRO-SHIELD™ OPTION*	ENVIRONMENT				
	Standard	Mild Coastal	Severe Coastal	Industrial	Combined Industrial/Coastal
Novation® Heat Exchanger (Standard)	See NACO Packaged Chiller Builder				
Novation Heat Exchanger, E-coat	See NACO Packaged Chiller Builder				
AL Fins	X				
CU Fins		X			
AL Fins, E-coat			X	X	X
CU Fins, E-coat			X		
AL Fins, Pre-coated		X			

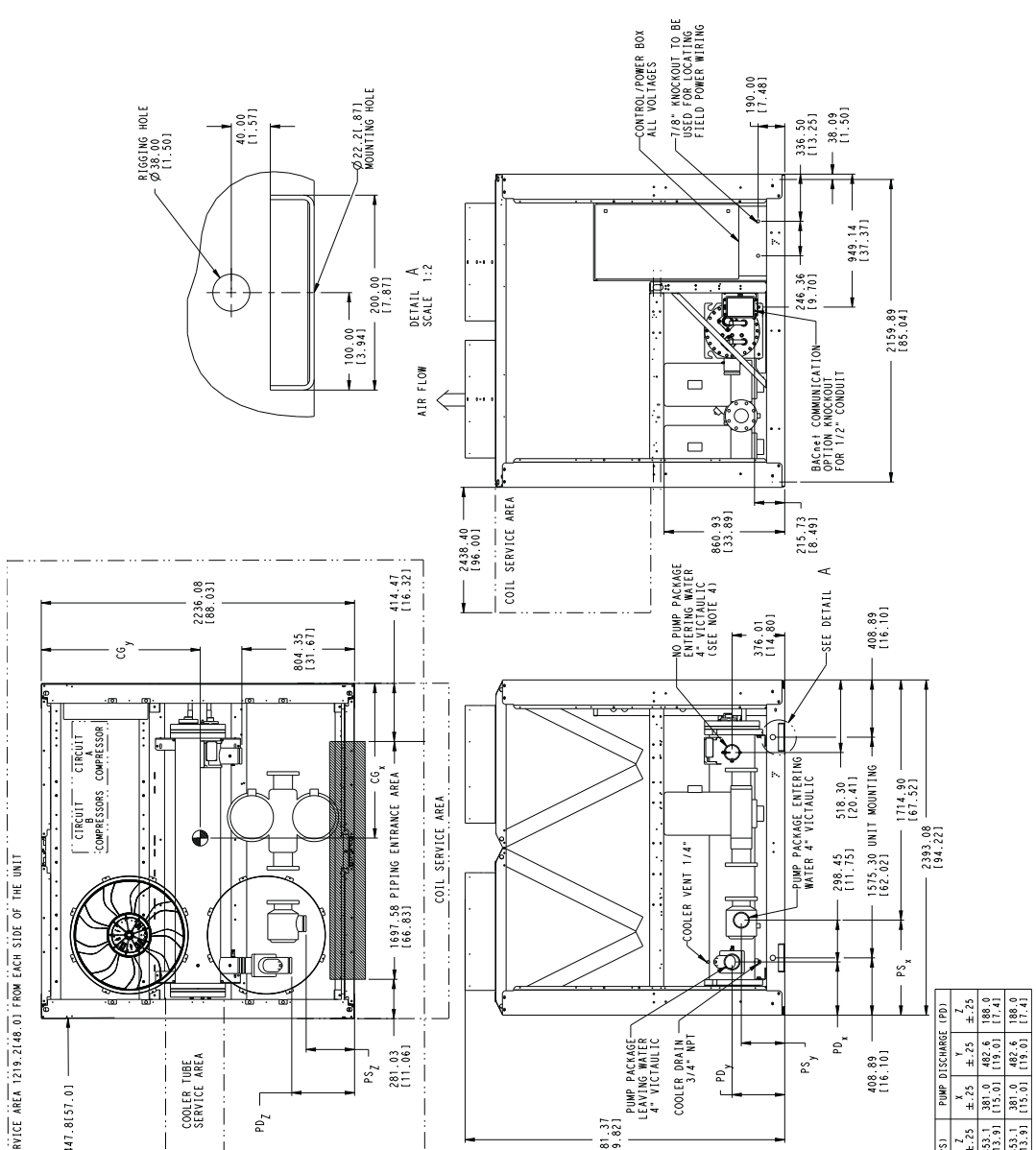
LEGEND

AL — Aluminum
CU — Copper
NACO — North American Commercial Operations

* See NACO Packaged Chiller Builder for details. Additional corrosion protection is available. For Novation or round tube/plate fin (RTPF) heat exchangers, see selection guide "Environmental Corrosion Protection" (Publication 04-581061-01).

Dimensions

30RB060, 070 AIR-COOLED CHILLER



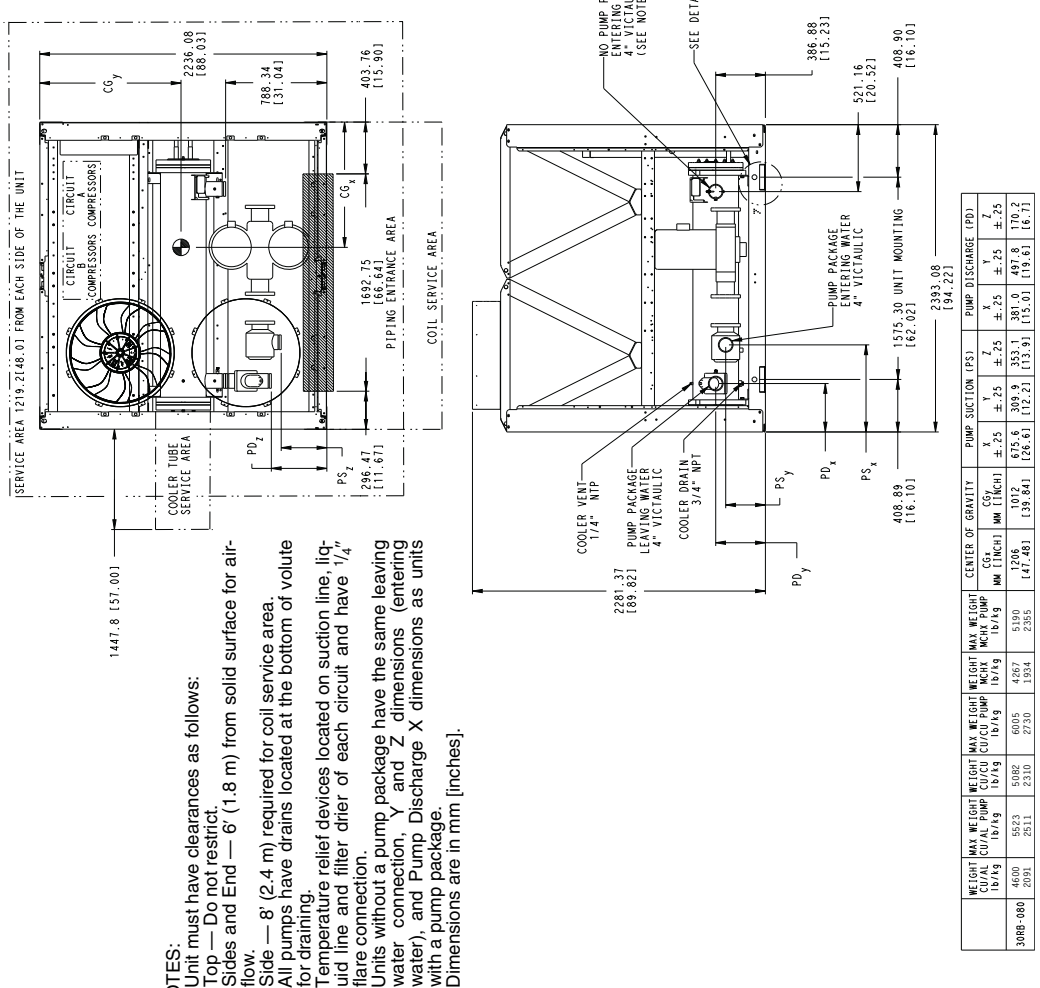
	WEIGHT CU/AL lb/kg	MAX. WEIGHT CU/AL PUMP lb/kg	WEIGHT CU/CU PUMP lb/kg	MAX WEIGHT CU/CU PUMP lb/kg	WEIGHT MCHX lb/kg	MAX WEIGHT MCHX PUMP lb/kg	CENTER OF GRAVITY CGx MM [INCH]	CGy MM [INCH]	PUMP SUCTION (PS) X ±.25	Y ±.25	Z ±.25	PUMP DISCHARGE (PD) X ±.25	Y ±.25	Z ±.25
30RB-060	4111 1869	4944 2247	4593 2088	5426 2466	3783 1716	4616 2094	1164 [45.82]	1038 [40.86]	675.6 [26.6]	309.9 [12.2]	353.1 [13.9]	381.0 [15.0]	482.6 [19.0]	188.0 [7.4]
30RB-070	4317 1932	5150 2641	4799 2181	5632 2560	3978 1804	4811 2182	1165 [45.86]	1013 [39.88]	675.6 [26.6]	309.9 [12.2]	353.1 [13.9]	381.0 [15.0]	482.6 [19.0]	188.0 [7.4]

NOTES:
1. Unit must have clearances as follows:
   Top — Do not restrict.
   Sides and End — 6' (1.8 m) from solid surface for airflow.
   Side — 8' (2.4 m) required for coil service area.
2. All pumps have drains located at the bottom of volute for draining.
3. Temperature relief devices located on suction line, liquid line and filter drier of each circuit and have 1/4" flare connection.
4. Units without a pump package have the same leaving water connection, Y and Z dimensions (entering water), and Pump Discharge X dimensions as units with a pump package.
5. Dimensions are in mm [inches].

LEGEND
MCHX — Microchannel Condenser Coil

Dimensions (cont)

30RB080 AIR-COOLED CHILLER



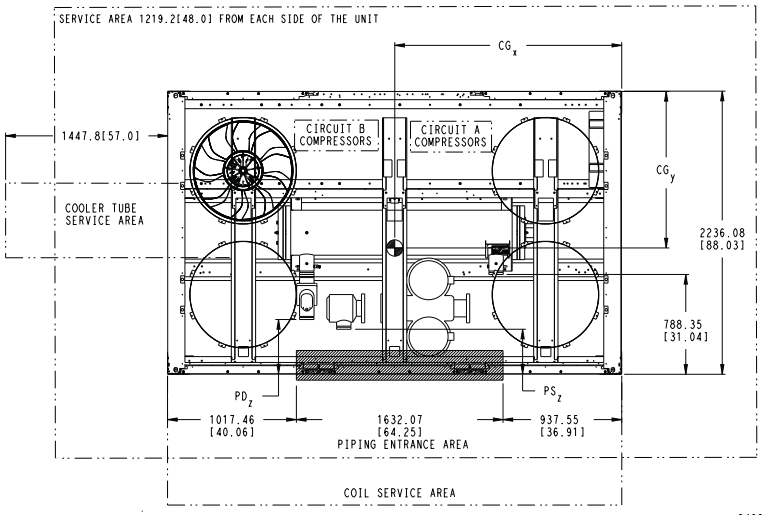
NOTES:
1. Unit must have clearances as follows:
   Top — Do not restrict.
   Sides and End — 6' (1.8 m) from solid surface for air-flow.
   Side — 8' (2.4 m) required for coil service area.
2. All pumps have drains located at the bottom of volute for draining.
3. Temperature relief devices located on suction line, liquid line and filter drier of each circuit and have 1/4" flare connection.
4. Units without a pump package have the same leaving water connection, Y and Z dimensions (entering water), and Pump Discharge X dimensions as units with a pump package.
5. Dimensions are in mm [inches].

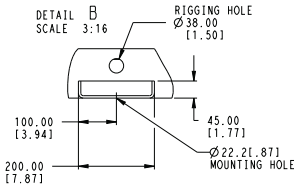
	WEIGHT COMPONENTS (TOTAL UNIT WEIGHT) lb/kg	MAX WEIGHT COMPONENTS (TOTAL UNIT WEIGHT) lb/kg	MAX WEIGHT CIRCUIT (CIRCUIT PUMP) lb/kg	WEIGHT MCHX lb/kg	MAX WEIGHT MCHX lb/kg	CENTER OF GRAVITY CG MM [INCH]	PUMP SUCTION (PS) X ±25	Y ±25	Z ±25	PUMP DISCHARGE (PD) X ±25	Z ±25
30RB-080	4600 2091	5523 2511	5082 2310	6005 2730	4267 1934	1206 [47.48]	1012 [39.84]	675.6 [26.6]	309.9 [12.2]	353.1 [13.9]	381.0 [15.0]	497.8 [19.6]	170.2 [6.7]

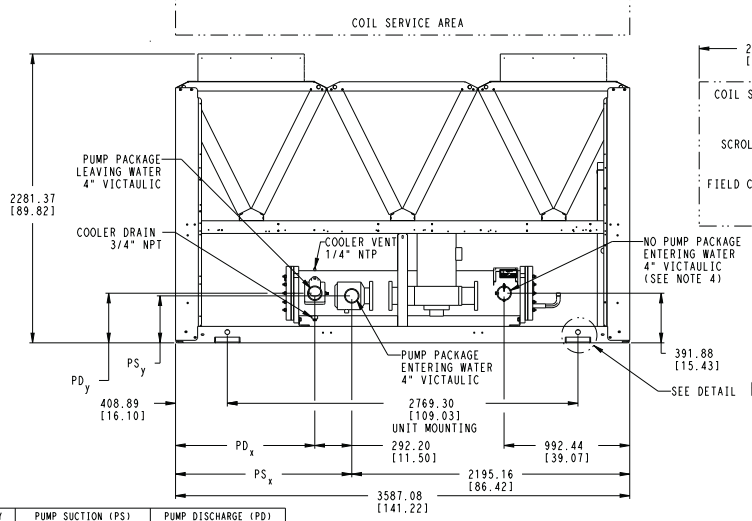
LEGEND
MCHX — Microchannel Condenser Coil

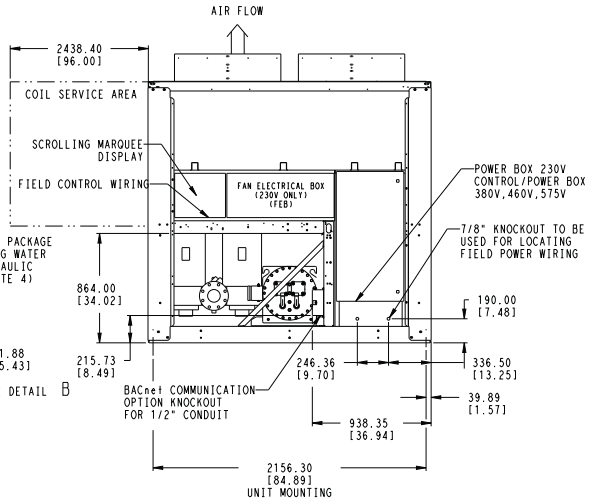
30RB090,100 AIR-COOLED CHILLER

NOTES:
1. Unit must have clearances as follows:
   Top — Do not restrict.
   Sides and End — 6′ (1.8 m) from solid surface for airflow.
   Side — 8′ (2.4 m) required for coil service area.
2. All pumps have drains located at the bottom of volute for draining.
3. Temperature relief devices located on suction line, liquid line and filter drier of each circuit and have 1/4″ flare connection.
4. Units without a pump package have the same leaving water connection, Y and Z dimensions (entering water), and Pump Discharge X dimensions as units with a pump package.
5. Dimensions are in mm [inches].







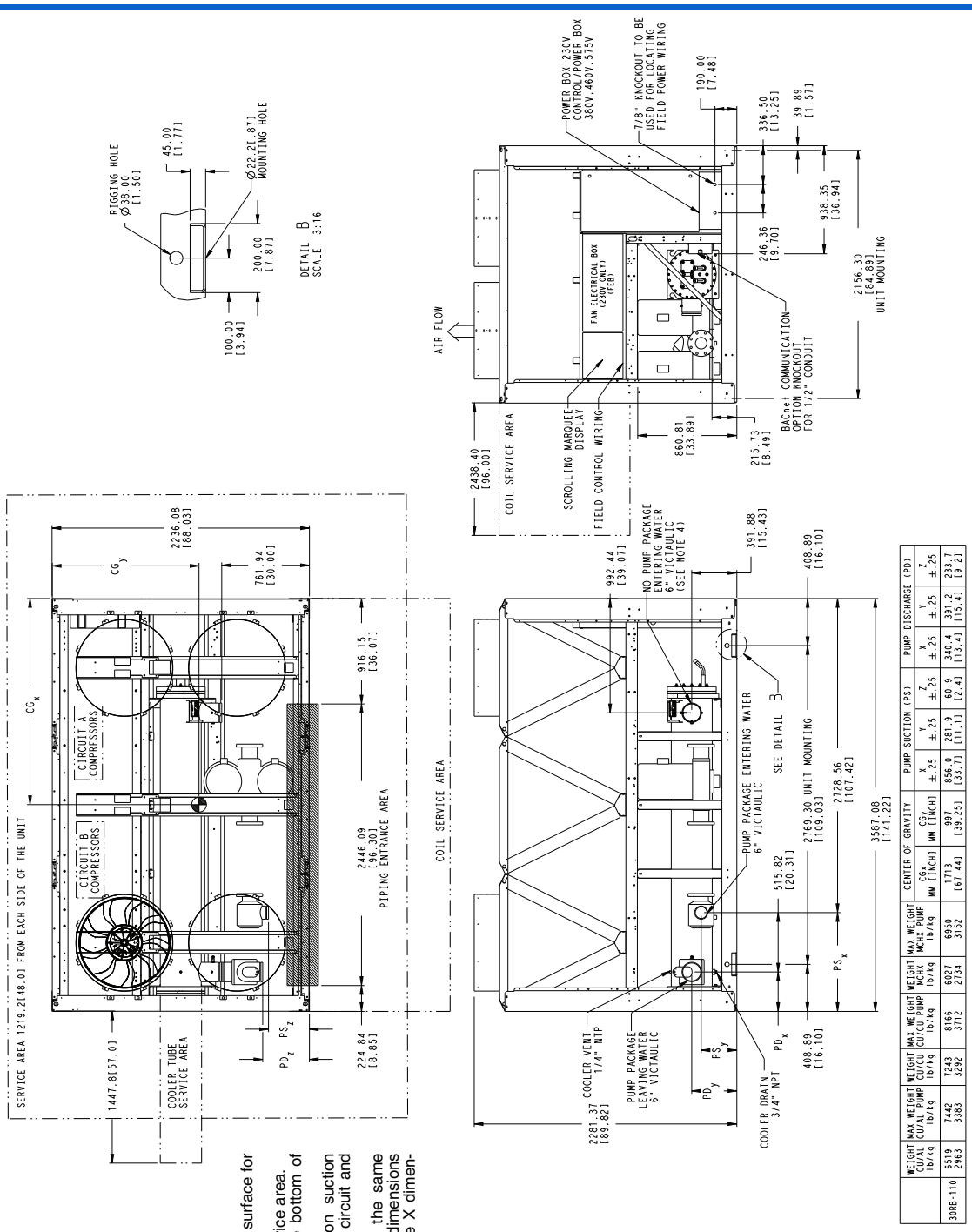


	WEIGHT CU/AL lb/kg	MAX WEIGHT CU/AL PUMP lb/kg	WEIGHT CU/CU lb/kg	MAX WEIGHT CU/CU PUMP lb/kg	WEIGHT MCHX lb/kg	MAX WEIGHT MCHX PUMP lb/kg	CENTER OF GRAVITY		PUMP SUCTION (PS)			PUMP DISCHARGE (PD)		
							CGx MM [INCH]	CGy MM [INCH]	X ±.25	Y ±.25	Z ±.25	X ±.25	Y ±.25	Z ±.25
30RB-090	5932 2697	6855 3116	6656 3026	7579 3445	5449 2472	6372 2890	1625 [64.0]	1017 [40.0]	1389.4 [54.7]	309.9 [12.2]	353.1 [13.9]	1097.3 [43.2]	497.8 [19.6]	170.2 [6.7]
30RB-100	6155 2798	7078 3217	6879 3127	7802 3547	5663 2569	6586 2987	1614 [63.5]	999 [39.3]	1389.4 [54.7]	309.9 [12.2]	353.1 [13.9]	1097.3 [43.2]	497.8 [19.6]	170.2 [6.7]

LEGEND
MCHX — Microchannel Condenser Coil

Dimensions (cont)

30RB110 AIR-COOLED CHILLER

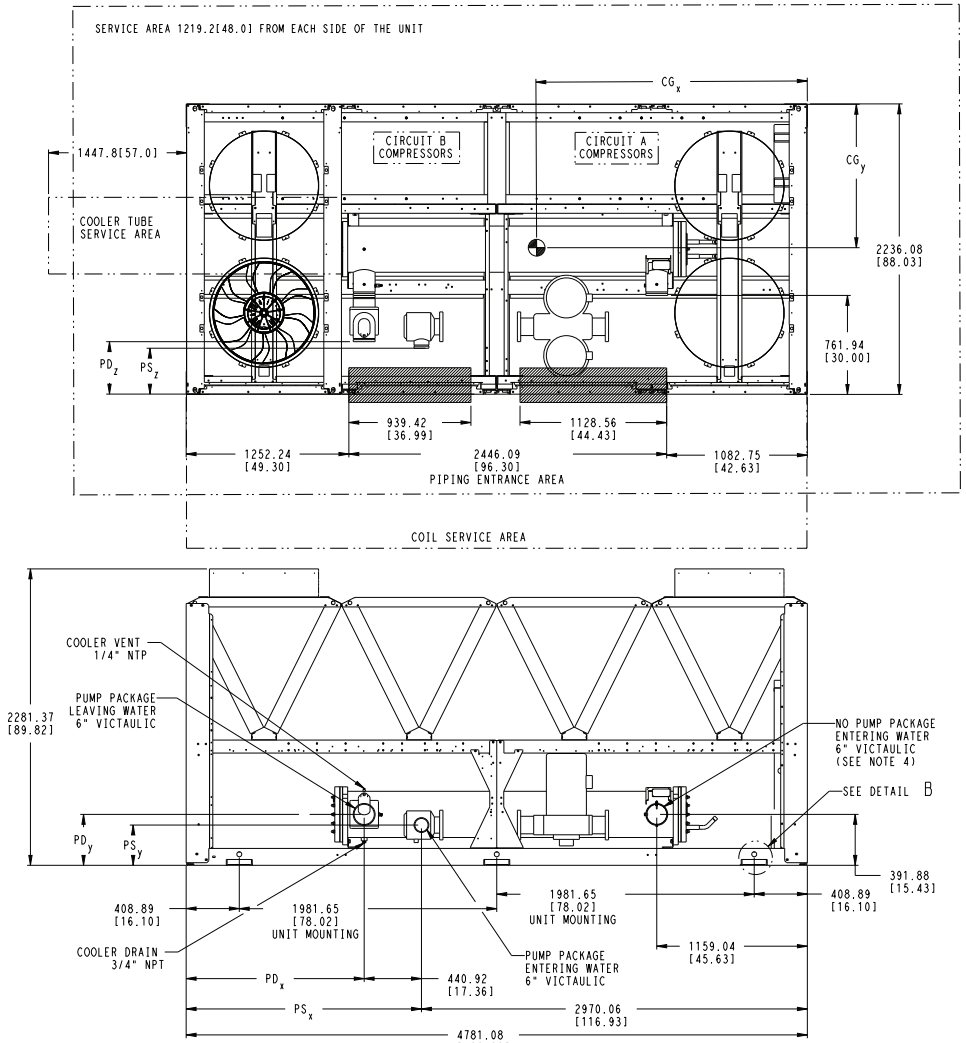


	WEIGHT CU/AL CU/AL lb/kg	MAX WEIGHT CU/AL PUMP lb/kg	WEIGHT CU/CU CU/CU lb/kg	MAX WEIGHT CU/CU PUMP lb/kg	WEIGHT MCHX lb/kg	MAX WEIGHT MCHX PUMP lb/kg	CENTER OF GRAVITY CGx MM [INCH]	CGy MM [INCH]	PUMP SUCTION (PS) X ± .25	Y ± .25	Z ± .25	PUMP DISCHARGE (PD) X ± .25	Y ± .25	Z ± .25
30RB-110	6519 2963	7442 3383	7243 3292	8166 3712	6027 2734	6950 3132	1713 [67.44]	997 [39.25]	856.0 [33.7]	281.9 [11.1]	60.9 [2.4]	340.4 [13.4]	391.2 [15.4]	233.7 [9.2]

NOTES:
1. Unit must have clearances as follows:
   Top — Do not restrict.
   Sides and End — 6' (1.8 m) from solid surface for airflow.
   Side — 8' (2.4 m) required for coil service area.
2. All pumps have drains located at the bottom of volute for draining.
3. Temperature relief devices located on suction line, liquid line and filter drier of each circuit and have 1/4" flare connection.
4. Units without a pump package have the same leaving water connection, Y and Z dimensions (entering water), and Pump Discharge X dimensions as units with a pump package.
5. Dimensions are in mm [inches].

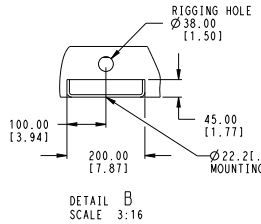
LEGEND
MCHX — Microchannel Condenser Coil

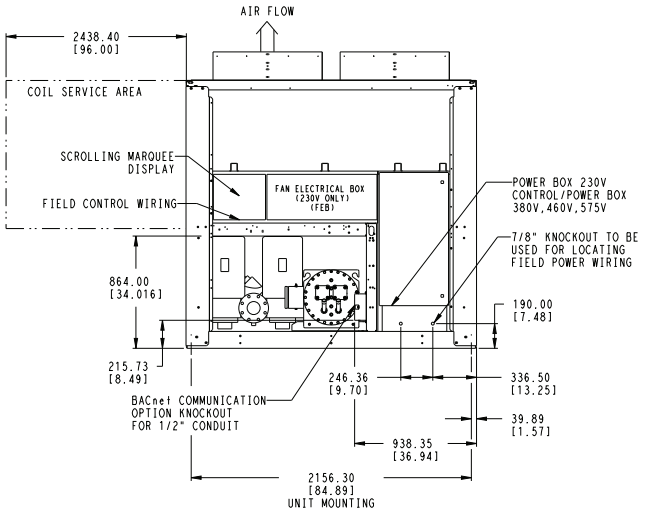
30RB120,130 AIR-COOLED CHILLER



NOTES:
1. Unit must have clearances as follows:
   Top — Do not restrict.
   Sides and End — 6′ (1.8 m) from solid surface for airflow.
   Side — 8′ (2.4 m) required for coil service area.
2. All pumps have drains located at the bottom of volute for draining.
3. Temperature relief devices located on suction line, liquid line and filter drier of each circuit and have 1/4″ flare connection.
4. Units without a pump package have the same leaving water connection, Y and Z dimensions (entering water), and Pump Discharge X dimensions as units with a pump package.
5. Dimensions are in mm [inches].

LEGEND
MCHX — Microchannel Condenser Coil





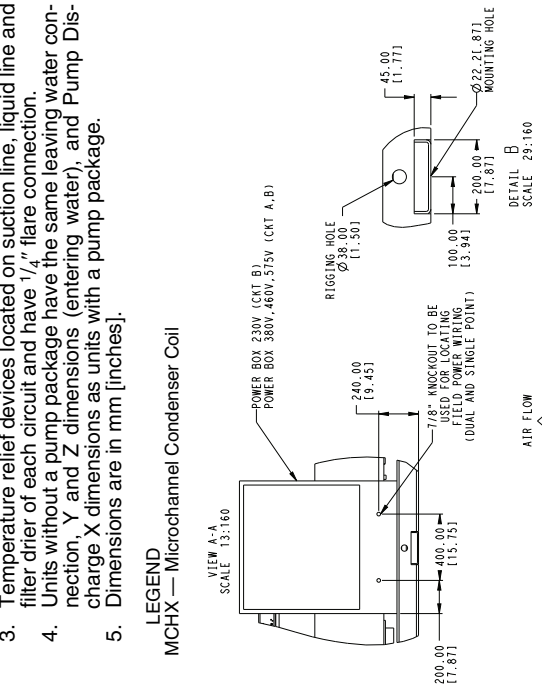
	WEIGHT CU/AL lb/kg	MAX WEIGHT CU/AL PUMP lb/kg	WEIGHT CU/CU lb/kg	MAX WEIGHT CU/CU PUMP lb/kg	WEIGHT MCHX lb/kg	MAX WEIGHT MCHX PUMP lb/kg	CENTER OF GRAVITY		PUMP SUCTION (PS)			PUMP DISCHARGE (PD)		
							CGx MM [INCH]	CGy MM [INCH]	X ±.25	Y ±.25	Z ±.25	X ±.25	Y ±.25	Z ±.25
30RB-120	7690 3488	8613 3907	8534 3871	9457 4290	7119 3229	8042 3648	2346 [92.36]	993 [39.09]	1808.5 [71.2]	281.9 [11.1]	60.9 [2.4]	1366.5 [53.8]	391.2 [15.4]	233.7 [9.2]

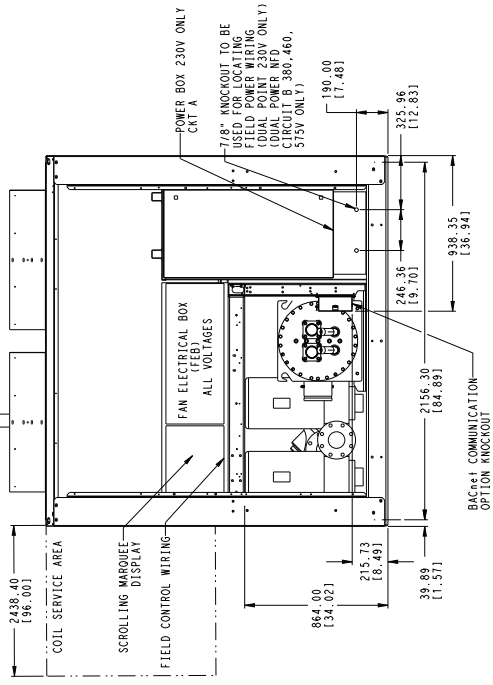
Dimensions (cont)

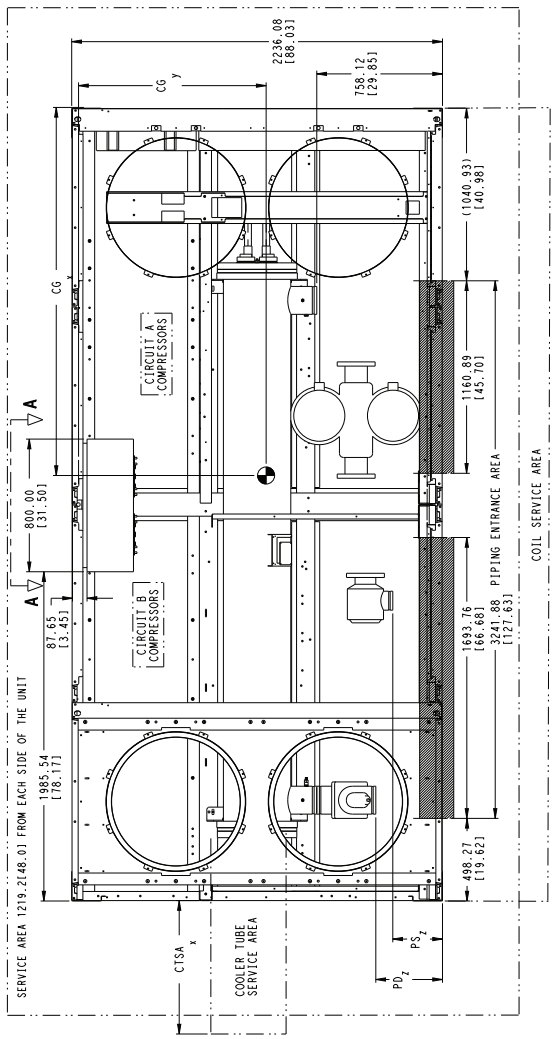
30RB150 AIR-COOLED CHILLER

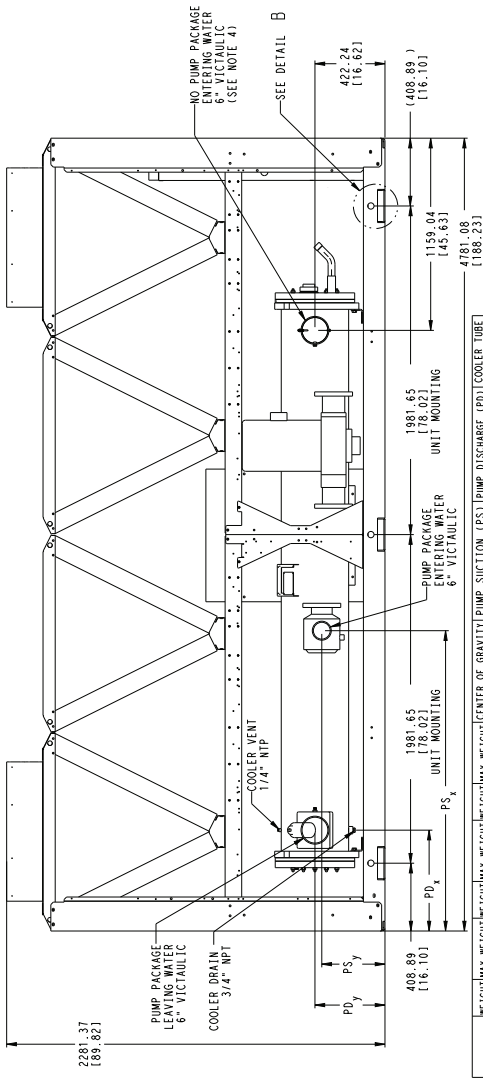
NOTES:
1. Unit must have clearances as follows:
   Top — Do not restrict.
   Sides and End — 6′ (1.8 m) from solid surface for airflow.
   Side — 8′ (2.4 m) required for coil service area.
2. All pumps have drains located at the bottom of volute for draining.
3. Temperature relief devices located on suction line, liquid line and filter drier of each circuit and have 1/4″ flare connection.
4. Units without a pump package have the same leaving water connection, Y and Z dimensions (entering water), and Pump Discharge X dimensions as units with a pump package.
5. Dimensions are in mm [inches].

LEGEND
MCHX — Microchannel Condenser Coil



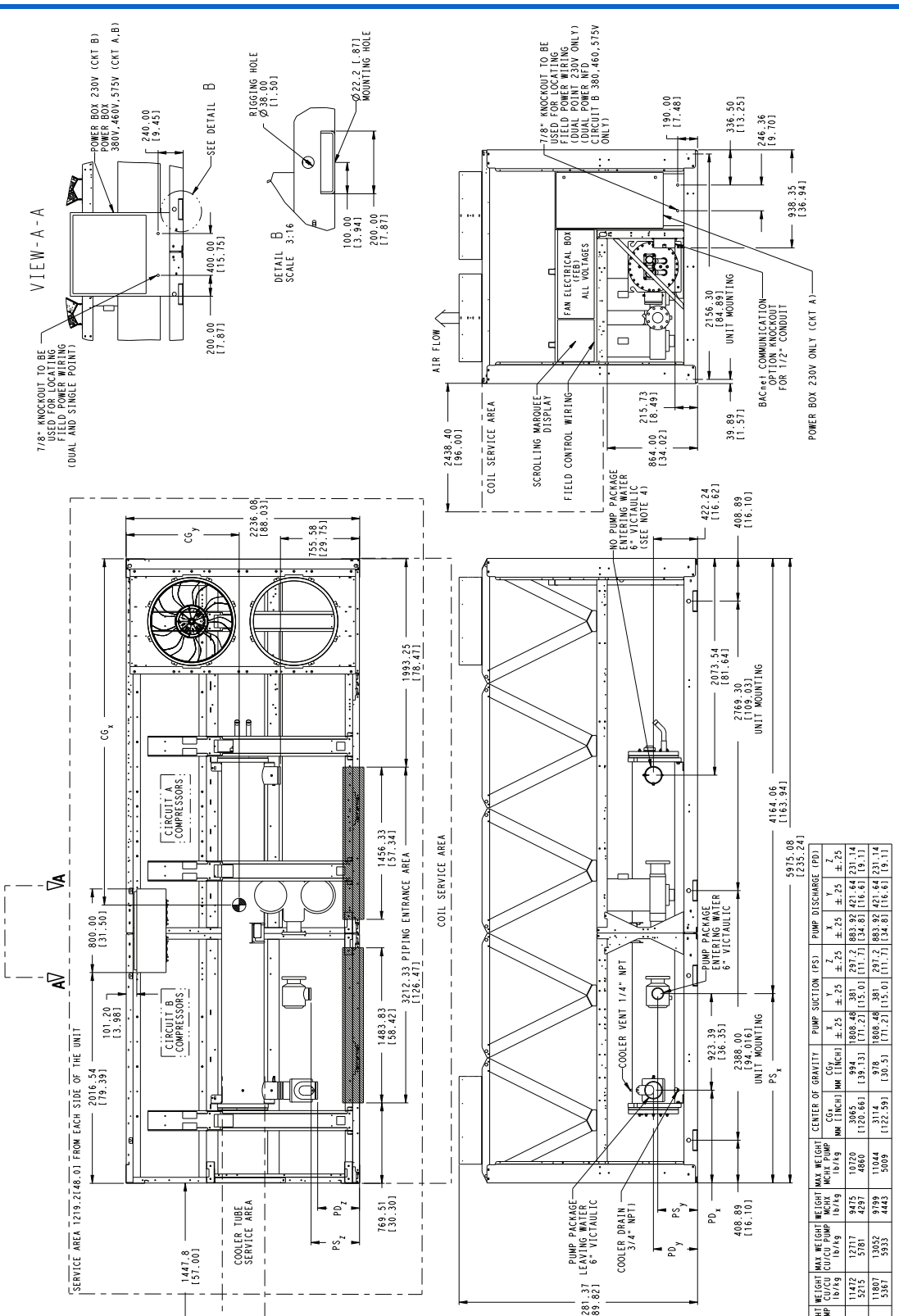






	WEIGHT CU/AL COIL kg/lb	MAX WEIGHT CU/AL PUMP kg/lb	WEIGHT CU/CU COIL kg/lb	MAX WEIGHT CU/CU PUMP kg/lb	WEIGHT MCHX COIL kg/lb	MAX WEIGHT MCHX PUMP kg/lb	CENTER OF GRAVITY CG$_x$ MM [INCH]	CG$_y$	PUMP SUCTION (PS) X ±.25	Y ±.25	Z ±.25	PUMP DISCHARGE (PD) X ±.25	Y ±.25	Z ±.25	COOLER TUBE SERVICE AREA CTSA * MM [INCH]
30RB-130	8045 3649	8968 4068	9010 4087	9933 4506	7402 3358	8325 3776	2272 [89.45]	983 [38.70]	1808.5 [71.2]	281.9 [11.1]	60.9 [2.4]	1366.5 [53.8]	391.2 [15.4]	233.7 [9.2]	1447.8 [57.0]
30RB-150	9174 4161	10419 4726	10139 4599	11384 5164	8517 3863	9762 4428	2392 [94.17]	983 [38.70]	1808.5 [71.2]	381 [15.0]	297.2 [11.7]	604.5 [23.8]	421.6 [16.6]	231.1 [9.1]	2905.8 [114.4]

30RB160, 170 AIR-COOLED CHILLER



	WEIGHT EQUAL CIRCUIT LOADING lb/kg	MAX WEIGHT EQUAL CIRCUIT LOADING lb/kg	WEIGHT CIRCUIT A CIRCUIT PUMP lb/kg	MAX WEIGHT CIRCUIT A CIRCUIT PUMP lb/kg	WEIGHT CIRCUIT B CIRCUIT PUMP lb/kg	MAX WEIGHT CIRCUIT B CIRCUIT PUMP lb/kg	CENTER OF GRAVITY		PUMP SUCTION (PS)			PUMP DISCHARGE (PD)		
							CGx MM [INCH]	CGy MM [INCH]	X ±.25	Y ±.25	Z ±.25	X ±.25	Y ±.25	Z ±.25
30RB-160	10266 4656	11511 5232	11472 5215	12717 5781	9475 4297	10720 4860	3065 [120.66]	994 [39.13]	1808.48 [71.2]	381 [15.0]	297.2 [11.7]	883.92 [34.8]	421.64 [16.6]	231.14 [9.1]
30RB-170	10601 4819	11846 5385	11807 5367	13052 5933	9739 4443	11044 5009	3114 [122.59]	978 [38.51]	1808.48 [71.2]	381 [15.0]	297.2 [11.7]	883.92 [34.8]	421.64 [16.6]	231.14 [9.1]

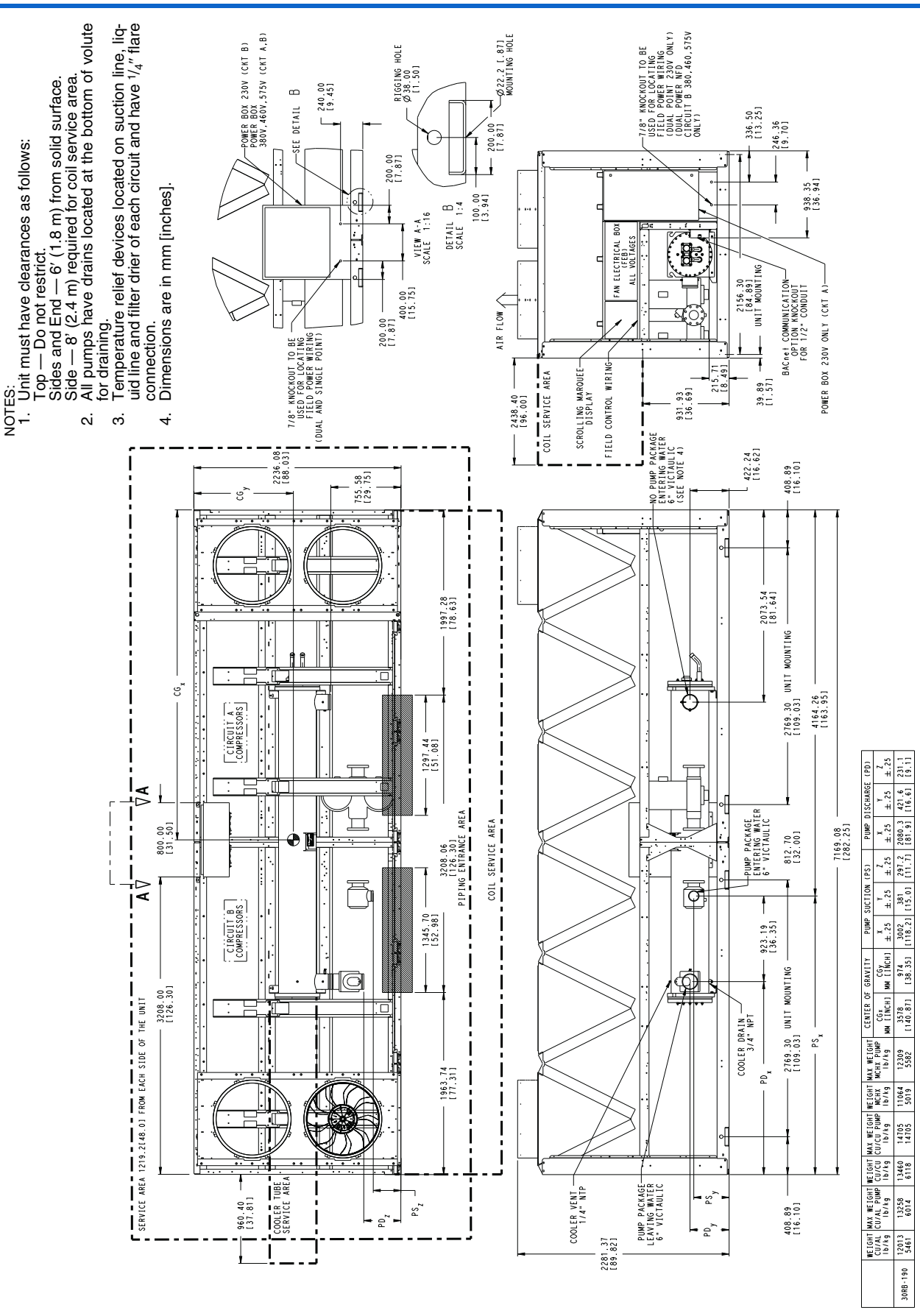
LEGEND
MCHX — Microchannel Condenser Coil

NOTES:
1. Unit must have clearances as follows:
   Top — Do not restrict.
   Sides and End — 6' (1.8 m) from solid surface for airflow.
   Side — 8' (2.4 m) required for coil service area.
2. All pumps have drains located at the bottom of volute for draining.
3. Temperature relief devices located on suction line, liquid line and filter drier of each circuit and have 1/4" flare connection.
4. Units without a pump package have the same leaving water connection, Y and Z dimensions (entering water), and Pump Discharge X dimensions as units with a pump package.
5. Dimensions are in mm [inches].

Dimensions (cont)

30RB190 AIR-COOLED CHILLER

NOTES:
1. Unit must have clearances as follows:
   Top — Do not restrict.
   Sides and End — 6' (1.8 m) from solid surface.
   Side — 8' (2.4 m) required for coil service area.
2. All pumps have drains located at the bottom of volute for draining.
3. Temperature relief devices located on suction line, liquid line and filter drier of each circuit and have 1/4" flare connection.
4. Dimensions are in mm [inches].

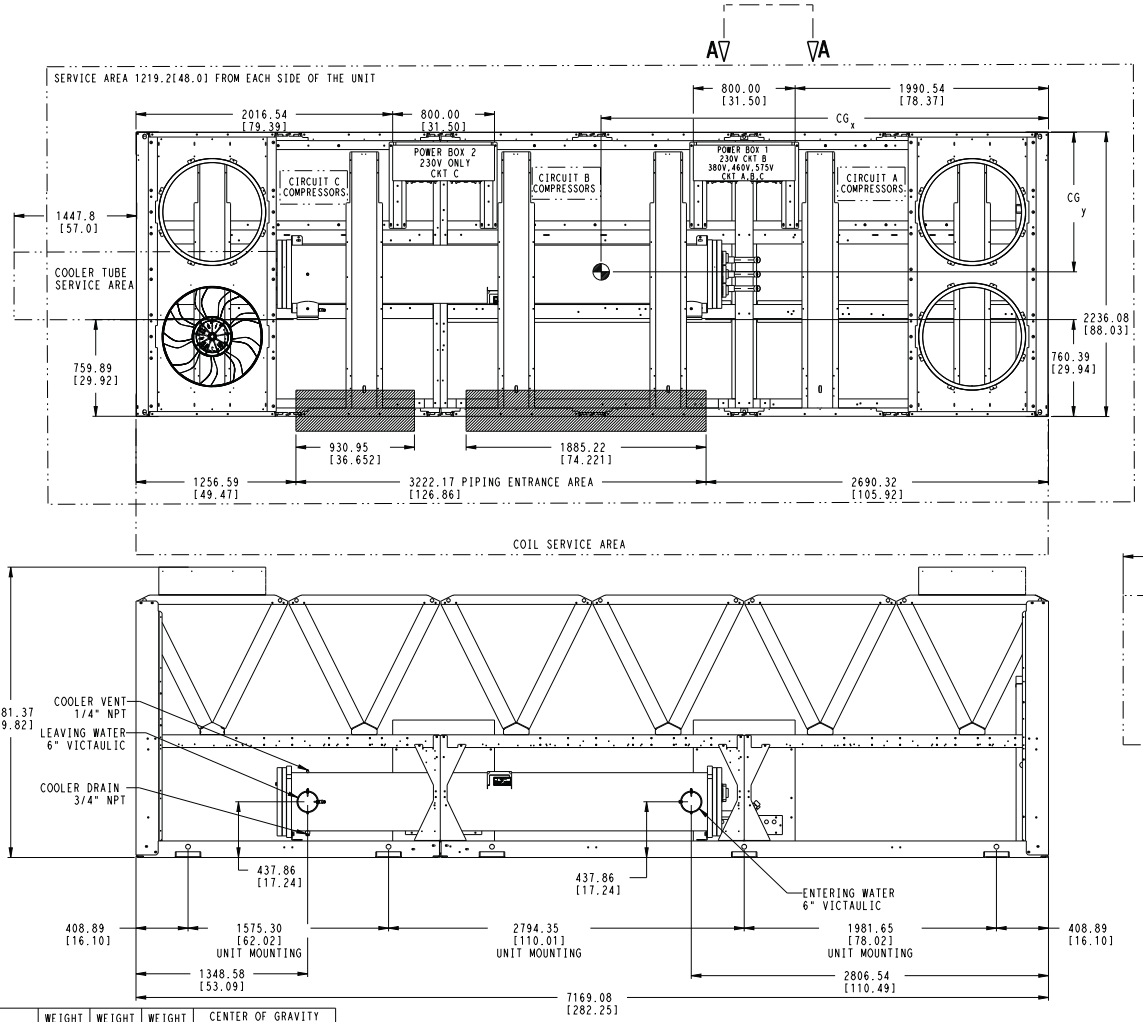


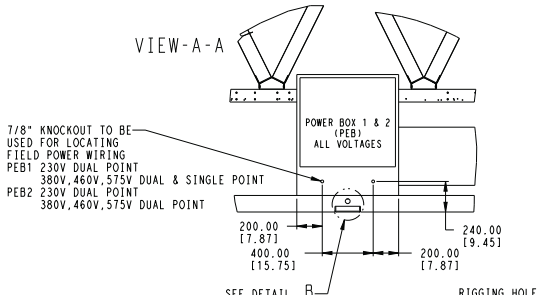
	WEIGHT CU/AL lb/kg	MAX WEIGHT CU/AL PUMP lb/kg	WEIGHT CU/CU lb/kg	MAX WEIGHT CU/CU PUMP lb/kg	WEIGHT MCHX lb/kg	MAX WEIGHT MCHX PUMP lb/kg	CENTER OF GRAVITY CGx MM [INCH]	CGy MM [INCH]	PUMP SUCTION (PS) X ±.25	Y ±.25	Z ±.25	PUMP DISCHARGE (PD) X ±.25	Y ±.25	Z ±.25
30RB-190	12013 5461	13258 6014	13460 6118	14705 14705	11064 5019	12309 5582	3578 [140.87]	974 [38.35]	3002 [118.2]	381 [15.0]	297.2 [11.7]	2080.3 [81.9]	421.6 [16.6]	231.1 [9.1]

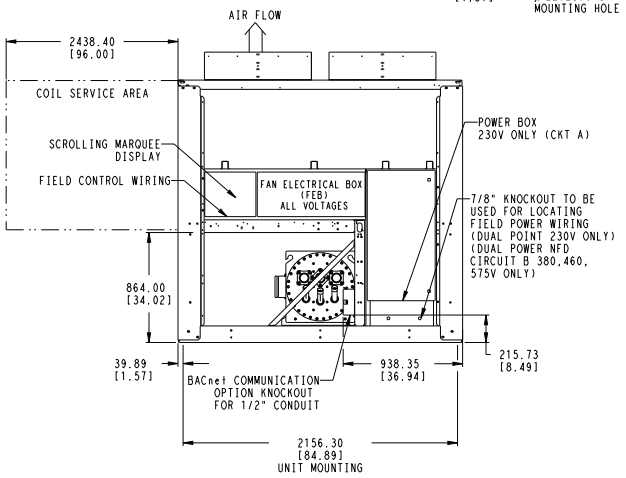
LEGEND
MCHX — Microchannel Condenser Coil

30RB210,225 AIR-COOLED CHILLER

NOTES:
1. Unit must have clearances as follows:
   Top — Do not restrict.
   Sides and End — 6′ (1.8 m) from solid surface.
   Side — 8′ (2.4 m) required for coil service area.
2. Temperature relief devices located on suction line, liquid line and filter drier of each circuit and have $^1/_4$″ flare connection.
3. Dimensions are in mm [inches].







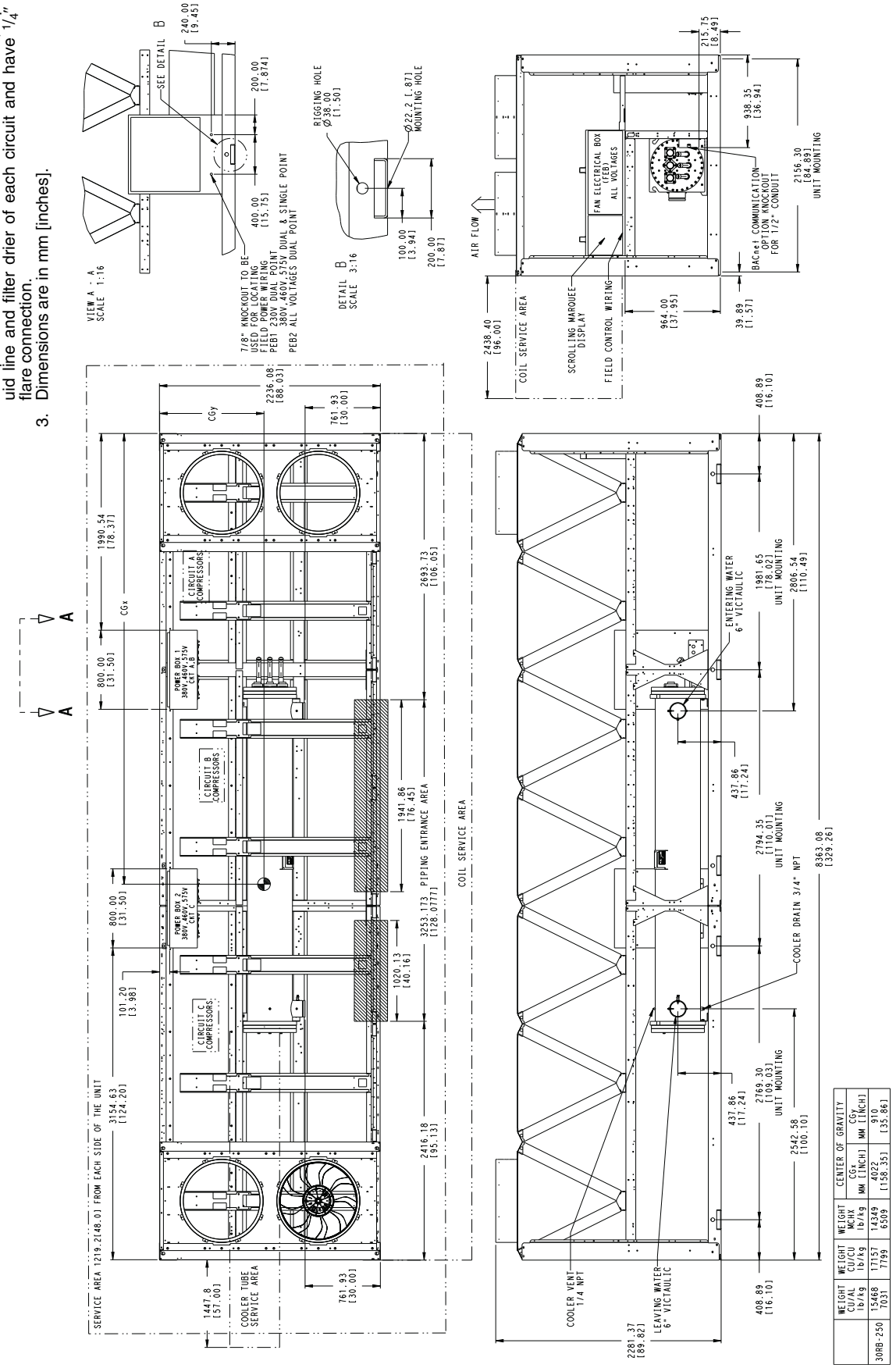
	WEIGHT CU/AL lb/kg	WEIGHT CU/CU lb/kg	WEIGHT MCHX lb/kg	CENTER OF GRAVITY CGx MM [INCH]	CGy MM [INCH]
30RB-210	13734 6243	15181 6901	12772 5793	3528 [138.90]	917 [36.10]
30RB-225	14067 6394	15514 7052	13093 5937	3588 [141.26]	906 [35.67]

LEGEND
MCHX — Microchannel Condenser Coil

Dimensions (cont)

30RB250 AIR-COOLED CHILLER

NOTES:
1. Unit must have clearances as follows:
   Top — Do not restrict.
   Sides and End — 6' (1.8 m) from solid surface.
   Side — 8' (2.4 m) required for coil service area.
2. Temperature relief devices located on suction line, liquid line and filter drier of each circuit and have 1/4" flare connection.
3. Dimensions are in mm [inches].

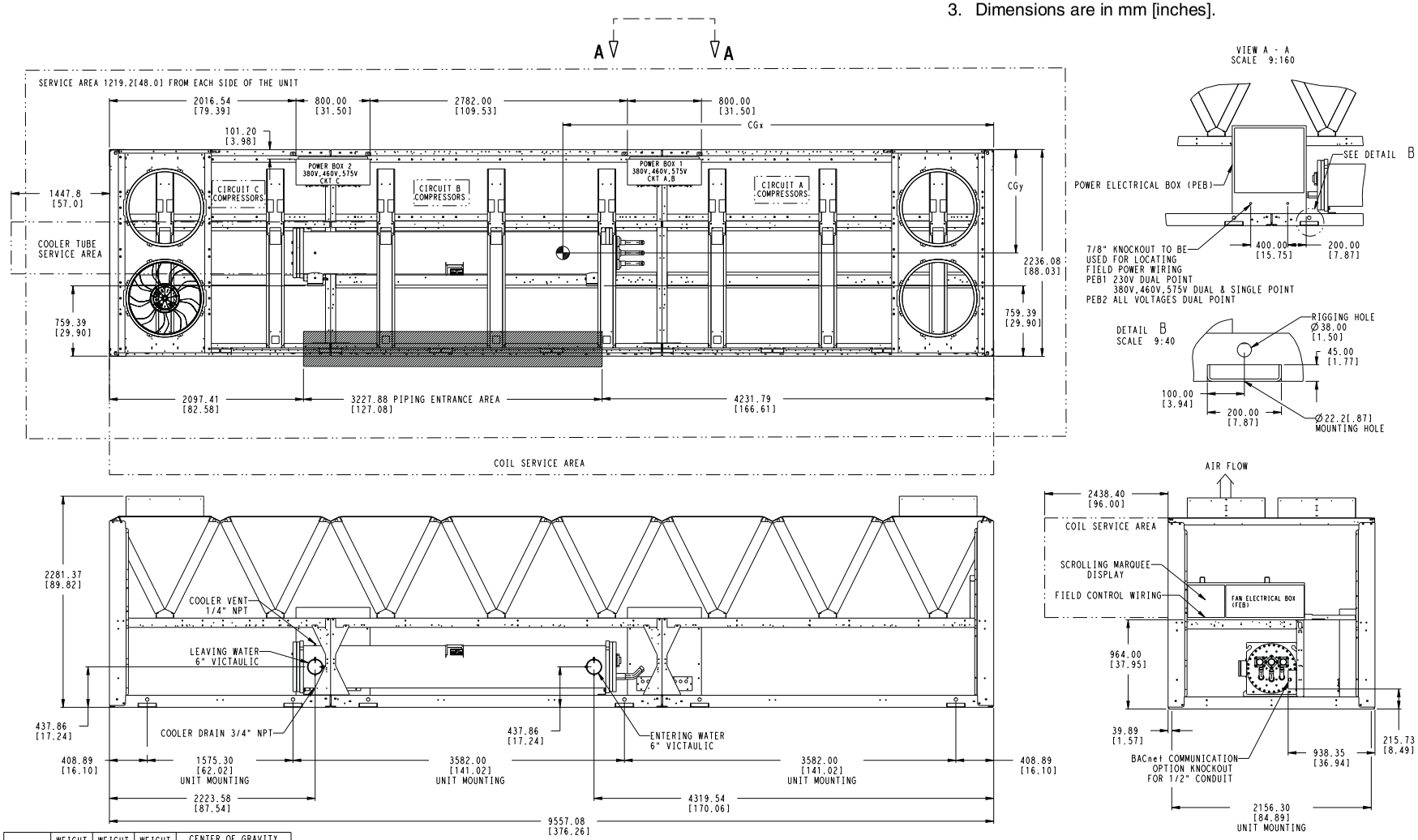


	WEIGHT CU/CI lb/kg	WEIGHT CU/AL lb/kg	WEIGHT MCHX lb/kg	CENTER OF GRAVITY CGx MM [INCH]	CGy MM [INCH]
30RB-250	15468 7031	17157 7799	14349 6509	4022 [158.35]	910 [35.86]

LEGEND
MCHX — Microchannel Condenser Coil

30RB275 AIR-COOLED CHILLER

NOTES:
1. Unit must have clearances as follows:
   Top — Do not restrict.
   Sides and End — 6′ (1.8 m) from solid surface.
   Side — 8′ (2.4 m) required for coil service area.
2. Temperature relief devices located on suction line, liquid line and filter drier of each circuit and have 1/4″ flare connection.
3. Dimensions are in mm [inches].



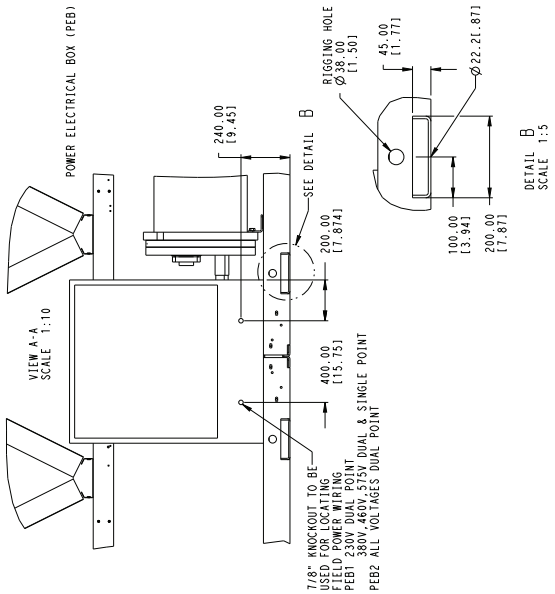
	WEIGHT CU/AL lb/kg	WEIGHT CU/CU lb/kg	WEIGHT MCHX lb/kg	CENTER OF GRAVITY CGx MM [INCH]	CGy MM [INCH]
30RB-275	16915 7689	18845 8566	15647 7096	4857 [191.22]	914 [35.98]

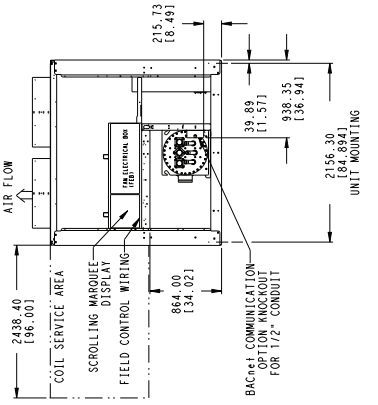
LEGEND
MCHX — Microchannel Condenser Coil

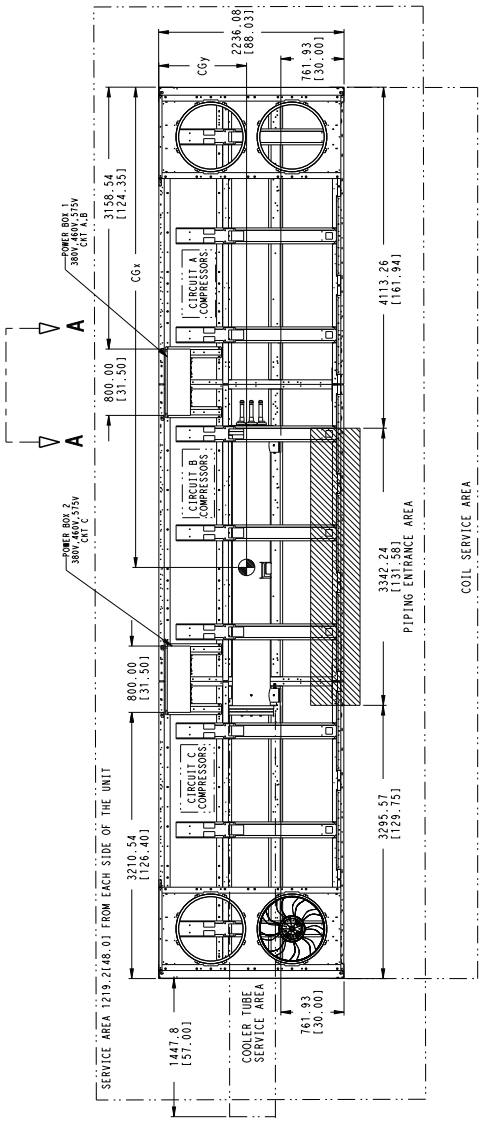
Dimensions (cont)

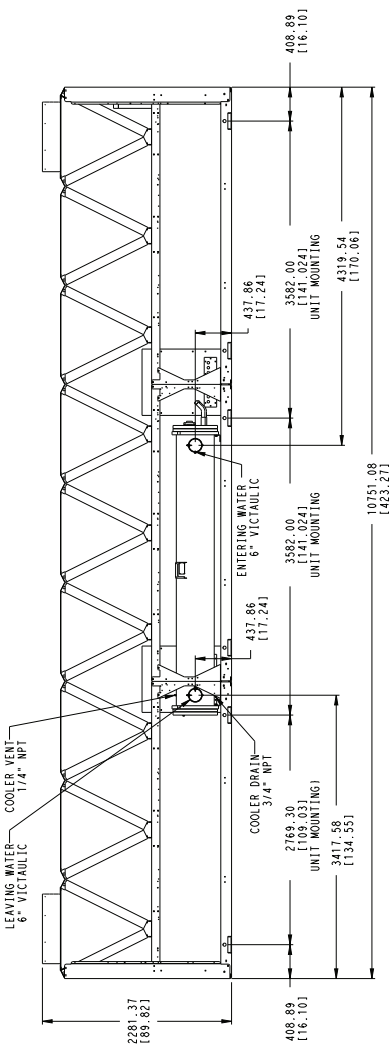
30RB300 AIR-COOLED CHILLER

NOTES:
1. Unit must have clearances as follows:
   Top — Do not restrict.
   Sides and End — 6' (1.8 m) from solid surface.
   Side — 8' (2.4 m) required for coil service area.
2. Temperature relief devices located on suction line, liquid line and filter drier of each circuit and have 1/4" flare connection.
3. Dimensions are in mm [inches].









	WEIGHT CU/AL lb/kg	WEIGHT CU/CU lb/kg	WEIGHT MCHX lb/kg	CENTER OF GRAVITY CGx MM [INCH]	CGy MM [INCH]
30RB-300	18306 8321	20477 9308	16893 7659	5317 [203.33]	916 [36.06]

LEGEND
MCHX — Microchannel Condenser Coil

Selection procedure

Carrier's NACO (North American Commercial Operations) Packaged Chiller Builder Program provides quick, easy selection of Carrier's air-cooled liquid chillers. The program considers specific temperature, fluid and flow requirements among other factors such as fouling and altitude corrections. Before selecting a chiller, consider the following points:

Leaving water (fluid) temperature (LWT)

- If the LWT is less than 40°F (4.4°C), loop freeze protection to a minimum of 30°F (16.6°C) below the LWT set point is required.
- If the LWT is to be between 15°F and 30°F (–9.4°C and –1.1°C) and the unit size is 30RB060-100, then both suction line insulation and low ambient head pressure control (or 30RB chiller with Greenspeed® intelligence) must be included. For unit sizes 30RB110-390, operation below 30°F (–1.1°C) is not available.
- If the LWT requirement is greater than 60°F (16°C), a mixing loop is required.

Entering water temperature (EWT)

- If the EWT requirement is greater than 70°F (21.1°C), a mixing loop is required. The EWT cannot exceed 70°F (21.1°C) for extended operation. Pulldown can be accomplished from 95°F (35°C).

Cooler flow rate or cooler delta-T

- The cooler delta-T must fall between 3 and 20°F (1.7 and 11°C) while still meeting both the fluid min/max temperature requirements as well as the fluid min/max flow requirements.
- For larger or smaller delta-T applications, a mixing loop is required.
- If the cooler flow is variable, then the rate of change of flow should not exceed 10% per minute. A loop volume of greater than 3 gallons per ton (3.25 L per kW) is recommended.

Cooler pressure drop

- A high cooler pressure drop can be expected when the cooler delta-T is low. A mixing loop can help to alleviate this situation.

Water quality, fouling factor

- Poor water quality can increase the cooler fouling.
- Higher than standard fouling factors lead to lower capacity and higher input kW from a given chiller size compared to running the same application with better quality water (and lower fouling factors).

Operation below 32°F (0°C)

- Low ambient head pressure control (or 30RB chiller with Greenspeed intelligence) is required.
- Wind baffles are required.
- Consider higher loop volumes, 6 to 10 gallons per nominal ton (6.5 to 10.75 L per kW).
- Loop freeze protection with glycol is strongly recommended to a minimum of 15°F (8°C) below lowest anticipated ambient temperature.
- Chilled water pump control is strongly recommended; otherwise override capability is required.
- Consider the remote cooler option. Do not bury refrigerant piping.

Chiller idle below 32°F (0°C)

- Loop freeze protection with glycol is strongly recommended to a minimum of 15°F (8°C) below lowest anticipated ambient temperature.
- Chilled water pump control is strongly recommended; otherwise override capability is required.
- Drain the cooler — This will require a small amount of glycol for residual water. Cooler heaters (if provided) will need to be disconnected.
- Consider the remote cooler option. Never bury refrigerant lines.

Ambient temperature

- Highest allowable ambient air temperature is 125°F (52°C) for all unit sizes.
- Lowest allowable ambient temperature for the standard unit to start and operate is 32°F (0°C). With the inclusion of wind baffles (field fabricated and installed) and low ambient head pressure control (low ambient control is not required on units with Greenspeed intelligence), the unit is capable to start as low as –13°F (–25°C) and to operate as low as –20°F (–29°C) ambient temperature.

Cooling capacity requirements

- Do not oversize the chillers by more than 15% at design conditions.
- If close capacity control is required below the standard minimum step of unloading, the minimum load control option should be employed.

Coil corrosion requirements

- Coastal application
- Industrial application
- Coastal/industrial application
- Urban application
- Farming

NOTE: See NACO Packaged Chiller Builder and appropriate selection guides for more information.

Chilled water pump external head requirement

Capacity control

- Temperature reset
- Return water reset
- Outside air temperature reset
- Space temperature reset
- 4 to 20 mA temperature reset (requires an energy management module)

Demand limit

- 2-step (requires an energy management module)
- 4 to 20 mA (requires an energy management module)
- CCN loadshed

To select a chiller, use the Packaged Chiller Builder Program.

AquaSnap® pump selection

Several pump sizes are available for each AquaSnap chiller size to provide flexibility in matching water system requirements. A dual pump option is also available for primary/standby operation. The Carrier Packaged Chiller Builder Program must be used for pump selection.

Proper water system design is critical; cooling loads, water pressure drops and proper water line sizing must be accounted for in order to ensure proper system operation. Incorrect or incomplete analysis/design of the water loop could lead to low water flow, loss of water temperature control, and excessive cycling of chiller compressors.

Selection procedure (cont)

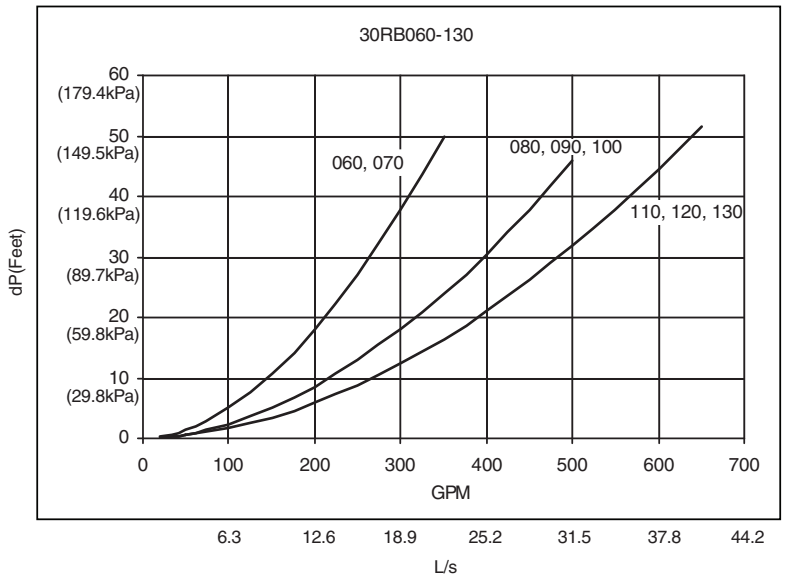
PUMP IMPELLER SIZES

UNIT 30RB	PUMP Hp	SINGLE PUMP				DUAL PUMP			
		Option Code*	Rpm	Impeller Dia. (in.)	Pump Curve	Option Code*	Rpm	Impeller Dia. (in.)	Pump Curve
060 070	3	0	1750	6.5	I	6	1750	6.5	V
	5	1	1750	7.3	I	7	1750	7.3	V
	7.5	2	1750	8.15	I	8	1750	8.15	V
						9	3450	5.25	VI
	10	3	3450	5.4	II	B	3450	5.9	VI
080 090 100 110 120 130	5	1	1750	7.3	I	7	1750	7.3	V
	7.5	2	1750	8.15	I	8	1750	8.15	V
	10	3	3450	5.4	II	B	3450	5.4	VIIA
	15	4	3450	6.1	II	C	3450	6.0	VIIC
150 160 170 190	5	1	1750	6.5	IIIA	—	—	—	—
	7.5	2	1750	7.4	IIIB	9	3450	5.0	VIIB
	10	3	3450	4.6	IVA	B	3450	4.6	VIIIA
	15	4	3450	5.2	IVB	C	3450	5.2	VIIIB

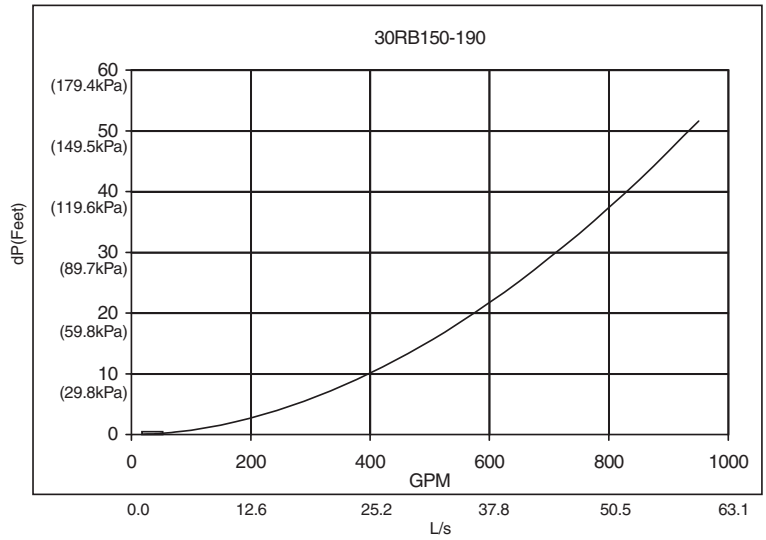
*Option Code refers to the Hydronics Option (position 11) in the model number. See the 30RB nomenclature on page 5 for option identification.

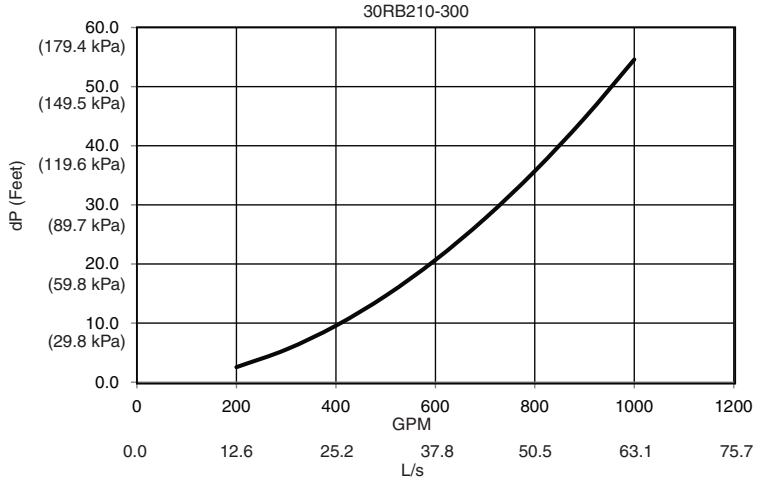
NOTE: Pump Selections are chiller-size dependent. For example, dual pump “C” on a 30RB170 chiller is not the same as dual pump “C” on a 30RB130 chiller. The pump option is not available on units with high SCCR option. The 30RB chillers with Greenspeed® intelligence are not available for size 060 and 070.

COOLER PRESSURE DROP CURVES



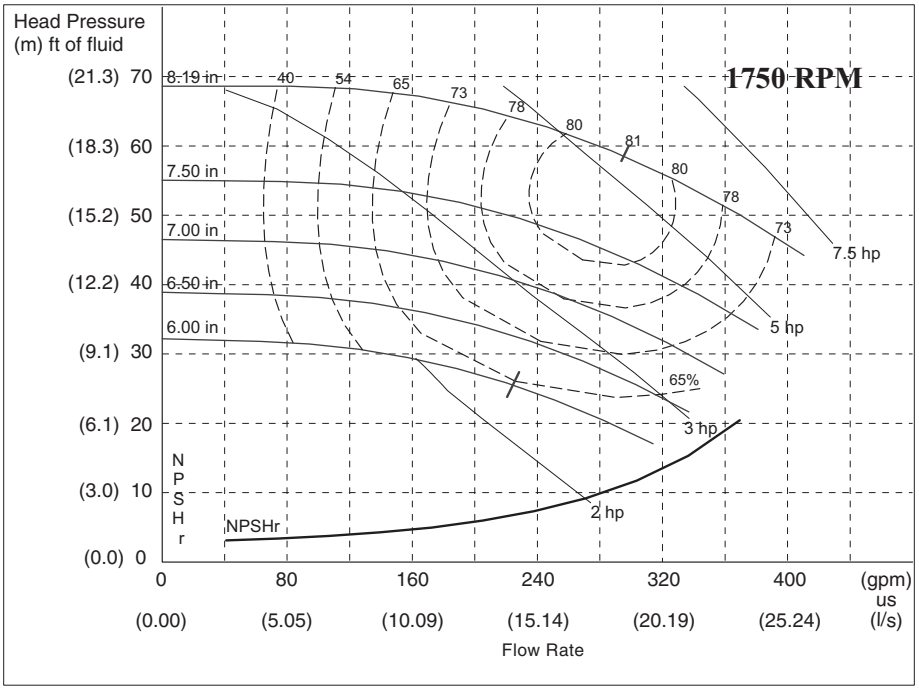
COOLER PRESSURE DROP CURVES (cont)





Selection procedure (cont)

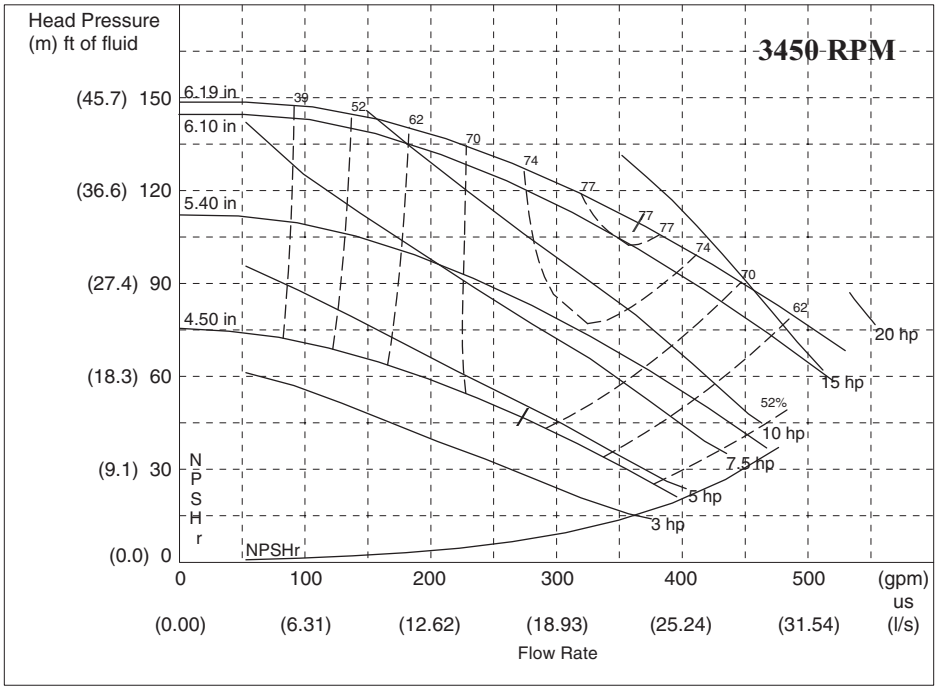
PUMP CURVE I FOR HYDRONIC PACKAGE SINGLE PUMP (Fresh Water)



LEGEND
NPSHr — Net Positive Suction Head (Pressure) Required

NOTE: Refer to the 30RB nomenclature on page 5 for option identification. Refer to the Pump Impeller Sizes table on page 30 for more information.

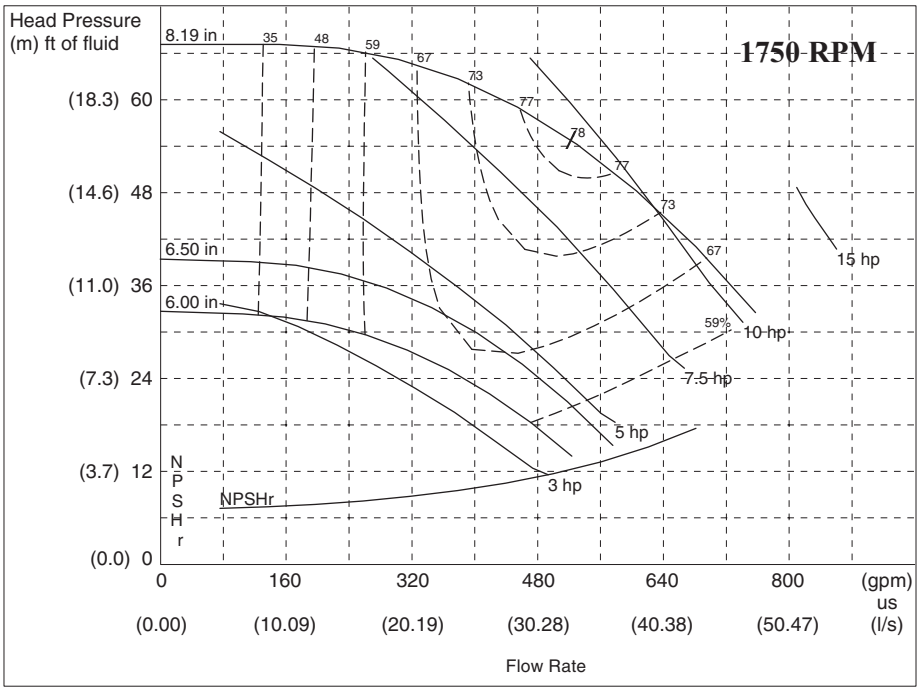
PUMP CURVE II FOR HYDRONIC PACKAGE SINGLE PUMP (Fresh Water)



LEGEND
NPSHr — Net Positive Suction Head (Pressure) Required

NOTE: Refer to the 30RB nomenclature on page 5 for option identification. Refer to the Pump Impeller Sizes table on page 30 for more information.

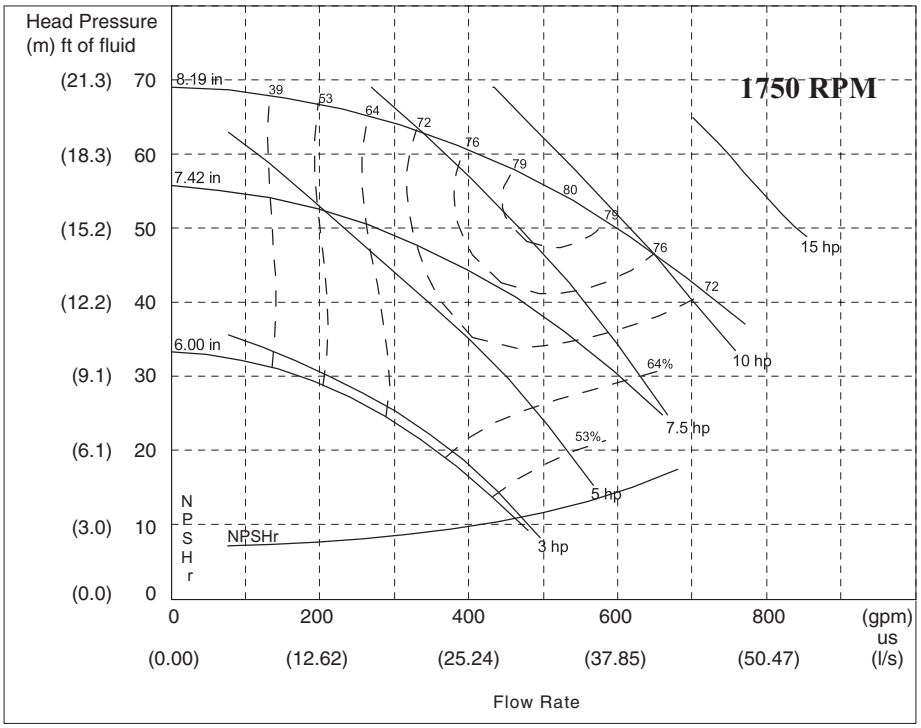
PUMP CURVE IIIA FOR HYDRONIC PACKAGE SINGLE PUMP (Fresh Water)



LEGEND
NPSHr — Net Positive Suction Head (Pressure) Required

NOTE: Refer to the 30RB nomenclature on page 5 for option identification. Refer to the Pump Impeller Sizes table on page 30 for more information.

PUMP CURVE IIIB FOR HYDRONIC PACKAGE SINGLE PUMP (Fresh Water)

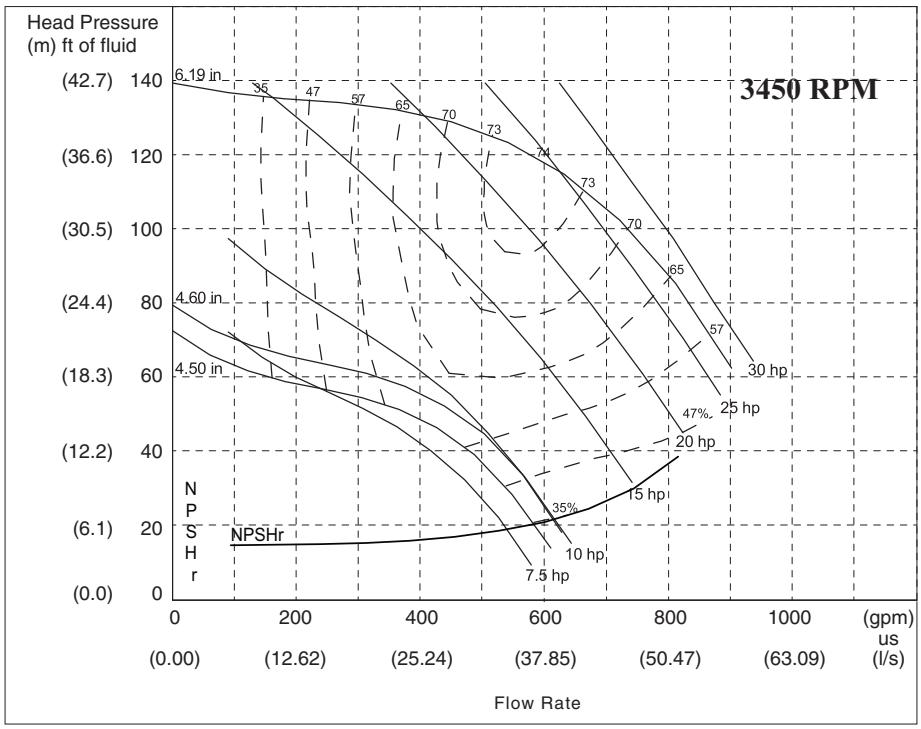


LEGEND
NPSHr — Net Positive Suction Head (Pressure) Required

NOTE: Refer to the 30RB nomenclature on page 5 for option identification. Refer to the Pump Impeller Sizes table on page 30 for more information.

Selection procedure (cont)

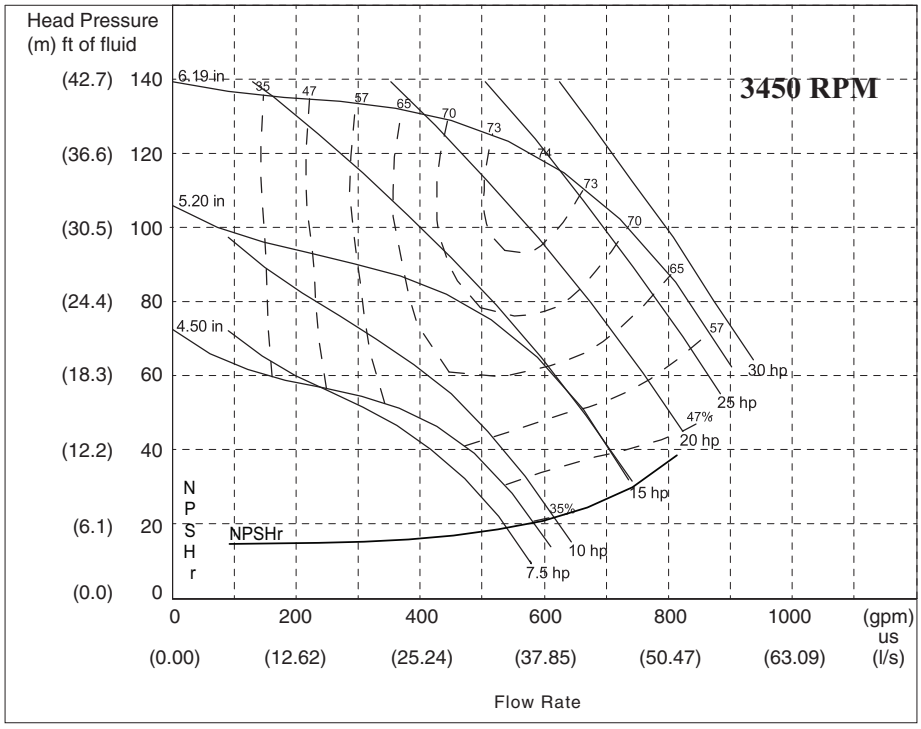
PUMP CURVE IVA FOR HYDRONIC PACKAGE SINGLE PUMP (Fresh Water)



LEGEND
NPSHr — Net Positive Suction Head (Pressure) Required

NOTE: Refer to the 30RB nomenclature on page 5 for option identification. Refer to the Pump Impeller Sizes table on page 30 for more information.

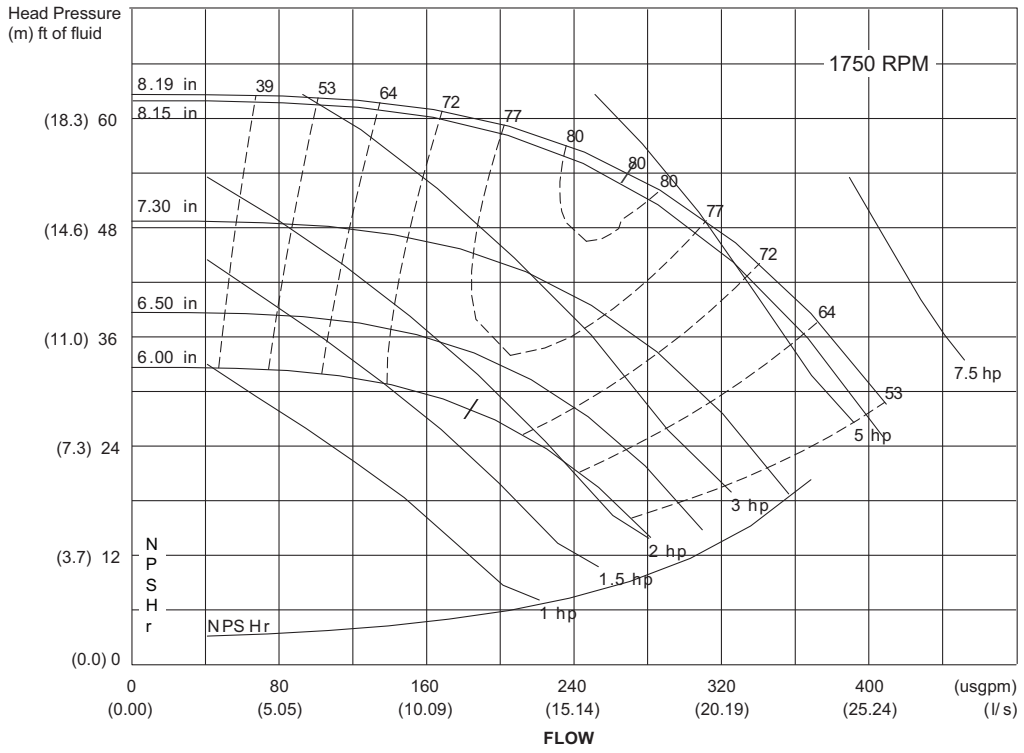
PUMP CURVE IVB FOR HYDRONIC PACKAGE SINGLE PUMP (Fresh Water)



LEGEND
NPSHr — Net Positive Suction Head (Pressure) Required

NOTE: Refer to the 30RB nomenclature on page 5 for option identification. Refer to the Pump Impeller Sizes table on page 30 for more information.

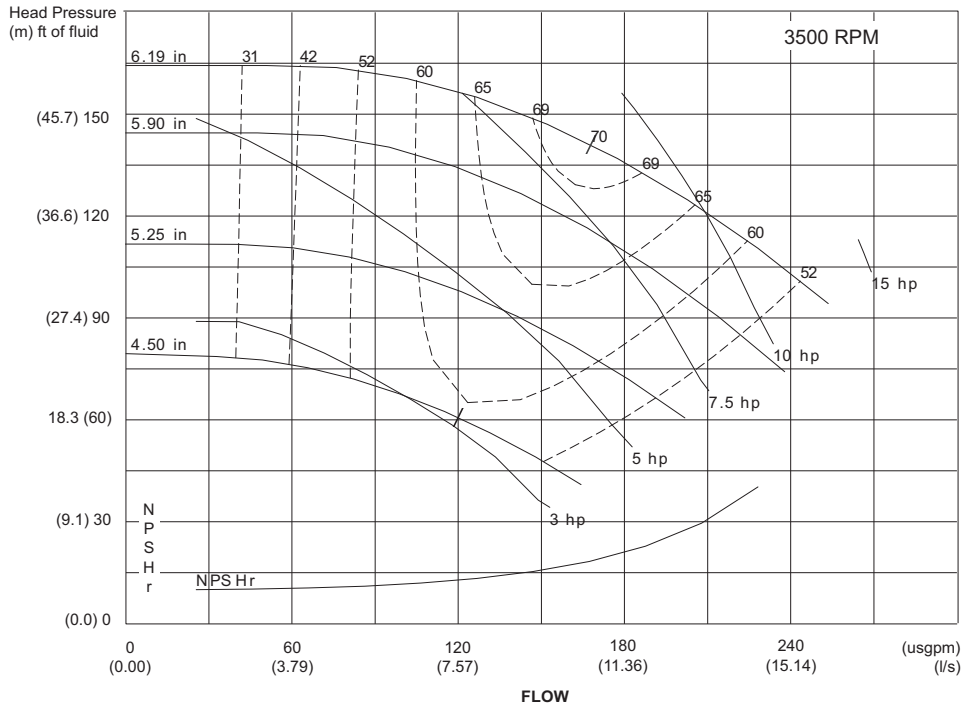
PUMP CURVE V FOR HYDRONIC PACKAGE DUAL PUMP (Fresh Water)



LEGEND
NPSHr — Net Positive Suction Head (Pressure) Required

NOTE: Refer to the 30RB nomenclature on page 5 for option identification. Refer to the Pump Impeller Sizes table on page 30 for more information.

PUMP CURVE VI FOR HYDRONIC PACKAGE DUAL PUMP (Fresh Water)

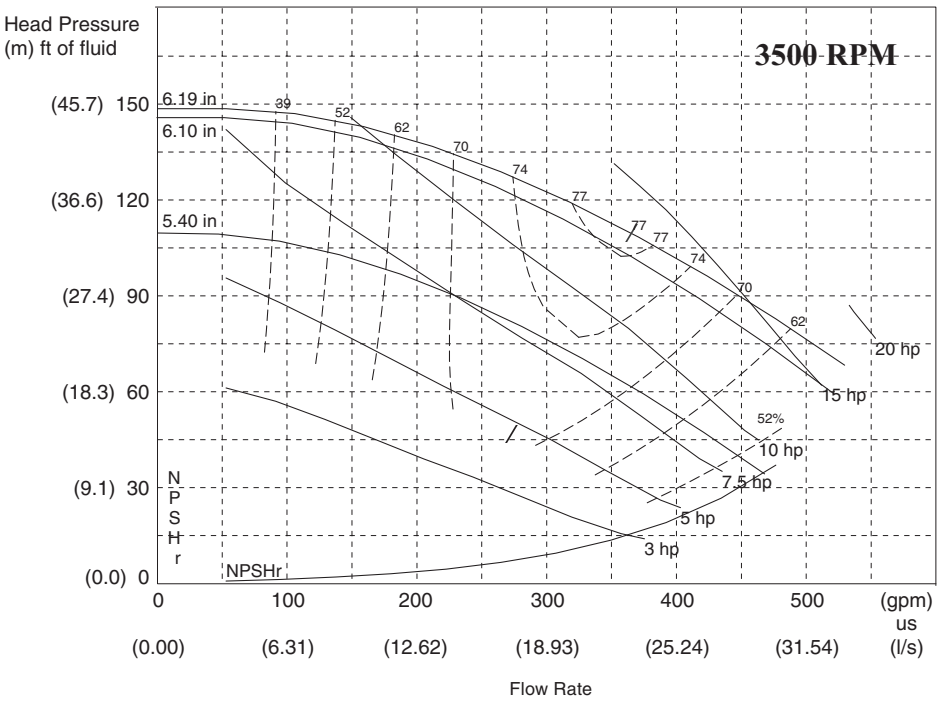


LEGEND
NPSHr — Net Positive Suction Head (Pressure) Required

NOTE: Refer to the 30RB nomenclature on page 5 for option identification. Refer to the Pump Impeller Sizes table on page 30 for more information.

Selection procedure (cont)

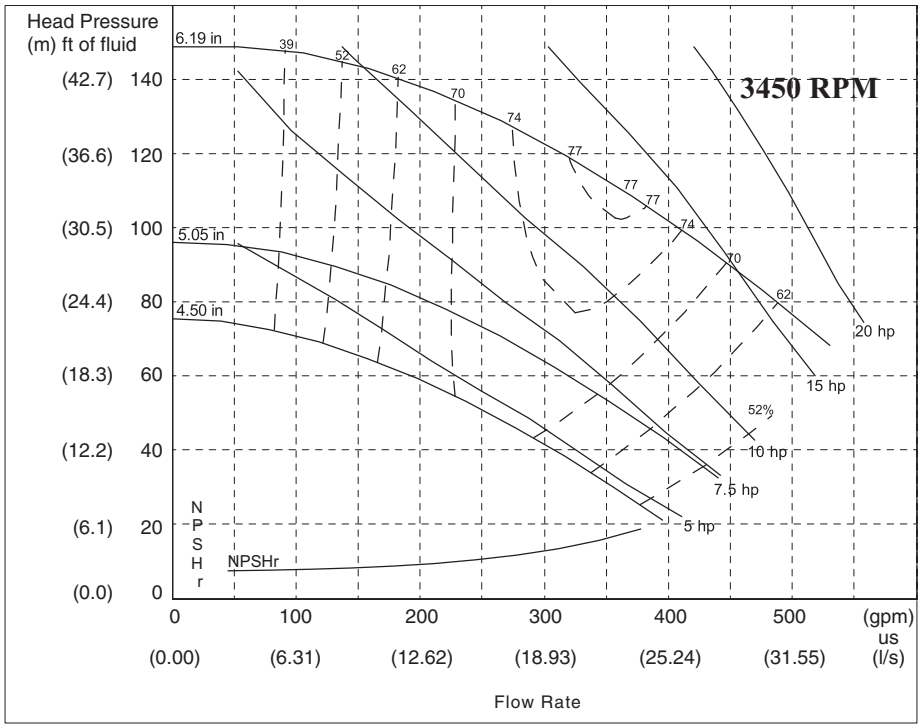
PUMP CURVE VIIA FOR HYDRONIC PACKAGE DUAL PUMP (Fresh Water)



LEGEND
NPSHr — Net Positive Suction Head (Pressure) Required

NOTE: Refer to the 30RB nomenclature on page 5 for option identification. Refer to the Pump Impeller Sizes table on page 30 for more information.

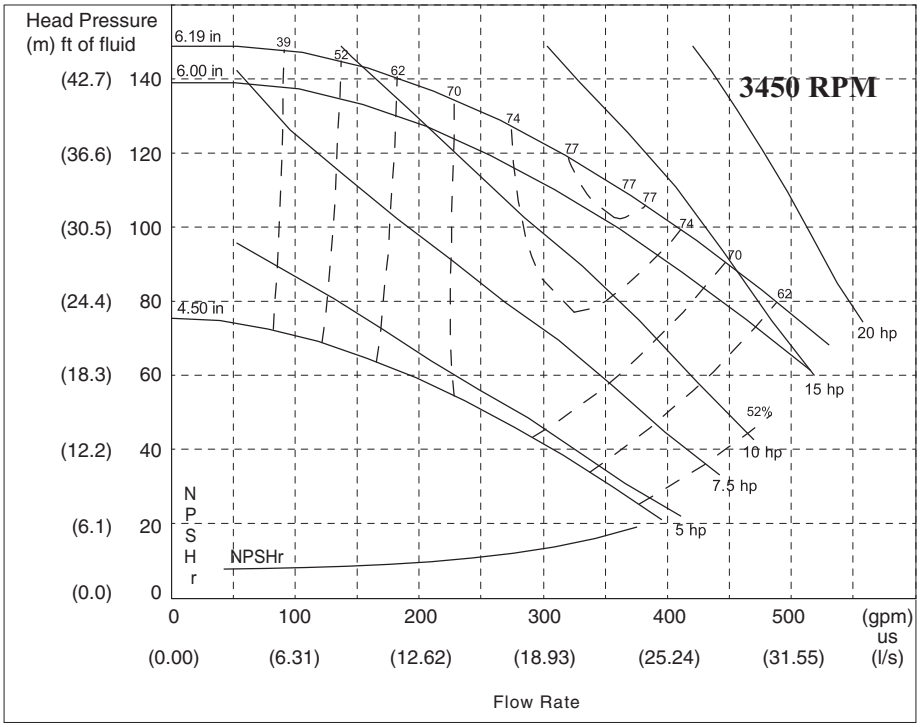
PUMP CURVE VIIB FOR HYDRONIC PACKAGE DUAL PUMP (Fresh Water)



LEGEND
NPSHr — Net Positive Suction Head (Pressure) Required

NOTE: Refer to the 30RB nomenclature on page 5 for option identification. Refer to the Pump Impeller Sizes table on page 30 for more information.

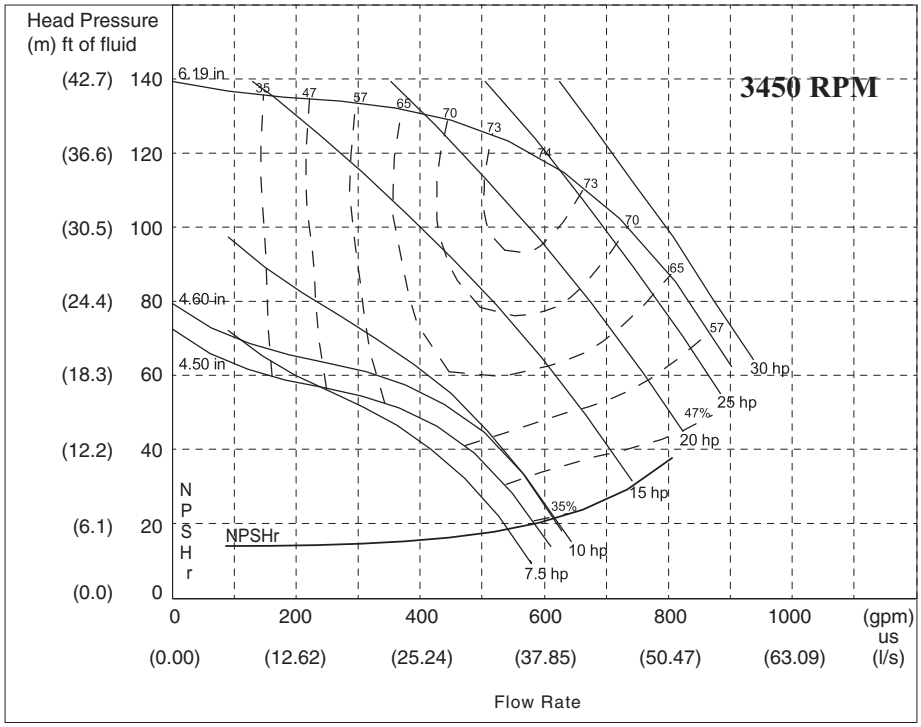
PUMP CURVE VIIC FOR HYDRONIC PACKAGE DUAL PUMP (Fresh Water)



LEGEND
NPSHr — Net Positive Suction Head (Pressure) Required

NOTE: Refer to the 30RB nomenclature on page 5 for option identification. Refer to the Pump Impeller Sizes table on page 30 for more information.

PUMP CURVE VIIIA FOR HYDRONIC PACKAGE DUAL PUMP (Fresh Water)

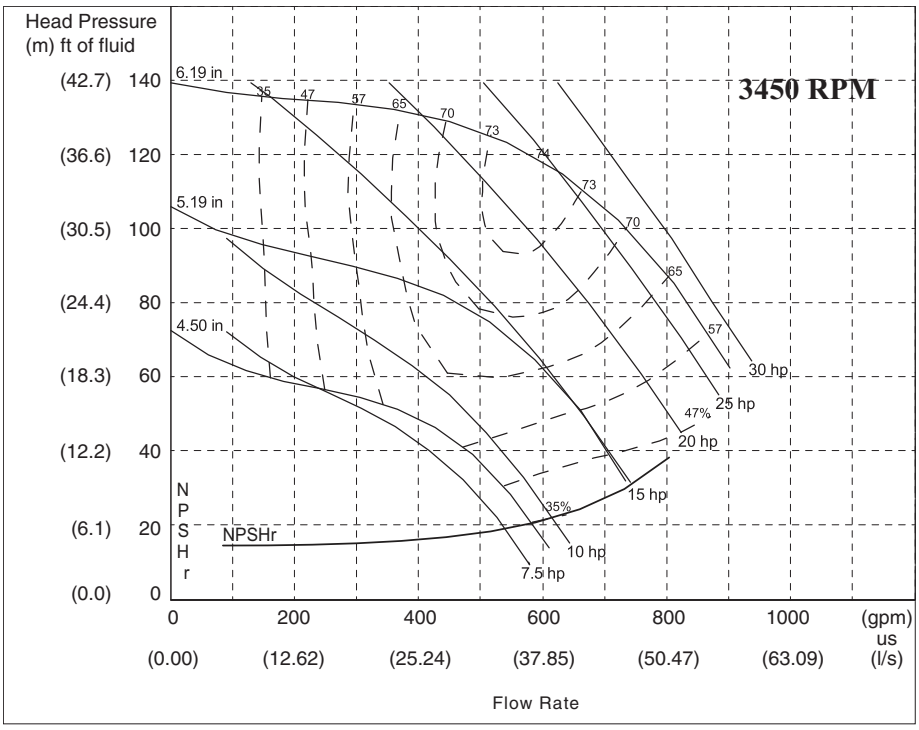


LEGEND
NPSHr — Net Positive Suction Head (Pressure) Required

NOTE: Refer to the 30RB nomenclature on page 5 for option identification. Refer to the Pump Impeller Sizes table on page 42 for more information.

Selection procedure (cont)

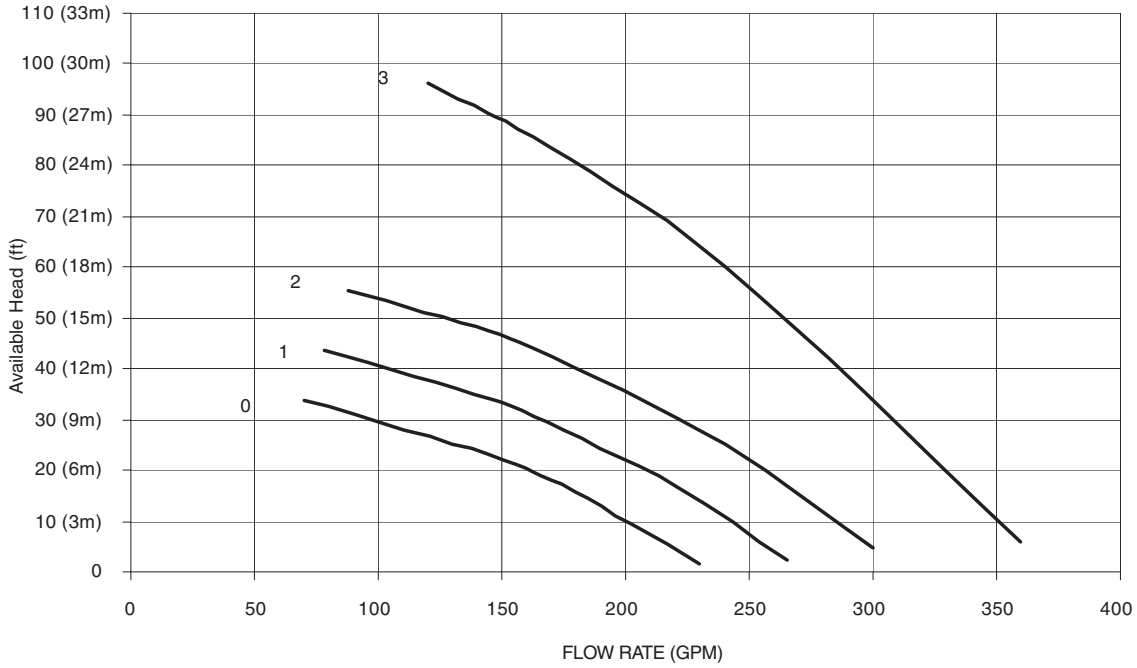
PUMP CURVE VIIIB FOR HYDRONIC PACKAGE DUAL PUMP (Fresh Water)



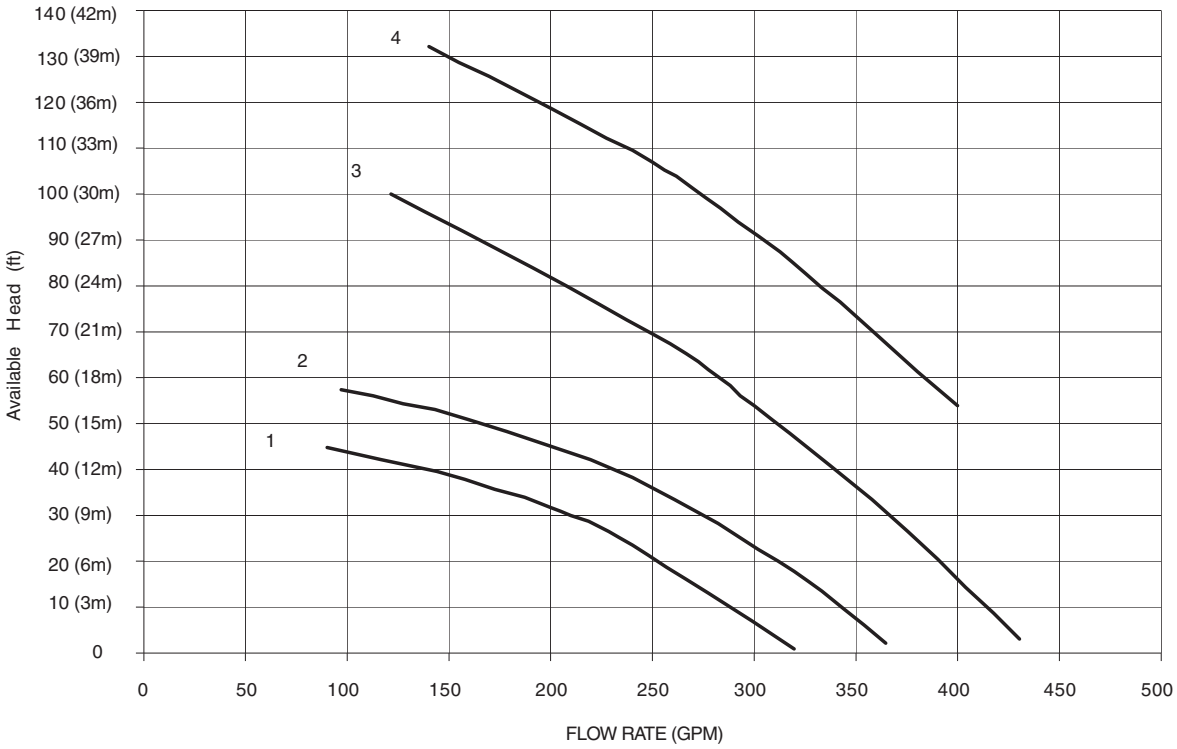
LEGEND
NPSHr — Net Positive Suction Head (Pressure) Required

NOTE: Refer to the 30RB nomenclature on page 5 for option identification. Refer to the Pump Impeller Sizes table on page 30 for more information.

30RB060, 070 — SINGLE PUMP ENVELOPE CURVES



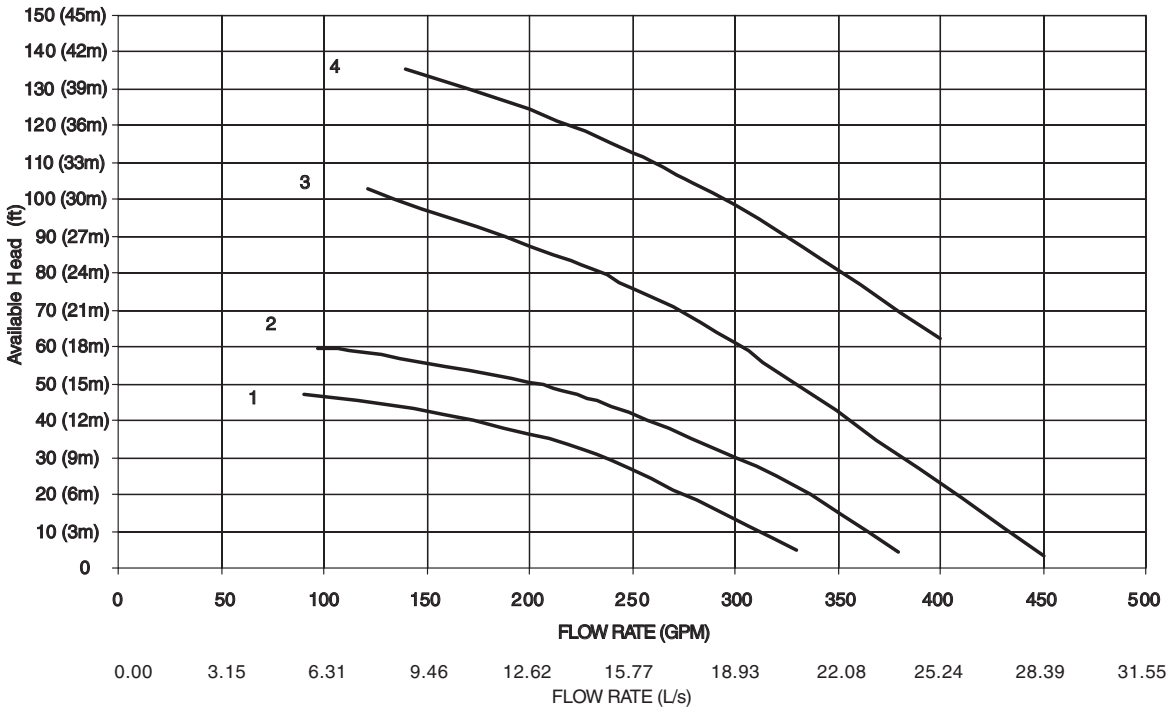
30RB080, 090, 100 — SINGLE PUMP ENVELOPE CURVES



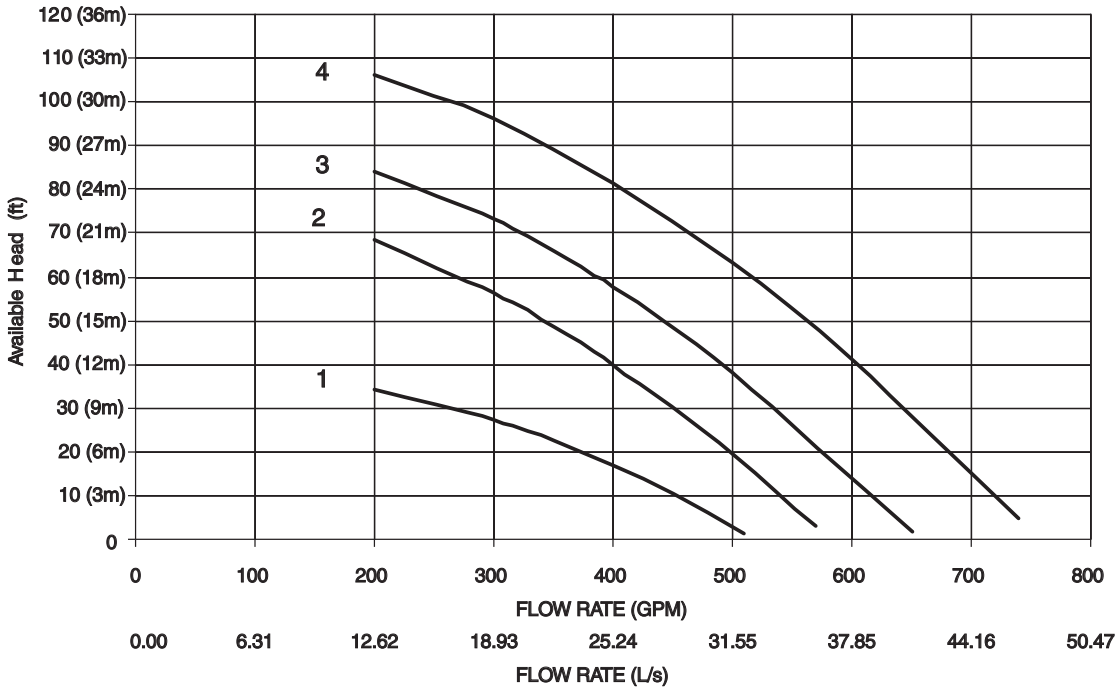
NOTE: Refer to the 30RB nomenclature on page 5 for pump envelope curve option identification.

Selection procedure (cont)

30RB110, 120, 130 — SINGLE PUMP ENVELOPE CURVES

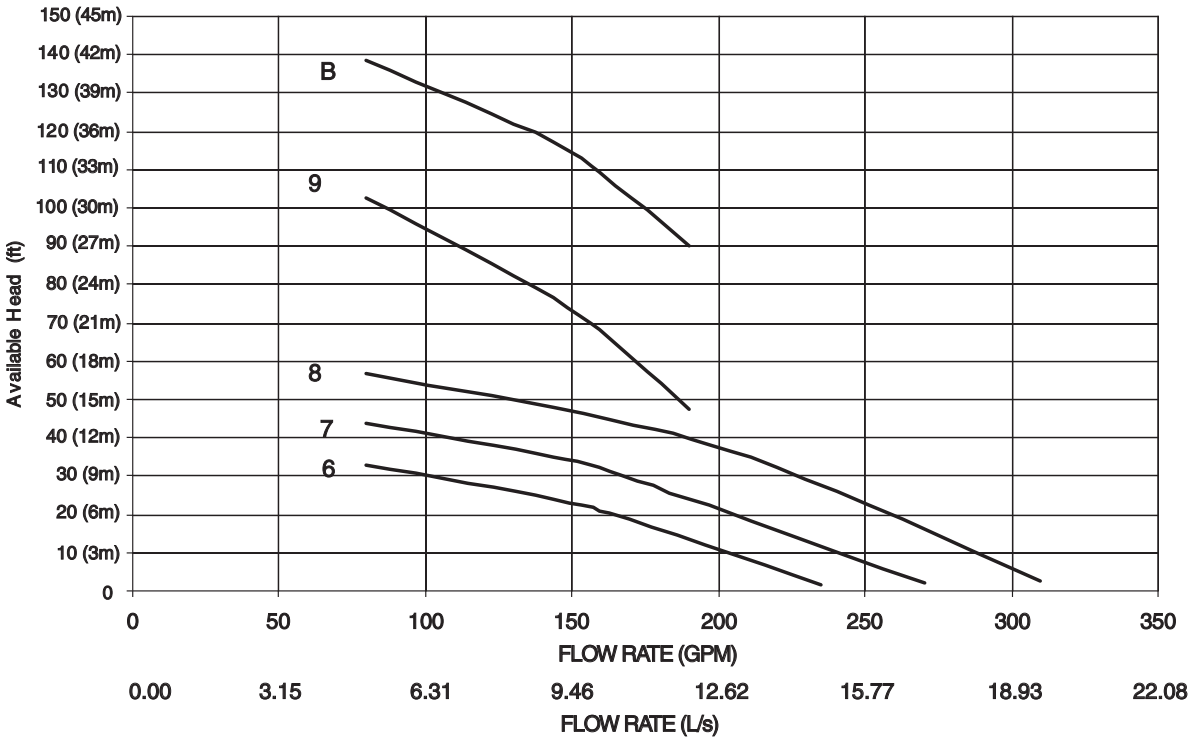


30RB150, 160, 170, 190 — SINGLE PUMP ENVELOPE CURVES

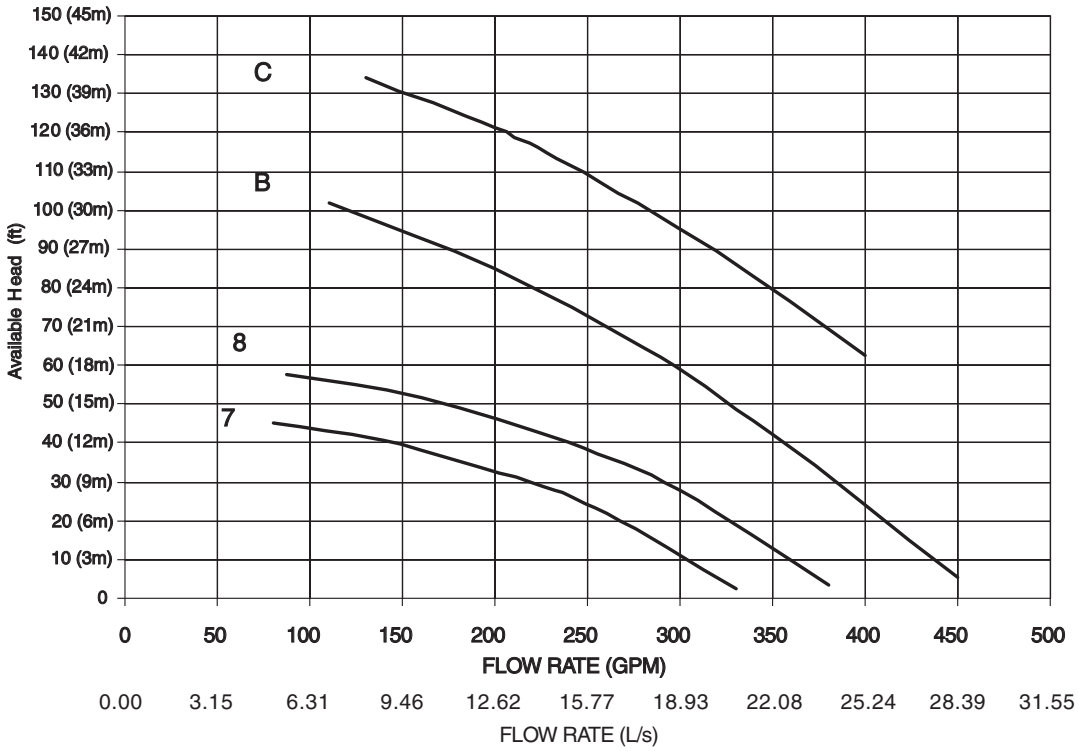


NOTE: Refer to the 30RB nomenclature on page 5 for pump envelope curve option identification.

30RB060, 070 — DUAL PUMP ENVELOPE CURVES



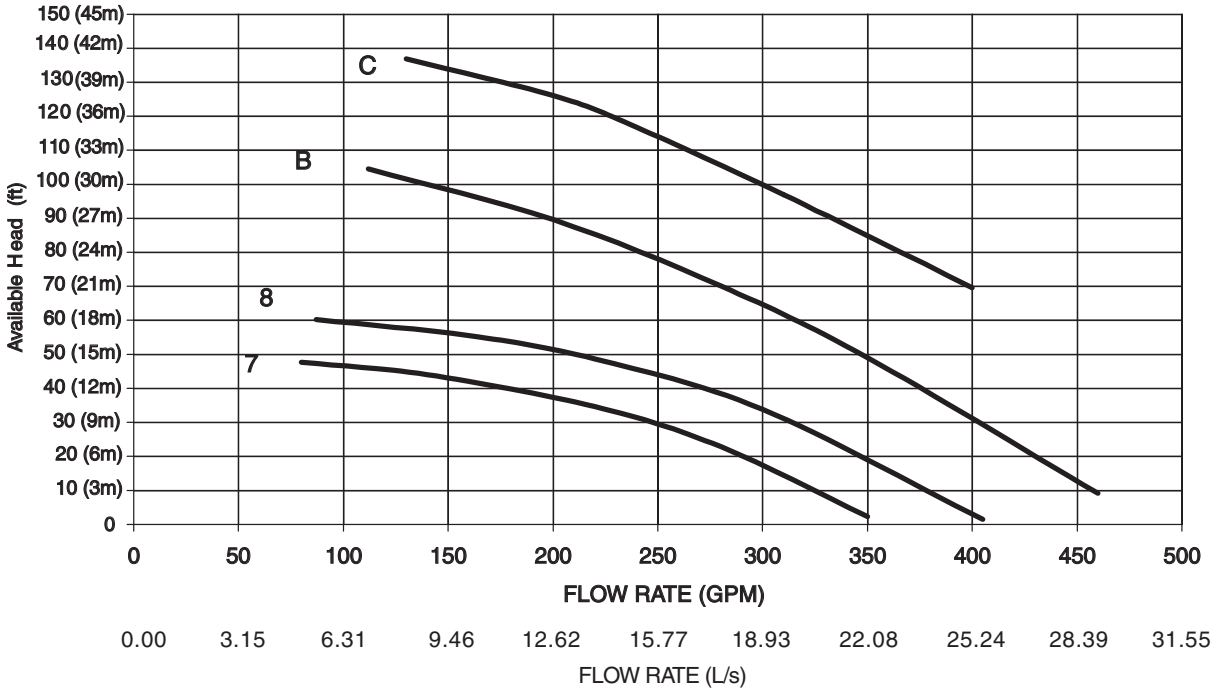
30RB080, 090, 100 — DUAL PUMP ENVELOPE CURVES



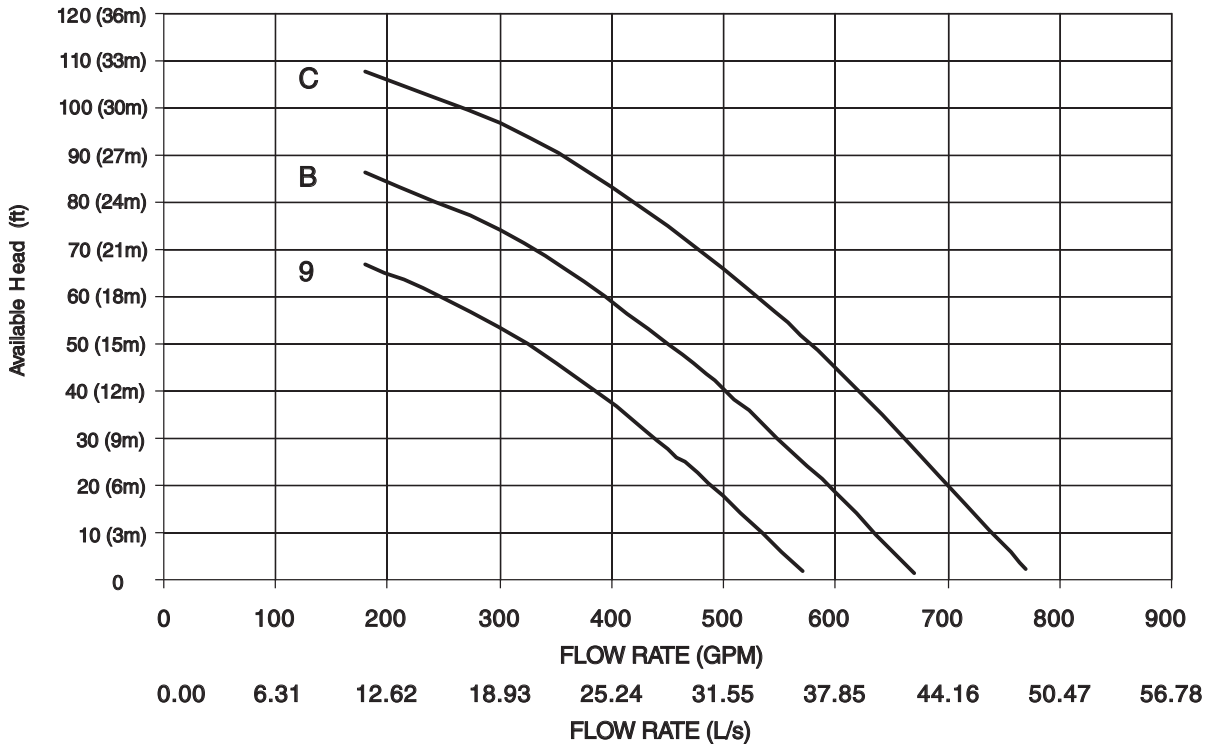
NOTE: Refer to the 30RB nomenclature on page 5 for pump envelope curve option identification.

Selection procedure (cont)

30RB110, 120, 130 — DUAL PUMP ENVELOPE CURVES



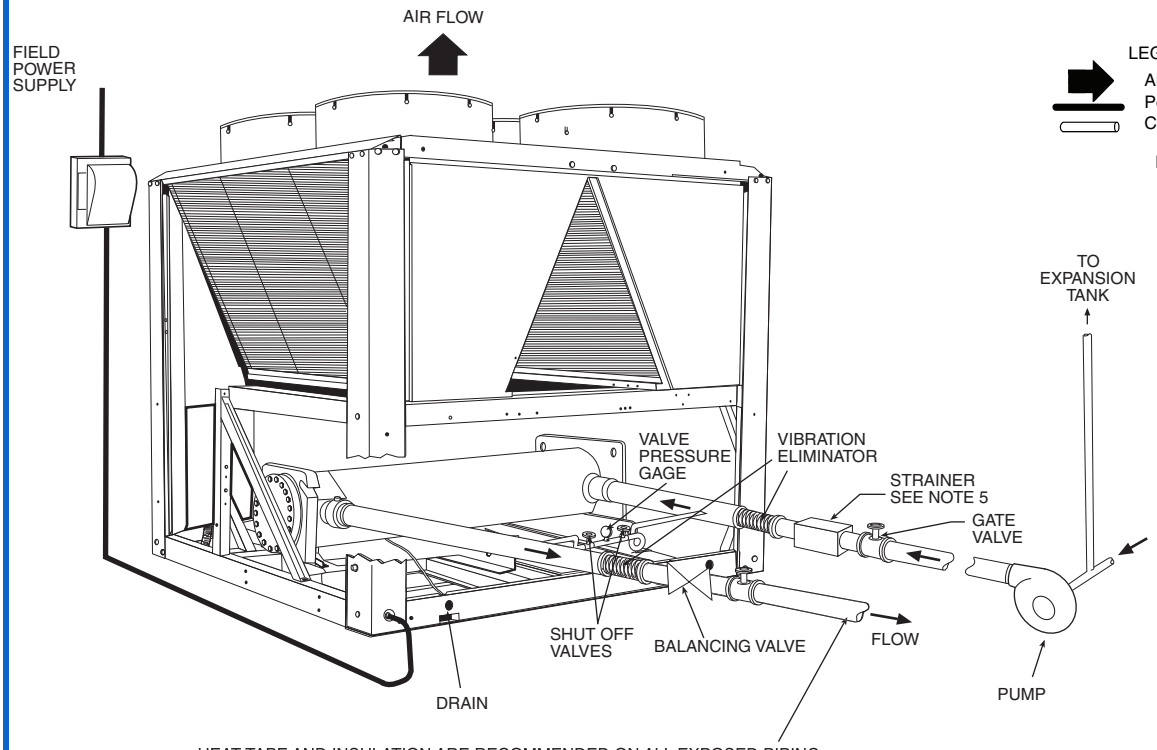
30RB150, 160, 170, 190 — DUAL PUMP ENVELOPE CURVES



NOTE: Refer to the 30RB nomenclature on page 5 for pump envelope curve option identification.

Typical piping and wiring

30RB UNITS WITHOUT HYDRONIC PACKAGE



LEGEND

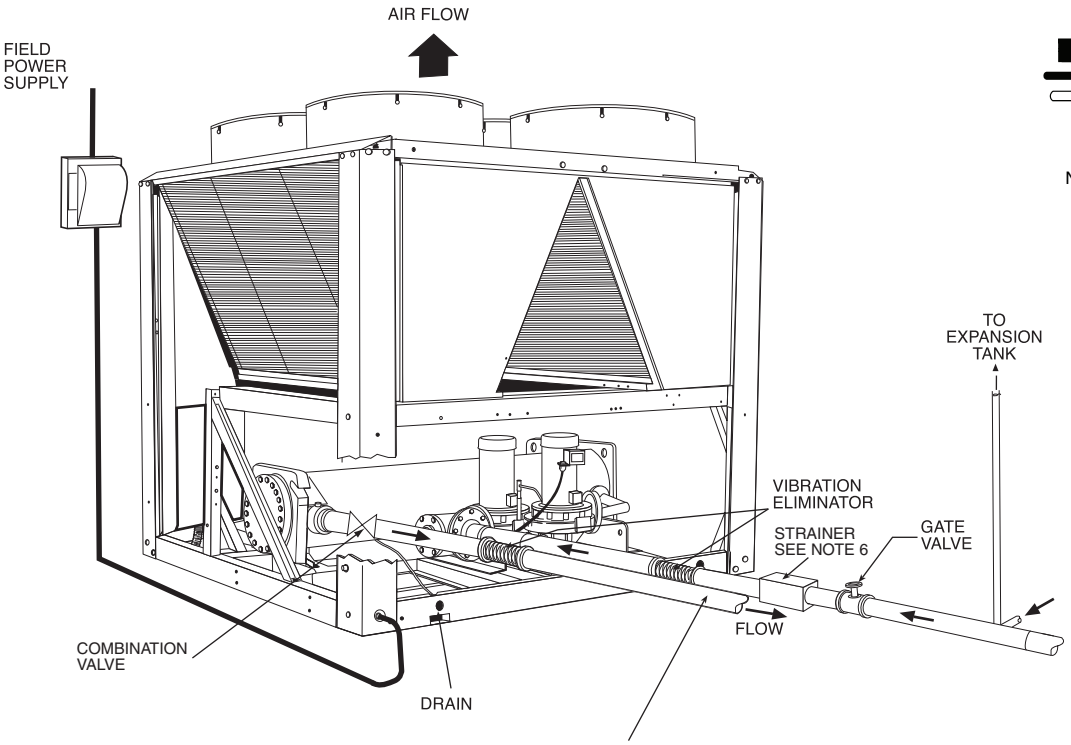
- Airflow Through Condenser
- Power Wiring
- Chilled Water Piping

NOTES:

1. Chiller must be installed level to maintain proper compressor oil return.
2. Piping shown are general points-of-connection guides only and are not intended for a specific installation. Wiring and piping shown are for a quick overview of system and are not in accordance with recognized standards.
3. All wiring must comply with applicable local and national codes.
4. All piping must follow standard piping techniques. Refer to Carrier System Design Manual or appropriate ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers) handbook for details.
5. A 20-mesh strainer must be field-supplied and installed within 10 ft (3 m) of the cooler inlet.

HEAT TAPE AND INSULATION ARE RECOMMENDED ON ALL EXPOSED PIPING
IF AMBIENT TEMPERATURE <32 F (0° C) AND NO ANTIFREEZE SOLUTION IS IN SYSTEM

30RB UNITS WITH HYDRONIC PACKAGE



LEGEND

- Airflow Through Condenser
- Power Wiring
- Chilled Water Piping

NOTES:

1. Chiller must be installed level to maintain proper compressor oil return.
2. Wiring and piping shown are general points-of-connection guides only and are not intended for a specific installation. Wiring and piping shown are for a quick overview of system and are not in accordance with recognized standards.
3. All wiring must comply with applicable local and national codes.
4. All piping must follow standard piping techniques. Refer to Carrier System Design Manual or appropriate ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers) handbook for details.
5. Air separator required as close to chiller as possible (except primary/secondary systems).
6. Additional 20 mesh strainer required for open loop systems.
7. A field-installed expansion tank is required.

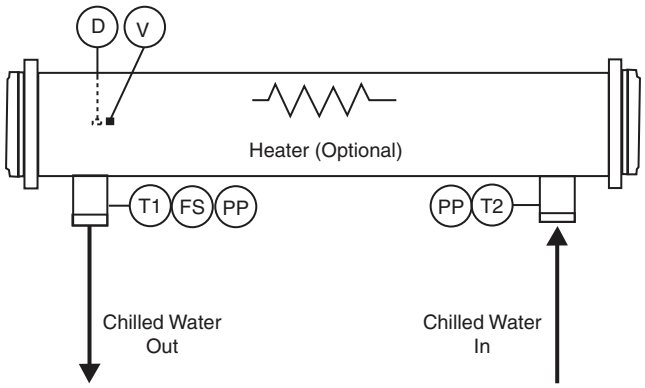
HEAT TAPE AND INSULATION ARE RECOMMENDED ON ALL EXPOSED PIPING
IF AMBIENT TEMPERATURE <32 F (0° C) AND NO ANTIFREEZE SOLUTION IS IN SYSTEM

Typical piping and wiring (cont)

TYPICAL PIPING DIAGRAM FOR 30RB UNITS WITHOUT HYDRONIC PACKAGE

LEGEND

D — Drain, $^{3}/_{4}$-in. NPT
FS — Flow Switch
PP — Pipe Plug, $^{1}/_{4}$-in. NPT
T1 — Leaving Water Thermistor
T2 — Entering Water Thermistor
V — Vent, $^{1}/_{4}$-in. NPT

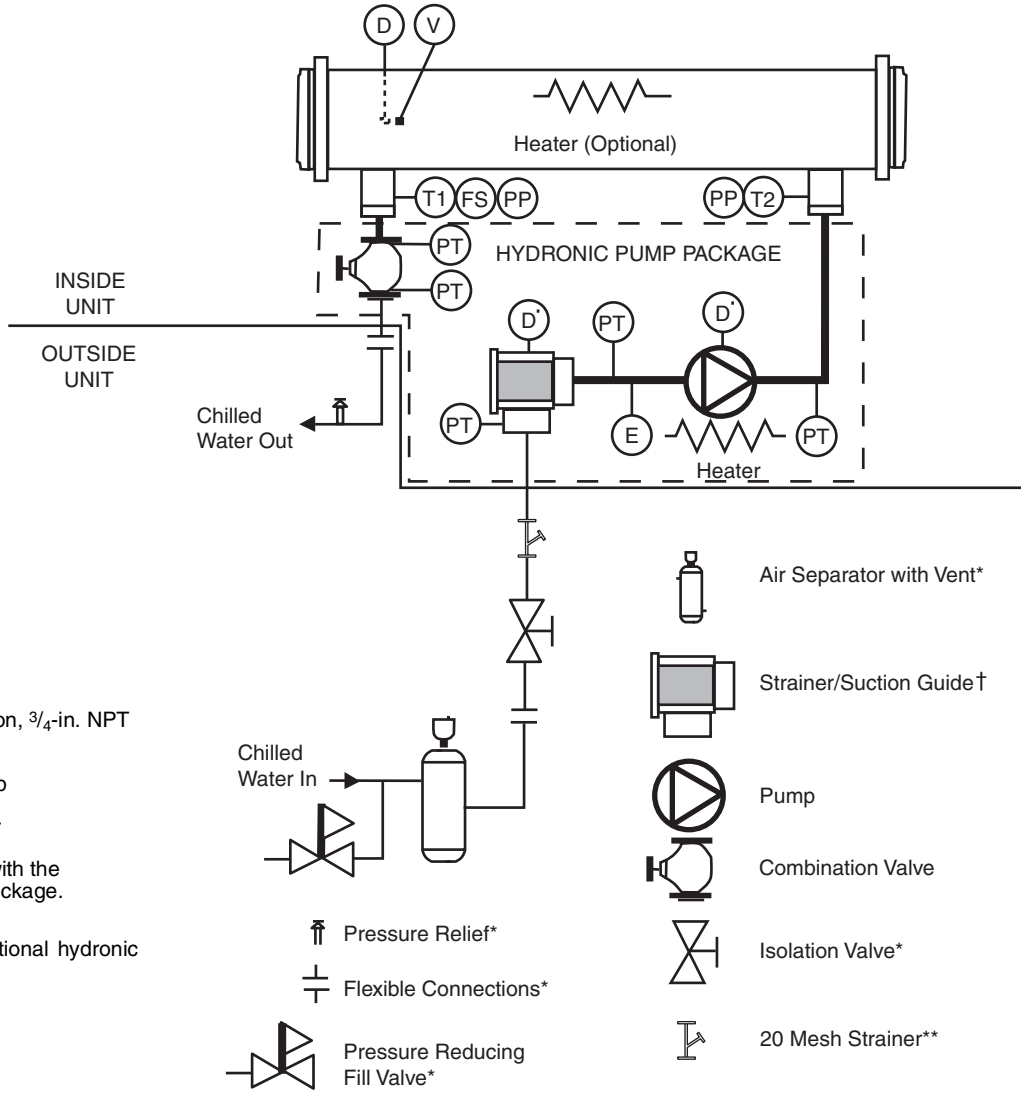


TYPICAL PIPING DIAGRAM FOR 30RB UNITS WITH HYDRONIC PACKAGE — SINGLE PUMP

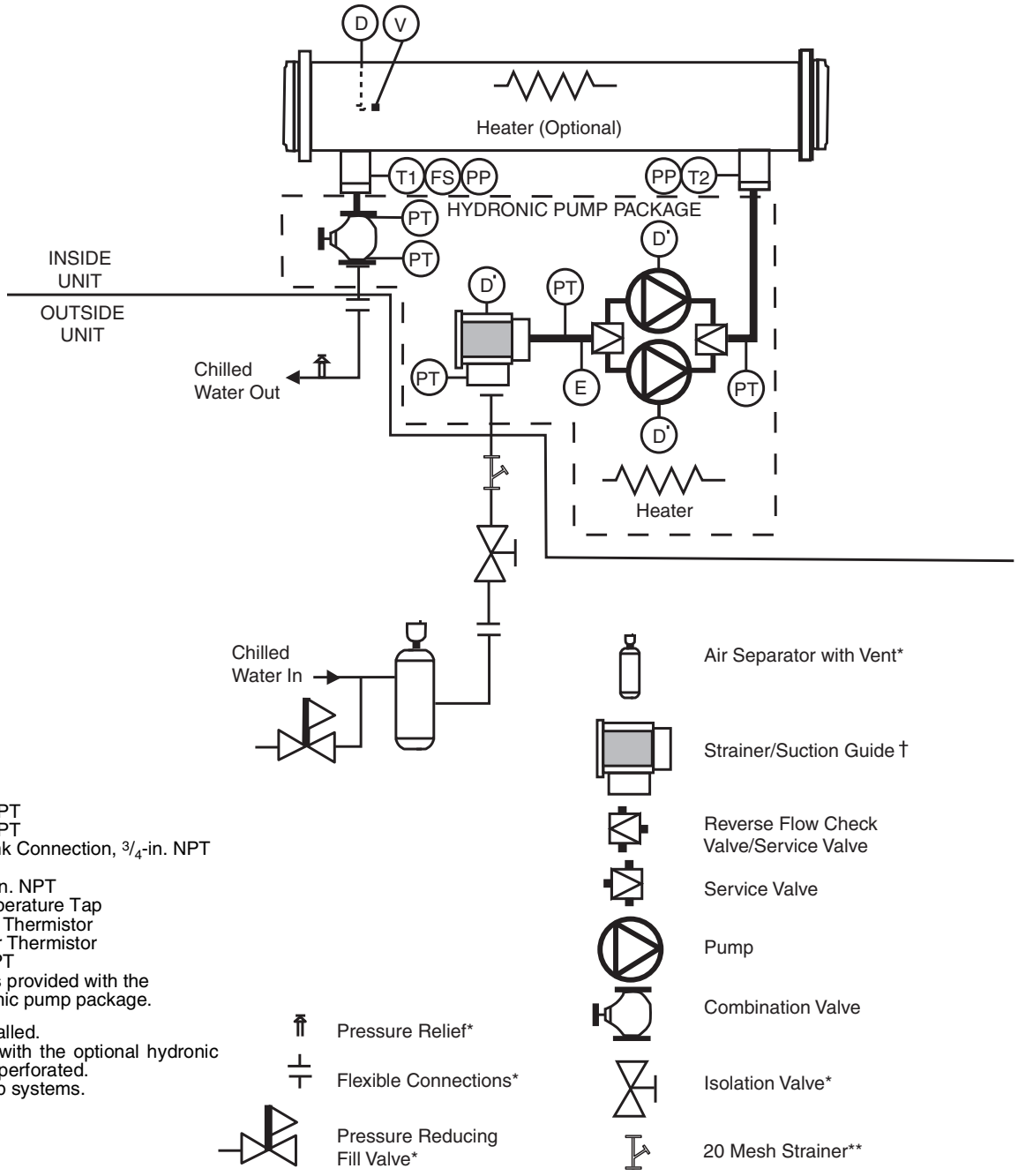
LEGEND

D — Drain, $^{3}/_{4}$-in. NPT
D′ — Drain, $^{1}/_{4}$-in. NPT
E — Expansion Tank Connection, $^{3}/_{4}$-in. NPT
FS — Flow Switch
PP — Pipe Plug, $^{1}/_{4}$-in. NPT
PT — Pressure/Temperature Tap
T1 — Leaving Water Thermistor
T2 — Entering Water Thermistor
V — Vent, $^{1}/_{4}$-in. NPT
– – – – Indicates items provided with the optional hydronic pump package.

*Field-supplied and installed.
†The strainer supplied with the optional hydronic pump package is $^{1}/_{8}$ in. perforated.
**Required for open loop systems.



TYPICAL PIPING DIAGRAM FOR 30RB UNITS WITH HYDRONIC PACKAGE — DUAL PUMPS



LEGEND

D — Drain, $^3/_4$-in. NPT
D′ — Drain, $^1/_4$-in. NPT
E — Expansion Tank Connection, $^3/_4$-in. NPT
FS — Flow Switch
PP — Pipe Plug, $^1/_4$-in. NPT
PT — Pressure/Temperature Tap
T1 — Leaving Water Thermistor
T2 — Entering Water Thermistor
V — Vent, $^1/_4$-in. NPT
– – – – Indicates items provided with the optional hydronic pump package.

*Field-supplied and installed.
†The strainer supplied with the optional hydronic pump package is $^1/_8$ in. perforated.
**Required for open loop systems.

Electrical data

30RB060-190 ELECTRICAL DATA — SINGLE POINT UNITS

30RB UNIT SIZE	UNIT VOLTAGE			NO HYDRONIC PACKAGE				3 HP PUMP, 1750 RPM				5 HP PUMP, 1750 RPM			
	V-Hz (3 Ph)	Supplied		MCA	MOCP	ICF	Rec Fuse Size	MCA	MOCP	ICF	Rec Fuse Size	MCA	MOCP	ICF	Rec Fuse Size
		Min	Max	XL	XL	XL		XL	XL	XL		XL	XL	XL	
060	208/230-60	187	253	291.5	350	682.8	350	300.6	350	693.6	350	306.9	350	700.5	350
	380-60	342	418	150.9	175	362.9	175	156.0	175	368.8	175	159.0	175	372.6	175
	460-60	414	506	127.9	150	302.0	150	132.1	150	306.9	150	135.0	150	310.0	150
	575-60	518	633	102.4	125	244.7	110	105.7	125	248.6	125	107.8	125	251.1	125
070	208/230-60	187	253	334.7	400	777.0	400	343.8	400	787.8	400	350.1	400	794.7	400
	380-60	342	418	175.5	200	428.8	200	108.8	225	434.7	200	183.6	225	438.5	200
	460-60	414	506	147.9	175	355.9	175	152.1	175	360.8	175	155.0	175	363.9	175
	575-60	518	633	119.8	150	287.4	150	123.1	150	291.3	150	125.2	150	293.8	150
080	208/230-60	187	253	366.5	400	757.8	400	—	—	—	—	381.9	450	775.5	450
	380-60	342	418	189.3	225	401.3	200	—	—	—	—	197.4	225	411.0	225
	460-60	414	506	160.6	175	334.7	175	—	—	—	—	167.7	200	342.7	200
	575-60	518	633	128.6	150	270.9	150	—	—	—	—	134.0	150	277.3	150
090	208/230-60	187	253	433.6	500	875.9	500	—	—	—	—	449.0	500	893.6	500
	380-60	342	418	248.7	250	502.1	250	—	—	—	—	235.0	250	490.0	250
	460-60	414	506	191.4	225	399.4	225	—	—	—	—	198.5	225	407.4	225
	575-60	518	633	154.6	175	322.2	175	—	—	—	—	160.0	175	328.6	175
100	208/230-60	187	253	472.0	500	914.3	500	—	—	—	—	487.4	500	932.0	500
	380-60	342	418	248.7	250	502.1	250	—	—	—	—	256.8	300	511.8	300
	460-60	414	506	209.2	250	417.2	225	—	—	—	—	216.3	250	425.2	250
	575-60	518	633	170.0	200	337.6	200	—	—	—	—	175.4	200	344.0	200
110	208/230-60	187	253	508.6	600	950.9	600	—	—	—	—	524.0	600	968.6	600
	380-60	342	418	265.3	300	518.7	300	—	—	—	—	273.4	300	528.4	300
	460-60	414	506	224.1	250	432.1	250	—	—	—	—	231.2	250	440.1	250
	575-60	518	633	180.8	200	348.4	200	—	—	—	—	186.2	200	354.8	200
120	208/230-60	187	253	578.1	600	1020.4	600	—	—	—	—	593.5	600	1038.1	600
	380-60	342	418	304.6	350	538.0	350	—	—	—	—	312.7	350	567.6	350
	460-60	414	506	256.2	300	464.2	300	—	—	—	—	263.3	300	472.2	300
	575-60	518	633	208.2	225	325.8	225	—	—	—	—	213.6	225	382.2	225
130	208/230-60	187	253	626.7	700	1068.9	700	—	—	—	—	642.1	700	1086.6	700
	380-60	342	418	327.7	350	581.1	350	—	—	—	—	335.8	350	590.8	350
	460-60	414	506	276.5	300	484.5	300	—	—	—	—	283.6	300	492.5	300
	575-60	518	633	223.3	250	391.0	250	—	—	—	—	228.7	250	397.4	250
150	208/230-60	187	253	684.3	700	1126.5	700	—	—	—	—	699.7	700	1144.2	700
	380-60	342	418	360.4	400	613.8	400	—	—	—	—	368.5	400	623.5	400
	460-60	414	506	303.2	350	511.2	350	—	—	—	—	310.3	350	519.2	350
	575-60	518	633	246.4	250	414.1	250	—	—	—	—	251.8	300	420.5	300
160	208/230-60	187	253	744.8	800	1187.0	800	—	—	—	—	760.2	800	1204.7	800
	380-60	342	418	390.1	400	643.5	400	—	—	—	—	398.2	400	653.2	400
	460-60	414	506	328.9	350	536.9	350	—	—	—	—	336.0	350	544.9	350
	575-60	518	633	265.9	300	433.5	300	—	—	—	—	271.3	300	439.9	300
170	208/230-60	187	253	802.4	1000	1244.6	1000	—	—	—	—	817.8	1000	1262.3	1000
	380-60	342	418	422.8	450	676.2	450	—	—	—	—	430.9	450	685.9	450
	460-60	414	506	355.6	400	563.6	400	—	—	—	—	362.7	400	571.6	400
	575-60	518	633	289.0	300	456.6	300	—	—	—	—	294.4	300	463.0	300
190	208/230-60	187	253	920.5	1000	1362.7	1000	—	—	—	—	935.9	1000	1380.4	1000
	380-60	342	418	485.2	500	738.5	500	—	—	—	—	493.3	500	748.2	500
	460-60	414	506	408.0	450	616.0	450	—	—	—	—	415.1	450	624.0	450
	575-60	518	633	331.5	350	499.1	350	—	—	—	—	336.9	350	505.5	350

LEGEND

ICF — Instantaneous Current Flow
MCA — Minimum Circuit Amps
MOCP — Maximum Overcurrent Protection
XL — Across-the-Line Start

NOTES:

1. Units are suitable for use on electrical systems where voltage supplied to the unit terminals is not below or above the listed minimum and maximum limits. Maximum allowable phase imbalance is: voltage, 2%; amps 10%.
2. All units have single point primary power connection. (Each unit requires its own power supply.) Main power must be supplied from a field-supplied disconnect.
3. Cooler heater is wired into the control circuit so it is always operable as long as the power supply disconnect is on, even if any safety device is open.
4. For MCA that is less than or equal to 380 amps, 3 conductors are required.
   For MCA between 381 and 760 amps, 6 conductors are required.
   For MCA between 761 and 1140 amps, 9 conductors are required.
   For MCA between 1141 and 1520 amps, 12 conductors are required.
   Calculation of conductors required is based on 75°C copper wire.
5. Wiring for main field supply must be rated 75°C minimum. Use copper for all units.
   a. Incoming wire size range for the terminal block is no. 4 AWG (American Wire Gage) to 500 kcmil.
   b. Incoming wire size range of non-fused disconnect with MCA up to 599.9 amps is 3/0 to 500 kcmil.
   c. Incoming wire size range of non-fused disconnect with MCA from 600 to 799.9 amps is 1/0 to 500 kcmil.
   d. Incoming wire size range of non-fused disconnect with MCA from 800 to 1199.9 amps is 250 kcmil to 500 kcmil.
6. Hydronic pump packages are not available as a factory-installed option for units 30RB210-300 and 30RB060-190 with high SCCR option.
7. Power draw includes both crankcase heaters and cooler heaters. Each compressor has a crankcase heater which draws 56 watts of power. Units have 1 (060-150) or 2 (160-300) cooler heaters, 825 watts each.
8. 30RB chillers with Greenspeed® intelligence are not available in size 060 and 070.

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30RB060-190 ELECTRICAL DATA — SINGLE POINT UNITS (cont)

30RB UNIT SIZE	UNIT VOLTAGE			7.5 HP PUMP, 1750/3450 RPM				10 HP PUMP, 3450 RPM				15 HP PUMP, 3450 RPM			
	V-Hz (3 Ph)	Supplied		MCA	MOCP	ICF	Rec Fuse Size	MCA	MOCP	ICF	Rec Fuse Size	MCA	MOCP	ICF	Rec Fuse Size
		Min	Max	XL	XL	XL		XL	XL	XL		XL	XL	XL	
060	208/230-60	187	253	313.5	350	708.5	350	316.5	350	716.4	350	—	—	—	—
	380-60	342	418	163.2	200	376.9	175	164.9	200	381.3	175	—	—	—	—
	460-60	414	506	138.0	150	313.6	150	139.4	150	317.2	150	—	—	—	—
	575-60	518	633	110.5	125	254.0	125	111.6	125	256.9	125	—	—	—	—
070	208/230-60	187	253	356.7	450	802.7	400	359.7	450	810.6	400	—	—	—	—
	380-60	342	418	187.8	225	442.8	225	189.5	225	447.2	225	—	—	—	—
	460-60	414	506	158.0	175	367.5	175	159.4	200	371.1	175	—	—	—	—
	575-60	518	633	127.9	150	296.7	150	129.0	150	299.6	150	—	—	—	—
080	208/230-60	187	253	388.5	450	783.5	450	391.5	450	791.4	450	403.2	450	807.6	450
	380-60	342	418	201.6	225	415.3	225	203.3	225	419.7	225	210.3	225	428.5	225
	460-60	414	506	170.7	200	346.3	200	172.1	200	349.9	200	177.6	200	357.2	200
	575-60	518	633	136.7	150	280.2	150	137.8	150	283.1	150	142.6	150	288.9	150
090	208/230-60	187	253	455.6	500	901.6	500	458.6	500	909.5	500	470.3	500	925.7	500
	380-60	342	418	239.2	250	494.3	250	240.9	250	498.7	250	247.9	250	507.5	300
	460-60	414	506	201.5	225	411.0	225	202.9	225	414.6	225	208.4	250	421.9	225
	575-60	518	633	162.7	175	331.5	175	163.8	175	334.4	175	168.6	200	340.2	200
100	208/230-60	187	253	494.0	500	940.0	500	497.0	500	947.9	500	508.7	600	964.1	600
	380-60	342	418	261.0	300	516.1	300	262.7	300	520.5	300	269.7	300	529.3	300
	460-60	414	506	219.3	250	428.8	250	220.7	250	432.4	250	226.2	250	439.7	250
	575-60	518	633	178.1	200	346.9	200	179.2	200	349.8	200	184.0	200	355.6	200
110	208/230-60	187	253	530.6	600	976.6	600	533.6	600	984.5	600	545.3	600	1000.7	600
	380-60	342	418	277.6	300	532.7	300	279.3	300	537.1	300	286.3	300	545.9	300
	460-60	414	506	234.2	250	443.7	250	235.6	250	447.3	250	241.1	250	454.6	250
	575-60	518	633	188.9	200	357.7	200	190.0	200	360.6	200	194.8	225	366.4	225
120	208/230-60	187	253	600.1	700	1046.1	700	603.1	700	1054.0	700	614.8	700	1070.2	700
	380-60	342	418	316.9	350	572.0	350	318.6	350	576.4	350	325.6	350	585.2	350
	460-60	414	506	266.3	300	425.8	300	267.7	300	479.4	300	273.2	300	486.7	300
	575-60	518	633	216.3	225	385.1	225	217.4	250	392.4	250	222.2	250	393.8	250
130	208/230-60	187	253	648.7	700	1094.6	700	651.7	700	1102.5	700	663.4	700	1118.7	700
	380-60	342	418	340.0	350	595.1	350	341.7	350	599.5	350	348.7	350	608.3	400
	460-60	414	506	286.6	300	496.1	300	288.0	300	499.7	300	293.5	300	507.0	300
	575-60	518	633	231.4	250	400.3	250	232.5	250	403.2	250	237.3	250	409.0	250
150	208/230-60	187	253	706.3	800	1152.2	800	709.3	800	1160.1	800	721.0	800	1176.3	800
	380-60	342	418	372.7	400	627.8	400	374.4	400	632.2	400	381.4	400	641.0	400
	460-60	414	506	313.3	350	522.8	350	314.7	350	526.4	350	320.2	350	533.7	350
	575-60	518	633	254.5	300	423.4	300	255.6	300	426.3	300	260.4	300	432.1	300
160	208/230-60	187	253	766.8	800	1212.7	800	769.8	800	1220.6	800	781.5	800	1236.8	800
	380-60	342	418	402.4	450	657.5	450	404.1	450	661.9	450	411.1	450	670.7	450
	460-60	414	506	339.0	350	548.5	350	340.4	350	552.1	350	345.9	350	559.4	350
	575-60	518	633	274.0	300	442.8	300	275.1	300	445.7	300	279.9	300	451.5	300
170	208/230-60	187	253	824.4	1000	1270.3	1000	827.4	1000	1278.2	1000	839.1	1000	1294.4	1000
	380-60	342	418	435.1	450	690.2	450	436.8	450	694.6	450	443.8	450	703.4	500
	460-60	414	506	365.7	400	575.2	400	367.1	400	578.8	400	372.6	400	586.1	400
	575-60	518	633	297.1	300	465.9	300	298.2	300	468.8	300	303.0	350	474.6	350
190	208/230-60	187	253	942.5	1000	1388.4	1000	945.5	1000	1396.3	1000	957.2	1000	1412.5	1000
	380-60	342	418	497.5	500	752.5	500	499.2	500	756.9	600	506.2	600	765.7	600
	460-60	414	506	418.1	450	627.6	450	419.5	450	631.2	450	425.0	450	638.5	450
	575-60	518	633	339.6	350	508.4	350	340.7	350	511.3	350	345.5	350	517.1	350

LEGEND

ICF — Instantaneous Current Flow
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MOCP — Maximum Overcurrent Protection
XL — Across-the-Line Start

NOTES:

1. Units are suitable for use on electrical systems where voltage supplied to the unit terminals is not below or above the listed minimum and maximum limits. Maximum allowable phase imbalance is: voltage, 2%; amps 10%.
2. All units have single point primary power connection. (Each unit requires its own power supply.) Main power must be supplied from a field-supplied disconnect.
3. Cooler heater is wired into the control circuit so it is always operable as long as the power supply disconnect is on, even if any safety device is open.
4. For MCA that is less than or equal to 380 amps, 3 conductors are required.
   For MCA between 381 and 760 amps, 6 conductors are required.
   For MCA between 761 and 1140 amps, 9 conductors are required.
   For MCA between 1141 and 1520 amps, 12 conductors are required.
   Calculation of conductors required is based on 75°C copper wire.
5. Wiring for main field supply must be rated 75°C minimum. Use copper for all units.
   a. Incoming wire size range for the terminal block is no. 4 AWG (American Wire Gage) to 500 kcmil.
   b. Incoming wire size range of non-fused disconnect with MCA up to 599.9 amps is 3/0 to 500 kcmil.
   c. Incoming wire size range of non-fused disconnect with MCA from 600 to 799.9 amps is 1/0 to 500 kcmil.
   d. Incoming wire size range of non-fused disconnect with MCA from 800 to 1199.9 amps is 250 kcmil to 500 kcmil.
6. Hydronic pump packages are not available as a factory-installed option for units 30RB210-300 and 30RB060-190 with high SCCR option.
7. Power draw includes both crankcase heaters and cooler heaters. Each compressor has a crankcase heater which draws 56 watts of power. Units have 1 (060-150) or 2 (160-300) cooler heaters, 825 watts each.
8. 30RB chillers with Greenspeed intelligence are not available in size 060 and 070.

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Electrical data (cont)

30RB210-300 ELECTRICAL DATA — SINGLE POINT UNITS

30RB UNIT SIZE	UNIT VOLTAGE			NO HYDRONIC PACKAGE			
	V-Hz (3 Ph)	Supplied		MCA	MOCP	ICF	Rec Fuse Size
		Min	Max	XL	XL	XL	
210	208/230-60	187	253	—	—	—	—
	380-60	342	418	501.8	600	755.1	600
	460-60	414	506	422.9	450	630.9	450
	575-60	518	633	342.3	350	509.9	350
225	208/230-60	187	253	—	—	—	—
	380-60	342	418	534.5	600	787.8	600
	460-60	414	506	449.6	450	657.6	450
	575-60	518	633	365.4	400	533.0	400
250	208/230-60	187	253	—	—	—	—
	380-60	342	418	596.8	600	850.2	600
	460-60	414	506	502.0	600	710.0	600
	575-60	518	633	408.0	450	575.6	450
275	208/230-60	187	253	—	—	—	—
	380-60	342	418	659.2	700	912.6	700
	460-60	414	506	554.4	600	762.4	600
	575-60	518	633	450.5	500	618.1	500
300	208/230-60	187	253	—	—	—	—
	380-60	342	418	721.6	800	975.0	800
	460-60	414	506	606.8	700	814.8	700
	575-60	518	633	493.0	500	660.7	500

LEGEND

ICF — Instantaneous Current Flow
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NOTES:

1. Units are suitable for use on electrical systems where voltage supplied to the unit terminals is not below or above the listed minimum and maximum limits. Maximum allowable phase imbalance is: voltage, 2%; amps 10%.
2. All units have single point primary power connection. (Each unit requires its own power supply.) Main power must be supplied from a field-supplied disconnect.
3. Cooler heater is wired into the control circuit so it is always operable as long as the power supply disconnect is on, even if any safety device is open.
4. For MCA that is less than or equal to 380 amps, 3 conductors are required.
   For MCA between 381 and 760 amps, 6 conductors are required.
   For MCA between 761 and 1140 amps, 9 conductors are required.
   For MCA between 1141 and 1520 amps, 12 conductors are required.
   Calculation of conductors required is based on 75°C copper wire.
5. Wiring for main field supply must be rated 75°C minimum. Use copper for all units.
   a. Incoming wire size range for the terminal block is no. 4 AWG (American Wire Gage) to 500 kcmil.
   b. Incoming wire size range of non-fused disconnect with MCA up to 599.9 amps is 3/0 to 500 kcmil.
   c. Incoming wire size range of non-fused disconnect with MCA from 600 to 799.9 amps is 1/0 to 500 kcmil.
   d. Incoming wire size range of non-fused disconnect with MCA from 800 to 1199.9 amps is 250 kcmil to 500 kcmil.
6. Hydronic pump packages are not available as a factory-installed option for units 30RB210-300 and 30RB060-190 with high SCCR option.
7. Power draw includes both crankcase heaters and cooler heaters. Each compressor has a crankcase heater which draws 56 watts of power. Units have 1 (060-150) or 2 (160-300) cooler heaters, 825 watts each.
8. 30RB chillers with Greenspeed intelligence are not available in size 060 and 070.

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30RB060-190 ELECTRICAL DATA — DUAL POINT UNITS

30RB UNIT SIZE	UNIT VOLTAGE			NO HYDRONIC PACKAGE				3 HP PUMP, 1750 RPM				5 HP PUMP, 1750 RPM			
	V-Hz (3 Ph)	Supplied		MCA	MOCP	ICF	Rec Fuse Size	MCA	MOCP	ICF	Rec Fuse Size	MCA	MOCP	ICF	Rec Fuse Size
		Min	Max	XL	XL	XL		XL	XL	XL		XL	XL	XL	
060	208/230-60	187	253	168.8/141.5	225/200	560.0/532.8	200/175	177.9/141.5	250/200	570.8/532.8	200/175	184.2/141.5	250/200	577.7/532.8	225/175
	380-60	342	418	86.4/ 74.1	110/110	298.4/286.1	100/ 90	91.5/ 74.1	125/110	304.3/286.1	110/ 90	94.5/ 74.1	125/110	308.1/286.1	110/ 90
	460-60	414	506	73.6/ 62.5	100/ 90	247.7/236.6	90/ 80	77.8/ 62.5	110/ 90	252.6/236.6	90/ 80	80.7/ 62.5	110/ 90	255.7/236.6	90/ 80
	575-60	518	633	59.0/ 50.0	80/ 70	201.2/192.3	70/ 60	62.3/ 50.0	80/ 70	205.1/192.3	70/ 60	64.4/ 50.0	90/ 70	207.6/192.3	80/ 60
070	208/230-60	187	253	212.0/141.5	300/200	654.2/532.8	250/175	221.1/141.5	300/200	665.0/532.8	250/175	227.4/141.5	300/200	671.9/532.8	300/175
	380-60	342	418	110.9/ 74.1	150/110	364.3/286.1	125/ 90	116.0/ 74.1	150/110	370.2/286.1	150/ 90	119.0/ 74.1	150/110	374.0/286.1	150/ 90
	460-60	414	506	93.6/ 62.5	125/ 90	301.6/236.6	110/ 80	97.8/ 62.5	125/ 90	306.5/236.6	110/ 80	100.7/ 62.5	125/ 90	309.6/236.6	125/ 80
	575-60	518	633	76.3/ 50.0	110/ 70	243.9/192.3	90/ 60	79.6/ 50.0	110/ 70	247.8/192.3	90/ 60	81.7/ 50.0	110/ 70	250.3/192.3	100/ 60
080	208/230-60	187	253	216.5/168.8	250/225	607.8/560.0	250/200	—	—	—	—	231.9/168.8	300/225	625.5/560.0	300/200
	380-60	342	418	112.5/ 86.4	150/110	324.5/298.4	125/100	—	—	—	—	120.6/ 86.4	150/110	334.2/298.4	150/100
	460-60	414	506	95.2/ 73.6	125/100	269.3/247.7	110/ 90	—	—	—	—	102.3/ 73.6	125/100	277.3/247.7	125/ 90
	575-60	518	633	76.2/ 59.0	100/ 80	218.5/201.2	90/ 70	—	—	—	—	81.6/ 59.0	100/ 80	224.9/201.2	90/ 70
090	208/230-60	187	253	283.6/168.8	350/225	725.9/560.0	350/200	—	—	—	—	299.0/168.8	350/225	743.5/560.0	350/200
	380-60	342	418	150.1/ 86.4	175/110	403.5/298.4	175/100	—	—	—	—	158.2/ 86.4	200/110	413.2/298.4	175/100
	460-60	414	506	126.0/ 73.6	150/100	334.0/247.7	150/ 90	—	—	—	—	133.1/ 73.6	150/100	342.0/247.7	150/ 90
	575-60	518	633	102.2/ 59.0	125/ 80	269.8/201.2	125/ 70	—	—	—	—	107.6/ 59.0	125/ 80	276.2/201.2	125/ 70
100	208/230-60	187	253	283.6/212.0	350/300	725.9/654.2	350/250	—	—	—	—	299.0/212.0	350/300	743.5/654.2	350/250
	380-60	342	418	150.1/110.9	175/150	403.5/364.3	175/125	—	—	—	—	158.2/110.9	200/150	413.2/364.3	175/125
	460-60	414	506	126.0/ 93.6	150/125	334.0/301.6	150/110	—	—	—	—	133.1/ 93.6	150/125	342.0/301.6	150/110
	575-60	518	633	102.2/ 76.3	125/110	269.8/243.9	125/ 90	—	—	—	—	107.6/ 76.3	125/110	276.2/243.9	125/ 90
110	208/230-60	187	253	283.6/243.8	350/300	725.9/635.0	350/300	—	—	—	—	299.0/243.8	350/300	743.5/635.0	350/300
	380-60	342	418	150.1/124.8	175/150	403.5/336.8	175/150	—	—	—	—	158.2/124.8	200/150	413.2/336.8	175/150
	460-60	414	506	126.0/106.3	150/125	334.0/280.4	150/125	—	—	—	—	133.1/106.3	150/125	342.0/280.4	150/125
	575-60	518	633	102.2/ 85.2	125/110	269.8/227.4	125/100	—	—	—	—	107.6/ 85.2	125/110	276.2/227.4	125/100
120	208/230-60	187	253	295.5/306.2	350/400	737.8/748.4	350/350	—	—	—	—	310.9/306.2	400/400	755.5/748.4	350/350
	380-60	342	418	156.7/160.2	200/200	410.1/413.6	175/175	—	—	—	—	164.8/160.2	200/200	419.7/413.6	200/175
	460-60	414	506	131.4/135.2	150/175	339.4/343.2	150/150	—	—	—	—	138.5/135.2	175/175	347.4/343.2	150/150
	575-60	518	633	106.5/110.2	125/125	274.1/277.8	125/125	—	—	—	—	111.9/110.2	125/125	280.5/277.8	125/125
130	208/230-60	187	253	401.7/243.8	450/300	843.9/635.0	450/300	—	—	—	—	417.1/243.8	500/300	861.6/635.0	450/300
	380-60	342	418	212.5/124.8	250/150	465.9/336.8	225/150	—	—	—	—	220.6/124.8	250/150	475.6/336.8	250/150
	460-60	414	506	178.4/106.3	200/125	386.4/280.4	200/125	—	—	—	—	185.5/106.3	225/125	394.4/280.4	200/125
	575-60	518	633	144.7/ 85.2	175/110	312.4/227.4	175/100	—	—	—	—	150.1/ 85.2	175/110	318.8/227.4	175/100
150	208/230-60	187	253	401.7/306.2	450/400	843.9/748.4	450/350	—	—	—	—	417.1/306.2	500/400	861.6/748.4	450/350
	380-60	342	418	212.5/160.2	250/200	465.9/413.6	225/175	—	—	—	—	220.6/160.2	250/200	475.6/413.6	250/175
	460-60	414	506	178.4/135.2	200/175	386.4/343.2	200/150	—	—	—	—	185.5/135.2	225/175	394.4/343.2	200/150
	575-60	518	633	144.7/110.2	175/125	312.4/277.8	175/125	—	—	—	—	150.1/110.2	175/125	318.8/277.8	175/125
160	208/230-60	187	253	519.8/243.8	600/300	962.0/635.0	600/300	—	—	—	—	535.2/243.8	600/300	979.7/635.0	600/300
	380-60	342	418	274.9/124.8	300/150	528.3/336.8	300/150	—	—	—	—	283.0/124.8	300/150	538.0/336.8	300/150
	460-60	414	506	230.8/106.3	250/125	438.8/280.4	250/125	—	—	—	—	237.9/106.3	250/125	446.8/280.4	250/125
	575-60	518	633	187.3/ 85.2	200/110	354.9/227.4	200/100	—	—	—	—	192.7/ 85.2	225/110	361.3/227.4	225/100
170	208/230-60	187	253	519.8/306.2	600/400	962.0/748.4	600/350	—	—	—	—	535.2/306.2	600/400	979.7/748.4	600/350
	380-60	342	418	274.9/160.2	300/200	528.3/413.6	300/175	—	—	—	—	283.0/160.2	300/200	538.0/413.6	300/175
	460-60	414	506	230.8/135.2	250/175	438.8/343.2	250/150	—	—	—	—	237.9/135.2	250/175	446.8/343.2	250/150
	575-60	518	633	187.3/110.2	200/125	354.9/277.8	200/125	—	—	—	—	192.7/110.2	225/125	361.3/277.8	225/125
190	208/230-60	187	253	543.7/400.4	600/450	985.9/842.6	600/450	—	—	—	—	559.1/400.4	600/450	1003.6/842.6	600/450
	380-60	342	418	288.0/209.5	300/250	541.3/462.9	300/225	—	—	—	—	296.1/209.5	300/250	551.0/462.9	300/225
	460-60	414	506	241.6/176.8	250/200	449.6/384.8	250/200	—	—	—	—	248.7/176.8	250/200	457.6/384.8	250/200
	575-60	518	633	195.9/144.1	225/175	363.5/311.7	225/175	—	—	—	—	201.3/144.1	225/175	369.9/311.7	225/175

LEGEND

ICF — Instantaneous Current Flow (Ckt1/Ckt2)
MCA — Minimum Circuit Amps (Ckt1/Ckt2)
MOCP — Maximum Overcurrent Protection (Ckt1/Ckt2)
XL — Across-the-Line Start

NOTES:

1. Units are suitable for use on electrical systems where voltage supplied to the unit terminals is not below or above the listed minimum and maximum limits. Maximum allowable phase imbalance is: voltage, 2%; amps 10%.
2. Control power is derived from main power. No separate control power connection is required.
3. Cooler heater is wired into the control circuit so it is always operable as long as the power supply disconnect is on, even if any safety device is open.
4. For MCA that is less than or equal to 380 amps, 3 conductors are required.
   For MCA between 381 and 760 amps, 6 conductors are required.
   For MCA between 761 and 1140 amps, 9 conductors are required.
   For MCA between 1141 and 1520 amps, 12 conductors are required.
   Calculation of conductors required is based on 75 C copper wire.
5. Wiring for main field supply must be rated 75 C minimum. Use copper for all units.
   a. Incoming wire size range for the terminal block is no. 4 AWG (American Wire Gage) to 500 kcmil.
   b. Incoming wire size range of non-fused disconnect with MCA up to 599.9 amps is 3/0 to 500 kcmil.
   c. Incoming wire size range of non-fused disconnect with MCA from 600 to 799.9 amps is 1/0 to 500 kcmil.
   d. Incoming wire size range of non-fused disconnect with MCA from 800 to 1199.9 amps is 250 kcmil to 500 kcmil.
6. Hydronic pump packages are not available as a factory-installed option for units 30RB210-300.
7. Power draw includes both crankcase heaters and cooler heaters (where used). Each compressor has a crankcase heater which draws 56 watts of power. Units ordered with the cooler heater option have 1 (060-150) or 2 (160-300) cooler heaters, 825 watts each.
8. 30RB chillers with Greenspeed® technology are not available in size 060 and 070.

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Intertek
208/230
460
575 v only

Electrical data (cont)

30RB060-190 ELECTRICAL DATA — DUAL POINT UNITS (cont)

30RB UNIT SIZE	UNIT VOLTAGE			7.5 HP PUMP, 1750/3450 RPM				10 HP PUMP, 3450 RPM				15 HP PUMP, 3450 RPM			
	V-Hz (3 Ph)	Supplied		MCA	MOCP	ICF	Rec Fuse Size	MCA	MOCP	ICF	Rec Fuse Size	MCA	MOCP	ICF	Rec Fuse Size
		Min	Max	XL	XL	XL		XL	XL	XL		XL	XL	XL	
060	208/230-60	187	253	190.8/141.5	250/200	585.7/532.8	225/175	193.8/141.5	250/200	593.6/532.8	225/175	—	—	—	—
	380-60	342	418	98.7/ 74.1	125/110	312.4/286.1	110/ 90	100.4/ 74.1	125/110	316.8/286.1	110/ 90	—	—	—	—
	460-60	414	506	83.7/ 62.5	110/ 90	259.3/236.6	100/ 80	85.1/ 62.5	110/ 90	262.9/236.6	100/ 80	—	—	—	—
	575-60	518	633	67.1/ 50.0	90/ 70	210.5/192.3	80/ 60	68.2/ 50.0	90/ 70	213.4/192.3	80/ 60	—	—	—	—
070	208/230-60	187	253	234.0/141.5	300/200	679.9/532.8	300/175	237.0/141.5	300/200	687.8/532.8	300/175	—	—	—	—
	380-60	342	418	123.2/ 74.1	150/110	378.3/286.1	150/ 90	124.9/ 74.1	150/110	382.7/286.1	150/ 90	—	—	—	—
	460-60	414	506	103.7/ 62.5	125/ 90	313.2/236.6	125/ 80	105.1/ 62.5	125/ 90	316.8/236.6	125/ 80	—	—	—	—
	575-60	518	633	84.4/ 50.0	110/ 70	253.2/192.3	100/ 60	85.5/ 50.0	110/ 70	256.1/192.3	100/ 60	—	—	—	—
080	208/230-60	187	253	238.5/168.8	300/225	633.4/560.0	300/200	241.5/168.8	300/225	641.4/560.0	300/200	253.2/168.8	300/225	657.5/560.0	300/200
	380-60	342	418	124.8/ 86.4	150/110	338.6/298.4	150/100	126.5/ 86.4	150/110	342.9/298.4	150/100	133.5/ 86.4	150/110	351.8/298.4	150/100
	460-60	414	506	105.3/ 73.6	125/100	280.9/247.7	125/ 90	106.7/ 73.6	125/100	284.5/247.7	125/ 90	112.2/ 73.6	125/100	291.8/247.7	125/ 90
	575-60	518	633	84.3/ 59.0	110/ 80	227.8/201.2	100/ 70	85.4/ 59.0	110/ 80	230.6/201.2	100/ 70	90.2/ 59.0	110/ 80	236.5/201.2	100/ 70
090	208/230-60	187	253	305.6/168.8	350/225	751.5/560.0	350/200	308.6/168.8	400/225	759.5/560.0	350/200	320.3/168.8	400/225	775.6/560.0	350/200
	380-60	342	418	162.4/ 86.4	200/110	417.6/298.4	175/100	164.1/ 86.4	200/110	421.9/298.4	200/100	171.1/ 86.4	200/110	430.8/298.4	200/100
	460-60	414	506	136.1/ 73.6	175/100	345.6/247.7	150/ 90	137.5/ 73.6	175/100	349.2/247.7	150/ 90	143.0/ 73.6	175/100	356.5/247.7	175/ 90
	575-60	518	633	110.3/ 59.0	125/ 80	279.1/201.2	125/ 70	111.4/ 59.0	125/ 80	282.0/201.2	125/ 70	116.2/ 59.0	150/ 80	287.8/201.2	125/ 70
100	208/230-60	187	253	305.6/212.0	350/300	751.5/654.2	350/250	308.6/212.0	400/300	759.5/654.2	350/250	320.3/212.0	400/300	775.6/654.2	350/250
	380-60	342	418	162.4/110.9	200/150	417.6/364.3	175/125	164.1/110.9	200/150	421.9/364.3	200/125	171.1/110.9	200/150	430.8/364.3	200/125
	460-60	414	506	136.1/ 93.6	175/125	345.6/301.6	150/110	137.5/ 93.6	175/125	349.2/301.6	150/110	143.0/ 93.6	175/125	356.5/301.6	175/110
	575-60	518	633	110.3/ 76.3	125/110	279.1/243.9	125/ 90	111.4/ 76.3	125/110	282.0/243.9	125/ 90	116.2/ 76.3	150/110	287.8/243.9	125/ 90
110	208/230-60	187	253	305.6/243.8	350/300	751.5/635.0	350/300	308.6/243.8	400/300	759.5/635.0	350/300	320.3/243.8	400/300	775.6/635.0	350/300
	380-60	342	418	162.4/124.8	200/150	417.6/336.8	175/150	164.1/124.8	200/150	421.9/336.8	200/150	171.1/124.8	200/150	430.8/336.8	200/150
	460-60	414	506	136.1/106.3	175/125	345.6/280.4	150/125	137.5/106.3	175/125	349.2/280.4	150/125	143.0/106.3	175/125	356.5/280.4	175/125
	575-60	518	633	110.3/ 85.2	125/110	279.1/227.4	125/100	111.4/ 85.2	125/110	282.0/227.4	125/100	116.2/ 85.2	150/110	287.8/227.4	125/100
120	208/230-60	187	253	317.5/306.2	400/400	763.5/748.4	350/350	320.5/306.2	400/400	771.4/748.4	350/350	332.2/306.2	400/400	787.6/748.4	400/350
	380-60	342	418	169.0/160.2	200/200	424.1/413.6	200/175	170.7/160.2	200/200	428.5/413.6	200/175	177.7/160.2	225/200	437.3/413.6	200/175
	460-60	414	506	141.5/135.2	175/175	351.0/343.2	175/150	142.9/135.2	175/175	354.6/343.2	175/150	148.4/135.2	175/175	361.9/343.2	175/150
	575-60	518	633	114.6/110.2	125/125	283.4/277.8	125/125	115.7/110.2	125/125	286.3/277.8	125/125	120.5/110.2	150/125	292.1/277.8	150/125
130	208/230-60	187	253	423.7/243.8	500/300	869.6/635.0	450/300	426.7/243.8	500/300	877.6/635.0	500/300	438.4/243.8	500/300	893.7/635.0	500/300
	380-60	342	418	224.8/124.8	250/150	479.9/336.8	250/150	226.5/124.8	250/150	484.3/336.8	250/150	233.5/124.8	250/150	493.1/336.8	250/150
	460-60	414	506	188.5/106.3	225/125	398.0/280.4	200/125	189.9/106.3	225/125	401.6/280.4	225/125	195.4/106.3	225/125	408.9/280.4	225/125
	575-60	518	633	152.8/ 85.2	175/110	321.6/227.4	175/100	153.9/ 85.2	175/110	324.5/227.4	175/100	158.7/ 85.2	175/110	330.4/227.4	175/100
150	208/230-60	187	253	423.7/306.2	500/400	869.6/748.4	450/350	426.7/306.2	500/400	877.6/748.4	500/350	438.4/306.2	500/400	893.7/748.4	500/350
	380-60	342	418	224.8/160.2	250/200	479.9/413.6	250/175	226.5/160.2	250/200	484.3/413.6	250/175	233.5/160.2	250/200	493.1/413.6	250/175
	460-60	414	506	188.5/135.2	225/175	398.0/343.2	200/150	189.9/135.2	225/175	401.6/343.2	225/150	195.4/135.2	225/175	408.9/343.2	225/150
	575-60	518	633	152.8/110.2	175/125	321.6/277.8	175/125	153.9/110.2	175/125	324.5/277.8	175/125	158.7/110.2	175/125	330.4/277.8	175/125
160	208/230-60	187	253	541.8/243.8	600/300	987.7/635.0	600/300	544.8/243.8	600/300	995.6/635.0	600/300	556.5/243.8	600/300	1011.8/635.0	600/300
	380-60	342	418	287.2/124.8	300/150	542.3/336.8	300/150	288.9/124.8	300/150	546.7/336.8	300/150	295.9/124.8	300/150	555.5/336.8	350/150
	460-60	414	506	240.9/106.3	250/125	450.4/280.4	250/125	242.3/106.3	250/125	454.0/280.4	250/125	247.8/106.3	250/125	461.3/280.4	300/125
	575-60	518	633	195.4/ 85.2	225/110	364.2/227.4	225/100	196.5/ 85.2	225/110	367.1/227.4	225/100	201.3/ 85.2	225/110	372.9/227.4	225/100
170	208/230-60	187	253	541.8/306.2	600/400	987.7/748.4	600/350	544.8/306.2	600/400	995.6/748.4	600/350	556.5/306.2	600/400	1011.8/748.4	600/350
	380-60	342	418	287.2/160.2	300/200	542.3/413.6	300/175	288.9/160.2	300/200	546.7/413.6	300/175	295.9/160.2	350/200	555.5/413.6	350/175
	460-60	414	506	240.9/135.2	250/175	450.4/343.2	250/150	242.3/135.2	250/175	454.0/343.2	250/150	247.8/135.2	250/175	461.3/343.2	300/150
	575-60	518	633	195.4/110.2	225/125	364.2/277.8	225/125	196.5/110.2	225/125	367.1/277.8	225/125	201.3/110.2	225/125	372.9/277.8	225/125
190	208/230-60	187	253	565.7/400.4	600/450	1011.6/842.6	600/450	568.7/400.4	600/450	1019.5/842.6	600/450	580.4/400.4	600/450	1035.7/842.6	600/450
	380-60	342	418	300.3/209.5	350/250	555.4/462.9	350/225	302.0/209.5	350/250	559.7/462.9	350/225	309.0/209.5	350/250	568.6/462.9	350/225
	460-60	414	506	251.7/176.8	300/200	461.2/384.8	300/200	253.1/176.8	300/200	464.8/384.8	300/200	258.6/176.8	300/200	472.1/384.8	300/200
	575-60	518	633	204.0/144.1	225/175	372.8/311.7	225/175	205.1/144.1	225/175	375.7/311.7	225/175	209.9/144.1	225/175	381.5/311.7	225/175

LEGEND

ICF — Instantaneous Current Flow (Ckt1/Ckt2)
MCA — Minimum Circuit Amps (Ckt1/Ckt2)
MOCP — Maximum Overcurrent Protection (Ckt1/Ckt2)
XL — Across-the-Line Start

NOTES:

1. Units are suitable for use on electrical systems where voltage supplied to the unit terminals is not below or above the listed minimum and maximum limits. Maximum allowable phase imbalance is: voltage, 2%; amps 10%.
2. Control power is derived from main power. No separate control power connection is required.
3. Cooler heater is wired into the control circuit so it is always operable as long as the power supply disconnect is on, even if any safety device is open.
4. For MCA that is less than or equal to 380 amps, 3 conductors are required.
   For MCA between 381 and 760 amps, 6 conductors are required.
   For MCA between 761 and 1140 amps, 9 conductors are required.
   For MCA between 1141 and 1520 amps, 12 conductors are required.
   Calculation of conductors required is based on 75 C copper wire.
5. Wiring for main field supply must be rated 75 C minimum. Use copper for all units.
   a. Incoming wire size range for the terminal block is no. 4 AWG (American Wire Gage) to 500 kcmil.
   b. Incoming wire size range of non-fused disconnect with MCA up to 599.9 amps is 3/0 to 500 kcmil.
   c. Incoming wire size range of non-fused disconnect with MCA from 600 to 799.9 amps is 1/0 to 500 kcmil.
   d. Incoming wire size range of non-fused disconnect with MCA from 800 to 1199.9 amps is 250 kcmil to 500 kcmil.
6. Hydronic pump packages are not available as a factory-installed option for units 30RB210-300.
7. Power draw includes both crankcase heaters and cooler heaters (where used). Each compressor has a crankcase heater which draws 56 watts of power. Units ordered with the cooler heater option have 1 (060-150) or 2 (160-300) cooler heaters, 825 watts each.
8. 30RB chillers with Greenspeed® technology are not available in size 060 and 070.

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30RB210-300 ELECTRICAL DATA — DUAL POINT UNITS

30RB UNIT SIZE	UNIT VOLTAGE			NO HYDRONIC PACKAGE			
	V-Hz (3 Ph)	Supplied		MCA	MOCP	ICF	Rec Fuse Size
		Min	Max	XL	XL	XL	
210	208/230-60	187	253	626.7/353.9	700/400	1068.9/796.2	700/400
	380-60	342	418	327.7/186.4	350/225	581.1/439.7	350/200
	460-60	414	506	233.3/200.0	250/225	441.3/408.0	250/225
	575-60	518	633	188.8/162.0	200/175	356.4/329.6	200/175
225	208/230-60	187	253	684.3/353.9	700/400	1126.5/796.2	700/400
	380-60	342	418	360.4/186.4	400/225	613.8/439.7	400/200
	460-60	414	506	260.0/200.0	300/225	468.0/408.0	300/225
	575-60	518	633	211.9/162.0	225/175	379.5/329.6	225/175
250	208/230-60	187	253	684.3/472.0	700/500	1126.5/914.3	700/500
	380-60	342	418	360.4/248.7	400/250	613.8/502.1	400/250
	460-60	414	506	303.2/209.2	350/250	511.2/417.2	350/225
	575-60	518	633	246.4/170.0	250/200	414.1/337.6	250/200
275	208/230-60	187	253	920.5/353.9	1000/400	1362.7/796.2	1000/400
	380-60	342	418	485.2/186.4	500/225	738.5/439.7	500/200
	460-60	414	506	408.0/156.8	450/175	616.0/364.8	450/175
	575-60	518	633	331.5/127.5	350/150	499.1/295.1	350/150
300	208/230-60	187	253	920.5/472.0	1000/500	1362.7/914.3	1000/500
	380-60	342	418	485.2/248.7	500/250	738.5/502.1	500/250
	460-60	414	506	408.0/209.2	450/250	616.0/417.2	450/225
	575-60	518	633	331.5/170.0	350/200	499.1/337.6	350/200

LEGEND

ICF — Instantaneous Current Flow (Ckt1/Ckt2)
MCA — Minimum Circuit Amps (Ckt1/Ckt2)
MOCP — Maximum Overcurrent Protection (Ckt1/Ckt2)
XL — Across-the-Line Start

NOTES:

1. Units are suitable for use on electrical systems where voltage supplied to the unit terminals is not below or above the listed minimum and maximum limits. Maximum allowable phase imbalance is: voltage, 2%; amps 10%.
2. Control power is derived from main power. No separate control power connection is required.
3. Cooler heater is wired into the control circuit so it is always operable as long as the power supply disconnect is on, even if any safety device is open.
4. For MCA that is less than or equal to 380 amps, 3 conductors are required.
   For MCA between 381 and 760 amps, 6 conductors are required.
   For MCA between 761 and 1140 amps, 9 conductors are required.
   For MCA between 1141 and 1520 amps, 12 conductors are required.
   Calculation of conductors required is based on 75 C copper wire.
5. Wiring for main field supply must be rated 75 C minimum. Use copper for all units.
   a. Incoming wire size range for the terminal block is no. 4 AWG (American Wire Gage) to 500 kcmil.
   b. Incoming wire size range of non-fused disconnect with MCA up to 599.9 amps is 3/0 to 500 kcmil.
   c. Incoming wire size range of non-fused disconnect with MCA from 600 to 799.9 amps is 1/0 to 500 kcmil.
   d. Incoming wire size range of non-fused disconnect with MCA from 800 to 1199.9 amps is 250 kcmil to 500 kcmil.
6. Hydronic pump packages are not available as a factory-installed option for units 30RB210-300.
7. Power draw includes both crankcase heaters and cooler heaters (where used). Each compressor has a crankcase heater which draws 56 watts of power. Units ordered with the cooler heater option have 1 (060-150) or 2 (160-300) cooler heaters, 825 watts each.
8. 30RB chillers with Greenspeed® technology are not available in size 060 and 070.

C ETL LISTED US
Intertek
208/230
460
575 v only

Electrical data (cont)

30RB ELECTRICAL DATA — POWER ENTRY

30RB UNIT SIZE	VOLTAGE	ELECTRICAL OPTION	CONNECTIONS	MAIN POWER ENTRANCE	CONTROL BOX
060,070	208/230, 380, 460, 575	Standard (Terminal Block)	Single Point	Circuit 1	Combination
			Dual Point	Circuit 1	Combination
				Circuit 2	Combination
		Non-Fused Disconnect Option*	Single Point	Circuit 1	Combination
080-120	208/230	Standard (Terminal Block)	Single Point	Circuit 1	Power-L
			Dual Point	Circuit 1	Power-L
				Circuit 2	Power-L
		Non-Fused Disconnect Option*	Single Point	Circuit 1	Power-L
	380, 460, 575	Standard (Terminal Block)	Single Point	Circuit 1	Combination
			Dual Point	Circuit 1	Combination
				Circuit 2	Combination
		Non-Fused Disconnect Option*	Single Point	Circuit 1	Combination
130-190	208/230	Standard (Terminal Block)	Single Point	Circuit 1	Power-L
			Dual Point	Circuit 1	Power-L
				Circuit 2	PEB1
		Non-Fused Disconnect Option	Single Point	Circuit 1	Power-L
			Dual Point	Circuit 1	Power-L
				Circuit 2	PEB1
	380, 460, 575	Standard (Terminal Block)	Single Point	Circuit 1	PEB1
			Dual Point	Circuit 1	PEB1
				Circuit 2	PEB1
		Non-Fused Disconnect Option	Single Point	Circuit 1	PEB1
			Dual Point	Circuit 1	PEB1
				Circuit 2	Power-L
210, 225	208/230†	Standard (Terminal Block)	Dual Point	Circuit 1	Power-L
				Circuit 2	PEB2
		Non-Fused Disconnect Option	Dual Point	Circuit 1	Power-L
				Circuit 2	PEB2
	380, 460, 575	Standard (Terminal Block)	Single Point	Circuit 1	PEB1
			Dual Point	Circuit 1	PEB1
				Circuit 2	PEB1
		Non-Fused Disconnect Option	Single Point	Circuit 1	PEB1
			Dual Point	Circuit 1	PEB1
				Circuit 2	Power-L
250-300	208/230†	Standard (Terminal Block)	Dual Point	Circuit 1	Power-L
				Circuit 2	PEB2
		Non-Fused Disconnect Option	Dual Point	Circuit 1	Power-L
				Circuit 2	PEB2
	380, 460, 575	Standard (Terminal Block)	Single Point	Circuit 1	PEB1
			Dual Point	Circuit 1	PEB1
				Circuit 2	PEB2
		Non-Fused Disconnect	Single Point	Circuit 1	PEB1
			Dual Point	Circuit 1	PEB1
				Circuit 2	PEB2

LEGEND

PEB — Power Electrical Box

*Dual point connection is not available when non-fused disconnect option is selected.
†Single point connection not available.

NOTE: 30RB chillers with Greenspeed® technology are not available in size 060

CONDENSER FAN ELECTRICAL DATA

30RB UNIT SIZE	UNIT VOLTAGE V-Hz (3 Ph)	STANDARD CONDENSER FANS					
		Circuit A Quantity	FLA (each)	Circuit B Quantity	FLA (each)	Circuit C Quantity	FLA (each)
060, 070	208/230-60	3	11.9	1	11.9	—	—
	380-60	3	6.5	1	6.5	—	—
	460-60	3	5.4	1	5.4	—	—
	575-60	3	4.3	1	4.3	—	—
080	208/230-60	2	11.9	2	11.9	—	—
	380-60	2	6.5	2	6.5	—	—
	460-60	2	5.4	2	5.4	—	—
	575-60	2	4.3	2	4.3	—	—
090, 100, 110	208/230-60	3	11.9	3	11.9	—	—
	380-60	3	6.5	3	6.5	—	—
	460-60	3	5.4	3	5.4	—	—
	575-60	3	4.3	3	4.3	—	—
120	208/230-60	3	11.9	4	11.9	—	—
	380-60	3	6.5	4	6.5	—	—
	460-60	3	5.4	4	5.4	—	—
	575-60	3	4.3	4	4.3	—	—
130, 150	208/230-60	4	11.9	4	11.9	—	—
	380-60	4	6.5	4	6.5	—	—
	460-60	4	5.4	4	5.4	—	—
	575-60	4	4.3	4	4.3	—	—
160,170	208/230-60	6	11.9	4	11.9	—	—
	380-60	6	6.5	4	6.5	—	—
	460-60	6	5.4	4	5.4	—	—
	575-60	6	4.3	4	4.3	—	—
190	208/230-60	6	11.9	6	11.9	—	—
	380-60	6	6.5	6	6.5	—	—
	460-60	6	5.4	6	5.4	—	—
	575-60	6	4.3	6	4.3	—	—
210, 225	208/230-60	4	11.9	4	11.9	4	11.9
	380-60	4	6.5	4	6.5	4	6.5
	460-60	4	5.4	4	5.4	4	5.4
	575-60	4	4.3	4	4.3	4	4.3
250	208/230-60	4	11.9	4	11.9	6	11.9
	380-60	4	6.5	4	6.5	6	6.5
	460-60	4	5.4	4	5.4	6	5.4
	575-60	4	4.3	4	4.3	6	4.3
275	208/230-60	6	11.9	6	11.9	4	11.9
	380-60	6	6.5	6	6.5	4	6.5
	460-60	6	5.4	6	5.4	4	5.4
	575-60	6	4.3	6	4.3	4	4.3
300	208/230-60	6	11.9	6	11.9	6	11.9
	380-60	6	6.5	6	6.5	6	6.5
	460-60	6	5.4	6	5.4	6	5.4
	575-60	6	4.3	6	4.3	6	4.3

LEGEND
FLA — Full Load Amps

NOTE: 30RB chillers with Greenspeed® technology are not available in size 060 and 070.

PUMP ELECTRICAL DATA

PUMP HP	UNIT VOLTAGE V-Hz (3 Ph)	HYDRONIC SYSTEM (SINGLE/DUAL) FLA (each)	USED ON 30RB SIZES*
3	208/230-60	9.1	060, 070
	380-60	5.1	
	460-60	4.2	
	575-60	3.3	
5	208/230-60	15.4	060-190
	380-60	8.1	
	460-60	7.1	
	575-60	5.4	
7.5	208/230-60	22.0	060-190
	380-60	12.3	
	460-60	10.1	
	575-60	8.1	
10	208/230-60	25.0	060-190
	380-60	14.0	
	460-60	11.5	
	575-60	9.2	
15	208/230-60	36.7	080-190
	380-60	21.0	
	460-60	17.0	
	575-60	14.0	

LEGEND
FLA — Full Load Amps
*Hydronic pump packages are not available as a factory-installed option for units 30RB210-300.

NOTE: 30RB chillers with Greenspeed® technology are not available in size 060 and 070.

Electrical data (cont)

COMPRESSOR ELECTRICAL DATA

30RB UNIT SIZE	UNIT VOLTAGE V-Hz (3 Ph)	COMPRESSOR A1		A2		A3		A4		B1		B2		B3		B4		C1		C2		C3		C4	
		RLA	LRA	RLA	LRA	RLA	LRA	RLA	LRA	RLA	LRA	RLA	LRA	RLA	LRA	RLA	LRA	RLA	LRA	RLA	LRA	RLA	LRA	RLA	LRA
060	208/230-60	75.0	485	75.0	485	—	—	—	—	75.0	485	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	380-60	38.4	260	38.4	260	—	—	—	—	38.4	260	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	460-60	32.7	215	32.7	215	—	—	—	—	32.7	215	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	575-60	26.2	175	26.2	175	—	—	—	—	26.2	175	—	—	—	—	—	—	—	—	—	—	—	—	—	—
070	208/230-60	94.2	560	94.2	560	—	—	—	—	75.0	485	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	380-60	49.3	315	49.3	315	—	—	—	—	38.4	260	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	460-60	41.6	260	41.6	260	—	—	—	—	32.7	215	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	575-60	33.9	210	33.9	210	—	—	—	—	26.2	175	—	—	—	—	—	—	—	—	—	—	—	—	—	—
080	208/230-60	75.0	485	75.0	485	—	—	—	—	75.0	485	75.0	485	—	—	—	—	—	—	—	—	—	—	—	—
	380-60	38.4	260	38.4	260	—	—	—	—	38.4	260	38.4	260	—	—	—	—	—	—	—	—	—	—	—	—
	460-60	32.7	215	32.7	215	—	—	—	—	32.7	215	32.7	215	—	—	—	—	—	—	—	—	—	—	—	—
	575-60	26.2	175	26.2	175	—	—	—	—	26.2	175	26.2	175	—	—	—	—	—	—	—	—	—	—	—	—
090	208/230-60	94.2	560	94.2	560	—	—	—	—	75.0	485	75.0	485	—	—	—	—	—	—	—	—	—	—	—	—
	380-60	49.3	315	49.3	315	—	—	—	—	38.4	260	38.4	260	—	—	—	—	—	—	—	—	—	—	—	—
	460-60	41.6	260	41.6	260	—	—	—	—	32.7	215	32.7	215	—	—	—	—	—	—	—	—	—	—	—	—
	575-60	33.9	210	33.9	210	—	—	—	—	26.2	175	26.2	175	—	—	—	—	—	—	—	—	—	—	—	—
100	208/230-60	94.2	560	94.2	560	—	—	—	—	94.2	560	94.2	560	—	—	—	—	—	—	—	—	—	—	—	—
	380-60	49.3	315	49.3	315	—	—	—	—	49.3	315	49.3	315	—	—	—	—	—	—	—	—	—	—	—	—
	460-60	41.6	260	41.6	260	—	—	—	—	41.6	260	41.6	260	—	—	—	—	—	—	—	—	—	—	—	—
	575-60	33.9	210	33.9	210	—	—	—	—	33.9	210	33.9	210	—	—	—	—	—	—	—	—	—	—	—	—
110	208/230-60	94.2	560	94.2	560	—	—	—	—	75.0	485	75.0	485	75.0	485	—	—	—	—	—	—	—	—	—	—
	380-60	49.3	315	49.3	315	—	—	—	—	38.4	260	38.4	260	38.4	260	—	—	—	—	—	—	—	—	—	—
	460-60	41.6	260	41.6	260	—	—	—	—	32.7	215	32.7	215	32.7	215	—	—	—	—	—	—	—	—	—	—
	575-60	33.9	210	33.9	210	—	—	—	—	26.2	175	26.2	175	26.2	175	—	—	—	—	—	—	—	—	—	—
120	208/230-60	94.2	560	94.2	560	—	—	—	—	94.2	560	94.2	560	94.2	560	—	—	—	—	—	—	—	—	—	—
	380-60	49.3	315	49.3	315	—	—	—	—	49.3	315	49.3	315	49.3	315	—	—	—	—	—	—	—	—	—	—
	460-60	41.6	260	41.6	260	—	—	—	—	41.6	260	41.6	260	41.6	260	—	—	—	—	—	—	—	—	—	—
	575-60	33.9	210	33.9	210	—	—	—	—	33.9	210	33.9	210	33.9	210	—	—	—	—	—	—	—	—	—	—
130	208/230-60	94.2	560	94.2	560	94.2	560	—	—	75.0	485	75.0	485	75.0	485	—	—	—	—	—	—	—	—	—	—
	380-60	49.3	315	49.3	315	49.3	315	—	—	38.4	260	38.4	260	38.4	260	—	—	—	—	—	—	—	—	—	—
	460-60	41.6	260	41.6	260	41.6	260	—	—	32.7	215	32.7	215	32.7	215	—	—	—	—	—	—	—	—	—	—
	575-60	33.9	210	33.9	210	33.9	210	—	—	26.2	175	26.2	175	26.2	175	—	—	—	—	—	—	—	—	—	—
150	208/230-60	94.2	560	94.2	560	94.2	560	—	—	94.2	560	94.2	560	94.2	560	—	—	—	—	—	—	—	—	—	—
	380-60	49.3	315	49.3	315	49.3	315	—	—	49.3	315	49.3	315	49.3	315	—	—	—	—	—	—	—	—	—	—
	460-60	41.6	260	41.6	260	41.6	260	—	—	41.6	260	41.6	260	41.6	260	—	—	—	—	—	—	—	—	—	—
	575-60	33.9	210	33.9	210	33.9	210	—	—	33.9	210	33.9	210	33.9	210	—	—	—	—	—	—	—	—	—	—
160	208/230-60	94.2	560	94.2	560	94.2	560	94.2	560	75.0	485	75.0	485	75.0	485	—	—	—	—	—	—	—	—	—	—
	380-60	49.3	315	49.3	315	49.3	315	49.3	315	38.4	260	38.4	260	38.4	260	—	—	—	—	—	—	—	—	—	—
	460-60	41.6	260	41.6	260	41.6	260	41.6	260	32.7	215	32.7	215	32.7	215	—	—	—	—	—	—	—	—	—	—
	575-60	33.9	210	33.9	210	33.9	210	33.9	210	26.2	175	26.2	175	26.2	175	—	—	—	—	—	—	—	—	—	—
170	208/230-60	94.2	560	94.2	560	94.2	560	94.2	560	94.2	560	94.2	560	94.2	560	—	—	—	—	—	—	—	—	—	—
	380-60	49.3	315	49.3	315	49.3	315	49.3	315	49.3	315	49.3	315	49.3	315	—	—	—	—	—	—	—	—	—	—
	460-60	41.6	260	41.6	260	41.6	260	41.6	260	41.6	260	41.6	260	41.6	260	—	—	—	—	—	—	—	—	—	—
	575-60	33.9	210	33.9	210	33.9	210	33.9	210	33.9	210	33.9	210	33.9	210	—	—	—	—	—	—	—	—	—	—
190	208/230-60	94.2	560	94.2	560	94.2	560	94.2	560	94.2	560	94.2	560	94.2	560	94.2	560	—	—	—	—	—	—	—	—
	380-60	49.3	315	49.3	315	49.3	315	49.3	315	49.3	315	49.3	315	49.3	315	49.3	315	—	—	—	—	—	—	—	—
	460-60	41.6	260	41.6	260	41.6	260	41.6	260	41.6	260	41.6	260	41.6	260	41.6	260	—	—	—	—	—	—	—	—
	575-60	33.9	210	33.9	210	33.9	210	33.9	210	33.9	210	33.9	210	33.9	210	33.9	210	—	—	—	—	—	—	—	—
210	208/230-60	94.2	560	94.2	560	94.2	560	—	—	75.0	485	75.0	485	75.0	485	—	—	94.2	560	94.2	560	94.2	560	—	—
	380-60	49.3	315	49.3	315	49.3	315	—	—	38.4	260	38.4	260	38.4	260	—	—	49.3	315	49.3	315	49.3	315	—	—
	460-60	41.6	260	41.6	260	41.6	260	—	—	32.7	215	32.7	215	32.7	215	—	—	41.6	260	41.6	260	41.6	260	—	—
	575-60	33.9	210	33.9	210	33.9	210	—	—	26.2	175	26.2	175	26.2	175	—	—	33.9	210	33.9	210	33.9	210	—	—
225	208/230-60	94.2	560	94.2	560	94.2	560	—	—	94.2	560	94.2	560	94.2	560	—	—	94.2	560	94.2	560	94.2	560	—	—
	380-60	49.3	315	49.3	315	49.3	315	—	—	49.3	315	49.3	315	49.3	315	—	—	49.3	315	49.3	315	49.3	315	—	—
	460-60	41.6	260	41.6	260	41.6	260	—	—	41.6	260	41.6	260	41.6	260	—	—	41.6	260	41.6	260	41.6	260	—	—
	575-60	33.9	210	33.9	210	33.9	210	—	—	33.9	210	33.9	210	33.9	210	—	—	33.9	210	33.9	210	33.9	210	—	—
250	208/230-60	94.2	560	94.2	560	94.2	560	—	—	94.2	560	94.2	560	94.2	560	—	—	94.2	560	94.2	560	94.2	560	94.2	560
	380-60	49.3	315	49.3	315	49.3	315	—	—	49.3	315	49.3	315	49.3	315	—	—	49.3	315	49.3	315	49.3	315	49.3	315
	460-60	41.6	260	41.6	260	41.6	260	—	—	41.6	260	41.6	260	41.6	260	—	—	41.6	260	41.6	260	41.6	260	41.6	260
	575-60	33.9	210	33.9	210	33.9	210	—	—	33.9	210	33.9	210	33.9	210	—	—	33.9	210	33.9	210	33.9	210	33.9	210
275	208/230-60	94.2	560	94.2	560	94.2	560	94.2	560	94.2	560	94.2	560	94.2	560	94.2	560	94.2	560	94.2	560	94.2	560	—	—
	380-60	49.3	315	49.3	315	49.3	315	49.3	315	49.3	315	49.3	315	49.3	315	49.3	315	49.3	315	49.3	315	49.3	315	—	—
	460-60	41.6	260	41.6	260	41.6	260	41.6	260	41.6	260	41.6	260	41.6	260	41.6	260	41.6	260	41.6	260	41.6	260	—	—
	575-60	33.9	210	33.9	210	33.9	210	33.9	210	33.9	210	33.9	210	33.9	210	33.9	210	33.9	210	33.9	210	33.9	210	—	—
300	208/230-60	94.2	560	94.2	560	94.2	560	94.2	560	94.2	560	94.2	560	94.2	560	94.2	560	94.2	560	94.2	560	94.2	560	94.2	560
	380-60	49.3	315	49.3	315	49.3	315	49.3	315	49.3	315	49.3	315	49.3	315	49.3	315	49.3	315	49.3	315	49.3	315	49.3	315
	460-60	41.6	260	41.6	260	41.6	260	41.6	260	41.6	260	41.6	260	41.6	260	41.6	260	41.6	260	41.6	260	41.6	260	41.6	260
	575-60	33.9	210	33.9	210	33.9	210	33.9	210	33.9	210	33.9	210	33.9	210	33.9	210	33.9	210	33.9	210	33.9	210	33.9	210

LEGEND

LRA — Locked Rotor Amps
RLA — Rated Load Amps

NOTE: 30RB chillers with Greenspeed technology are not available in size 060 and 070.

Microprocessor

The *Comfort*Link microprocessor controls overall unit operation. Its central executive routine controls a number of processes simultaneously. These include internal timers, reading inputs, analog to digital conversions, fan control, display control, diagnostic control, output relay control, demand limit, capacity control, head pressure control, and temperature reset. Some processes are updated almost continuously, others every 2 to 3 seconds, and some every 30 seconds. The microprocessor routine is started by switching the Emergency ON-OFF switch to ON position. Pump control of external pumps (where so configured) or optional internal pump, will energize the cooler pump to the internal (or CCN) time schedule (or input occupied signal from external system).

Where dual pumps are utilized only one pump will be operated at a time. The control will start the pump with the least hours. When the unit receives a call for cooling (based on a deviation from chilled water set point), the unit stages up in capacity to maintain the cooler fluid set point. The first compressor starts 1 to 3 minutes after the call for cooling. The *Comfort*Link microprocessor controls the capacity of the chiller by cycling compressors at a rate to satisfy actual dynamic load conditions. The control maintains leaving-fluid temperature set point shown on the scrolling marquee display board through intelligent cycling. Accuracy depends on loop volume, loop flow rate, load, outdoor-air temperature, number of stages, and particular stage being cycled off. No adjustment for cooling range or cooler flow rate is required, because the control automatically compensates for cooling range by measuring both return-fluid temperature and leaving-fluid temperature. This is referred to as leaving-fluid temperature control with return-fluid temperature compensation.

The basic logic for determining when to add or remove a stage is a time band integration of deviation from set point plus rate of change of leaving-fluid temperature. When leaving-fluid temperature is close to set point and slowly moving closer, logic prevents addition of another stage.

If 1°F per minute (0.6°C per minute) pulldown control has been selected (adjustable setting), no additional steps of capacity are added as long as the difference between leaving-fluid temperature and set point is greater than 4°F (2.2°C) and rate of change in leaving-fluid temperature is greater than the selected pulldown control rate. If it has been less than 90 seconds since the last capacity change, compressors will continue to run unless a safety device trips. This prevents rapid cycling and also helps return oil during short on periods.

Sensors

Thermistors are used to control temperature-sensing inputs to microprocessor. Additional thermistor sensors may be used as remote temperature sensors for optional LCWT (leaving chilled fluid temperature) reset.

- Cooler leaving chilled fluid temperature (T1)
- Cooler entering fluid (return) temperature (T2)
- Outside-air temperature (T9)

Two refrigerant pressure transducers are used in each circuit for sensing suction and discharge pressure. The microprocessor uses these inputs to control capacity and fan cycling.

- Saturated condensing temperature
- Cooler saturation temperature

Control sequence

Off cycle

If ambient temperature is below 36°F (2°C), cooler heaters (if equipped) are also energized.

Start-up

After the control circuit switches on, the prestart process takes place, then microprocessor checks itself, starts pump (if configured) and waits for temperature to stabilize. The controlled pulldown feature limits compressor loading on start-up to reduce demand on start-up and unnecessary compressor usage. The microprocessor limits supply-fluid temperature decrease (start-up only) to 1°F (0.6°C) per minute.

Capacity control

On first call for cooling, microprocessor starts initial compressor and fan stage on lead circuit.

As additional cooling is required, additional compressors are energized.

Speed at which capacity is added or reduced is controlled by temperature deviation from set point and rate of temperature change of chilled fluid.

The Main Base Board (MBB) responds to the supply chilled water temperature to cycle the compressors to match cooling load requirements.

Minimum load control valve is energized by the MBB. Valve allows hot gas to pass directly into the cooler circuit on the final step of unloading, permitting the unit to operate at lower loads with less compressor cycling.

Additional information

Detailed information on controls and operation is available in the Controls, Start-Up, Operation and Troubleshooting guide included with each unit. Packaged Service Training programs are also available. Contact your Carrier representative for more information.

High-efficiency variable condenser fans (30RB chillers with Greenspeed® intelligence only)

All fans on a circuit run at the same speed and are controlled by a VFD with special CCN software to maintain SCT (saturated condensing temperature) set point. The set point is calculated from operating conditions and adjusted to the most efficient operating point. The high-efficiency variable condenser fan option uses Danfoss VLT 102 variable frequency drives, each with a display. Drives are connected to the LEN communication bus. Fan speed is determined by the chiller controller and communicated to the drive to provide excellent part load efficiency and reduced sound level operation over the life of the chiller.

Dual chiller control

The *Comfort*Link controller allows 2 chillers (piped in parallel) to operate as a single chilled water plant with standard control functions coordinated through the master chiller controller. This standard *Comfort*Link feature requires a communication link between the 2 chillers and, in the case of parallel chillers, requires an additional thermistor and well for each chiller.

Controls (cont)

Dynamic *Comfort*Link controls

Dynamic *Comfort*Link controls keep the chiller on line during periods of extreme operating conditions. If the entering fluid temperature is 85°F (29°C) or higher and the saturated suction temperature is 50°F (10°C) or higher the maximum operating pressure (MOP) feature limits the suction to keep the chiller online. The control automatically starts the chiller in the unloaded state to eliminate the potential of compressor overload due to high head pressure or low suction pressure. The controller will equalize run time on each circuit through the lead/lag feature. If a circuit becomes disabled, the control will automatically set the active circuit to lead, keeping the chiller online at a reduced capacity.

CAPACITY CONTROL STEPS*

UNIT 30RB	STANDARD CAPACITY STEPS (%)
060	0, 33, 67, 100
070	0, 29, 64, 100
080	0, 25, 50, 75, 100
090	0, 22, 50, 72,100
100	0, 25, 50, 75, 100
110	0, 18, 41, 59, 82, 100
120	0, 20, 40, 60, 80, 100
130	0, 15, 33, 48, 67, 81, 100
150	0, 17, 33, 50, 67, 83, 100
160	0, 13, 28, 41, 56, 69, 84, 100
170	0, 14, 29, 43, 57, 71, 86, 100
190	0, 13, 25, 38, 50, 63, 75, 88, 100
210	0, 10, 21, 33, 43, 55, 67, 76, 88, 100
225	0, 11, 22, 33, 44, 56, 67, 78, 89, 100
250	0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100
275	0, 9, 18, 27, 36, 45, 55, 64, 73, 82, 91, 100
300	0, 8, 17, 25, 33, 42, 50, 58, 67, 75, 83, 92, 100

*Capacity control steps may vary due to compressor sequencing.

Standard *Comfort*Link controls with scrolling marquee display

A four-digit alphanumeric display shows all of the *Comfort*Link control codes (with 60-character expandable clear language), plus set points, time of day, temperatures, pressures, and superheat. Additional information can be displayed all at once with the accessory Navigator™ display.

Navigator display

An optional 4-line, 20-character per line display and also available as a field-installed accessory.

Low-temperature override

This feature prevents LCWT from overshooting the set point and possibly causing a nuisance trip-out by the freeze protection.

High-temperature override

This feature allows chiller to add capacity quickly during rapid load variations.

Abnormal conditions

All control safeties in chiller operate through compressor protection board or control relay and microprocessor.

Loss of feedback signal to the MBB will cause the compressor(s) to shut down. For other safeties, microprocessor makes appropriate decision to shut down a compressor due to a safety trip or bad sensor reading and displays appropriate failure code on the display. Chiller remains in safety mode until reset. It then reverts to normal control when unit is reset.

Low-pressure safety

Safety cuts out if system pressure drops below minimum.

High-pressure cutout

Switch shuts down compressors if compressor discharge pressure increases to 641 psig (4420 kPa).

Compressor anti-cycling

This feature limits compressor cycling.

Loss of flow protection

Proof of flow switches are standard and installed on all 30RB chillers.

Sensor failures

Failures are detected by the microprocessor.

Temperature reset

The energy management module (EMM) is required for 4 to 20 mA reset of LCWT in constant fluid systems. Reset by return fluid, outdoor-air temperature, or space temperature does not require this option. Reset reduces compressor power usage at part load when design LCWT is not necessary. Humidity control should be considered since higher coil temperatures resulting from reset will reduce latent heat capacity. Three reset options are offered, based on the following:

Return-fluid temperature

Increases LCWT set point as return (or entering) fluid temperature decreases (indicating load decrease). Option may be used in any application where return fluid provides accurate load indication. Limitation of return fluid reset is that LCWT may only be reset to value of design return fluid temperature.

Outdoor-air temperature

Increases LCWT as outdoor ambient temperature decreases (indicating load decrease). This reset should be applied only where outdoor ambient temperature is an accurate indication of load. An accessory thermistor is required.

Space temperature

Increases LCWT as space temperature decreases (indicating load decrease). This reset should be applied only where space temperature is an accurate indication of load. An accessory thermistor and the energy management module accessory is required.

For details on applying a reset option, refer to unit Controls and Troubleshooting literature. Obtain ordering part numbers for reset option from the Packaged Chiller Builder program or contact your local Carrier representative.

Accessory controls

Demand can be limited by controlling the chiller capacity through the demand limit control (the energy management module is required for this function). This factory-installed option or accessory interfaces with microprocessor to control unit so that chiller's kW demand does not exceed its setting. It is activated from an external switch or a 4 to 20 mA signal.

The standard *Comfort*Link controller is programmed to accept various accessory temperature reset options (based on outdoor-air temperature [standard], return-fluid temperature, or space temperature), that reset the LCWT. An accessory thermistor (T10) is required if outdoor-air temperature or space temperature reset is selected. The

energy management module (EMM) is only required for temperature reset that is initiated by a 4 to 20 mA signal.

Demand limit

If applied, this limits the total power draw of unit to selected point by controlling number of operational compressors during periods of peak electrical demand. The energy management module is required for either 2-step or 4 to 20 mA demand limit.

Electronic expansion valve (EXV)

The EXV controls refrigerant flow to the cooler for different operating conditions by moving an orifice to increase or decrease the flow area through the valve based on microprocessor input. The orifice is positioned by a stepper motor through approximately 3,600 discrete steps and is monitored every three seconds. The EXV maintains an approximate 8°F (5°C) refrigerant superheat entering the compressor.

Diagnostics

The microprocessor may be put through a service test (see Controls, Start-Up, Operation, Service, and Troubleshooting literature). Service test confirms microprocessor is functional, informs observer through display the condition of each sensor and switch in chiller, and allows observer to check for proper operation of fans and compressors.

Default settings

To facilitate quick start-ups, 30RB chillers with *Comfort*Link controls are pre-configured with a default setting that assumes stand-alone operation supplying 44°F (6.7°C) chilled water.

Configuration settings will be based on any options or accessories included with the unit at the time of manufacturing.

Date and time are set to U.S.A. Eastern Time zone and will need reconfiguring based on location and local time zone. If operation based on occupancy scheduling is desired, this will also need to be set during installation.

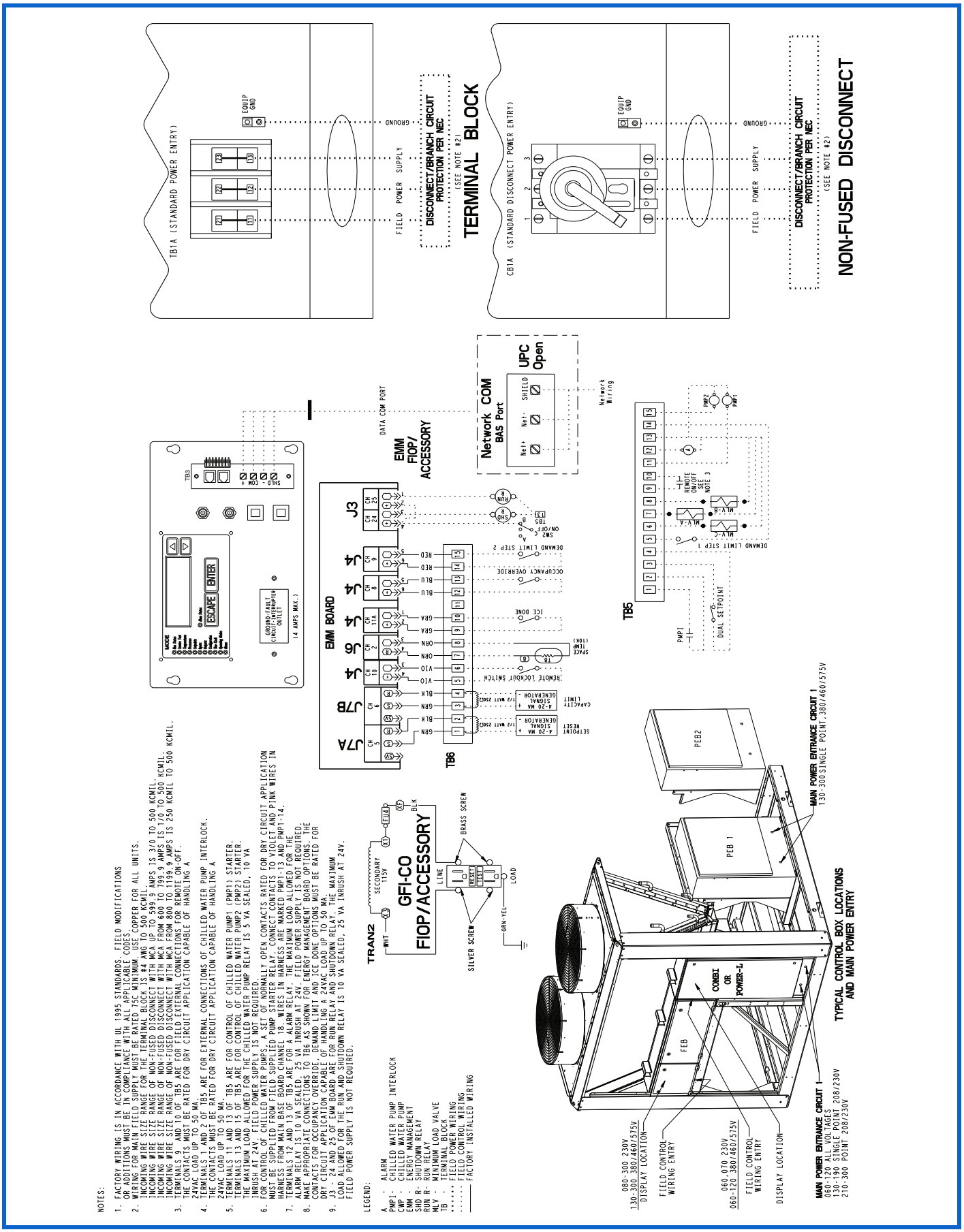
Ice duty

*Comfort*Link controls have the capability of reduced leaving fluid temperature operation for thermal storage, or ice duty. On unit sizes 060-100 the optional energy management module includes input contacts for the “ice done” signal generated by the thermal storage control system. The ice duty feature may be configured to start on an external input command or by the *Comfort*Link standard internal scheduling function. Ice duty may be used in combination with any other standard features offered by the energy management module and *Comfort*Link controls.

The production of ice, which is stored for peak cooling demands, can significantly decrease energy costs. The unit produces ice (normally at night) by supplying ice storage tanks with low temperature cooling fluid. The chiller takes advantage of reduced ambient conditions at night for ice-making mode, so the capacity suffers a lower penalty for the low leaving fluid temperatures.

At peak cooling demands the chiller and the stored ice may share the cooling load to reduce operating costs. The thermal storage system may potentially reduce the size of the chiller plant required to meet demand loads.

Typical control wiring schematic



Application data

Chiller location and clearances

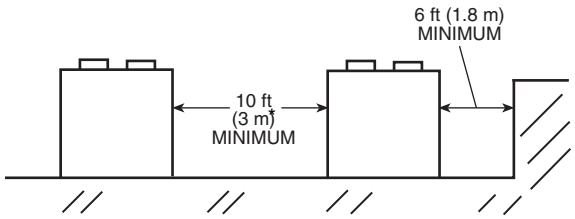
The 30RB unit must be installed outdoors.

Do not locate near sound sensitive areas without proper acoustic consideration. For applications requiring mounting a chiller on a building rooftop, consideration should be given to using rubber-in-shear or spring isolators to minimize structure-borne transmission. Unit must be level when installed to ensure proper oil return to the compressors. Clearances must be provided around chillers for airflow, service and local code requirements. See dimensional drawings for specific unit clearance requirements. Ensure adequate clearance between adjacent chillers is maintained. A minimum of 10 ft (3048 mm) is recommended. Chiller fan is strongly recommended to be at least as high as adjacent solid walls. Installation in pits is not recommended.

Minimum clearances

The recommended minimum clearance to ensure proper airflow through the condenser coils and to allow fan maintenance is as shown below.

MULTIPLE UNIT SEPARATION



* 12 ft (3.7m) recommended for unit sizes 275 and 300.

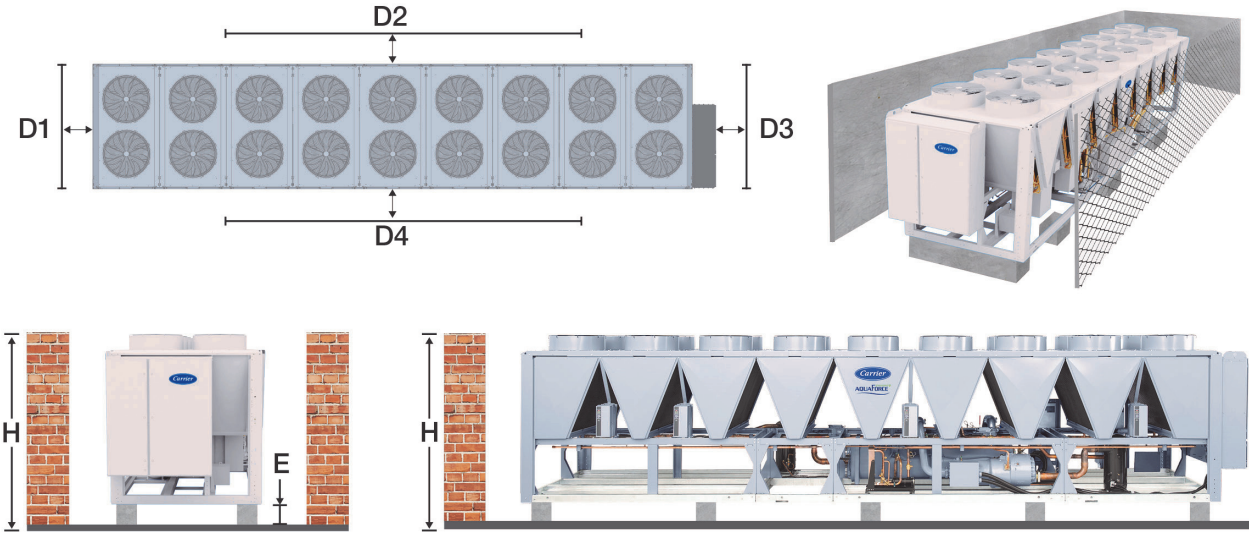
Acceptable clearance on the cooler connection side or end opposite the control box of the unit can be reduced to 3 ft (1 m) without sacrificing performance as long as the remaining three sides are unrestricted. Acceptable clearance on the side with a control box can be reduced to 4 ft (1.3 m) due to NEC (National Electric Code) regulations, without sacrificing performance as long as the remaining three sides are unrestricted. Clearances between chillers in dual chiller applications may be reduced to 6 ft (1.8 m) without sacrificing performance provided the remaining sides are unrestricted.

There are applications, however, in which recommended minimum clearances are not available. In these situations, customers request a prediction of the chiller performance within the confined space. A generalized derating factor may be insufficient to fully predict performance with various real-life physical layouts and ambient conditions.

To improve performance predictions when recommended clearances cannot be met, Carrier has developed the ExpertFit™ Software Model. An interface in the computerized chiller selection program predicts air-cooled chiller performance within a confined space, taking into account various spatial constraints and conditions, thus providing actual performance reports and not just derate guidelines.

Using this tool will provide the customer with a realistic expectation for their actual installation. The illustration below is an example of a typical installation that the software can model.

EXPERTFIT™ MODEL EXAMPLE



Application data (cont)

Oversizing chillers

Oversizing chillers by more than 15% at design conditions must be avoided as the system operating efficiency is adversely affected (resulting in greater or excessive electrical demand). When future expansion of equipment is anticipated, install a single chiller to meet present load requirements and add a second chiller to meet the additional load demand. It is also recommended that 2 smaller chillers be installed where operation at minimum load is critical. The operation of a smaller chiller loaded to a greater percentage over minimum is preferred to operating a single chiller at or near its minimum recommended value. Minimum load control should not be used as a means to allow oversizing chillers. Minimum load control should be given consideration where substantial operating time is anticipated below the minimum unloading step.

Piping duplex units

The 30RB duplex chillers (sizes 315 - 390) are shipped and rigged as 2 separate units. The units must be piped in parallel. If units are to be aligned end-to-end, minimum spacing of 42 to 48-in. (depending on local codes) between chillers is recommended to provide adequate service access and piping clearance.

Multiple chillers

Where chiller capacities greater than can be supplied by a single 30RB chiller are required, or where standby capability is desired, chillers may be installed in parallel. Units may be of the same or different sizes with this piping arrangement. However, cooler flow rates must be balanced to ensure proper flow to each chiller.

Unit software is capable of controlling two parallel units as a single plant by making use of the dual chiller control feature. Refer to the Controls, Start-up, Operation, Service and Troubleshooting guide for further details. The accessory Chillervisor System Manager can be used to ensure proper staging sequence of up to 8 chillers arranged in a parallel configuration. Refer to the accessory Chillervisor System Manager installation instructions for further details.

If the dual chiller algorithm is used, and the machines are installed in parallel, an additional chilled water sensor must be installed for each module. For 30RB315-390, where it is understood that these are duplex chillers comprised of 2 chillers to be installed in parallel, two factory-supplied thermistors and wells are shipped in the control box of one of the modules (for other 30RB chiller sizes which will be installed in a parallel piping configuration, a dual chiller accessory kit is available). Install one thermistor and well per chiller in the common leaving water header.

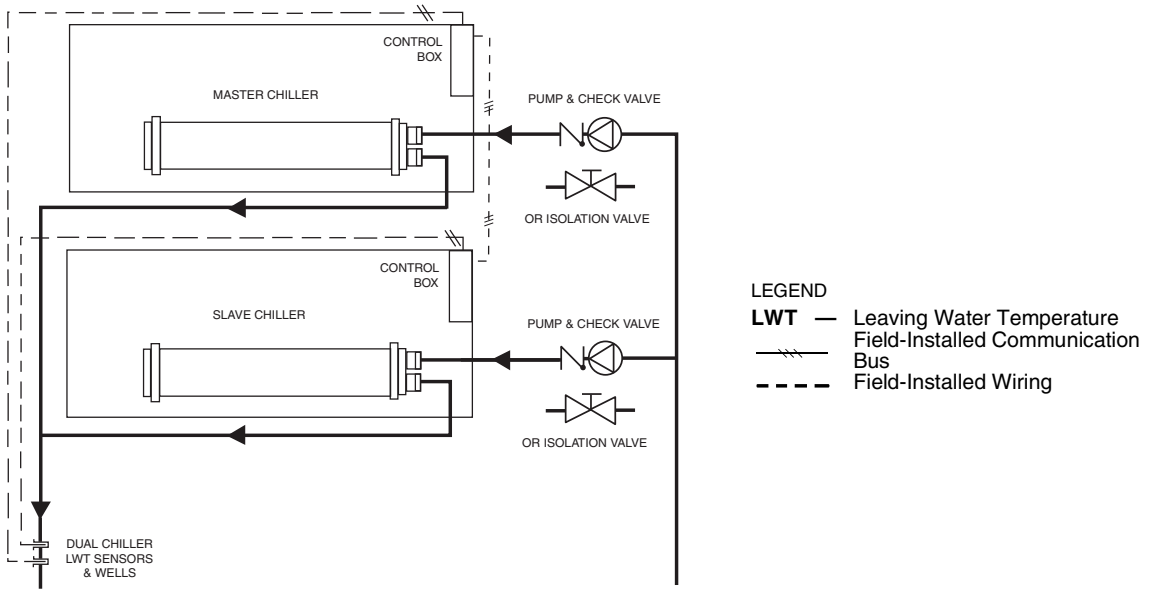
Parallel chiller control with dedicated pumps is recommended. The chiller must start and stop its own water pump located in its own piping. Check valves are required at the discharge of each pump (*when the factory hydronic package option is chosen, and* ***dual pumps*** *are selected, the check valves are automatically supplied*). If pumps are not dedicated for each chiller, then isolation valves are required. Each chiller must open and close its own isolation valve through the unit control (the valve must be connected to the pump outputs). Refer to the chiller piping configuration shown on the next page.

If a series application is required, the master/slave control feature cannot be used. Hydronic pump packages may not be applied in series applications.

Series chillers

Where a large temperature drop (greater than 20°F [11.1°C]) is desired or where chiller capacities greater than can be supplied by a single 30RB chiller are required or where standby capability is required, chillers may be installed in series. The leaving fluid temperature sensors need not be relocated. However, the cooler minimum entering fluid temperature limitations should be considered for the chillers located downstream of other chillers. Use of reduced pass heads may be required to keep water-side pressure drop at an acceptable level.

PARALLEL DUAL CHILLER OPERATION



Cooler water temperature

1. Maximum leaving chilled water temperature (LCWT) for the unit is 60°F (15.6°C). Unit can start and pull down with up to 95°F (35°C) entering-water temperature. It is recommended that entering-water temperature not exceed 70°F (21.1°C).
2. Minimum LCWT for standard unit is 30°F (–1.1°C). For leaving-fluid temperatures between 15 and 39.9°F (–9.4°C and 3.3°C) an inhibited antifreeze solution is required. Application of chiller to 15°F (–9.4°C) is standard on unit sizes 30RB060-100 provided that the unit is supplied with suction line insulation and low ambient head pressure control or optional 30RB chillers with Greenspeed® intelligence. For unit sizes 30RB110-390, applications with leaving fluid temperatures below 30°F (–1.1°C) are not available.

NOTE: Water flowing through cooler should not exceed 100°F (38°C).

Strainers

For any application that does not have a factory-installed hydronic package, and for all open-loop applications, a screen strainer with a minimum screen size of 20 mesh must be installed a maximum of 10 ft (3.0 m) from the unit to prevent debris from damaging internal tubes of the cooler.

STRAINER REQUIREMENTS

APPLICATION	30RB WITH DX (SHELL-IN-TUBE) HEAT EXCHANGER	
	With Hydronic Package*	Without Hydronic Package
	Type of Strainer	
Closed Loop	1/8-in. Perforated (Factory Supplied)	20 Mesh†
Open Loop	1/8-in. Perforated (Factory Supplied) and 20 Mesh†	20 Mesh†

* Units with a hydronic package are shipped with a fine mesh start-up strainer that must be removed within 24 hours after start-up.
† A 20-mesh strainer must be field supplied and installed within 10 ft (3 m) of the cooler inlet.

Cooler flow/range

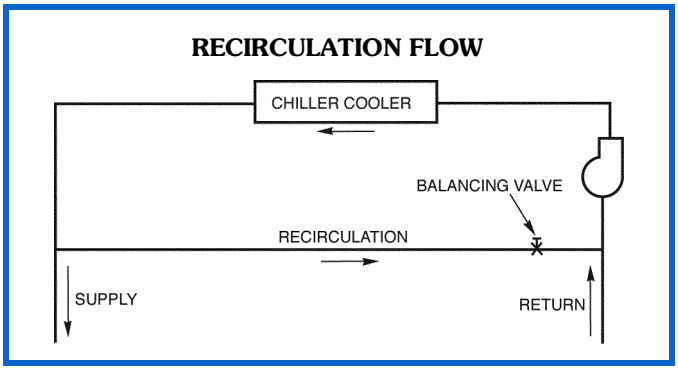
Ratings and performance data in this publication are for a cooling temperature rise of 10°F (6°C). The 30RB chillers may be operated at a different temperature rise, providing flow limits are not exceeded and corrections to system guidelines are made. For minimum and maximum cooler flow rates, see the Minimum and Maximum Cooler Flow Rates table on page 62. A high flow rate is generally limited by the maximum pressure drop that can be tolerated by the unit. The 30RB chillers are designed for a full load temperature rise of 3° to 20°F (1.7° to 11.1°C). Use the Packaged Chiller Builder Program to obtain the rating if a temperature rise other than 10°F (6°C) is used.

Minimum cooler flow (maximum cooler temperature rise)

The minimum cooler flow for standard units is shown in Minimum and Maximum Cooler Fluid Flow Rates table on page 62. When system design conditions require a lower flow (or higher rise) than the minimum allowable cooler flow, follow the recommendations below.

a. Multiple smaller chillers may be applied in series, each providing a portion of the design temperature rise.
b. Cooler fluid may be recirculated to raise the flow rate to the chiller. The mixed temperature entering the cooler must be maintained to a minimum of at least 3°F (1.7°C) above the LCWT and to a maximum of no more than 20°F (11.1°C) above the LCWT.

NOTE: Recirculation flow is shown below.

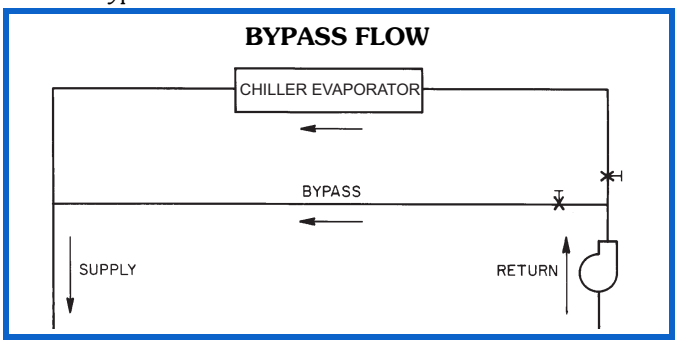


Maximum cooler flow

The maximum cooler flow (see the Minimum and Maximum Cooler Flow Rates table on page 62) results in a practical maximum pressure drop through cooler.

Return fluid may bypass the cooler to keep the pressure drop through the cooler within acceptable limits. This permits a higher delta T with lower fluid flow through cooler and mixing after the cooler. The mixed temperature entering the cooler must be maintained to a minimum of at least 3°F (1.7°C) above the LCWT and to a maximum of no more than 20°F (11.1°C) above the LCWT.

NOTE: Bypass flow is shown below.



Variable cooler flow rates

Variable flow rates may be applied to a standard chiller. The unit will, however, attempt to maintain a constant leaving chilled water temperature. In such cases, the minimum flow must be in excess of the minimum flow given in the Minimum and Maximum Cooler Fluid Flow Rates table (page 62), adjusted for glycol in the system, and the minimum fluid volume must be in excess of 3 gallons per ton (3.2 L per kW). The flow rate must change at a rate less than 10% per minute. Apply a minimum of 6 gallons per ton (6.5 L per kW) water loop volume if the flow rate changes more rapidly.

Application data (cont)

MINIMUM AND MAXIMUM COOLER FLOW RATES
30RB060-300*

30RB UNIT SIZE	MINIMUM COOLER FLOW RATE (gpm)†	MAXIMUM COOLER FLOW RATE (gpm)	MINIMUM LOOP VOLUME (gal.)	MINIMUM COOLER FLOW RATE (l/s)†	MAXIMUM COOLER FLOW RATE (l/s)	MINIMUM LOOP VOLUME (liters)
060	72	288	180	5	18	681
070	84	336	210	5	21	795
080	96	384	240	6	24	908
090	108	432	270	7	27	1022
100	120	480	300	8	30	1136
110	132	528	330	8	33	1249
120	144	576	360	9	36	1363
130	156	624	390	10	39	1476
150	180	720	450	11	45	1703
160	192	768	480	12	48	1817
170	204	816	510	13	51	1931
190	228	912	570	14	58	2158
210	252	950	630	16	60	2385
225	270	950	675	17	60	2555
250	300	950	750	19	60	2839
275	330	950	825	21	60	3123
300	360	950	900	23	60	3407

* 30RB chillers with Greenspeed® intelligence are not available in size 060 and 070.

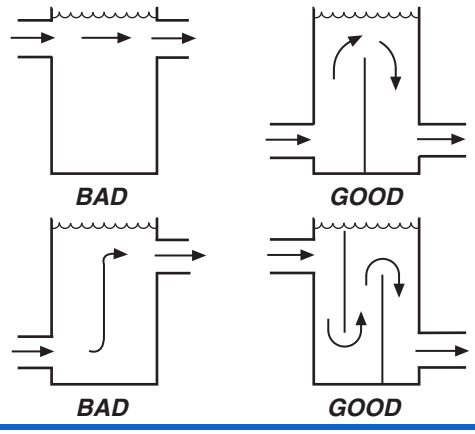
† For minimum cooler flow rate with brine applications, refer to E-cat software performance.

Fluid loop volume

The volume in circulation must equal or exceed 3 gal. per nominal ton (3.25 L per kW) of cooling for temperature stability and accuracy in normal air conditioning applications. In process cooling applications, or for operation at ambient temperature below 32°F (0°C) with low loading conditions, there should be from 6 to 10 gal. per ton (6.5 to 10.8 L per kW). To achieve this volume, it is often necessary to install a tank in the loop.

Tank should be baffled to ensure there is no stratification and that water (or brine) entering tank is adequately mixed with liquid in the tank.

TANK INSTALLATION



The piping between the chiller and the fluid loop volume tank can be done to allow the tank to be on the return side of the chiller (tank piped to chiller inlet) or the supply side of the chiller (tank piped to the chiller outlet). However, it is recommended that the tank be piped to the return side of the chiller to buffer any changes in load to allow more stable chiller operation.

Minimum time to power chiller before start-up

In order to ensure that the crankcase heaters are provided sufficient time to raise the crankcase temperature to the required operating point, power must be applied to the control circuit a minimum or 24 hours prior to chiller start-up. On 30RB chillers, the control circuit obtains its power via a control transformer off the main 3-phase power supply. Therefore, the main (3-phase) power is to be supplied at least 24 hours prior to chiller start-up unless there are special means for providing control power.

Cooler fouling factor

The fouling factor used to calculate tabulated ratings is 0.00010 $ft^2 \cdot hr \cdot °F/Btu$ (0.000018 $m^2 \cdot °C/W$). As fouling factor is increased, unit capacity decreases and compressor power increases. Corrections to published ratings can be approximated by using the multipliers in the fouling factors table.

FOULING FACTORS

FOULING FACTOR (English) ($ft^2 \cdot hr \cdot F/Btu$)	FOULING FACTOR (SI) ($m^2 \cdot C/W$)	CAPACITY MULTIPLIER	COMPRESSOR POWER MULTIPLIER
0.00025	0.000044	0.991	0.995
0.00050	0.000088	0.977	0.987
0.00075	0.000132	0.955	0.979
0.00175	0.000308	0.910	0.952

Cooler and hydronic system freeze protection

Freeze protection for down to –20°F (–28.9°C) for the cooler and hydronic package is standard. Since power is sometimes lost for extended periods during winter storms, freeze protection provided by heater tapes will be effective only if a back-up power supply can be assured for the unit's control circuit, heater and cooler pump. If not protected with an antifreeze solution, draining the cooler and outdoor piping is recommended if the system will not be used during freezing weather conditions.

Two conditions that must be considered when determining antifreeze concentration are leaving water set point and ambient freeze conditions. Both of these parameters can help determine the recommended concentration level. Higher concentration must be used to adequately protect the machine.

NOTE: Use only antifreeze solutions approved for heat exchanger duty.

For applications in which the leaving water temperature set point is less than 40°F (4.4°C), a suitable inhibited antifreeze solution must be used. The solution concentration must be sufficient to protect the chilled water loop to a freeze protection (first crystals) concentration of at least 15°F (8.3°C) below the leaving water temperature set point.

If the chiller refrigerant or fluid lines are in an area where ambient conditions fall below 34°F (1°C), it is required that an antifreeze solution be added to protect the unit and fluid piping to a temperature of 15°F (8.3°C) below the lowest anticipated ambient temperature.

Select concentration based on either burst or freeze protection as dictated by the application. If the chiller does not operate during the winter, nor is a start-up expected, a burst protection concentration is recommended. This concentration may not be high enough to pump the fluid through the unit. Burst protection is typically a lower concentration that will provide better performance from the machine. If the chiller does operate during winter, a freeze protection concentration is recommended. This concentration will be high enough to keep the fluid in a condition that it can be pumped at low ambient conditions.

IMPORTANT: Glycol anti-freeze solutions are highly recommended since heater tapes provide no protection in the event of a power failure.

Consult glycol fluid manufacturers for burst protection recommendations and fluid specifications.

High ambient temperature operation

High outdoor ambient chiller start-up and operation is possible for standard 30RB chillers at ambient temperatures up to 125°F (52°C) at nominal voltage. In some cases, where return water temperature is expected to exceed 60°F (15.5°C), an accessory kit may be required.

Low ambient temperature operation

Units will start and operate down to 32°F (0°C) as standard.

NOTE: Minimum load on chiller must be above the minimum step of unloading.

With the inclusion of wind baffles (field-fabricated and installed) and low ambient head pressure control (low ambient control is not required on units with Greenspeed® intelligence) the unit is capable to start as low as –13°F (–25°C) and be operational to as low as –20°F (–29°C) ambient temperature. Inhibited propylene glycol or other suitable corrosion-resistant anti-freeze solution must be field supplied and installed in all units for unit operation below 34°F (1.1°C). Solution must be added to fluid loop to protect loop down to 15°F (8.3°C) below minimum operating ambient temperature. Concentration should be based on expected minimum temperature and either "Burst" or "Freeze" protection levels. At least 6 gal. per ton (6.5 L per kW) of water volume is the recommended minimum for a moderate system load.

High-efficiency variable condenser fans

Highly efficient part load performance is available with variable speed condenser fan motors controlled by variable speed drives. In most applications, the chiller will run at part load conditions the vast majority of the time, and this is particularly the case if the application has a 24/7 duty cycle. This option will lower utility costs while producing a scroll compressor design that provides excellent part load efficiency. This is the essence of 30RB chillers with Greenspeed® intelligence. (High-efficiency variable condenser fans are not available with sizes 060 and 070.)

Altitude correction factors

Correction factors must be applied to standard ratings at altitudes above 2000 ft (610 m) using the following multipliers:

ALTITUDE CORRECTION FACTORS

ALTITUDE (ft)	ALTITUDE (m)	CAPACITY MULTIPLIER	COMPRESSOR POWER MULTIPLIER
2,000	610	0.99	1.01
4,000	1220	0.98	1.02
6,000	1830	0.97	1.03
8,000	2440	0.96	1.04
10,000	3050	0.95	1.05

Condenser airflow

Airflow restrictions on units with standard fans will affect the unit capacity, condenser head pressure, and compressor power input. Correction factors to be applied for external static restrictions up to 0.2 in. wg (50 Pa) are as follows:

EXTERNAL STATIC		CAPACITY MULTIPLIER	COMPRESSOR POWER MULTIPLIER
in. wg	Pa		
0.0	0.0	1.000	1.00
0.1	25.0	0.986	1.01
0.2	50.0	0.968	1.03

Condenser coil protection (*Enviro-Shield*™)

Refer to the environmental selection guides for more information. If the standard Novation® (microchannel) coil does not meet the corrosion requirements for a given application, additional coil options are available. For specific geographical recommendations, please refer to the NACO (North American Commercial Operations) Packaged Chiller Builder program.

Aluminum fin/copper tube coils are constructed of seamless copper tubes mechanically bonded to aluminum fins. The fins have wavy enhancements. These condenser coils are recommended with remote cooler applications. These coils are not recommended for corrosive environments.

Pre-coated aluminum-fin coils have a durable epoxy-phenolic coating applied to the fin prior to the fin stamping process to provide protection in mildly corrosive coastal environments. Pre-coated coils have an inert barrier between the aluminum fin and copper tube. This barrier electrically disconnects the dissimilar metals to minimize the potential for galvanic corrosion. This economical option provides substantial corrosion protection beyond the standard uncoated coil construction.

Copper-fin coils provide increased corrosion resistance compared to aluminum fin coils. All-copper coils eliminate bimetallic construction to eliminate the potential for galvanic corrosion. Application in industrial environments is

not recommended due to potential attack from sulfur, sulfur oxide, nitrogen oxides, carbon and several other industrial airborne contaminants.

E-coated Novation® coils have an extremely flexible and durable epoxy coating uniformly applied to all coil surfaces. Unlike brittle phenolic dip and bake coatings, e-coat provides superior protection with unmatched flexibility, edge coverage, metal adhesion, thermal performance and most importantly, corrosion resistance. E-coated coils provide this protection since all coil surfaces are completely encapsulated from environmental contamination. This option provides the best protection for Novation coil technology. E-coated aluminum microchannel coils shall be capable of withstanding an 8000-hour salt spray test in accordance with the ASTM (American Society for Testing and Materials) (U.S.A.) B-117 Standard.

E-coated aluminum-fin coils have the same flexible and durable epoxy coating as e-coated Novation coils. This option provides better protection compared to standard or pre-coated aluminum-fin coils in many environments.

E-coated copper-fin coils have the same flexible and durable epoxy coating as other e-coated coils. However, this option combines the natural salt and environmental resistance of all-copper construction with the highest level of corrosion protection within the round-tube, plate-fin type of coils.

Electrical/utility interests

Use of energy management practices can significantly reduce operating costs, especially during off-peak modes of operation. Demand limiting and temperature reset are 2 techniques for accomplishing efficient energy management. See Demand Limiting (also called load shedding) section below for further details.

Demand limiting (load shedding)

When a utility's demand for electricity exceeds a certain level, loads are shed to keep electricity demand below a prescribed maximum level. Typically, this happens on hot days when air conditioning is most needed. The energy management module (EMM) can be added to accomplish this reduction. Demand may be limited on unit by resetting fluid temperature, or by unloading the chiller to a given predetermined percentage of the load. Demand limit may also be driven by an external 4 to 20 mA signal. These features require a signal from an intelligent central control. Do not cycle demand limiter for less than 10 minutes on and 5 minutes off. Duty cycling cycles electrical loads at regular intervals regardless of need. This reduces the electrical operating costs of building by "fooling" demand indicating devices. Duty cycling of compressors or fans is not recommended since motor winding and bearing life will suffer from constant cycling.

Remote on-off control

Remote on-off control may be applied by hard-wired connection (see Controls and Troubleshooting literature) or by connection to a Carrier Comfort Network® (CCN) system.

Optional hydronic system selection

Select pump gpm from resulting chiller selection and total pressure loss in the system plus the chiller internal pressure loss.

NOTE: Maximum gpm (L/s), pressure and pump hp must not exceed maximum on pump curve.

Pump flow can be reduced by using the factory-supplied triple-duty valve up to 10%. Beyond that, impeller trimming is recommended to reduce energy consumption. Follow local codes or ASHRAE 90.1 recommendations. Contact your Carrier representative for specific amount of trim required.

The AquaSnap® 30RB chiller will require a field-supplied expansion tank when the optional pumping package is provided.

The expansion tank is based on fluid type, temperature range, fluid pressure and loop volume.

Parallel chillers with hydronic packages require that pump inlets be equalized to prevent pump cavitation. Pump expansion tanks must be removed and located together in the common pump suction header. All materials needed for expansion tank relocation are field supplied. Appropriate measures must be taken for freeze protection.

Air separation

The AquaSnap 30RB chiller will require a field-supplied air separation device when the optional pumping package is provided.

Air must be controlled in a hydronic system if it is to perform properly. Air can block the flow of chilled water to its destinations and can cause cavitation in the pump, which will aerate the pump and potentially cause pump failure. The air separator is sized according to the total flow through the system. The air separator should be located inside the building. There are several types of air separators to choose from. For more information and product selection contact your local manufacturer's representative.

Heat reclaim (Desuperheater)

Whenever a chiller is operating, the heat removed from the cooler fluid, as well as, the energy associated with the compression process must be moved to another location. Under standard operation, an air-cooled chiller moves and releases this heat to the atmosphere. There are times, however, when it is beneficial to capture this heat and convert it into useful hot water.

A desuperheater, available with all coil types, may be used to serve this purpose. The desuperheater is available for sizes 080-300, and variable speed condenser fans are required when the desuperheater is employed. The leaving-water temperature can reach a maximum 140°F (60°C) under steady state and constant hot water flow conditions.

To operate in heat reclaim, there must be a simultaneous need for chilled water and tempered hot water. Just as the chiller operates in standard duty, the chiller always controls the leaving chilled water temperature.

The leaving hot-water temperature is a function of the entering hot water temperature, hot water flow and chiller capacity. As a consequence, these applications are useful for make-up water or preheating of process hot water systems that have alternative means of controlling the desired hot-water temperature.

Freeze protection for desuperheater

The desuperheater is located within the standard chiller envelope. Therefore, this device, as well as its associated water piping, must be located outdoors. A form of freeze protection must be provided.

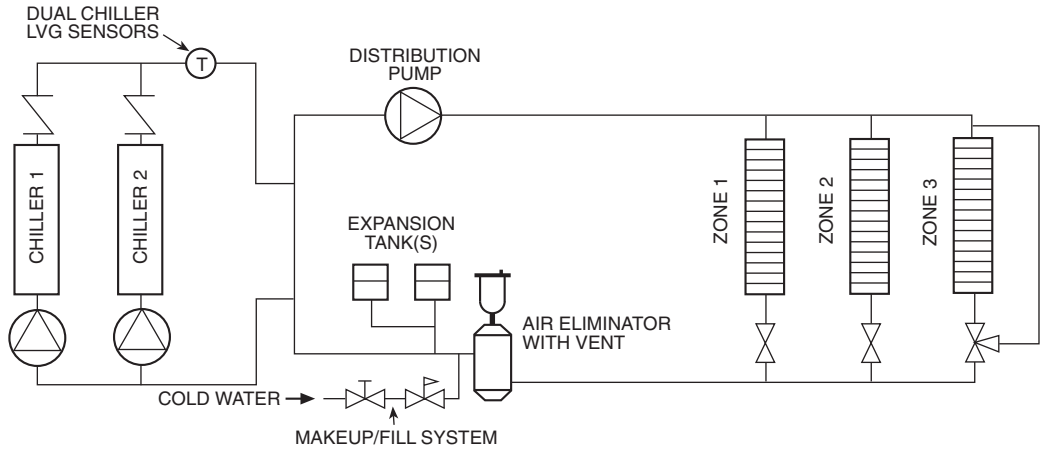
The same basic guidelines that have already been discussed for cooler freeze protection and preparation for winter shutdown must be followed. The Carrier warranty does not cover damage due to freezing. The piping, however, must either be provided with heat trace or an antifreeze solution must be added to the hot water fluid.

Adding antifreeze solution is the only certain means of protecting the unit from freeze-up if the heater fails or electrical power is interrupted or lost while temperatures are below 32°F (0°C).

General heat reclaim application data

The desuperheater may be used with chiller sizes 30RB080-300, and with all coil types. The overall chiller dimensions are unchanged when the desuperheater is selected. The desuperheater water piping connections are Victaulic, and field-installed piping is connected to a header such that there is only 1 hot-water inlet and 1 hot-water outlet connection.

TYPICAL MULTIPLE CHILLER CONFIGURATION WITH AIR ELIMINATOR AND EXPANSION TANK LOCATION



Guide specifications

Outdoor Air-Cooled Liquid Chiller

HVAC Guide Specifications

Size Range: **60 to 300 Tons (210 to 1055 kW) Nominal**
80 to 300 Tons (280 to 1055 kW) Nominal with Greenspeed® Intelligence

Carrier Model Number: **30RB**

Part 1 — General

1.01 SYSTEM DESCRIPTION

Microprocessor controlled, air-cooled liquid chiller for outdoor installation, utilizing scroll compressors, low sound fans and optional hydronic pump system.

For units that incorporate Greenspeed intelligence, all fans are controlled with variable speed fan drive motors. Chiller software shall be specifically developed to coordinate optimal fan speed for application conditions and provide refrigerant circuit optimization, resulting in higher part-load efficiency and reduced acoustic levels.

NOTE: Hydronic pump packages are only available via ETO on 30RB060-190 units. Hydronic pump packages are not available on units with high SCCR option.

1.02 QUALITY ASSURANCE

A. Unit shall be rated in accordance with AHRI (Air-Conditioning, Heating and Refrigeration Institute) Standard 550/590, latest edition (U.S.A.) and all units shall be in compliance with ASHRAE (American Society of Heating, Refrigeration, and Air-Conditioning Engineers) 90.1.2007 and ASHRAE 90.1 2010.

B. Unit construction shall comply with ASHRAE 15 Safety Code, UL (Underwriters Laboratories) latest edition, and ASME (American Society of Mechanical Engineers) applicable codes (U.S.A. codes).

C. The management system governing the manufacture of this product is ISO 9001:2015 certified.

D. Unit shall be full load run tested at the factory.

1.03 DELIVERY, STORAGE AND HANDLING

A. Unit controls shall be capable of withstanding 150°F (66°C) storage temperatures in the control compartment.

B. Unit shall be stored and handled per unit manufacturer's recommendations.

Part 2 — Products

2.01 EQUIPMENT

A. General:

Factory assembled, single-piece air-cooled liquid chiller. Contained within the unit cabinet shall be all factory wiring, piping, controls, refrigerant charge (R-410A), and special features required prior to field start-up.

B. Materials of Construction:

1. The base rail is industrial-quality, 7ga, zinc-dipped, galvanized frame (with Magni-coated screws).
2. Cabinet shall be galvanized steel casing with a baked enamel powder or pre-painted finish.
3. Painted parts shall withstand 1000 hours in constant neutral salt spray under ASTM B117 conditions with a 1 mm scribe per ASTM D1654. After test, painted parts shall show no signs of wrinkling or cracking, no loss of adhesion, no evidence of blistering, and the mean creepage shall not exceed $^{1}/_{4}$ in. (Rating ≥ 4 per ASTM D1654) on either side of the scribe line.

C. Fans:

1. Condenser fans shall be direct-driven (VFD [variable frequency drive] controlled on units with Greenspeed intelligence), 9-blade airfoil cross-section, reinforced polymer construction, shrouded-axial type, and shall be statically and dynamically balanced with inherent corrosion resistance.
2. The variable speed drives for the condenser fans on 30RB units with Greenspeed intelligence shall include a DC link reactor.
3. Air shall be discharged vertically upward.
4. Fans shall be protected by coated steel wire safety guards.

D. Compressor/Compressor Assembly:

1. Fully hermetic scroll type compressors.
2. Direct drive, 3500 rpm (60 Hz), protected by motor temperature sensors, suction gas cooled motor.
3. External vibration isolation rubber-in-shear.
4. Each compressor shall be equipped with crankcase heaters to minimize oil dilution.

E. Cooler:

1. Shell-and-tube type, direct expansion.
2. Tubes shall be internally enhanced seamless-copper type rolled into tube sheets.
3. Shall be equipped with Victaulic-type water connections.
4. Shell shall be insulated with $^{3}/_{4}$-in. (19-mm) PVC foam (closed-cell) with a maximum K factor of 0.28.
5. Design shall incorporate a minimum of 2 independent direct-expansion refrigerant circuits.
6. Cooler shall be tested and stamped in accordance with ASME Code for a refrigerant working side pressure of 445 psig (3068 kPa). Cooler shall have a maximum water-side pressure of 300 psig (2068 kPa).
7. Cooler shall be provided with a factory-installed flow switch and heater.

F. Condenser:

1. Coil shall be air-cooled Novation® heat exchanger technology with microchannel (MCHX) coils and shall have a series of flat tubes containing a series of multiple, parallel flow microchannels layered between the refrigerant manifolds. Coils shall consist of a two-pass arrangement. Coil construction shall consist of aluminum alloys for fins, tubes, and manifolds in combination with a corrosion-resistant coating.
2. Tubes shall be cleaned, dehydrated, and sealed.
3. Assembled condenser coils shall be leak tested and pressure tested at 656 psig (4522 kPa).
4. To plan the chiller installation and for ease of maintenance/coil removal, all refrigerant piping entering and leaving the condenser coils shall be located on only one side of the chiller so the coils can be removed (when needed) from the side free of piping. This is important to consider because removing the coils from the header side, although possible, involves extra labor due to extra bending and brazing of the coil headers.

G. Refrigeration Components:

Refrigerant circuit components shall include replaceable-core filter drier, moisture indicating sight glass, electronic expansion device, discharge service valve and liquid line service valves, and complete operating charge of both refrigerant R-410A and compressor oil.

H. Controls, Safeties, and Diagnostics:

1. Unit controls shall include the following minimum components:
   a. Microprocessor with non-volatile memory. Battery backup system shall not be accepted.
   b. Separate terminal block for power and controls.
   c. Control transformer to serve all controllers, relays, and control components.
   d. ON/OFF control switch.
   e. Replaceable solid-state controllers.
   f. Pressure sensors shall be installed to measure suction and discharge pressure. Thermistors shall be installed to measure cooler entering and leaving fluid temperatures.
2. Unit controls shall include the following functions:
   a. Automatic circuit lead/lag.
   b. Hermetic scroll compressors are maintenance free and protected by an auto-adaptive control that minimizes compressor wear.
   c. Capacity control based on leaving chilled fluid temperature and compensated by rate of change of return-fluid temperature with temperature set point accuracy to 0.1°F (0.06°C).
   d. Limiting the chilled fluid temperature pull-down rate at start-up to an adjustable range of 0.2°F to 2°F (0.11°C to 1.1°C) per minute to prevent excessive demand spikes at start-up.
   e. Seven-day time schedule.
   f. Leaving chilled fluid temperature reset from return fluid and outside air temperature.
   g. Chilled water pump start/stop control and primary/standby sequencing to ensure equal pump run time.
   h. Dual chiller control for parallel chiller applications without addition of hardware modules and control panels (additional thermistors and wells are required).
   i. Timed maintenance scheduling to signal maintenance activities for pumps, strainer maintenance and user-defined maintenance activities.
   j. Low ambient protection to energize cooler or hydronic system heaters.
   k. Periodic pump start to ensure pump seals are properly maintained during off-season periods.
   l. Single step demand limit control activated by remote contact closure.
   m. Nighttime sound mode to reduce the sound of the machine by a user-defined schedule.
3. Diagnostics:
   a. The control panel shall include, as standard, a scrolling marquee display capable of indicating the safety lockout condition by displaying a code for which an explanation may be scrolled at the display with time and date stamp.
   b. Information included for display shall be:
      1) Compressor lockout.
      2) Loss of charge.
      3) Low fluid flow.
      4) Cooler coil freeze protection.
      5) Cooler set point.
      6) Chilled water reset parameters.
      7) Thermistor and transducer malfunction.
      8) Entering and leaving-fluid temperature.
      9) Evaporator and condenser pressure.
      10) System refrigerant temperatures.
      11) Chiller run hours.
      12) Compressor run hours.
      13) Compressor number of starts.
      Time of day:
      a) Display module, in conjunction with the microprocessor, must also be capable of displaying the output (results) of a service test. Service test shall verify operation of every switch, thermistor, fan, and compressor before chiller is started.
      b) Diagnostics shall include the ability to review a list of the 30 most recent

alarms with clear language descriptions of the alarm event. Display of alarm codes without the ability for clear language descriptions shall be prohibited.

c) An alarm history buffer shall allow the user to store no less than 30 alarm events with clear language descriptions, time and date stamp event entry.

d) The chiller controller shall include multiple connection ports for communicating with the local equipment network, the Carrier Comfort Network® (CCN) system and access to chiller control functions from any point on the chiller.

e) The control system shall allow software upgrade without the need for new hardware modules.

Crankcase heater failure.

4. Safeties:
   a. Unit shall be equipped with thermistors and all necessary components in conjunction with the control system to provide the unit with the following protections:
      1) Loss of refrigerant charge.
      2) Reverse rotation.
      3) Low chilled fluid temperature.
      4) Thermal overload.
      5) High pressure.
      6) Electrical overload.
   b. Condenser fan and factory pump motors shall have external overcurrent protection.

I. Operating Characteristics:
   1. Unit shall be capable of starting and running at outdoor ambient temperatures from 32°F to 125°F (0°to 52°C) for all sizes.
   2. Unit shall be capable of starting up with 95°F (35°C) entering fluid temperature to the cooler.

J. Motors:

Condenser-fan motors shall be totally enclosed single-speed, 3-phase type with permanently lubricated bearings and Class F insulation.

K. Electrical Requirements:
   1. Unit/module primary electrical power supply shall enter the unit at a single location.
   2. Unit shall operate on 3-phase power at the voltage shown in the equipment schedule.
   3. Control points shall be accessed through terminal block.
   4. Unit shall be shipped with factory control and power wiring installed.

L. Chilled Water Circuit:
   1. Chilled water circuit shall be rated for 300 psig (2068 kPa). Units with optional pump package are rated for 150 psig (1034 kPa) working pressure.
   2. Thermal dispersion proof of flow switch shall be factory installed and wired.
   3. Optional hydronic package:
      a. 30RB060-190 units only:
         1) Field pipe connections shall be Victaulic type.
         2) Optional single or primary/standby operation pump systems. Dual pump systems shall have a pump discharge check valve.
         3) Pumps shall be vertical in-line, single stage design, and capable of being serviced without disturbing piping connections.
            a) Pump casing shall be of class 30 cast iron.
            b) The impeller shall be of cast bronze, closed type, dynamically balanced, keyed to the shaft and secured by locking cap screw.
            c) The hydronic kit will be provided with a flush line connection to ensure lubrication at the seal face and allow for positive venting of the seal chamber.
            d) Each port shall be fitted with an isolation valve that allow the units to operate in parallel or standby, yet may be used to isolate one pumping unit for servicing or removal with the other pump still running.
            e) Pump shall be rated for 150 psig (1034 kPa) working pressure.
            f) The pump case shall have gage tappings at the suction and discharge nozzles and include drain ports.
            g) Dual pumps shall allow for the servicing of one pump without draining the chilled water loop.
            h) Motors shall be premium efficiency, totally enclosed fan cooled (TEFC) 3-phase type with grease lubricated ball bearings.
            i) Each pump shall be factory tested per Hydraulic Institute Standards.
         4) Pressure/temperature taps (3) shall be factory installed to measure the pressure differential across the pump and across the strainer.
         5) Combination valve (which includes check, isolation, and modulation) shall be factory installed. Pressure/temperature taps (2) shall be factory installed to measure the pressure differential across the combination valve.
         6) Hydronic assembly shall have factory-supplied electric freeze protection to –20°F (–29°C).
         7) Piping shall be Schedule 40 black steel.

8) Cast iron or ductile iron body 1/8-in. perforated strainer. A factory-installed, removable fine mesh start-up strainer for initial run period shall be included. The start-up strainer must be removed within 24 hours after chiller start-up.

M. Special Features:

Certain standard features are not applicable when the features designated by * are specified. For assistance in amending the specifications, contact your Carrier representative.

1. High-efficiency variable condenser fans:

   All fans on the unit shall have variable speed fan motors to provide higher part load efficiency and reduced acoustic levels. Each fan circuit shall have a factory-installed, independent variable speed drive with display. Variable speed drives are rated IP-55 enclosures and UL Listed. The use of this option, with the addition of antifreeze in the cooler circuit and wind baffles, shall allow running with outdoor ambient temperatures down to –20°F (–28.9°C). This option is not available with sizes 060 and 070, and it is not available in combination with low ambient head pressure control.

* 2. Low Ambient Head Pressure Control:

   Unit shall be capable of running at outdoor ambient temperatures down to –20°F (–29°C) with the addition of antifreeze in the cooler circuit, wind baffles, and field-installed or factory-installed solid-state head pressure control with condenser coil minimum step capacity temperature sensor. This option or accessory is neither required nor available with the high-efficiency variable condenser fan option.

3. Unit-Mounted Non-Fused Disconnect:

   Unit shall be supplied with factory-installed, non-fused electrical disconnect for main power supply. This option is not available on 30RB060-120 with dual point power. This option is included with the high SCCR option.

4. Optional Condenser Coil Materials:

   a. E-coated microchannel coils:

      E-coated aluminum microchannel coil shall have flexible epoxy polymer coating uniformly applied to all coil external surface areas without material bridging between fins or louvers. Coating process shall ensure complete coil encapsulation, including all exposed fin edges. E-coat shall have a thickness of 0.8 to 1.2 mil with top coat having a uniform dry film thickness from 1.0 to 2.0 mil on all external coil surface areas including fin edges. E-coated coils shall have superior hardness characteristics of 2H per ASTM D3363-00 and cross hatch adhesion of 4B-5B per ASTM D3359-02. Impact resistance shall be up to 160 in./lb (ASTM D2794-93). E-coated coil shall have superior impact resistance with no cracking, chipping, or peeling per NSF/ANSI 51-2002 Method 10.2. E-coated aluminum micro-channel coils shall be capable of withstanding an 8000-hour salt spray test in accordance with the ASTM (American Society for Testing and Materials) (U.S.A.) B-117 Standard.

   b. Aluminum fin/copper tube coils:

      Coil shall be constructed of seamless copper tubes mechanically bonded to aluminum fins. Fins shall have wavy enhancements. These condenser coils are recommended with remote cooler applications. These coils are not recommended for corrosive environments.

   c. Pre-coated aluminum-fin coils:

      Coil shall have a durable epoxy-phenolic coating to provide protection in mildly corrosive coastal environments. Coating shall be applied to the aluminum fin stock prior to the fin stamping process to create an inert barrier between the aluminum fin and copper tube. Epoxy-phenolic barrier shall minimize galvanic action between dissimilar metals.

   d. Copper-fin coils:

      Coil shall be constructed of copper fins mechanically bonded to copper tubes and copper tube sheets. Galvanized steel tube sheets shall not be acceptable. A polymer strip shall prevent coil assembly from contacting sheet metal coil pan to minimize potential for galvanic corrosion between the coil and pan. All-copper construction shall provide protection in moderate coastal applications.

   e. E-coated aluminum-fin coils:

      Coil shall have a flexible epoxy polymer coating uniformly applied to all coil surface areas without material bridging between fins. Coating process shall ensure complete coil encapsulation. Color shall be high gloss black with gloss — 60° of 65 to 90% per ASTM ID523-89. Uniform dry film thickness from 0.8 to 1.2 mil on all surface areas including fin edges. Superior hardness characteristics of 2H per ASTM D3363-92A and cross hatch adhesion of 4B-5B per ASTM D3359-93. Impact resistance shall be up to 160 in./lb (ASTM D2794-93). Humidity and water immersion resistance shall be up to minimum 1000 and 250 hours respectively (ASTM D2247-92 and ASTM D870-92). Corrosion durability shall be confirmed through testing to no less than 3000 hours salt spray per ASTM B117-90. Coil construction shall be aluminum fins mechanically bonded to copper tubes.

f. E-coated copper-fin coils:

Coil shall have a flexible epoxy polymer coating uniformly applied to all coil surface areas without material bridging between fins. Coating process shall ensure complete coil encapsulation. Color shall be high gloss black with gloss — 60° of 65 to 90% per ASTM D523-89. Uniform dry film thickness from 0.8 to 1.2 mil on all surface areas including fin edges. Superior hardness characteristics of 2H per ASTM D3363-92A and cross hatch adhesion of 4B-5B per ASTM D3359-93. Impact resistance shall be up to 160 in./lb (ASTM D2794-93). Humidity and water immersion resistance shall be up to minimum 1000 and 250 hours respectively (ASTM D2247-92 and ASTM D870-92). Corrosion durability shall be confirmed through testing to no less than 3000 hours salt spray per ASTM B117-90. Coil construction shall be copper-fins mechanically bonded to copper tube sheets. Galvanized steel tube sheets shall not be acceptable. A polymer strip shall prevent coil assembly from contacting sheet metal coil pan to maintain coating integrity and minimize corrosion potential between the coil and pan.

5. Heat Reclaim (Desuperheater):

Unit shall be equipped with a desuperheater (on sizes 080-300) to obtain beneficial use of some of the system heat rejection.

a. Desuperheater shall be of brazed-plate design, and be rated for a maximum refrigerant pressure of 653 psig (4506 kPa).

b. Desuperheater plates shall be of stainless-steel construction.

c. Water connections shall be Victaulic.

d. One desuperheater per refrigerant circuit shall be provided, but the system water piping shall be of header construction so that only one inlet and one outlet water connection is required.

e. Chillers employing desuperheaters must also employ variable speed condenser fans.

f. For all climates which experience temperatures below 32°F (0°C), a form of freeze protections must be field-supplied (some type of glycol is recommended).

g. A strainer with a minimum of 40 mesh must be installed within 10 ft (3 m) of the desuperheater fluid inlet to prevent debris from clogging the heat exchanger.

6. Remote Enhanced Display:

Unit shall be supplied with indoor-mounted, remote, 40-character per line, 16-line display panel for field installation.

7. Chillervisor System Manager Multi-Unit Control:

Field-installed control shall sequence between 2 and 8 chillers in parallel in a single system.

8. Minimum Load Control:

Unit shall be equipped with field-installed, microprocessor-controlled, minimum load control that shall permit unit operation down to a minimum of 6% capacity (varies with unit size). This accessory is not available on applications with leaving fluid temperature less than 38°F (3.3°C).

9. Energy Management Control Module:

A factory or field-installed module shall provide the following energy management capabilities: 4 to 20 mA signals for leaving fluid temperature reset, cooling set point reset or demand limit control; 2-step demand limit control (from 0% to 100%) activated by a remote contact closure; and discrete input for "Ice Done" indication for ice storage system interface.

10. Condenser Coil Trim Panels and Security Grilles:

Unit shall be supplied with factory or field-installed coil covers and painted grilles to protect the condenser coil and internal chiller components from physical damage.

11. Upper Hail Guard:

Unit shall be equipped with a factory-installed option consisting of louvered panels on the ends of the machine which firmly fasten to the machine frame. These panels shall cover the unit from the top to the bottom of the coils, thus providing protection of the coils from hail damage.

12. Full Hail Guard:

Unit shall be equipped with field-installed accessory consisting of hinged, louvered panels, which cover both ends of the unit. This accessory provides complete protection from hail.

13. Full End Screen:

Unit shall be equipped with a factory-installed option consisting of louvered panels that cover the machine ends from top to bottom and firmly fasten to the machine frame. These end screens function as a privacy screen and also provide hail protection.

14. BACnet[1] Communication:

Shall provide pre-programmed factory-installed communication capability with a BACnet MS/TP network. Allows integration with i-Vu® Open control system or a third-party BACnet building automation system. No field programming shall be required.

1. BACnet is a registered trademark of ASHRAE (American Society of Heating, Refrigeration, and Air Conditioning Engineers).

15. BACnet/Modbus[1] Translator Control:

    Unit shall be supplied with factory or field-installed interface between the chiller and a BACnet Local Area Network (LAN, i.e., MS/TP EIA-485). Field programming shall be required.

16. LON Translator Control:

    Unit shall be supplied with factory or field-installed interface between the chiller and a Local Operating Network (LON, i.e., LonWorks[2] FT-10A ANSI/EIA-709.1). Field programming is required.

17. Navigator™ Hand Held Display:

    a. Portable hand held display module with a minimum of 4 lines and 20 characters per line, of clear English, Spanish, Portuguese or French language.

    b. Display menus shall provide clear language descriptions of all menu items, operating modes, configuration points and alarm diagnostics. Reference to factory codes shall not be accepted.

    c. RJ-14 connection plug shall allow display module to be connected to factory-installed receptacle.

    d. Industrial grade coiled extension cord shall allow the display module to be moved around the chiller.

    e. Magnets shall hold the display module to any sheet metal panel to allow hands-free operation.

    f. Display module shall have NEMA (National Electrical Manufacturers Association) 4x housing suitable for use in outdoor environments.

    g. Display shall have back light and contrast adjustment for easy viewing in bright sunlight or night conditions.

    h. Raised surface buttons with positive tactile response.

18. Touch Pilot™ Display:

    Unit shall be supplied with a remote mount touch screen display for network attachment to the chiller.

19. Compressor Suction Service Valve:

    Standard refrigerant discharge isolation and liquid valves shall enable service personnel to store the refrigerant charge in the cooler or condenser during servicing. This factory-installed option (one valve per refrigerant circuit) shall allow for further isolation of the compressor from the cooler vessel.

20. Suction Line Insulation:

    Insulation shall be tubular closed-cell insulation. This option shall be required on applications with leaving fluid temperatures below 30°F (–1.1°C) and recommended for areas of high dewpoints where condensation may be a concern.

21. Remote Cooler Kit:

    Shall allow remote installation of cooler. Kit shall include expansion valve and flow switch cable extensions, and instructions.

22. CRN Cooler (Canada Only):

    Shall provide minor cooler modifications to meet Canadian code.

23. Compressor Sound Reduction:

    Shall provide sound reduction for the scroll compressors.

    a. Unit shall be equipped with factory-installed option low sound - compressor sound reduction blanket which reduces unit sound levels by providing an acoustic blanket on each compressor.

    b. Unit shall be equipped with factory-installed option ultra low sound - compressor sound reduction enclosure which provides an enclosure to encase each compressor that is covered with an acoustic blanket.

24. High SCCR (Short Circuit Current Rating):

    The optional high SCCR (short circuit current rating) device shall allow the chiller to tolerate a 65 kA short circuit current for a brief period of time while protecting downstream components. The high SCCR option shall provide a higher level of protection than the standard unit. This option is not available on 30RB250-300 units. This option includes the unit-mounted non-fused disconnect option. This option is only available in 460-v units.

25. Dual Chiller Accessory Kit:

    For dual chiller applications (with units piped in parallel), unit shall be provided with the additional hardware (thermistors, wells, connectors) required for proper system operation.

26. GFI Convenience Outlet:

    Shall be factory or field-installed and mounted with easily accessible 115-v female receptacle and shall include a 4-amp GFI receptacle.

27. Seismic Certification:

    A seismic kit is available which will result in a unit SDS (seismic design acceleration parameter) level of 2.0.

1. Modbus is a registered trademark of Schneider Electric.
2. LonWorks is a registered trademark of Echelon Corporation.

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Manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligations.

Carrier
United Technologies

Product Data

WeatherMaster®
Gas Heat/Electric Cooling
Packaged Rooftop Units

15 to 25 Nominal Tons

WeatherMaster®



Unit shown with economizer and power exhaust.

48HC Sizes 17 to 28
Packaged Rooftop Units with Gas Heat, Optional EnergyX® Energy Recovery Device, and *Comfort*Link Controls

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Features/Benefits

The 15 to 25 Ton WeatherMaster® Carrier rooftop unit (RTU) was designed by customers for customers. With a newly designed cabinet that integrates "no-strip" screw collars, handled access panels, and more, we've made your unit easy to install, easy to maintain, easy to use and reliable.

Easy to install

These WeatherMaster units are designed for dedicated factory-supplied vertical or horizontal air flow duct configurations. No special field kits are required. Designed to fit on pre-installed curbs by another manufacturer, these units also fit on past designed Carrier installed curbs with a new certified and authorized adapter curb. This cabinet design also integrates a large control box that gives you room to work and room to mount Carrier accessory controls.

Easy to maintain

Easy access handles by Carrier provide quick and easy access to all normally serviced components. Our "no-strip" screw system has superior holding power and guides screws into position while preventing the screw from stripping the unit's metal. Take accurate pressure readings by reading system pressures with panels in place as compressors are strategically located to eliminate any air bypass.

Easy to use

The newly designed, central terminal board by Carrier puts all your connections and troubleshooting points in one convenient place, standard. Most low voltage connections are made to the same board and make it easy to find what you're looking for and easy to access it.

Reliable

Each unit comes with precision sized and tested scroll compressor that is internally protected from over temperature and pressures. In addition, each refrigerant circuit is further protected with a high-pressure and low-pressure switch as well as containing a liquid line filter drier. Each unit is factory tested prior to shipment to help ensure unit operation once properly installed.

Key features

- Two stage cooling capability with independent circuits and control.
- High performance copper tube / aluminum plate (RTPF) fin condenser and evaporator coils with optional coating.
- EERs up to 12.0
- IEERs up to 13.2 with single speed indoor fan motor and 13.8 with SAV™ (Staged Air Volume) 2-speed/VFD indoor fan motor.
- Gas heating efficiencies up to 81% thermal efficiency.
- Dedicated vertical and horizontal air flow duct configuration models. No field kits required.
- Utility connections through the side or bottom. Bottom connections are also in an enclosed environment to help prevent water entry. Field supplied couplings are required.
- Standardized components and layout. Standardized components and controls make service and stocking parts easier.
- Scroll compressors on all units. This makes service, stocking parts, replacement, and trouble-shooting easier.
- Precision sized TXV metering device on each refrigerant circuit.
- Easy-adjust, belt-drive motor available. Motor assembly also contains a fan belt break protection system on all models and reliable pillow block bearing system that allows lubrication thru front of the unit.
- Single-point gas/electrical connection.
- Sloped, composite drain pan sheds water; and won't rust.
- Standardized controls and control box layout. Standardized components and controls make stocking parts and service easier.
- Clean, large, easy to use control box.
- Color-coded wiring.
- Large, laminated wiring and power wiring drawings which are affixed to unit make troubleshooting easy.
- Single, central terminal board for test and wiring connections.
- Fast-access, handled, panels for easy access on normally accessed service panels.
- "No-strip" screw system guides screws into the panel and captures them tightly without stripping the screw, the panel, or the unit.
- Mechanical cooling (125°F to 35°F/ 52°C to –2°C) standard on all models. Low ambient controller allows operation down to –20°F/–29°C
- Redundant gas valve for 2-stage gas heating capacity control with induced-draft flue exhaust design to help ensure no flue gas can escape into the indoor air stream.
- Exclusive IGC solid state gas controller for on board diagnostics with LED error code designation, burner control logic and energy saving indoor fan motor delay.
- 2-in. (51 mm) disposable filters on all units, with 4-in. (102 mm) filter track field-installed.
- Refrigerant filter-drier on each circuit.
- High and low pressure switches. Added reliability with high-pressure switch and low-pressure switch.
- Many factory-installed options ranging from air management economizers, 2 position dampers, manual outdoor air dampers, plus convenience outlets, disconnect switch and smoke detectors.
- Factory-installed Humidi-MiZer® adaptive dehumidification system.
- Standard Parts Warranty: 10 year aluminized heat exchanger, 5 year compressor, 1 year others.
- Optional Staged Air Volume (SAV) system utilizes a Variable Frequency Drive (VFD) to automatically adjust the indoor fan motor speed between cooling stages. Available on 2-stage cooling models 17-28 with electromechanical controls or RTU Open.

Table of contents

	Page
Features/Benefits	2
Model Number Nomenclature	3
Capacity Ratings	4
Physical Data	6
Options and Accessories	11
Base Unit Dimensions	17
Accessory Dimensions	44
Performance Data	47
Fan Data	60
Typical Wiring Diagram	68
Electrical Data	73
Controls	76
Application Data	78
Guide Specifications	81

Model number nomenclature

48HC MODEL NUMBER NOMENCLATURE

48 HC D E 17 A 2 A 6 - 0 A 3 B 0

Unit Heat Type
48 = Gas Heat Packaged Rooftop

Model Series - WeatherMaster®
HC = High Efficiency

Heat Options
D = Low Gas Heat
E = Medium Gas Heat
F = High Gas Heat
S = Low Heat w/ Stainless Steel Exchanger
R = Medium Heat w/ Stainless Steel Exchanger
T = High Heat w/ Stainless Steel Exchanger

Refrig. Systems Options
D = Two stage cooling model with Round Tube/Plate Fin
E = Two stage cooling models with Humidi-MiZer® System
G = Two stage cooling models with Motormaster® Low Ambient controller

Cooling Tons
17 = 15 tons
20 = 17.5 tons
24 = 20 tons
28 = 25 tons

Sensor Options
A = None
B = RA Smoke Detector
C = SA Smoke Detector
D = RA + SA Smoke Detector
E = CO_2 Sensor
F = RA Smoke Detector and CO_2
G = SA Smoke Detector and CO_2
H = RA + SA Smoke Detector and CO_2
J = Condensate Overflow Switch
K = Condensate Overflow Switch and RA Smoke Detectors
L = Condensate Overflow Switch and RA and SA Smoke Detectors

Indoor Fan Options & Air Flow Configuration
1 = Standard Static/Vertical Supply, Return Air Flow
2 = Medium Static/Vertical Supply, Return Air Flow
3 = High Static/Vertical Supply, Return Air Flow
B = Medium Static, High Efficiency Motor/Vertical Supply, Return Air Flow
C = High Static, High Efficiency Motor/Vertical Supply, Return Air Flow
5 = Standard Static/Horizontal Supply, Return Air Flow
6 = Medium Static/Horizontal Supply, Return Air Flow
7 = High Static/Horizontal Supply, Return Air Flow
F = Medium Static, High Efficiency Motor/Horizontal Supply, Return Air Flow
G = High Static, High Efficiency Motor/Horizontal Supply, Return Air Flow

Coil Options – RTPF (Outdoor - Indoor - Hail Guard)
A = Al/Cu - Al/Cu
B = Precoat Al/Cu - Al/Cu
C = E-coat Al/Cu - Al/Cu
D = E-coat Al/Cu - E-coat Al/Cu
E = Cu/Cu - Al/Cu
F = Cu/Cu - Cu/Cu
M = Al/Cu -Al/Cu — Louvered Hail Guard
N = Precoat Al/Cu - Al/Cu — Louvered Hail Guard
P = E-coat Al/Cu - Al/Cu — Louvered Hail Guard
Q = E-coat Al/Cu - E-coat Al/Cu — Louvered Hail Guard
R = Cu/Cu - Al/Cu — Louvered Hail Guard
S = Cu/Cu - Cu/Cu — Louvered Hail Guard

Packaging
0 = Standard
3 = California Seismic Complaint - OSHPD

Electrical Options
A = None
B = HACR Breaker
C = Non-Fused Disconnect
D = Through-the-base Connection
C = Non-Fused Disconnect and Through-the-base Connection
G = 2-Speed Indoor Fan (VFD) Controller
J = 2 Speed Fan Controller (VFD) and Non-Fused Disconnect

Service Options
0 = None
1 = Unpowered Convenience Outlet
2 = Powered Convenience Outlet
3 = Hinged Panels
4 = Hinged Panels & Unpowered Convenience Outlet
5 = Hinged Panels & Powered Convenience Outlet
C = Foil Faced Insulation

Intake / Exhaust Options
A = None
B = Temperature Economizer w/ Barometric Relief
F = Enthalpy Economizer w/ Barometric Relief
K = 2-Position Damper
P = Manual Outdoor Air Damper
Q = EnergyX® Only
R = EnergyX with Economizer Only
S = EnergyX with Frost Protection Only
T = EnergyX with Economizer and Frost Protection
U = Temp Ultra Low Leak Economizer w/ Barometric Relief
V = Temp Ultra Low Leak Economizer w/ Power Exhaust - Vertical Air Only
W = Enthalpy Ultra Low Leak Economizer w/ Barometric Relief
X = Enthalpy Ultra Low Leak Economizer w/ Power Exhaust - Vertical Air Only

Base Unit Controls
0 = Electro-mechanical Controls. Can be used with W7212 EconoMi$er® IV (Non-Fault Detection and Diagnostic)
1 = PremierLink™ Controller
2 = RTU Open Multi-Protocol Controller
6 = Electro-mechanical w/ 2-Speed Fan and W7220 Economizer Controller. Can be used with W7220 EconoMi$er X (with Fault Detection and Diagnostic)
D = ComfortLink Controls (Standard with EnergyX)

Design Revision
- = Factory Design Revision

Voltage
1 = 575/3/60
5 = 208-230/3/60
6 = 460/3/60

NOTE: Not all possible options are displayed. See the current 48HC and 48HCX 15 to 25 ton price page for more details.

Capacity ratings

AHRI RATINGS (2-STAGE COOLING)

48HC UNIT	CONFIGURATION	NOM. CAPACITY (TONS)	NET COOLING CAPACITY (MBH)	TOTAL POWER (kW)	EER	IEER (Single Speed)	IEER (2-Speed)
17	Vertical	15.0	174	14.5	12.0	13.0	13.5
	Horizontal			15.1	11.5	12.2	13.0
20	Vertical	17.5	202	16.8	12.0	13.0	13.6
	Horizontal			17.9	11.3	11.5	13.2
24	Vertical	20.0	232	19.3	12.0	13.2	13.8
	Horizontal			20.4	11.4	12.0	13.0
28	Vertical	25.0	282	25.2	11.2	12.0	12.5
	Horizontal			26.9	10.5	N/A	12.2

LEGEND

AHRI — Air-Conditioning, Heating and Refrigeration Institute
EER — Energy Efficiency Ratio
IEER — Integrated Energy Efficiency Ratio

NOTE: 48HC**28 horizontal units are only available with a 2-speed option.





SOUND RATINGS TABLE

48HC UNIT	COOLING STAGES	OUTDOOR SOUND (dB) AT 60 Hz											
		A-WEIGHTED	LINEAR	AHRI-370 RATING	31.5	63	125	250	500	1000	2000	4000	8000
17	2	84.1	96.2	84	92.6	92.0	84.0	80.0	82.0	78.7	76.5	72.2	65.4
20	2	84.1	96.2	84	92.6	92.0	84.0	80.0	82.0	78.7	76.5	72.2	65.4
24	2	86.5	99.6	87	96.2	95.6	87.5	84.2	84.2	81.7	77.9	73.2	66.3
28	2	85.9	103.0	86	101.0	97.0	88.0	84.0	83.0	80.7	77.4	73.4	67.3

LEGEND

dB — Decibel

NOTES:

1. Outdoor sound data is measured in accordance with AHRI 370.
2. Measurements are expressed in terms of sound power. Do not compare these values to sound pressure values because sound pressure depends on specific environmental factors which normally do not match individual applications. Sound power values are independent of the environment and therefore more accurate.
3. A-weighted sound ratings filter out very high and very low frequencies, to better approximate the response of “average” human ear. A-weighted measurements for Carrier units are taken in accordance with AHRI 370.

MINIMUM - MAXIMUM AIRFLOW RATINGS (CFM) — NATURAL GAS AND PROPANE

48HC UNIT	HEAT LEVEL	COOLING				ALUMINUM HEATING		STAINLESS STEEL HEATING	
		MINIMUM SINGLE SPEED FAN MOTOR	MINIMUM 2-SPEED FAN MOTOR (AT HIGH SPEED)	MINIMUM 2-SPEED FAN MOTOR (AT LOW SPEED)	MAXIMUM	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
17	LOW	4,500	5,070	3,380	7,500	3,000	8,250	3,000	8,250
	MED					3,880	7,750	3,880	7,750
	HIGH					4,620	8,570	4,620	8,570
20	LOW	5,250	5,915	3,943	9,000	3,000	11,000	3,000	11,000
	MED					3,880	9,300	3,880	9,300
	HIGH					4,620	10,000	4,620	10,000
24	LOW	6,000	7,500	5,000	10,000	3,000	11,000	3,000	11,000
	MED					3,880	11,630	3,880	11,630
	HIGH					4,620	10,000	4,620	10,000
28	LOW	7,500	8,450	5,633	12,500	3,000	16,500	3,000	16,500
	MED					3,880	15,500	3,880	15,500
	HIGH					4,620	15,000	4,620	15,000

HEAT RATING TABLE — NATURAL GAS AND PROPANE

48HC UNIT	GAS HEAT	AL/SS HEAT EXCHANGER		TEMPERATURE RISE (F)	THERMAL EFFICIENCY (%)
		INPUT/OUTPUT STAGE 1 (MBH)	INPUT/OUTPUT STAGE 2 (MBH)		
17	LOW	176/142	220/178	20-55	81%
	MED	248/200	310/251	30-60	
	HIGH	320/260	400/324	35-65	
20	LOW	176/142	220/178	15-55	81%
	MED	248/200	310/251	25-60	
	HIGH	320/260	400/324	30-65	
24	LOW	176/142	220/178	15-55	81%
	MED	248/200	310/251	20-60	
	HIGH	320/260	400/324	30-65	
28	LOW	176/142	220/178	10-55	81%
	MED	248/200	310/251	15-60	
	HIGH	320/260	400/324	20-65	

NOTES:

1. Heat ratings are for natural gas heat exchangers operated at or below 2000 ft (610 m). For information on Propane or altitudes above 2000 ft (610 m), see the Application Data section of this book. Accessory Propane/High Altitude kits are also available.
2. In the USA the input rating for altitudes above 2000 ft (610 m) must be derated by 4% for each 1000 ft (305 m) above sea level. In Canada, the input rating must be derated by 10% for altitudes of 2000 ft (610 m) to 4500 ft (1372 m) above sea level.

Physical data

48HC 15 TO 25 TON PHYSICAL DATA

48HC UNIT		48HC*D17	48HC*E17	48HC*D20	48HC*E20	48HC*D24	48HC*E24	48HC*D28	48HC*E28
48HC BASE UNIT TONS		15	15	17.5	17.5	20	20	25	25
48HC BASE UNIT WEIGHT - lb (kg)		1892 (858)		2102 (953)		2247 (1019)		2292 (1040)	
REFRIGERATION SYSTEM									
	# Circuits / # Comp. / Type	2 / 2 / Scroll	2 / 2 / Scroll	2 / 2 / Scroll	2 / 2 / Scroll	2 / 2 / Scroll	2 / 2 / Scroll	2 / 2 / Scroll	2 / 2 / Scroll
	R-410A Charge A/B (lbs)	17/16.4	24.5/25.7	17.5/16.8	25.5/25.5	23.8/23.1	30.0/30.7	24.9/27.7	35.1/35.4
	Metering device	TXV	TXV	TXV	TXV	TXV	TXV	TXV	TXV
	High-Pressure Trip / Reset (psig)	630 / 505	630 / 505	630 / 505	630 / 505	630 / 505	630 / 505	630 / 505	630 / 505
	Low-Pressure Trip / Reset (psig)	54 / 117	27 / 44	54 / 117	27 / 44	54 / 117	27 / 44	54 / 117	27 / 44
EVAPORATOR COIL									
	Material	Cu / Al	Cu / Al	Cu / Al	Cu / Al	Cu / Al	Cu / Al	Cu / Al	Cu / Al
	Tube Diameter (in.)	3/8 RTPF	3/8 RTPF	3/8 RTPF	3/8 RTPF	3/8 RTPF	3/8 RTPF	3/8 RTPF	3/8 RTPF
	Rows / FPI	4 / 15	4 / 15	4 / 15	4 / 15	4 / 15	4 / 15	4 / 15	4 / 15
	Total Face Area (ft²)	22	22	22	22	26	26	26	26
	Condensate Drain Connection Size (in.)	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4
HUMIDI-MIZER COIL									
	Material	—	Cu / Al	—	Cu / Al	—	Cu / Al	—	Cu / Al
	Tube Diameter		3/8 RTPF		3/8 RTPF		3/8 RTPF		3/8 RTPF
	Rows / FPI		1 / 17		1 / 17		1 / 17		1 / 17
	Total Face Area (ft²)		22		22		26		26
EVAPORATOR FAN AND MOTOR VERTICAL SUPPLY									
STANDARD STATIC	Motor Qty / Belt Qty / Driver Type	1 / 1 /Belt	1 / 1 /Belt	1 / 1 /Belt	1 / 1 /Belt	N/A	N/A	1 / 1 /Belt	1 / 1 /Belt
	Nominal / Nameplate hp	2.9	2.9	3.7	3.7	N/A	N/A	5.25	5.25
	Max bhp	2.9	2.9	3.7	3.7	N/A	N/A	4.9	4.9
	Rpm Range	514-680	514-680	622-822	622-822	N/A	N/A	717-911	717-911
	Max Blower/Shaft rpm	1200	1200	1200	1200	N/A	N/A	1200	1200
	Motor Frame Size	56	56	56	56	N/A	N/A	56	56
	Fan Qty / Type	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal	N/A	N/A	2 / Centrifugal	2 / Centrifugal
	Fan Diameter (in.)	15 X 15	15 X 15	15 X 15	15 X 15	N/A	N/A	15 X 15	15 X 15
MEDIUM STATIC	Motor Qty / Belt Qty / Driver Type	1 / 1 /Belt	1 / 1 /Belt	1 / 1 /Belt	1 / 1 /Belt	N/A	N/A	N/A	N/A
	Nominal / Nameplate hp	3.7	3.7	5.25	5.25	N/A	N/A	N/A	N/A
	Max bhp	3.7	3.7	4.9	4.9	N/A	N/A	N/A	N/A
	Rpm Range	679-863	679-863	713-879	713-879	N/A	N/A	N/A	N/A
	Max Blower/Shaft rpm	1200	1200	1200	1200	N/A	N/A	N/A	N/A
	Motor Frame Size	56	56	56	56	N/A	N/A	N/A	N/A
	Fan Qty / Type	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal	N/A	N/A	N/A	N/A
	Fan Diameter (in.)	15 X 15	15 X 15	15 X 15	15 X 15	N/A	N/A	N/A	N/A
HIGH STATIC	Motor Qty / Belt Qty / Driver Type	1 / 1/ BELT	1 / 1/ BELT	N/A	N/A	N/A	N/A	N/A	N/A
	Nominal / Nameplate hp	5.25	5.25	N/A	N/A	N/A	N/A	N/A	N/A
	Max bhp	4.9	4.9	N/A	N/A	N/A	N/A	N/A	N/A
	Rpm Range	826-1009	826-1009	N/A	N/A	N/A	N/A	N/A	N/A
	Max Blower/Shaft rpm	1200	1200	N/A	N/A	N/A	N/A	N/A	N/A
	Motor Frame Size	56	56	N/A	N/A	N/A	N/A	N/A	N/A
	Fan Qty / Type	2 / Centrifugal	2 / Centrifugal	N/A	N/A	N/A	N/A	N/A	N/A
	Fan Diameter (in.)	15 X 15	15 X 15	N/A	N/A	N/A	N/A	N/A	N/A

48HC 15 TO 25 TON PHYSICAL DATA (CONT)

48HC UNIT		48HC*D17	48HC*E17	48HC*D20	48HC*E20	48HC*D24	48HC*E24	48HC*D28	48HC*E28
EVAPORATOR FAN AND MOTOR VERTICAL SUPPLY (CONT)									
STANDARD STATIC - HIGH EFFCY	Motor Qty / Belt Qty / Driver Type	N/A	N/A	N/A	N/A	1 / 1 /Belt	1 / 1 /Belt	N/A	N/A
	Nominal / Nameplate hp	N/A	N/A	N/A	N/A	5.0	5.0	N/A	N/A
	Max bhp	N/A	N/A	N/A	N/A	6.5/ 6.9/ 7.0/ 8.3	6.5/ 6.9/ 7.0/ 8.3	N/A	N/A
	Rpm Range	N/A	N/A	N/A	N/A	690-863	690-863	N/A	N/A
	Max Blower/Shaft rpm	N/A	N/A	N/A	N/A	1200	1200	N/A	N/A
	Motor Frame Size	N/A	N/A	N/A	N/A	184T	184T	N/A	N/A
	Fan Qty / Type	N/A	N/A	N/A	N/A	2 / Centrifugal	2 / Centrifugal	N/A	N/A
	Fan Diameter (in.)	N/A	N/A	N/A	N/A	15 X 15	15 X 15	N/A	N/A
MEDIUM STATIC - HIGH EFFICIENCY	Motor Qty / Belt Qty / Driver Type	N/A	N/A	N/A	N/A	1 / 1/ Belt	1 / 1/ Belt	1 / 1/ Belt	1 / 1/ Belt
	Nominal / Nameplate hp	N/A	N/A	N/A	N/A	5.0	5.0	5.0	5.0
	Max bhp	N/A	N/A	N/A	N/A	6.5/ 6.9/ 7.0/ 8.3	6.5/ 6.9/ 7.0/ 8.3	6.5/ 6.9/ 7.0/ 8.3	6.5/ 6.9/ 7.0/ 8.3
	Rpm Range	N/A	N/A	N/A	N/A	835-1021	835-1021	913-1116	913-1116
	Max Blower/Shaft rpm	N/A	N/A	N/A	N/A	1200	1200	1200	1200
	Motor Frame Size	N/A	N/A	N/A	N/A	184T	184T	184T	184T
	Fan Qty / Type	N/A	N/A	N/A	N/A	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal
	Fan Diameter (in.)	N/A	N/A	N/A	N/A	15 X 15	15 X 15	15 X 15	15 X 15
HIGH STATIC- HIGH EFFICIENCY	Motor Qty / Belt Qty / Driver Type	N/A	N/A	1 / 1 /Belt	1 / 1 /Belt	1 / 1 /Belt	1 / 1 /Belt	1 / 1 /Belt	1 / 1 /Belt
	Nominal Nameplate H.p.	N/A	N/A	5.0	5.0	7.5	7.5	7.5	7.5
	Max Bhp (208/230/460/ 575v)	N/A	N/A	6.5/ 6.9/ 7.0/ 8.3	6.5/ 6.9/ 7.0/ 8.3	10.5/11.9/11.9/ 11	10.5/11.9/11.9/ 11	10.5/11.9/11.9/ 11	10.5/11.9/11.9/ 11
	Rpm Range	N/A	N/A	882-1078	882-1078	941-1176	941-1176	941-1176	941-1176
	Max Blower/shaft Rpm	N/A	N/A	1200	1200	1200	1200	1200	1200
	Motor Frame Size	N/A	N/A	184T	184T	213T	213T	213T	213T
	Fan Qty / Type	N/A	N/A	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal
	Fan Diameter (In)	N/A	N/A	15 X 15	15 X 15	15 X 15	15 X 15	15 X 15	15 X 15
EVAPORATOR FAN AND MOTOR HORIZONTAL SUPPLY									
STANDARD STATIC	Motor Qty / Belt Qty / Driver Type	1 / 1 /Belt	1 / 1 /Belt	1 / 1 /Belt	1 / 1 /Belt	N/A	N/A	N/A	N/A
	Nominal / Nameplate hp	2.9	2.9	3.7	3.7	N/A	N/A	N/A	N/A
	Max bhp	2.9	2.9	3.7	3.7	N/A	N/A	N/A	N/A
	Rpm Range	514-680	514-680	622-822	622-822	N/A	N/A	N/A	N/A
	Max Blower/Shaft rpm	1100	1100	1100	1100	N/A	N/A	N/A	N/A
	Motor Frame Size	56	56	56	56	N/A	N/A	N/A	N/A
	Fan Qty / Type	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal	N/A	N/A	N/A	N/A
	Fan Diameter (in.)	18 x 15/15 X 11	18 x 15/15 X 11	18 x 15/15 X 11	18 x 15/15 X 11	N/A	N/A	N/A	N/A
MEDIUM STATIC	Motor Qty / Belt Qty / Driver Type	1 / 1 /Belt	1 / 1 /Belt	1 / 1 /Belt	1 / 1 /Belt	N/A	N/A	N/A	N/A
	Nominal / Nameplate hp	3.7	3.7	5.25	5.25	N/A	N/A	N/A	N/A
	Max bhp	3.7	3.7	4.9	4.9	N/A	N/A	N/A	N/A
	Rpm Range	614-780	614-780	713-879	713-879	N/A	N/A	N/A	N/A
	Max Blower/Shaft rpm	1100	1100	1100	1100	N/A	N/A	N/A	N/A
	Motor Frame Size	56	56	56	56	N/A	N/A	N/A	N/A
	Fan Qty / Type	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal	N/A	N/A	N/A	N/A
	Fan Diameter (in.)	18 x 15/15 X 11	18 x 15/15 X 11	18 x 15/15 X 11	18 x 15/15 X 11	N/A	N/A	N/A	N/A

Physical data (cont)

48HC 15 TO 25 TON PHYSICAL DATA (CONT)

48HC UNIT		48HC*D17	48HC*E17	48HC*D20	48HC*E20	48HC*D24	48HC*E24	48HC*D28	48HC*E28
HIGH STATIC	Motor Qty / Belt Qty / Driver Type	1 / 1 /Belt	1 / 1 /Belt	N/A	N/A	N/A	N/A	N/A	N/A
	Nominal / Nameplate hp	4.9	4.9	N/A	N/A	N/A	N/A	N/A	N/A
	Max bhp	4.9	4.9	N/A	N/A	N/A	N/A	N/A	N/A
	Rpm Range	746-912	746-912	N/A	N/A	N/A	N/A	N/A	N/A
	Max Blower/Shaft rpm	1100	1100	N/A	N/A	N/A	N/A	N/A	N/A
	Motor Frame Size	56	56	N/A	N/A	N/A	N/A	N/A	N/A
	Fan Qty / Type	2 / Centrifugal	2 / Centrifugal	N/A	N/A	N/A	N/A	N/A	N/A
	Fan Diameter (in.)	18 x 15/15 X 11	18 x 15/15 X 11	N/A	N/A	N/A	N/A	N/A	N/A
STANDARD STATIC - HIGH EFFICIENCY	Motor Qty / Belt Qty / Driver Type	N/A	N/A	N/A	N/A	1 / 1 /Belt	1 / 1 /Belt	N/A	N/A
	Nominal / Nameplate hp	N/A	N/A	N/A	N/A	5.0	5.0	N/A	N/A
	Max bhp	N/A	N/A	N/A	N/A	6.5/ 6.9/ 7.0/ 8.3	6.5/ 6.9/ 7.0/ 8.3	N/A	N/A
	Rpm Range	N/A	N/A	N/A	N/A	690-863	690-863	N/A	N/A
	Max Blower/Shaft rpm	N/A	N/A	N/A	N/A	1200	1200	N/A	N/A
	Motor Frame Size	N/A	N/A	N/A	N/A	184T	184T	N/A	N/A
	Fan Qty / Type	N/A	N/A	N/A	N/A	2 / Centrifugal	2 / Centrifugal	N/A	N/A
	Fan Diameter (in.)	N/A	N/A	N/A	N/A	18 x 15/15 X 11	18 x 15/15 X 11	N/A	N/A
MEDIUM STATIC - HIGH EFFICIENCY	Motor Qty / Belt Qty / Driver Type	N/A	N/A	N/A	N/A	1 / 1 /Belt	1 / 1 /Belt	1 / 1 /Belt	1 / 1 /Belt
	Nominal / Nameplate hp	N/A	N/A	N/A	N/A	5.0	5.0	5.0	5.0
	Max bhp	N/A	N/A	N/A	N/A	6.5/ 6.9/ 7.0/ 8.3	6.5/ 6.9/ 7.0/ 8.3	6.5/ 6.9/ 7.0/ 8.3	6.5/ 6.9/ 7.0/ 8.3
	Rpm Range	N/A	N/A	N/A	N/A	835-1021	835-1021	755-923	755-923
	Max Blower/Shaft rpm	N/A	N/A	N/A	N/A	1100	1100	1100	1100
	Motor Frame Size	N/A	N/A	N/A	N/A	184T	184T	184T	184T
	Fan Qty / Type	N/A	N/A	N/A	N/A	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal
	Fan Diameter (in.)	N/A	N/A	N/A	N/A	18 x 15/15 X 11	18 x 15/15 X 11	18 x 15/15 X 11	18 x 15/15 X 11
HIGH STATIC- HIGH EFFICIENCY	Motor Qty / Belt Qty / Driver Type	N/A	N/A	1 / 1 /Belt	1 / 1 /Belt	1 / 1 /Belt	1 / 1 /Belt	1 / 1 /Belt	1 / 1 /Belt
	Nominal / Nameplate hp	N/A	N/A	5.0	5.0	7.5	7.5	7.5	7.5
	Max bhp	N/A	N/A	6.5/ 6.9/ 7.0/ 8.3	6.5/ 6.9/ 7.0/ 8.3	10.5/11.9/11.9/ 11	10.5/11.9/11.9/ 11	10.5/11.9/11.9/ 11	10.5/11.9/11.9/ 11
	Rpm Range	N/A	N/A	835-1021	835-1021	941-1100	941-1100	906-1100	906-1100
	Max Blower/Shaft rpm	N/A	N/A	1100	1100	1100	1100	1100	1100
	Motor Frame Size	N/A	N/A	184T	184T	213T	213T	213T	213T
	Fan Qty / Type	N/A	N/A	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal
	Fan Diameter (in.)	N/A	N/A	18 x 15/15 X 11	18 x 15/15 X 11	18 x 15/15 X 11	18 x 15/15 X 11	18 x 15/15 X 11	18 x 15/15 X 11
COND. COIL (CIRCUIT A)									
	Coil Type	RTPF	RTPF	RTPF	RTPF	RTPF	RTPF	RTPF	RTPF
	Coil Length (in.)	70	70	72	72	82	82	95	95
	Coil Height (in.)	44	44	44	44	52	52	52	52
	Rows / fpi	2 /17	2 /17	2 /17	2 /17	2 /17	2 /17	2 /17	2 /17
	Total Face Area (Ft^2)	21.4	21.4	22.0	22.0	29.6	29.6	34.3	34.3
COND. COIL (CIRCUIT B)									
	Coil Type	RTPF	RTPF	RTPF	RTPF	RTPF	RTPF	RTPF	RTPF
	Coil Type	70	70	64	64	80	80	95	95
	Coil Length (in.)	44	44	44	44	52	52	52	52
	Coil Height (in.)	2 /17	2 /17	2 /17	2 /17	2 /17	2 /17	2 /17	2 /17
	Rows / fpi	21.4	21.4	19.5	19.5	29.6	29.6	34.3	34.3
COND. FAN / MOTOR									
	Qty / Motor Drive Type	3 / direct	3 / direct	4 / direct	4 / direct	4/ direct	4/ direct	6 / direct	6 / direct
	Motor Hp / Rpm	1/4 / 1100	1/4 / 1100	1/4 / 1100	1/4 / 1100	1/4 / 1100	1/4 / 1100	1/4 / 1100	1/4 / 1100
	Fan Diameter (in.)	22	22	22	22	22	22	22	22
FILTERS									
	RA Filter # / Size (in.)	6 / 20 x 25 x 2	6 / 20 x 25 x 2	6 / 20 x 25 x 2	6 / 20 x 25 x 2	9 / 16 x 25 x 2	9 / 16 x 25 x 2	9 / 16 x 25 x 2	9 / 16 x 25 x 2
	OA Inlet Screen # / Size (in.)	4 / 16 x 25 x 1	4 / 16 x 25 x 1	4 / 16 x 25 x 1	4 / 16 x 25 x 1	4 / 16 x 25 x 1	4 / 16 x 25 x 1	4 / 16 x 25 x 1	4 / 16 x 25 x 1

48HC 15 TO 25 TON PHYSICAL DATA (CONT)

48HC UNIT		48HC*D17	48HC*E17	48HC*D20	48HC*E20	48HC*D24	48HC*E24	48HC*D28	48HC*E28
GAS CONNECTION									
Number of Gas Valves		1		1		1		1	
Nat. gas supply line press (in. wg) / (PSIG)		5 -13 / 0.18-0.47		5 -13 / 0.18-0.47		5 -13 / 0.18-0.47		5 -13 / 0.18-0.47	
LP supply line press (in. wg) / (PSIG)		11-13 / 0.40-0.47		11-13 / 0.40-0.47		11-13 / 0.40-0.47		11-13 / 0.40-0.47	
HEAT ANTICIPATOR SETTING (AMPS)									
First stage		0.14		0.14		0.14		0.14	
Second stage		0.14		0.14		0.14		0.14	
NATURAL GAS HEAT									
LOW	**# of stages / # of burners (total)**	2 / 5		2 / 5		2 / 5		2 / 5	
	Connection Size (in.)	3/4 NPT		3/4 NPT		3/4 NPT		3/4 NPT	
	Rollout switch opens / closes (F)	195 / 115		195 / 115		195 / 115		195 / 115	
	Temperature Rise (F)	25 - 55		25 - 55		25 - 55		25 - 55	
MED	**# of stages / # of burners (total)**	2 / 7		2 / 7		2 / 7		2 / 7	
	Connection Size (in.)	3/4 NPT		3/4 NPT		3/4 NPT		3/4 NPT	
	Rollout switch opens / closes (F)	195 / 115		195 / 115		195 / 115		195 / 115	
	Temperature Rise (F)	30 - 60		30 - 60		30 - 60		30 - 60	
HIGH	**# of stages / # of burners (total)**	2 / 10		2 / 10		2 / 10		2 / 10	
	Connection Size (in.)	3/4 NPT		3/4 NPT		3/4 NPT		3/4 NPT	
	Rollout switch opens / closes (F)	195 / 115		195 / 115		195 / 115		195 / 115	
	Temperature Rise (F)	35 - 65		35 - 65		35 - 65		35 - 65	
LIQUID PROPANE HEAT									
LOW	**# of stages / # of burners (total)**	2 / 5		2 / 5		2 / 5		2 / 5	
	Connection Size (in.)	3/4 NPT		3/4 NPT		3/4 NPT		3/4 NPT	
	Rollout switch opens / closes (F)	195 / 115		195 / 115		195 / 115		195 / 115	
	Temperature Rise (F)	25 - 55		25 - 55		25 - 55		25 - 55	
MED	**# of stages / # of burners (total)**	2 / 7		2 / 7		2 / 7		2 / 7	
	Connection Size (in.)	3/4 NPT		3/4 NPT		3/4 NPT		3/4 NPT	
	Rollout switch opens / closes (F)	195 / 115		196 / 115		197 / 115		198 / 115	
	Temperature Rise (F)	30 - 60		30 - 60		30 - 60		30 - 60	
HIGH	**# of stages / # of burners (total)**	2 / 10		2 / 10		2 / 10		2 / 10	
	Connection Size (in.)	3/4 NPT		3/4 NPT		3/4 NPT		3/4 NPT	
	Rollout switch opens / closes (F)	195 / 115		195 / 115		195 / 115		195 / 115	
	Temperature Rise (F)	35 - 65		35 - 65		35 - 65		35 - 65	

Physical data (cont)

48HC 15 TO 25 TON PHYSICAL DATA (CONT)

48HC UNIT	48HC*D17	48HC*E17	48HC*D20	48HC*E20	48HC*D24	48HC*E24	48HC*D28	48HC*E28
ENERGYX® UNIT TYPE	Modulating Air Flow Capability / Electro-Mechanical Constant Speed				Modulating Air Flow Capability / Electro-Mechanical Constant Speed			
ENERGYX WHEEL OA (CFM)	1400-3675				2200-6000			
ENERGYX WHEEL EA (CFM)	1400-3675				2200-6000			
ENERGYX RECOVERY WHEEL								
Type	Enthalpy Lightweight Polymer with Silica Gel Desiccant Coating				Enthalpy Lightweight Polymer with Silica Gel Desiccant Coating			
Model (AirXchange)	ERC-3628C				ERC-4646C			
Size (Dia. x Depth) (in.)	36 x 3				46 x 3			
Nominal Drive Motor Hp	0.1				1/6			
ENERGYX SUPPLY FAN #1								
Qty - Type	1 - Backward Curved				1 - Backward Curved			
Drive Type	Direct				Direct			
Blower Size (Diameter)	15.75" (400 mm)				17.7" (450 mm)			
Nominal Motor Hp	1.2				3.7			
ENERGYX SUPPLY FAN #2								
Qty - Type	1 - Backward Curved				1 - Backward Curved			
Drive Type	Direct				Direct			
Blower Size	15.75" (400 mm)				17.7" (450 mm)			
Nominal Motor Hp	1.2				3.7			
ENERGYX EXHAUST FAN #1								
Qty - Type	1 - Backward Curved				1 - Backward Curved			
Drive Type	Direct				Direct			
Blower Size	17.7" (450 mm)				17.7" (450 mm)			
Nominal Motor Hp	3.7				3.7			
ENERGYX EXHAUST FAN #2*								
Qty - Type	1 - Backward Curved				1 - Backward Curved			
Drive Type	Direct				Direct			
Blower Size	17.7" (450 mm)				17.7" (450 mm)			
Nominal Motor Hp	3.7				3.7			
ENERGYX FILTERS								
Type	2-in. Pleated, 30% Efficiency				2-in. Pleated, 30% Efficiency			
Supply Air (Qty) - Size (in.)	(2) 16 x 20 x 2				(2) 20 x 25 x 2			
Exhaust Air (Qty) - Size (in.)	(2) 16 x 20 x 2				(2)20 x 25 x 2			
Type	Aluminum Water Filter				Aluminum Water Filter			
Water Entrapment (Qty) - Size (in.)	(2) 34.375 x 17.25 x 1				(2) 34.375 x 24.5 x 1			

LEGEND

BHP — Brake Horsepower
EA — Entering Air
FPI — Fins Per Inch
OA — Outdoor Air

* Exhaust fan #2 data is not applicable to 15-17.5 ton high non-economizer models.

Options and accessories

ITEM	OPTION*	ACCESSORY†
CABINET		
Dedicated Vertical Air Flow Duct Configuration	X	
Dedicated Horizontal Air Flow Duct Configuration	X	
Hinged Access Panels	X	
Foil Faced Insulation Throughout Entire Cabinet	X	
Thru-the-Base Electrical or Gas-Line Connections	X	
COIL OPTIONS		
Cu/Cu (Indoor) Coils	X	
Premium, E-coated Outdoor Coils	X	
Pre-coated (outdoor and indoor) Coils	X	
HUMIDITY CONTROL		
Humidi-MiZer® Adaptive Dehumidification System	X	
CONDENSER PROTECTION		
Condenser Coil Louvered Hail Guard	X	X
CONTROLS		
PremierLink™ DDC Communicating Controller	X	X
*Comfort*Link Controller	X	
RTU Open Multi-Protocol Controller	X	
Thermostats, Temperature Sensors, and Subbase		X
Smoke Detector (Supply and/or Return Air)	X	X
Horn/Strobe Annunciator[1]		X
Time Guard II Compressor Delay Control Circuit		X
Phase Monitor		X
Condensate Overflow Switch	X	X
ECONOMIZERS AND OUTDOOR AIR DAMPERS		
Economi$er® IV for Electro-Mechanical Controls — Non-FDD (Standard Air Leak Damper Models)[2]	X	X
EconoMi$er 2 for DDC controls (Standard and Ultra Low Leak Air Damper Models)[2, 3]	X	X
EconoMi$er X For Electro-Mechanical Controls, Complies with FDD. (Standard and Ultra Low Leak air damper models)[2]	X	X
Motorized 2 Position Outdoor-Air Damper[9]	X	X
Manual Outdoor-Air Damper (25%)[9]		X
Barometric Relief[4]	X	X
Barometric Hood (Horizontal economizer)		X
Power Exhaust (Prop Design)	X	X
ECONOMIZER SENSORS AND IAQ DEVICES		
Single Dry Bulb Temperature Sensors[5]	X	X
Differential Dry Bulb Temperature Sensors[5]		X
Single Enthalpy Sensors[5]	X	X
Differential Enthalpy Sensors[5]		X
Wall or Duct Mounted CO_2 Sensor[5]		X
Unit Mounted CO_2 Sensor[5]	X	X
4-in. Filter Track Assembly		X

ITEM	OPTION*	ACCESSORY†
GAS HEAT		
Propane Conversion Kit		X
Stainless Steel Heat Exchanger	X	
High Altitude Conversion Kit		X
Flue Discharge Deflector		X
INDOOR MOTOR AND DRIVE		
Multiple Motor and Drive Packages	X	
Staged Air Volume (SAV™) System with VFD Controller (2-Stage Cooling Models Only)	X	
Display Kit or SAV System with VFD		X
LOW AMBIENT CONTROL		
Winter Start Kit[6]		X
Motormaster® Head Pressure Controller to –20°F[6]		X
POWER OPTIONS		
Cooling Low Ambient Controller to 0°F	X	
Powered Convenience Outlet	X	
Unpowered Convenience Outlet (125 amp Factory-Installed, 20 amp Field-Installed)	X	X
HACR Circuit Breaker[7]	X	
Non-Fused Disconnect[8]	X	
ROOF CURBS		
Roof Curb 14-in. (356 mm)		X
Roof Curb 24-in. (610 mm)		X
Horizontal Curb Adapter (Vertical to Horizontal Airflow)		X
EnergyX® SYSTEM		
EnergyX Energy Recovery	X	
EnergyX with Economizer	X	
EnergyX with Frost Protection	X	
EnergyX with Frost Protection and Economizer	X	
Filter Maintenance Sensor		X
Motor Status Sensor		X
California OSHPD Seismic Certification Label 10		

*Factory-installed option.

†Field-installed accessory.

NOTES:

1. Requires a field-supplied 24V transformer for each application. See price page for details.
2. FDD (Fault Detection and Diagnostics System) capability per ASHRAE 90.1-2016 and California Title 24-2015 Section 120.2.
3. Models with RTU Open and *Comfort*Link DDC controls comply with ASHRAE 90.1-2016 section 6.4.3.1.b and California Title 24-2015 section 120.2.
4. Included with economizer.
5. Sensors used to optimize economizer performance.
6. See application data for assistance.
7. HACR circuit breaker cannot be used when rooftop MOCP electrical rating exceeds 200 amps at 208/230 volt, and 90 amps at 460 and 575 volt, 575 volt can only be used on Wye power supply. Delta power supply is prohibited. Carrier RTUBuilder selects this automatically.
8. Non-fused disconnect switch cannot be used when MOCP electrical rating exceeds 70 amps at 460/575 volt and 150 amps at 208/230 volt. Carrier Packaged RTUBuilder selects this automatically.
9. Not compatible with Staged Air Volume (SAV) system.
10. OSHPD not available on units with Humidi-MiZer, HACR breaker, MCHX coil, low ambient controls, hail-guards, or EnergyX.

Options and accessories (cont)

Factory Installed Options

Economizer (dry-bulb or enthalpy) — Economizers save money. They bring in fresh, outside air for ventilation; and provide cool, outside air to cool your building. This is the preferred method of low-ambient cooling. When coupled to CO_2 sensors, economizers can provide even more savings by coupling the ventilation air to only that amount required.

Economizers are available, installed and tested by the factory, with either enthalpy or dry-bulb temperature inputs. Additional sensors are available as accessories to optimize the economizers. Economizers include a powered exhaust system to help equalize building pressures.

Economizers include gravity controlled barometric relief that helps equalize building pressure and ambient air pressures. This can be a cost effective solution to prevent building pressurization. Economizers are available in Ultra Low Leak and standard low leak versions. Economizers can be factory-installed or easily field-installed.

Optional Humidi-MiZer® Adaptive Dehumidification System — Carrier's Humidi-MiZer adaptive dehumidification system is an all-inclusive factory-installed option that can be ordered with any WeatherMaster® 48HC17-28 rooftop unit.

This system expands the envelope of operation of Carrier's WeatherMaster rooftop products to provide unprecedented flexibility to meet year round comfort conditions.

The Humidi-MiZer adaptive dehumidification system has a unique dual operational mode setting. The Humidi-MiZer system includes two new modes of operation.

The WeatherMaster 48HC17-28 rooftop coupled with the Humidi-MiZer system is capable of operating in normal design cooling mode, subcooling mode, and hot gas reheat mode. Normal design cooling mode is when the unit will operate under its normal sequence of operation by cycling compressors to maintain comfort conditions.

Subcooling mode will operate to satisfy part load type conditions when the space requires combined sensible and a higher proportion of latent load control. Hot Gas Reheat mode will operate when outdoor temperatures diminish and the need for latent capacity is required for sole humidity control. Hot Gas Reheat mode will provide neutral air for maximum dehumidification operation.

Thru-the-Base Connections — Thru-the-base provisions/connection points are available as standard with every unit. When bottom connections are required, field furnished couplings are required.

Hinged Access Panels — Allows access to unit's major components with specifically designed hinged access panels. Panels are filter, control box, indoor fan motor.

Cu/Cu (Indoor) Coils (3-Phase Models Only) — Copper fins and copper tubes are mechanically bonded to copper tubes and copper tube sheets. A polymer strip prevents coil assembly from contacting the sheet metal coil pan to minimize potential for galvanic corrosion between coil and pan.

E-coated (Outdoor and Indoor) Coils — A flexible epoxy polymer coating uniformly applied to all coil surface areas without material bridging between fins. Coating process shall ensure complete coil encapsulation of tubes, fins and headers.

Pre-Coated Outdoor Coils — A durable epoxy-phenolic coating to provide protection in mildly corrosive coastal environments. The coating minimizes galvanic action between dissimilar metals. Coating is applied to the aluminum fin stock prior to the fin stamping process to create an inert barrier between the aluminum fin and copper tube.

Condenser Coil Hail Guard — Sleek, louvered panels protect the condenser coil from hail damage, foreign objects, and incidental contact. This can be purchased as a factory installed option or as a field installed accessory.

Smoke Detectors — Trust the experts. Smoke detectors make your application safer and your job easier. Carrier smoke detectors immediately shut down the rooftop unit when smoke is detected. They are available, installed by the factory, for supply air, return air, or both.

Optional Stainless Steel Heat Exchanger — The stainless steel heat exchanger option provides the tubular heat exchanger be made out of a minimum 20 gauge type 409 stainless steel for applications where the mixed air to the heat exchanger is expected to drop below 45°F (7°C). Stainless steel may be specified on applications where the presence of airborne contaminants require its use (applications such as paper mills) or in area with very high outdoor humidity that may result in severe condensation in the heat exchanger during cooling operation.

Convenience Outlet (Powered or Un-powered) — Reduce service and/or installation costs by including a convenience outlet in your specification. Carrier will install this service feature at our factory. Provides a convenient, 15 amp, 115v GFCI receptacle with "Wet in Use" cover. The "powered" option allows the installer to power the outlet from the line side of the disconnect side as required by code. The "unpowered" option is to be powered from a separate 115/120v power source.

Non-Fused Disconnect — This OSHA-compliant, factory-installed, safety switch allows a service technician to locally secure power to the rooftop.

When selecting a factory-installed non-fused disconnect, note they are sized for unit as ordered from the factory. The sizing of these does not accommodate any power exhaust devices, etc.

HACR Breaker — These manual reset devices provide overload and short circuit protection for the unit. Factory wired and mounted with the units with access cover to help provide environment protection.

On 575V applications, HACR breaker can only be used with WYE power distribution systems. Use on Delta power distribution systems is prohibited.

Foil Faced Insulated Cabinet — Cabinet is fully insulated with non-fibrous, foil faced cleanable insulation that is secured and encapsulated in unit design.

PremierLink™ DDC Controller — This CCN controller regulates your rooftop's performance to tighter tolerances and expanded limits, as well as facilitates zoning systems and digital accessories. It also unites your Carrier HVAC equipment together on one, coherent CCN network. The PremierLink Controller can be factory-installed, or easily field-installed.

***Comfort*Link Controls —** Models with the optional Carrier *Comfort*Link Controls allow added unit diagnostics and operation setup capabilities, as well as controlling logic for single zone Variable Air Volume (VAV) applications.

The *Comfort*Link control is your link to a world of simple and easy to use rooftop units that offer outstanding performance and value. It optimizes the performance of the refrigeration circuits as conditions change, resulting in the following features:

- Better control of temperature and humidity
- Superior reliability
- Automatic redundancy
- Low ambient cooling operation to 0°F (–18°C)
- More accurate diagnostics, at unit or remote

The *Comfort*Link Scrolling Marquee is very easy to use. The messages are displayed in easy to understand English, no decoding is required. A scrolling readout provides detailed explanations of control information. Only four, large, easy-to-use buttons are required to maneuver through the entire menu. The readout is designed to be visible even in the brightest sunlight. A hand-held Navigator™ accessory or wall-mounted System Pilot™ accessory can be used for added service flexibility.

The *Comfort*Link control provides service diagnostic information. Temperature and pressure can be read directly from the display with no need for separate gauges. Other data, such as compressor cycles, unit run time hours, current alarms, can also be accessed. A history of alarms is also available for viewing.

The service run test can be very helpful when troubleshooting. The user can run test major components to determine the root cause of a problem. The unit can be run-tested before an installation is complete to ensure satisfactory start-up. To ensure reliability, the *Comfort*Link control prevents reverse compressor rotation. No laptop computers are required for start-up.

Time schedules are built in and the Scrolling Marquee display provides easy access to setpoints. The *Comfort*Link control accepts input from a CO_2 sensor and a smoke detector. Both are available as factory-installed options or as field-installed accessories.

RTU Open Protocol Controller — Connect the rooftop to an existing BAS without needing complicated translators or adapter modules using the RTU Open controller. This new controller speaks the 4 most common building automation system languages (BACnet[1], Modbus[2], N2, and LonWorks[3]). Use this controller when you have an existing BAS.

Condensate Overflow Switch (Factory-Installed Option) — This sensor and related controller monitors the condensate level in the drain pan and shuts down compression operation when overflow conditions occur. It includes:

- Indicator light - solid red (more than 10 seconds on water contact - compressors disabled), blinking red (sensor disconnected)
- 10 second delay to break - eliminates nuisance trips from splashing or waves in pan (sensor needs 10 seconds of constant water contact before tripping)
- Disables the compressor(s) operation when condensate plug is detected, but still allows fans to run for Economizer.

Power Exhaust with Barometric Relief — Superior internal building pressure control. This field-installed accessory or factory-installed option may eliminate the need for costly, external pressure control fans.

Low Ambient Controller — The low ambient controller is a head pressure controller kit that is designed to maintain the unit's condenser head pressure during periods of low ambient cooling operation. This device should be used as an alternative to economizer free cooling not when economizer usage is either not appropriate or desired. The low ambient controller will either cycle the outdoor fan motors or operate them at reduced speed to maintain the unit operation, depending on the model. This controller allows cooling operation down to 0°F (–18°C) ambient conditions.

Manual OA Damper — Manual outdoor air dampers are an economical way to bring in ventilation air. The dampers are available in 25% versions.

Staged Air Volume (SAV™) Indoor Fan Speed System — Carrier's Staged Air Volume (SAV) system saves energy and installation time by utilizing a Variable Frequency Drive (VFD) to automatically adjust the indoor fan motor speed in sequence with the units cooling operation. Per ASHRAE 90.1-2016 standard, during the first stage of cooling operation the VFD will adjust the fan motor to provide 66% of the total cfm established for the unit. When a call for the second stage of cooling is required, the VFD will allow the total cfm for the unit established (100%). During the heating mode the VFD will allow total design cfm (100%) operation and during the ventilation mode the VFD will allow operation to 66% of total cfm. Compared to single speed indoor fan motor systems, Carrier's SAV system can save substantial energy, 25%+, versus single speed indoor fan motor systems.

1. BACnet is a registered trademark of ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers).
2. Modbus is a registered trademark of Schneider Electric.
3. LonWorks is a registered trademark of Echelon Corporation.

Options and accessories (cont)

IMPORTANT: Data based on 0.10 ($/kWh) in an office application utilizing Carrier's HAP 4.6 simulation software program.

The VFD used in Carrier's SAV™ system has soft start capabilities to slowly ramp up the speeds, thus eliminating any high inrush air volume during initial start-up. It also has internal over current protection for the fan motor and a field-installed display kit that allows adjustment and in depth diagnostics of the VFD.

This SAV system is available on models with 2-stage cooling operation with electrical mechanical or RTU Open, Multi Protocol controls. Both space sensor and conventional thermostats controls can be used to provide accurate control in any application.

The SAV system is very flexible for initial fan performance set up and adjustment. The standard factory shipped VFD is pre-programmed to automatically stage the fan speed between the first and second stage of cooling. The unit fan performance static pressure and cfm can be easily adjusted using the traditional means of pulley adjustments. The other means to adjust the unit static and cfm performance is to utilize the field-installed Display Kit and adjust the frequency and voltage in the VFD to required performance requirements. In either case, once set up, the VFD will automatically adjust the speed between the cooling stage operations.

Alternate Motors and Drives — Some applications need larger horsepower motors, some need more airflow, and some need both. Regardless of the case, your Carrier expert has a factory-installed combination to meet your application. A wide selection of motors and pulleys (drives) are available, factory-installed, to handle nearly any application.

Barometric Hood — For Horizontal Economizer applications where relief damper is installed in duct work. This kit provides the needed protection.

EnergyX® Energy Recovery Ventilator (ERV) — EnergyX System is a factory installed Energy Recovery Ventilator (ERV) module on a Carrier packaged rooftop unit. It is integrated with the base rooftop unit structurally, electrically and with regard to controls operation.

EnergyX with Economizer (3-phase Models Only) — Allows true modulating economizer capability when OA is suitable for free cooling.

- operates as a true wheel bypass
- uses stop/jog operation for wheel required when using CO_2 sensor for DCV operation
- economizer integrated into EnergyX unit

EnergyX with Economizer (3-phase Models Only) — Senses pressure differential across the energy recovery cassette. Uses exhaust air to defrost the wheel when necessary.

California OSHPD Seismic Certification Label — Units meet the seismic requirements of the International Code Council Evaluation Service (ICC-ES) document AC156 (Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems) and per International Building Code (IBC 2009) at an SDS (g) value of 2.00 z/h=1.0, Ip=1.5 and certified by independent structural engineers. A certification label is applied to the unit that meets the CA OSHPD Special Seismic Certification pre-approval labeling requirements on the external chassis of the unit.

OSHPD not available on units with factory installed Humidi-MiZer, HACR breaker, MCHX coils, low ambient controls, hailguards, or EnergyX.

Field-Installed Accessories

Differential Enthalpy Sensor — The differential enthalpy sensor is comprised of an outdoor and return air enthalpy sensors to provide differential.

Wall or duct mounted CO_2 Sensor — The IAQ sensor shall be available in duct or wall mount. The sensor provides demand ventilation indoor air quality (IAQ) control.

Time Guard II Control Circuit — This accessory protects your compressor by preventing short-cycling in the event of some other failure, prevents the compressor from restarting for 30 seconds after stopping. Not required with PremierLink, RTU Open, or authorized commercial thermostats.

Propane Conversion Kit — Convert your gas heat rooftop from standard natural gas operation to Propane using this field-installed kit.

High Altitude Heating — High altitudes have less oxygen, which affects the fuel/air mixture in heat ex- changers. In order to maintain a proper fuel/air mixture, heat exchangers operating in altitudes above 2000 ft (610 m) require different orifices. To select the correct burner orifices or determine the heat capacity for a high altitude application, use either the selection software, or the unit's service manual. High altitudes have less oxygen, which means heat exchangers need less fuel. The new gas orifices in this field-installed kit make the necessary adjustment for high altitude applications. They restore the optimal fuel to air mixture and maintain healthy combustion on altitudes above 2000 ft (610 m).

NOTE: Typical natural gas heating value ranges from 975 to 1050 Btu/ft^3 at sea level nationally. The heating value goes down approximately 1.7% per every thousand feet elevation. Standard factory orifices can typically be used up to 2000 ft (610 m) elevation without any operational issues.

Flue Discharge Deflector — The flue discharge deflector is a useful accessory when flue gas recirculation is a concern. By venting the flue discharge upwards, the deflector minimizes the chance for a neighboring unit to intake the flue exhaust.

Winter Start Kit — The winter start kit by Carrier extends the low ambient limit of your rooftop to 25°F (–4°C). The kit bypasses the low pressure switch, preventing nuisance tripping of the low pressure switch. Other low ambient precautions may still be prudent.

Motormaster® Head Pressure Controller — The Motormaster motor controller is a low ambient, head pressure controller kit that is designed to maintain the unit's condenser head pressure during periods of low ambient cooling operation. This device should be used as an alternative to economizer free cooling when economizer usage is either not appropriate or desired. The Motormaster controller will either cycle the outdoor-fan motors or operate them at reduced speed to maintain the unit operation, depending on the model.

Motormaster controller allows cooling operation down to –20°F (–29°C) ambient conditions.

Roof Curb (14-in./356 mm or 24-in./610 mm) — Full perimeter roof curb with exhaust capability provides separate air streams for energy recovery from the exhaust air without supply air contamination.

Horizontal Roof Curb Adapter (Vertical to Horizontal Airflow) — Horizontal Roof Curb Adapters — Used when horizontal supply and/or return is desired. Motor Status Indicator Accessory – monitors wheel, supply and exhaust motors and provides indication if not operating. Filter status indicator accessory – monitors static pressure across supply and exhaust filters and provides indication when filters become clogged.

EnergyX Filter Maintenance Sensor — When the optional factory installed filter maintenance indicator is used, a factory-installed differential pressure switch measures pressure drop across the outside air filter and activates a field-supplied dry contact indicator when the pressure differential exceeds the adjustable switch setpoint. The EnergyX® wheel operation is not interrupted.

EnergyX Motor Status Sensor — Monitors the EnergyX wheel/motor and supply and exhaust fan motors to provide indication of operation.

EnergyX Motorized Exhaust Damper Accessory — Replaces the standard barometric exhaust damper blades with motorized (open/shut) damper.

Options and accessories (cont)

OPTIONS AND ACCESSORY WEIGHTS

OPTION / ACCESSORY NAME	48HC UNIT WEIGHT							
	17		20		24		28	
	lb	kg	lb	kg	lb	kg	lb	kg
EnergyX® Energy Recovery Ventilator	1466	665	1466	665	1676	760	1676	760
Barometric Relief Damper	50	23	50	23	50	23	50	23
Humidi-MiZer® System*	110	50	120	55	120	55	120	55
Economizer	498	226	498	226	505	229	505	229
Power Exhaust	125	57	125	57	125	57	125	57
EconoMi$er® (IV, X, or 2)	170	77	170	77	170	77	195	88
Copper Tube/Fin Condenser Coil	28	13	30	14	34	15	34	15
Copper Tube/Fin Evaporator Coil	110	50	110	50	135	61	16	73
Copper Tube/Fin Condenser and Evaporator Coil	—	—	—	—	—	—	—	—
Low Gas Heat	85	39	85	39	85	39	85	39
Medium Gas Heat	90	41	90	41	90	41	90	41
High Gas Heat	113	51	113	51	113	51	113	51
Flue Discharge Deflector	7	3	7	3	7	3	7	3
Roof Curb 14-in. (356 mm)	240	109	240	109	240	109	255	116
Roof Curb 24-in. (610 mm)	340	154	340	154	340	154	355	161
Louvered Hail Guard	60	27	60	27	120	54	150	68
CO_2 Sensor	5	2	5	2	5	2	5	2
Return Smoke Detector	5	2	5	2	5	2	5	2
Supply Smoke Detector	5	2	5	2	5	2	5	2
Fan/Filter Status Switch	2	1	2	1	2	1	2	1
Non-Fused Disconnect	15	7	15	7	15	7	15	7
HACR Circuit Breaker	2	1	2	1	2	1	2	1
Powered Convenience Outlet	35	16	35	16	35	16	35	16
Powered Exhaust	125	57	125	57	125	57	125	57
Non-Powered Convenience Outlet	5	2	5	2	5	2	5	2
Enthalpy Sensor	2	1	2	1	2	1	2	1
Differential Enthalpy Sensor	3	1	3	1	3	1	3	1
Two Position Motorized Damper	50	23	50	23	50	23	65	29
Manual Damper	35	16	35	16	35	16	40	18
Field Filter Track 4-in. (102mm)	12	5	12	5	12	5	12	5
Motormaster® Controller	35	16	35	16	35	16	35	16
Medium Static Motor/Drive	5	2	6	3	6	3	6	3
High Static Motor/Drive	11	5	12	5	16	7	16	7
Barometric Relief Hood (Horizontal)	25	11	25	11	25	11	25	11
SAV™ System with VFD	20	9	20	9	20	9	20	9

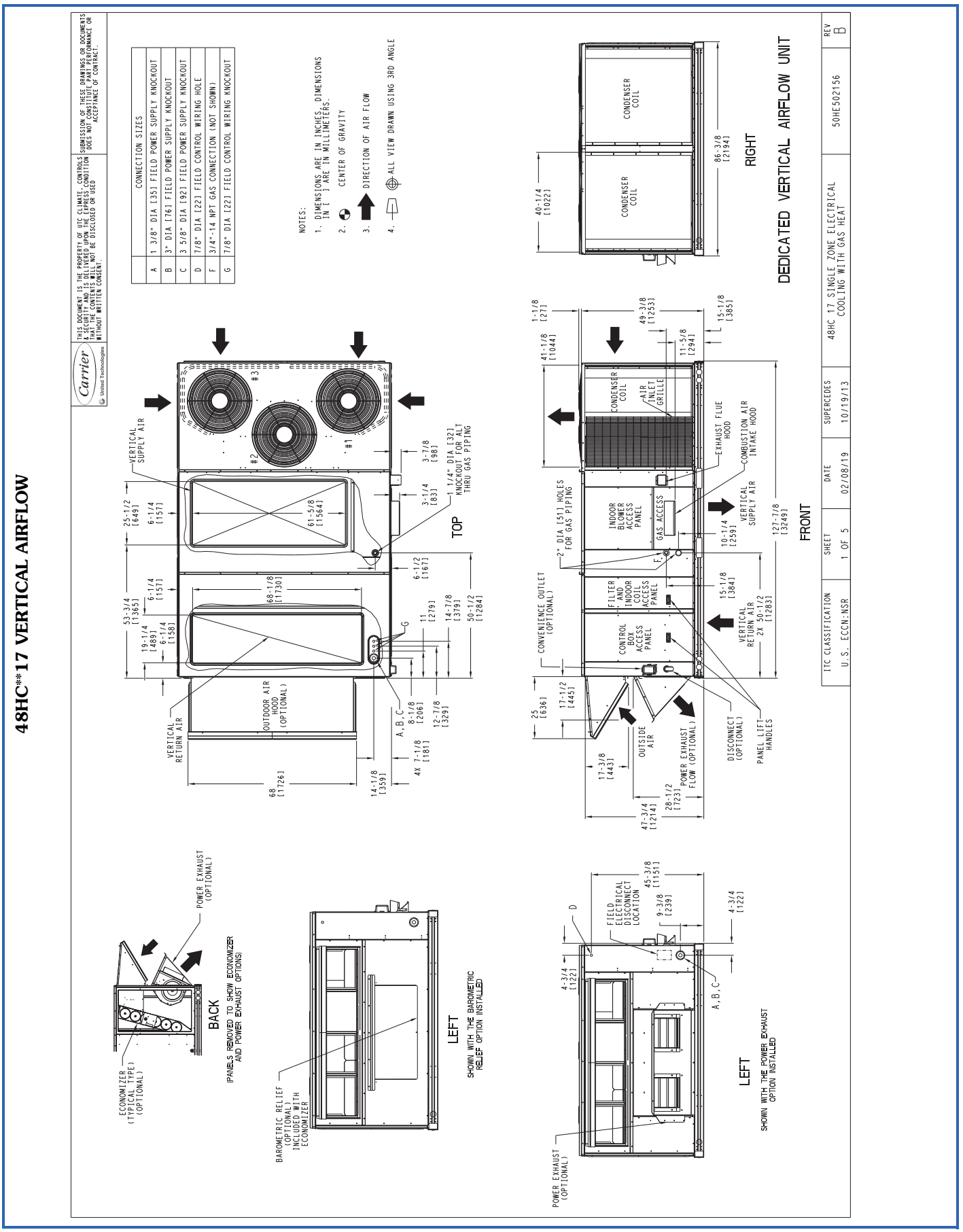
LEGEND

— Not Available

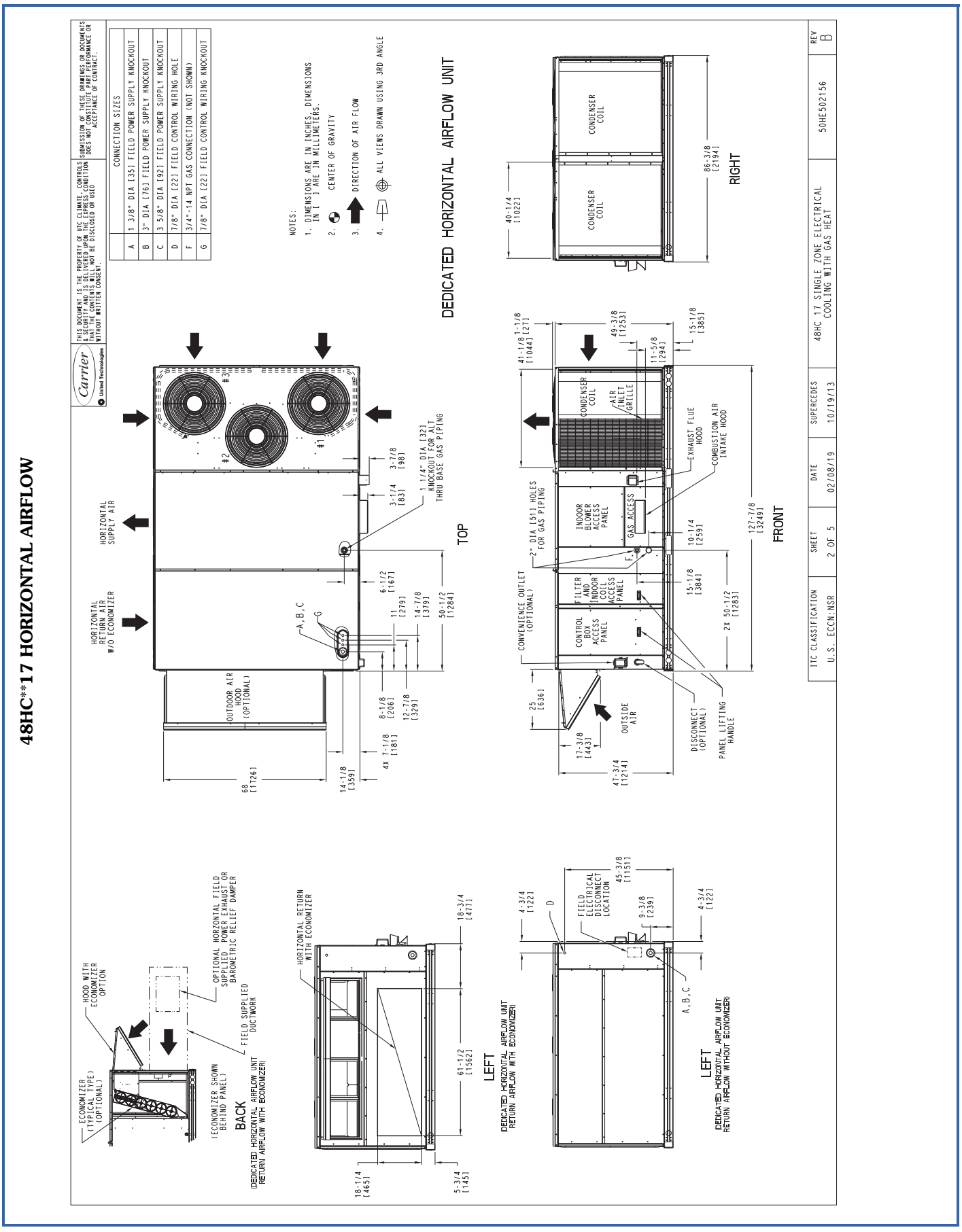
* For Humidi-MiZer system add Motormaster® controller.

NOTE: Where multiple variations are available, the heaviest combination is listed.

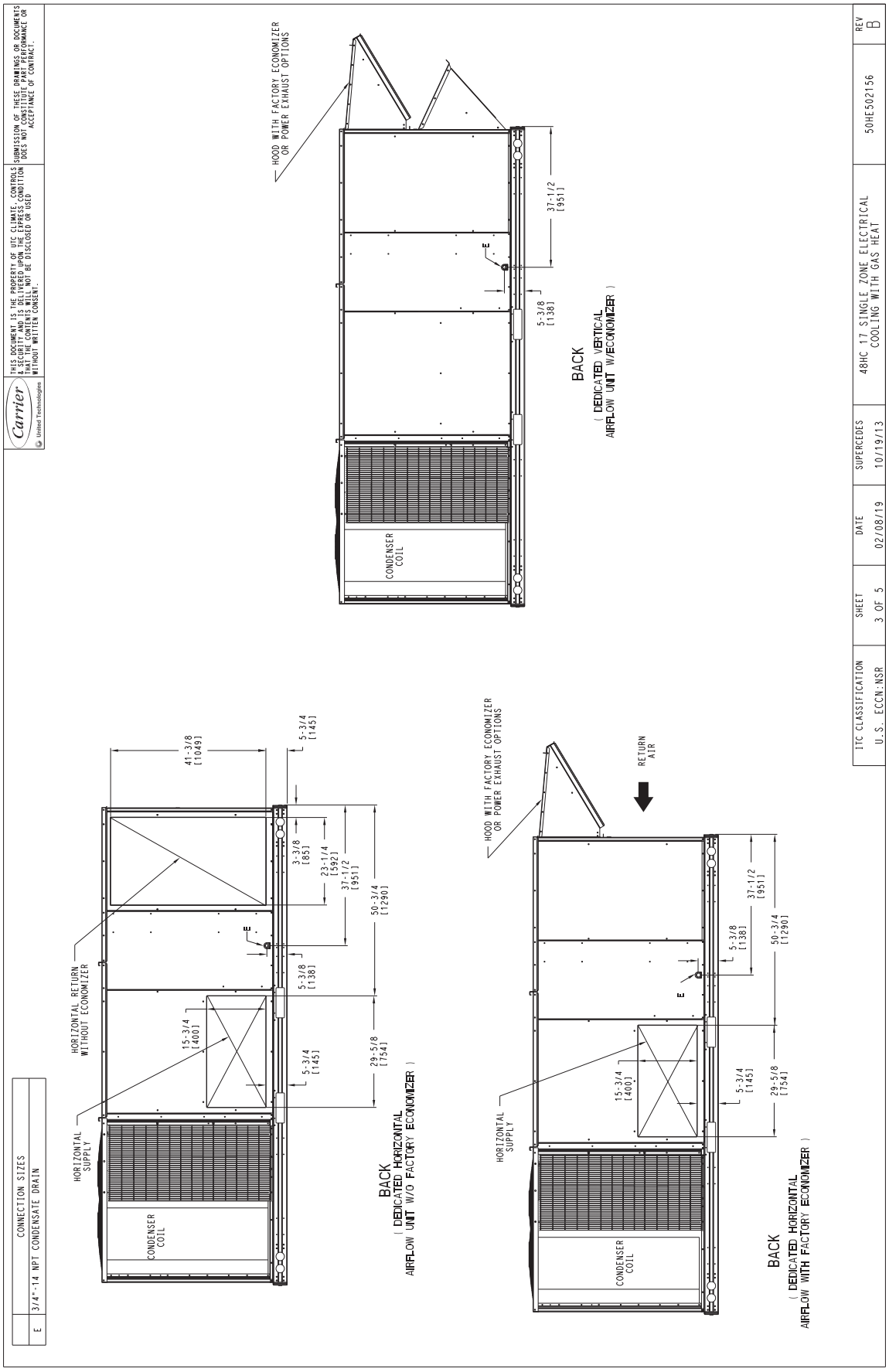
Base unit dimensions



Base unit dimensions (cont)



48HC**17 BACK VIEW AND CONDENSATE DRAIN LOCATION

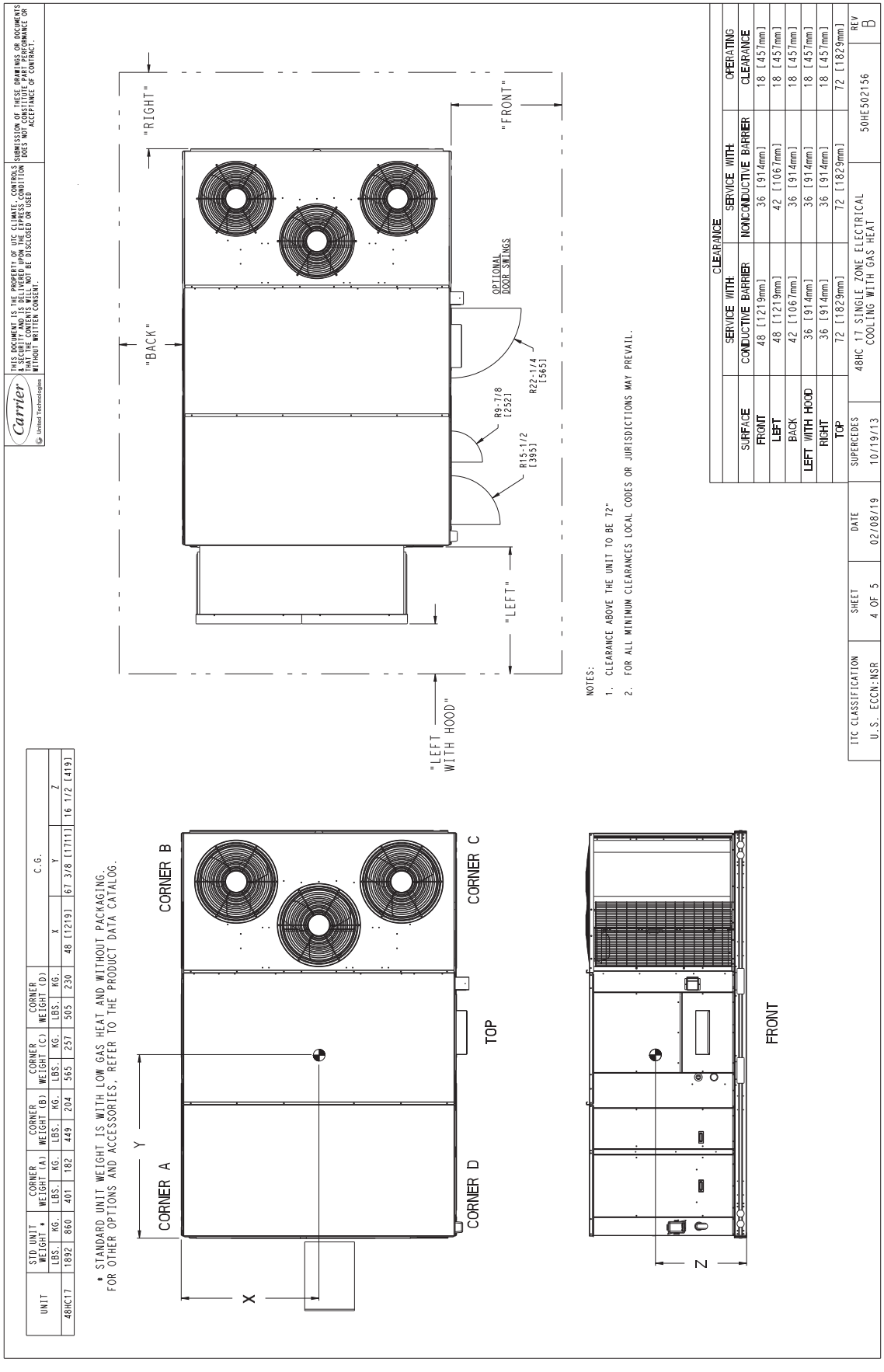


Base unit dimensions (cont)

48HC**17 CORNER WEIGHTS AND CLEARANCES

UNIT	STD UNIT WEIGHT *		CORNER WEIGHT (A)		CORNER WEIGHT (B)		CORNER WEIGHT (C)		CORNER WEIGHT (D)		C.G.		
	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	X	Y	Z
48HC17	1892	860	401	182	449	204	565	257	505	230	48 [1219]	67 3/8 [1711]	16 1/2 [419]

* STANDARD UNIT WEIGHT IS WITH LOW GAS HEAT AND WITHOUT PACKAGING.
FOR OTHER OPTIONS AND ACCESSORIES, REFER TO THE PRODUCT DATA CATALOG.



NOTES:
1. CLEARANCE ABOVE THE UNIT TO BE 72"
2. FOR ALL MINIMUM CLEARANCES LOCAL CODES OR JURISDICTIONS MAY PREVAIL.

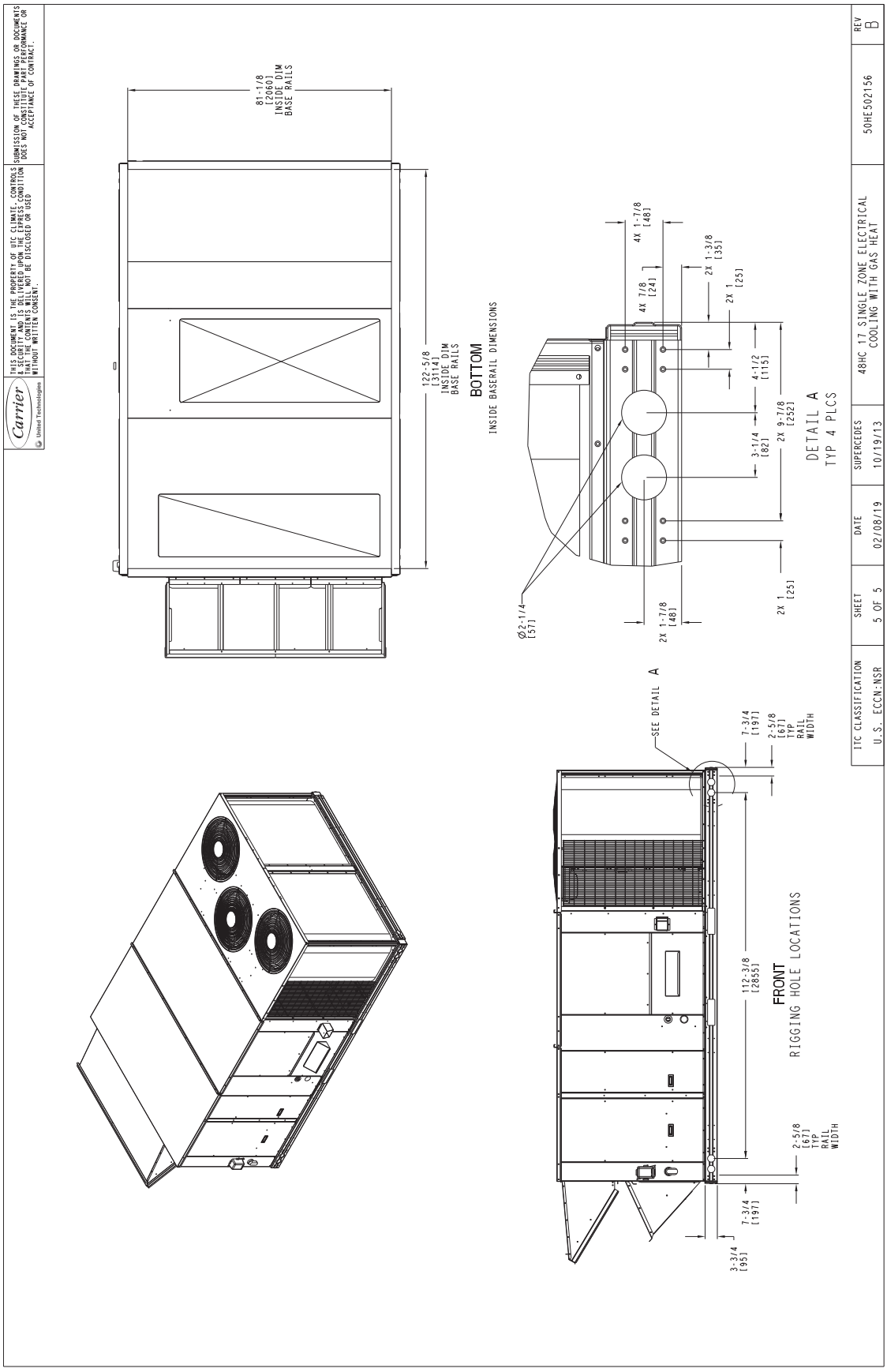
CLEARANCE			
	SERVICE WITH:	SERVICE WITH:	OPERATING
SURFACE	CONDUCTIVE BARRIER	NONCONDUCTIVE BARRIER	CLEARANCE
FRONT	48 [1219mm]	36 [914mm]	18 [457mm]
LEFT	48 [1219mm]	42 [1067mm]	18 [457mm]
BACK	42 [1067mm]	36 [914mm]	18 [457mm]
LEFT WITH HOOD	36 [914mm]	36 [914mm]	18 [457mm]
RIGHT	36 [914mm]	36 [914mm]	18 [457mm]
TOP	72 [1829mm]	72 [1829mm]	72 [1829mm]

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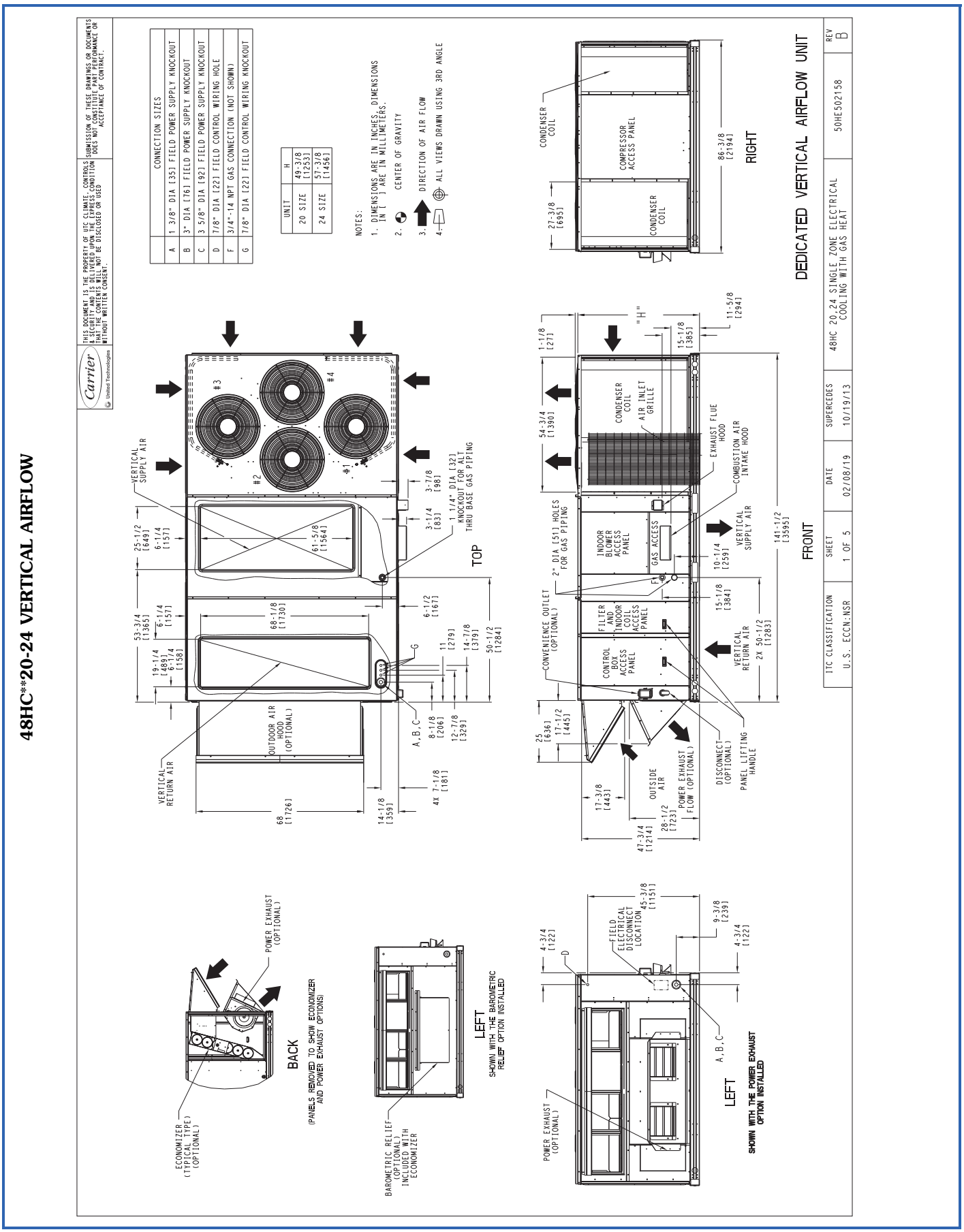
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UTC CLASSIFICATION	SHEET	DATE	SUPERCEDES	48HC 17 SINGLE ZONE ELECTRICAL COOLING WITH GAS HEAT	50HE502156	REV
U.S. ECCN:NSR	4 OF 5	02/08/19	10/19/13			B

48HC**17 BOTTOM VIEW

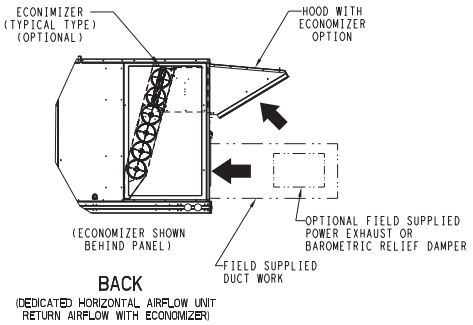


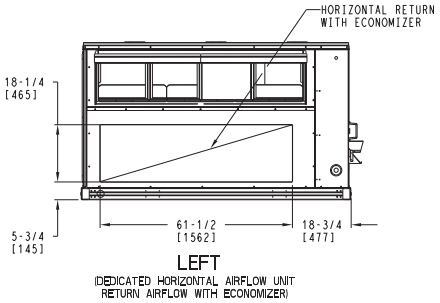
Base unit dimensions (cont)

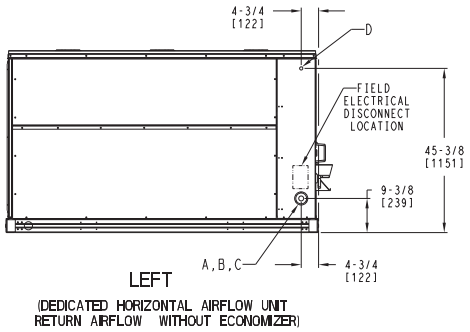


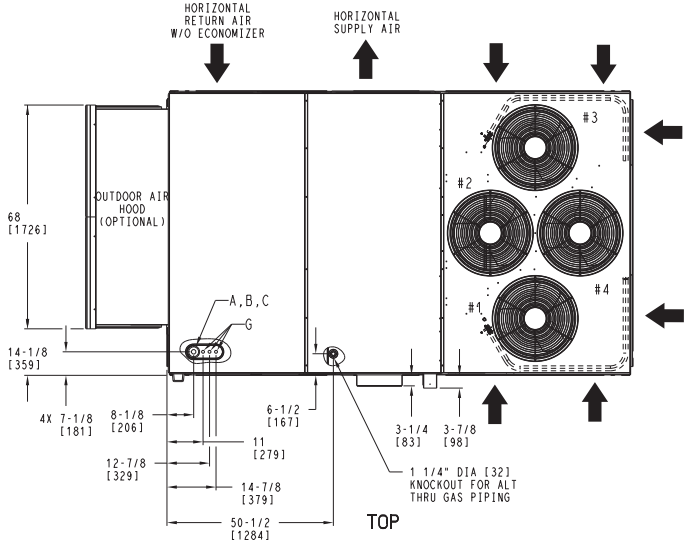
48HC**20-24 HORIZONTAL AIRFLOW

Carrier United Technologies
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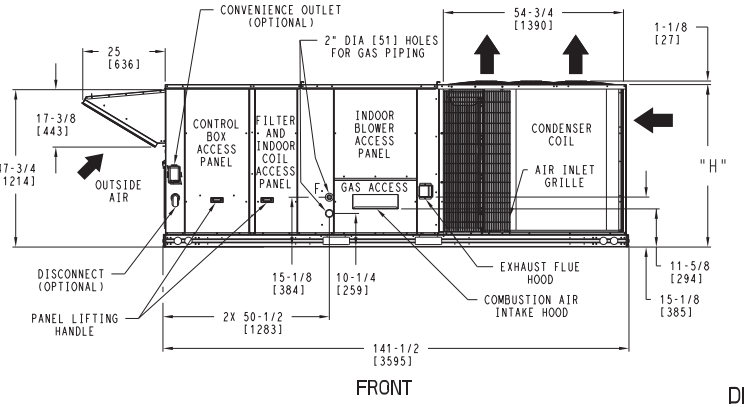


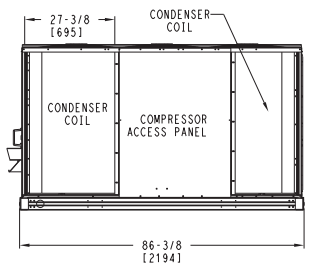


	CONNECTION SIZES
A	1 3/8" DIA [35] FIELD POWER SUPPLY KNOCKOUT
B	3" DIA [76] FIELD POWER SUPPLY KNOCKOUT
C	3 5/8" DIA [92] FIELD POWER SUPPLY KNOCKOUT
D	7/8" DIA [22] FIELD CONTROL WIRING HOLE
F	3/4"-14 NPT GAS CONNECTION (NOT SHOWN)
G	7/8" DIA [22] FIELD CONTROL WIRING KNOCKOUT

UNIT	H
20 SIZE	49-3/8 [1253]
24 SIZE	57-3/8 [1456]

NOTES:
1. DIMENSIONS ARE IN INCHES. DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. CENTER OF GRAVITY
3. DIRECTION OF AIR FLOW
4. ALL VIEWS DRAWN USING 3RD ANGLE



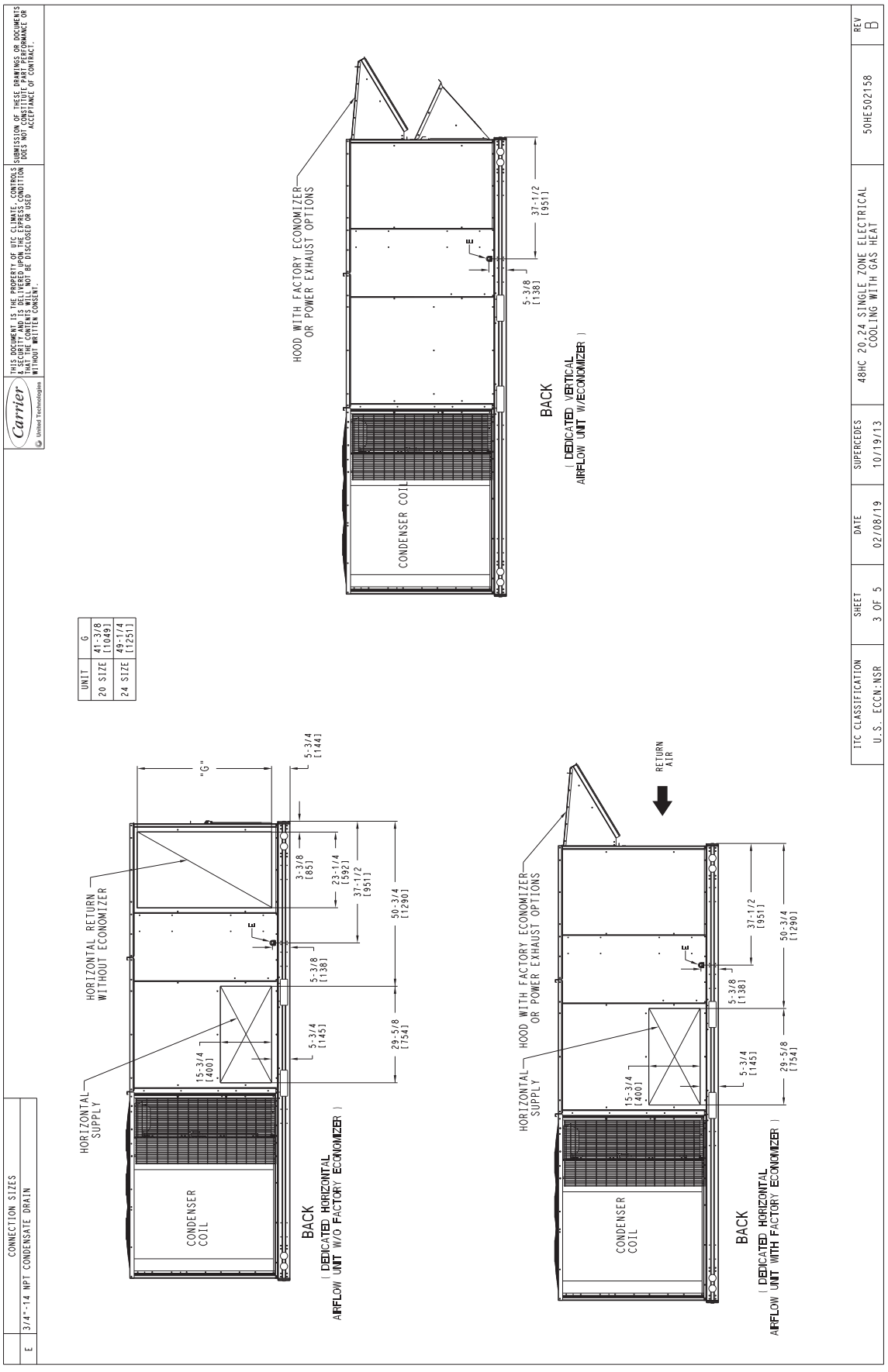


DEDICATED HORIZONTAL AIRFLOW UNIT

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN:NSR	2 OF 5	02/08/19	10/19/13	48HC 20,24 SINGLE ZONE ELECTRICAL COOLING WITH GAS HEAT	50HE502158	B

Base unit dimensions (cont)

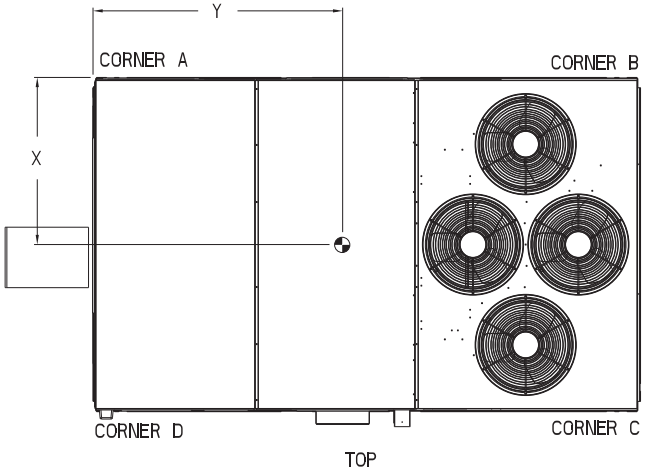
48HC**20-24 BACK VIEW AND CONDENSATE DRAIN LOCATION

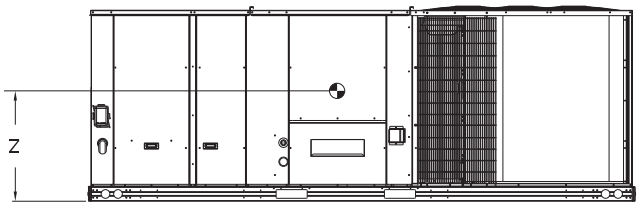


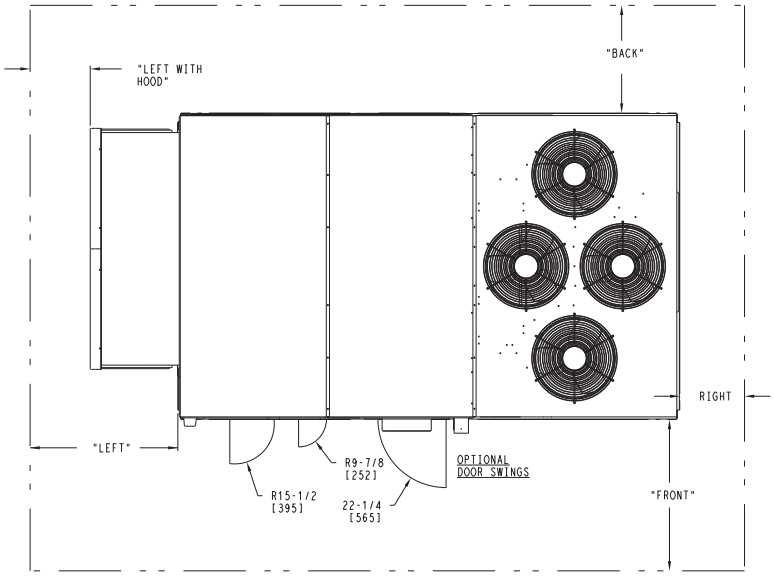
48HC**20-24 CORNER WEIGHTS AND CLEARANCES

UNIT	STD. UNIT WEIGHT *		CORNER WEIGHT (A)		CORNER WEIGHT (B)		CORNER WEIGHT (C)		CORNER WEIGHT (D)		C.G.		
	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	X	Y	Z
48HC20	2102	956	474	215	390	177	593	269	582	265	47 1/2 [1207]	71 1/4 [1810]	16 1/2 [419]
48HC24	2247	1021	540	246	556	253	598	272	581	264	44 5/8 [1133]	71 5/8 [1819]	19 [483]

* STANDARD UNIT WEIGHT IS WITH LOW GAS HEAT AND WITHOUT PACKAGING.
FOR OTHER OPTIONS AND ACCESSORIES, REFER TO THE PRODUCT DATA CATALOG.







NOTES:

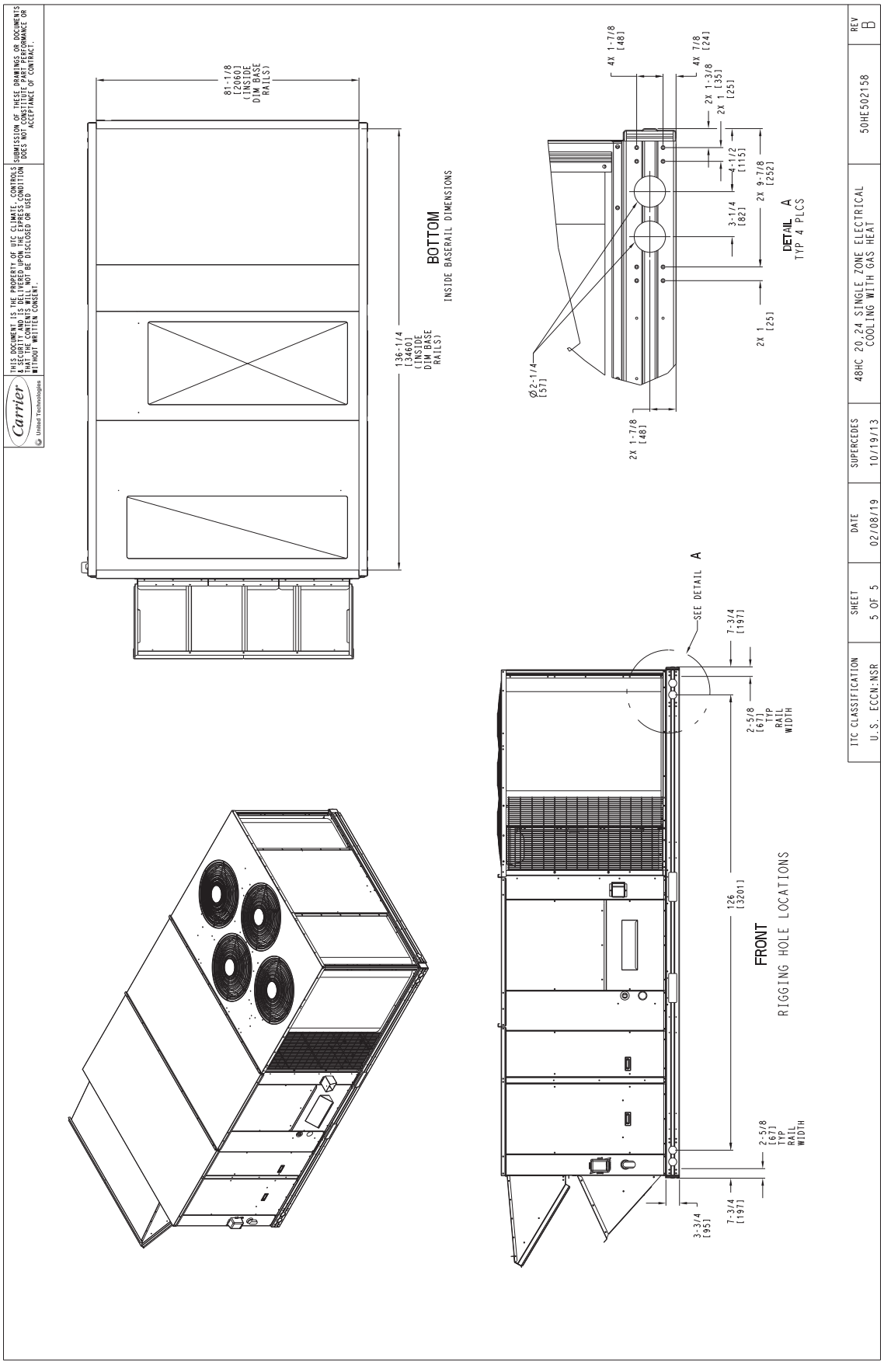
1. CLEARANCE ABOVE THE UNIT TO BE 72"
2. FOR ALL MINIMUM CLEARANCES LOCAL CODES OR JURISDICTIONS MAY PREVAIL.

	CLEARANCE		
	SERVICE WITH:	SERVICE WITH:	OPERATING
SURFACE	CONDUCTIVE BARRIER	NONCONDUCTIVE BARRIER	CLEARANCE
FRONT	48 [1219mm]	36 [914mm]	18 [457mm]
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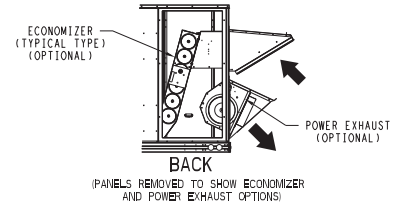
Base unit dimensions (cont)

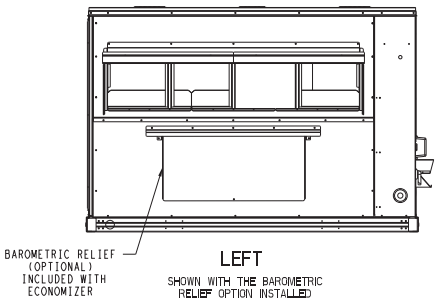
48HC20-24 BOTTOM VIEW**

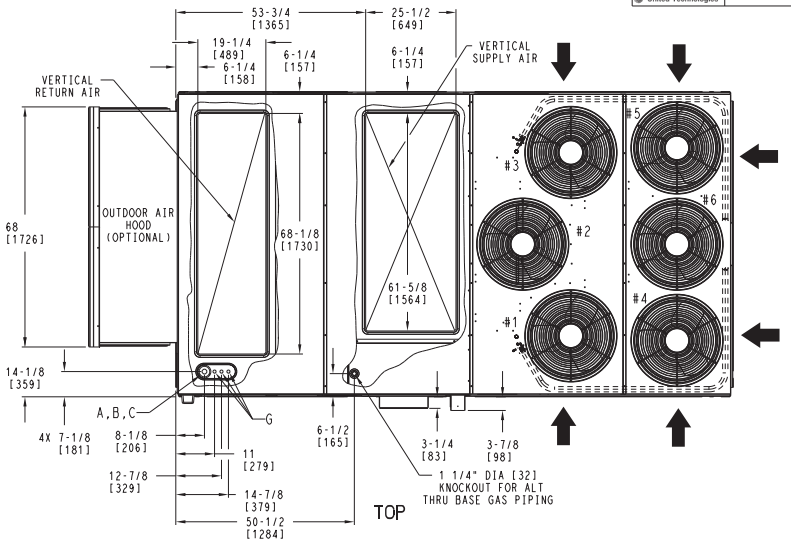


48HC**28 VERTICAL AIRFLOW

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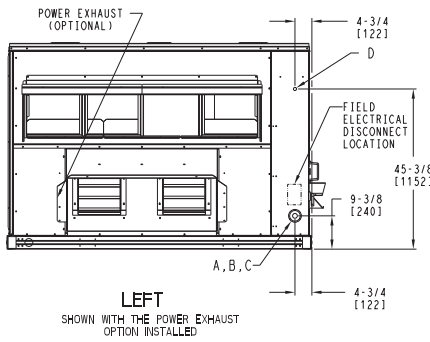


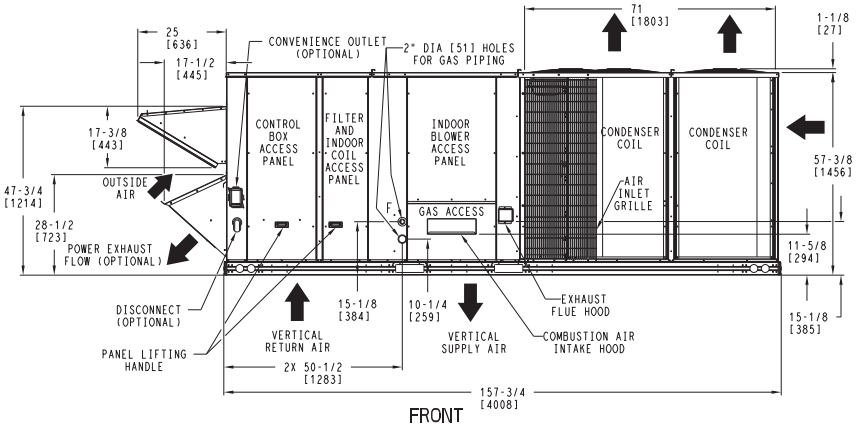


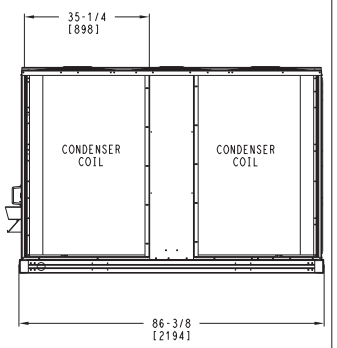


	CONNECTION SIZES
A	1 3/8" DIA [35] FIELD POWER SUPPLY KNOCKOUT
B	3" DIA [76] FIELD POWER SUPPLY KNOCKOUT
C	3 5/8" DIA [92] FIELD POWER SUPPLY KNOCKOUT
D	7/8" DIA [22] FIELD CONTROL WIRING HOLE
F	3/4"-14 NPT GAS CONNECTION (NOT SHOWN)
G	7/8" DIA [22] FIELD CONTROL WIRING KNOCKOUT

NOTES:
1. DIMENSIONS ARE IN INCHES. DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. CENTER OF GRAVITY
3. DIRECTION OF AIR FLOW
4. ALL VIEW DRAWN USING 3RD ANGLE



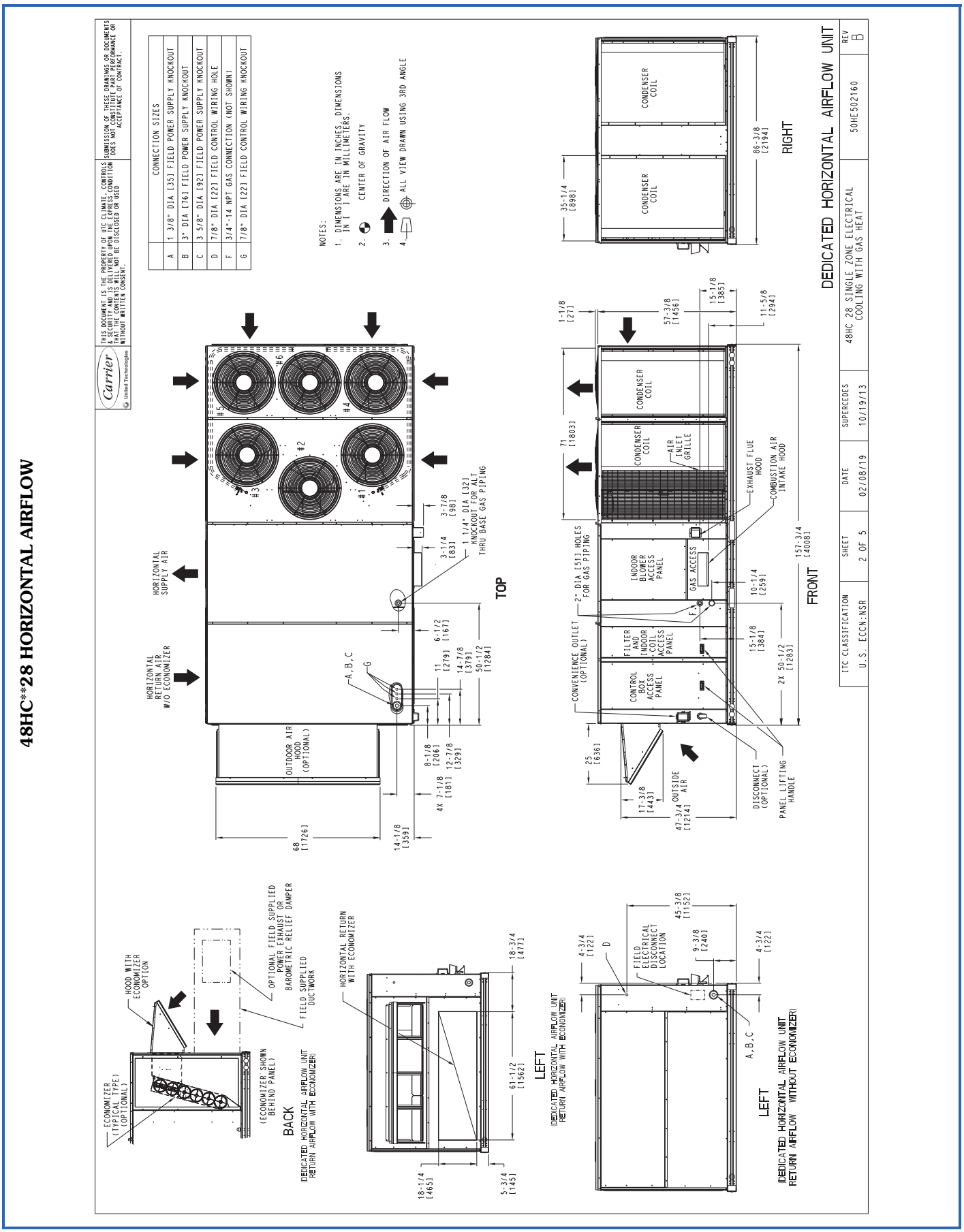




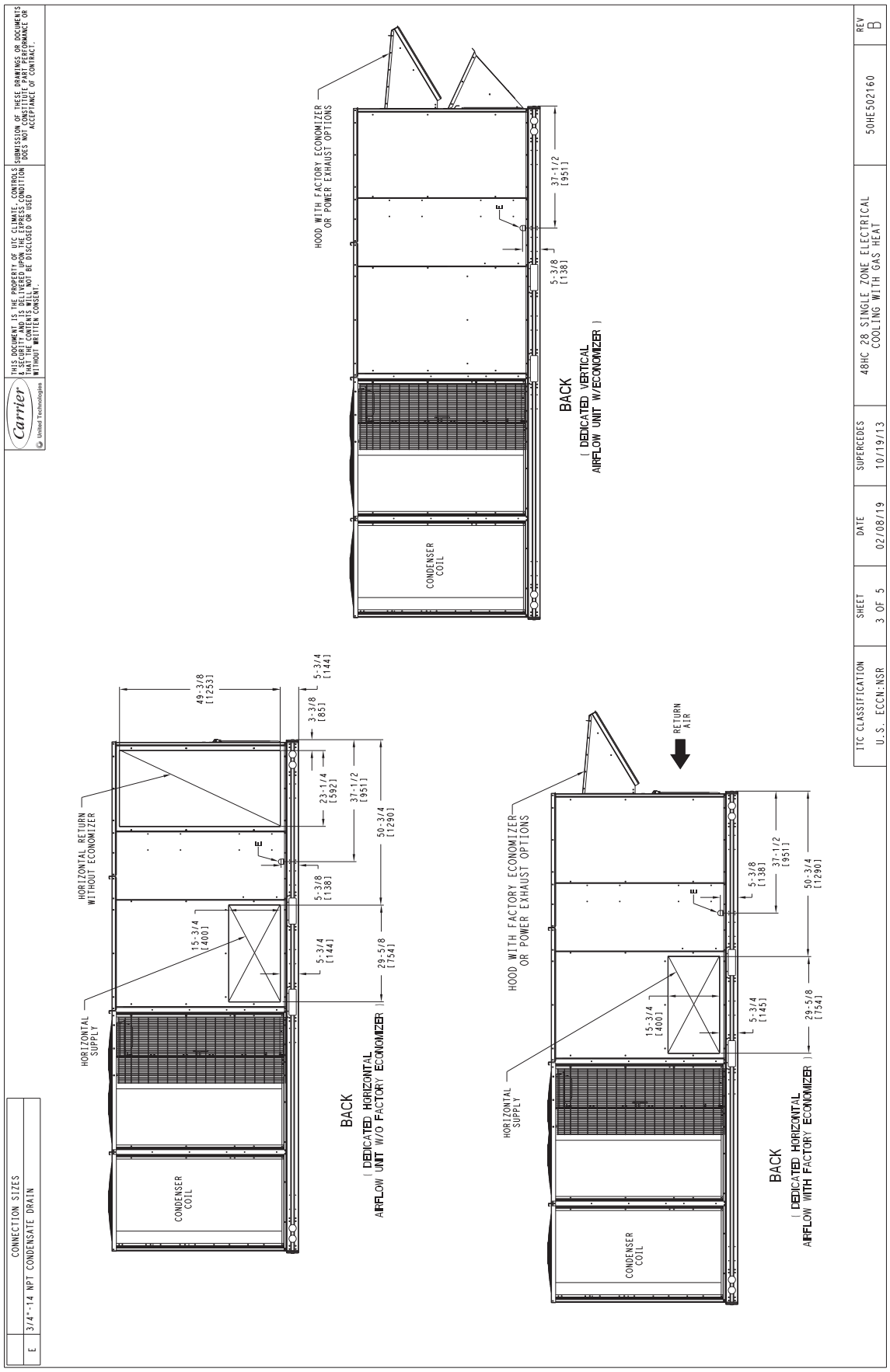
DEDICATED VERTICAL AIRFLOW UNIT

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN:NSR	1 OF 5	02/08/19	10/19/13	48HC 28 SINGLE ZONE ELECTRICAL COOLING WITH GAS HEAT	50HE502160	B

Base unit dimensions (cont)



48HC**28 BACK VIEW AND CONDENSATE DRAIN LOCATION

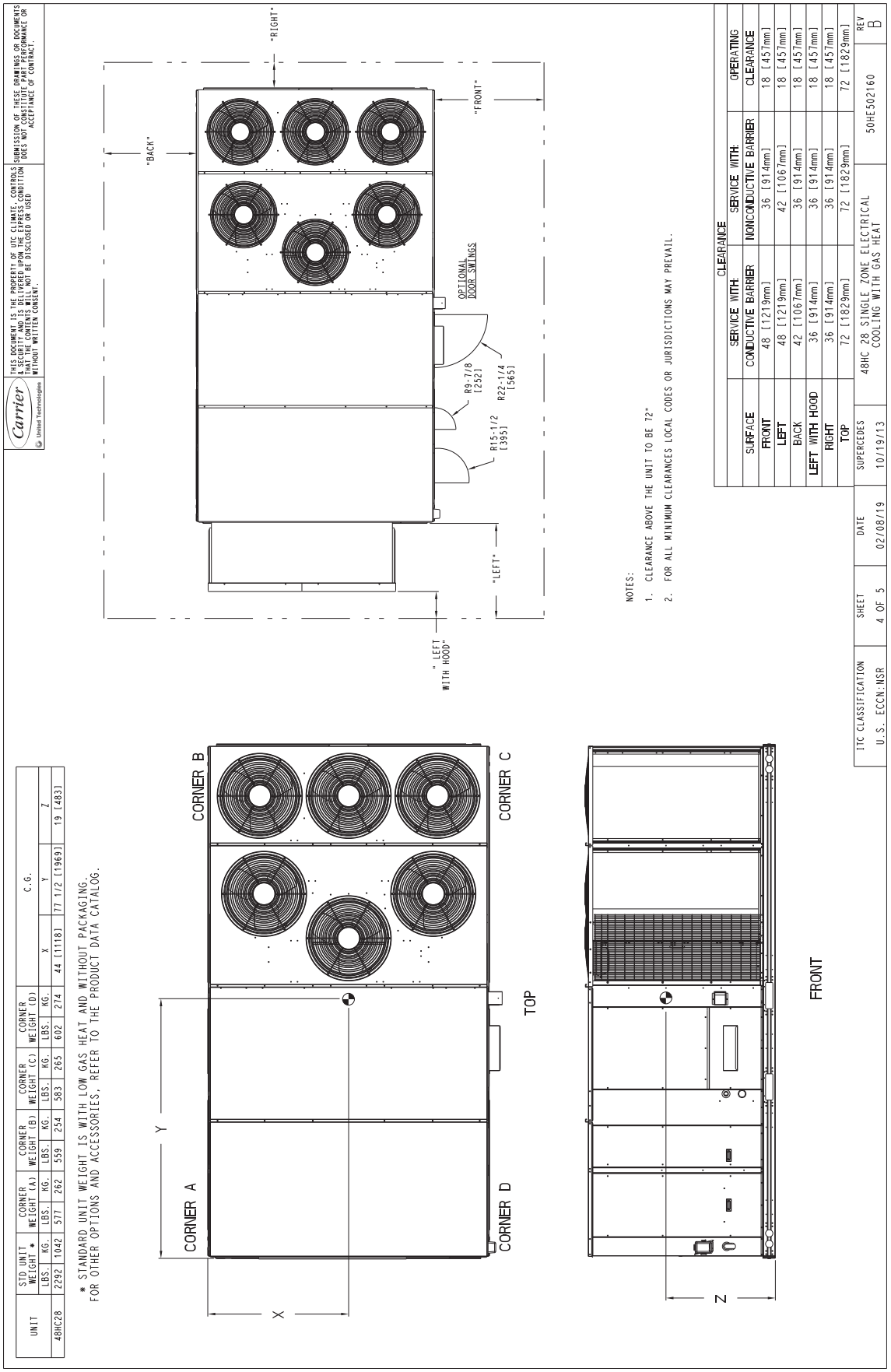


Base unit dimensions (cont)

48HC**28 CORNER WEIGHTS AND CLEARANCES

UNIT	STD UNIT WEIGHT *		CORNER WEIGHT (A)		CORNER WEIGHT (B)		CORNER WEIGHT (C)		CORNER WEIGHT (D)		C.G.		
	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	X	Y	Z
48HC28	2292	1042	577	262	559	254	583	265	602	274	44 [1118]	77 1/2 [1969]	19 [483]

* STANDARD UNIT WEIGHT IS WITH LOW GAS HEAT AND WITHOUT PACKAGING.
FOR OTHER OPTIONS AND ACCESSORIES, REFER TO THE PRODUCT DATA CATALOG.



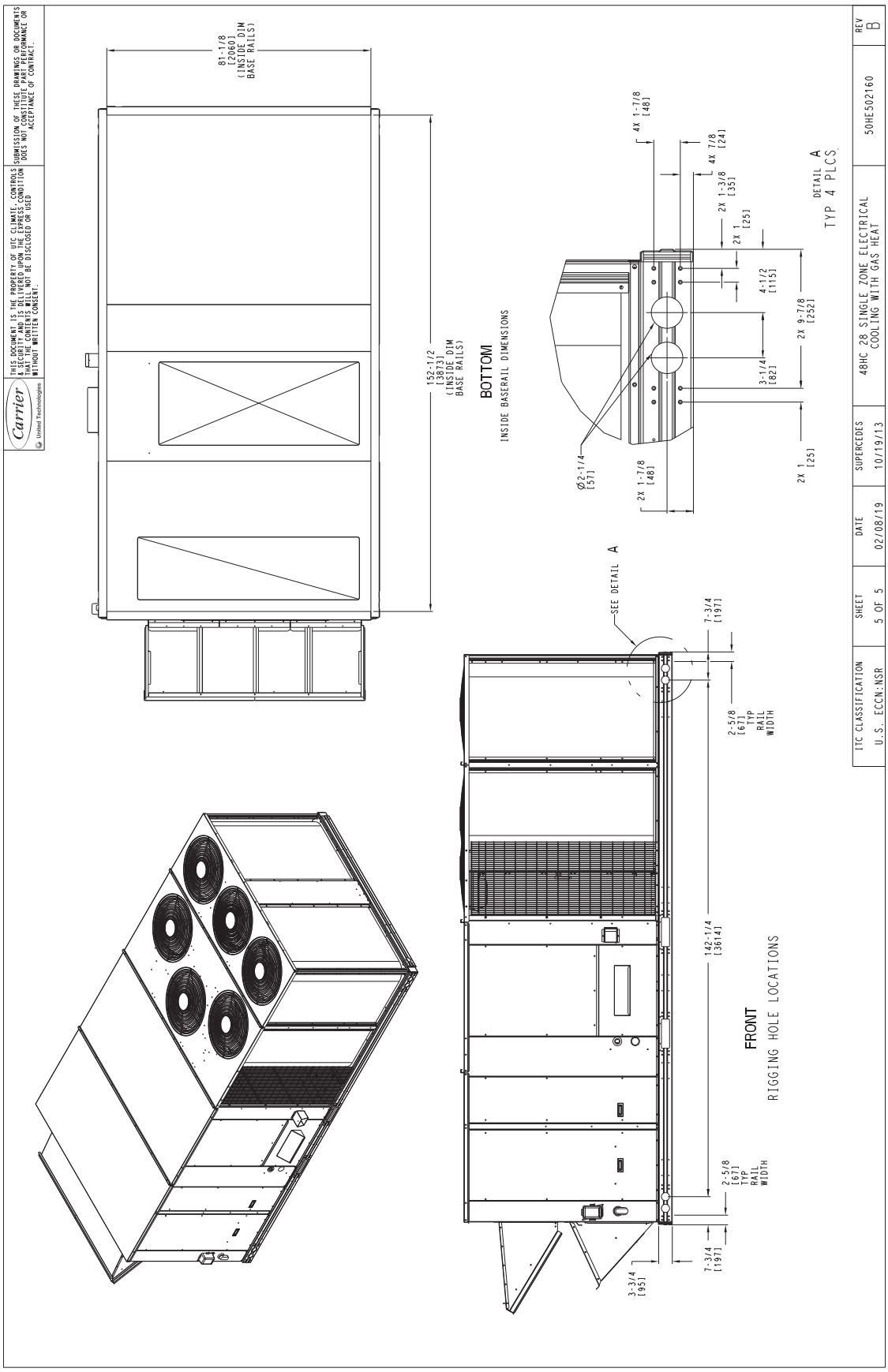
CLEARANCE		
	SERVICE WITH:	SERVICE WITH:	OPERATING
SURFACE	CONDUCTIVE BARRIER	NONCONDUCTIVE BARRIER	CLEARANCE
FRONT	48 [1219mm]	36 [914mm]	18 [457mm]
LEFT	48 [1219mm]	42 [1067mm]	18 [457mm]
BACK	42 [1067mm]	36 [914mm]	18 [457mm]
LEFT WITH HOOD	36 [914mm]	36 [914mm]	18 [457mm]
RIGHT	36 [914mm]	36 [914mm]	18 [457mm]
TOP	72 [1829mm]	72 [1829mm]	72 [1829mm]

NOTES:
1. CLEARANCE ABOVE THE UNIT TO BE 72"
2. FOR ALL MINIMUM CLEARANCES LOCAL CODES OR JURISDICTIONS MAY PREVAIL.

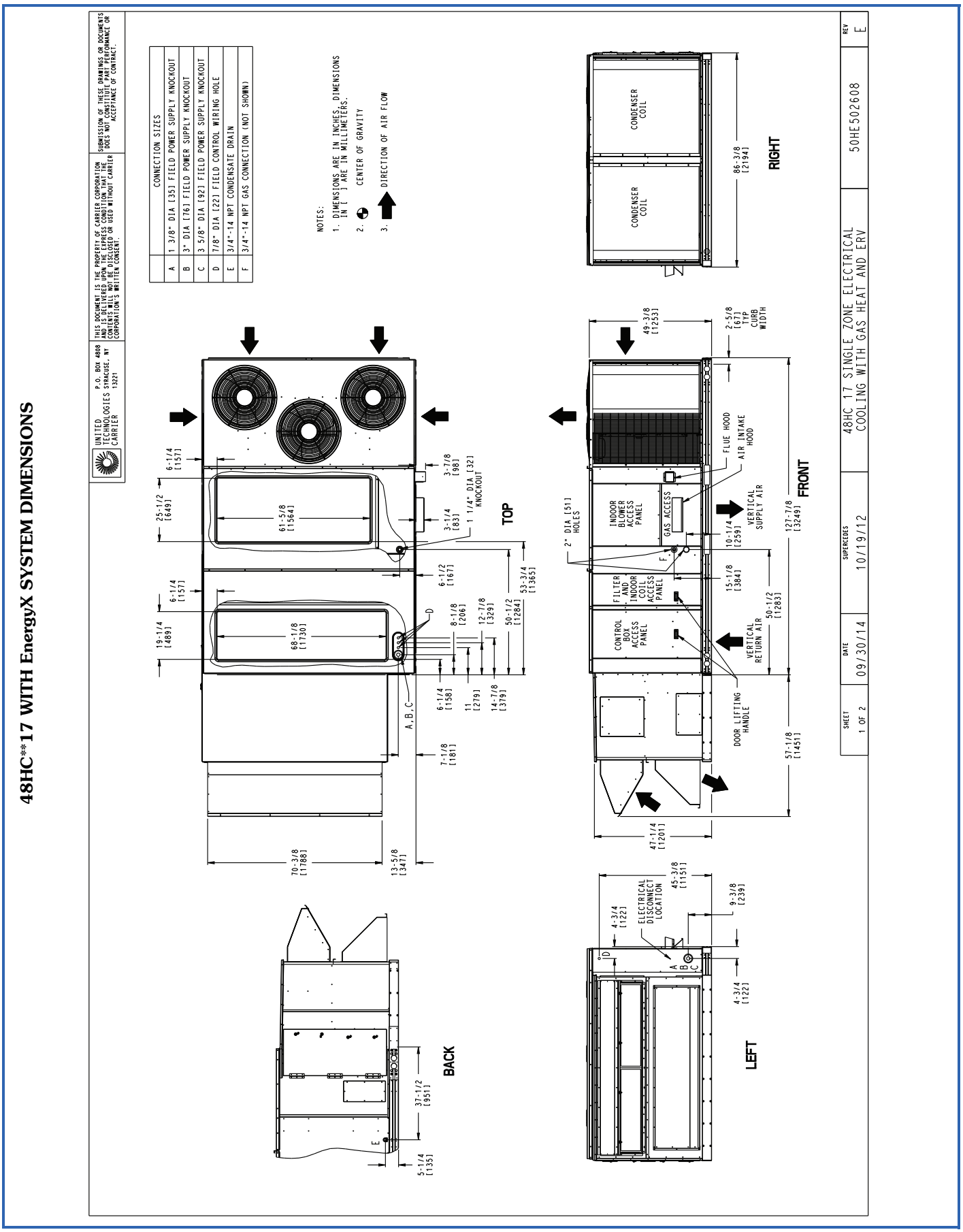
Carrier United Technologies
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SUBMISSION OF THESE DRAWINGS OR DOCUMENTS DOES NOT CONSTITUTE PART PERFORMANCE OR ACCEPTANCE OF CONTRACT.

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES	48HC 28 SINGLE ZONE ELECTRICAL COOLING WITH GAS HEAT	50HE502160	REV
U.S. ECCN:NSR	4 OF 5	02/08/13	10/19/13			B

48HC**28 BOTTOM VIEW



Base unit dimensions (cont)



48HC**17 WITH EnergyX SYSTEM CORNER WEIGHTS

UNIT	ERV **	STD UNIT WEIGHT *		CORNER WEIGHT (A)		CORNER WEIGHT (B)		CORNER WEIGHT (C)		CORNER WEIGHT (D)		C.G.		
		LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	X	Y	Z
48HC17	HIGH CFM	3330	1514	1168	531	495	225	496	226	1171	532	43 1/8 [1095]	38 [965]	16 1/2 [419]
48HC17	LOW CFM	2919	1324	954	433	551	250	518	235	896	406	41 7/8 [1063]	47 [1190]	19 1/8 [486]

* STANDARD UNIT WEIGHT IS WITH LOW GAS HEAT AND WITHOUT PACKAGING.
FOR OTHER OPTIONS AND ACCESSORIES, REFER TO THE PRODUCT DATA CATALOG.

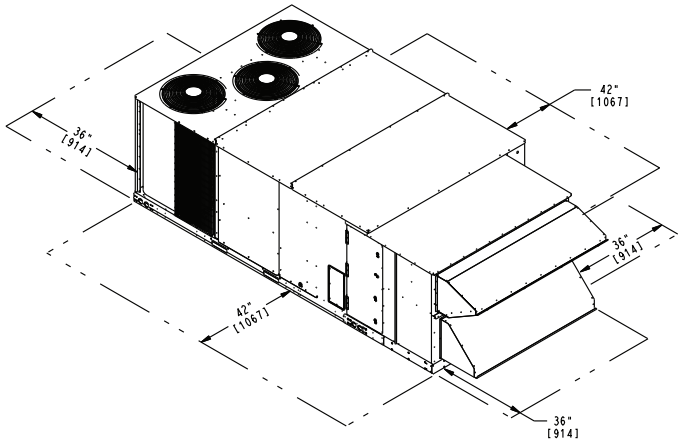
** FOR COMFORT LINK UNITS, ONLY HIGH CFM ERV IS AVAILABLE.

UNITED TECHNOLOGIES CARRIER P.O. BOX 4808 SYRACUSE, NY 13221

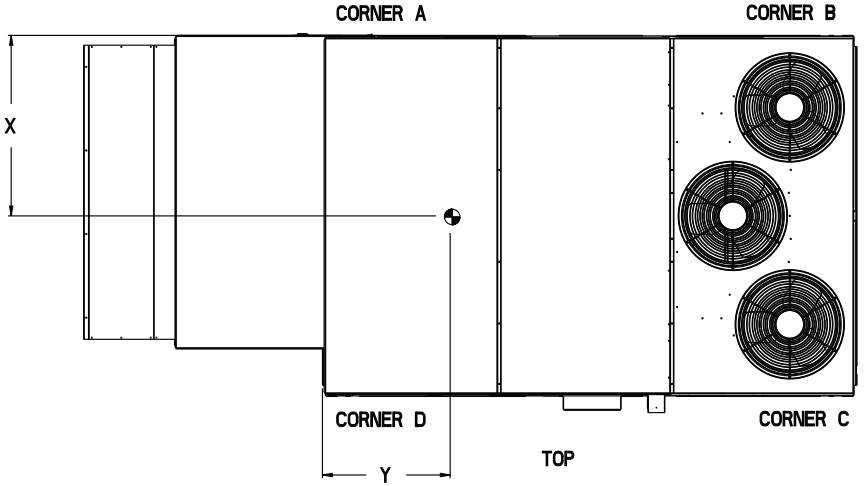
THIS DOCUMENT IS THE PROPERTY OF CARRIER CORPORATION AND IS DELIVERED UPON THE EXPRESS CONDITION THAT THE CONTENTS WILL NOT BE DISCLOSED OR USED WITHOUT CARRIER CORPORATION'S WRITTEN CONSENT.

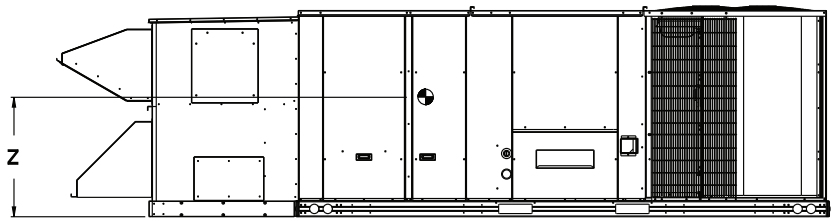
SUBMISSION OF THESE DRAWINGS OR DOCUMENTS DOES NOT CONSTITUTE PART PERFORMANCE OR ACCEPTANCE OF CONTRACT.

NOTE:
UNIT IS NOT DESIGNED TO HAVE OVERHEAD OBSTRUCTION. CONTACT APPLICATION ENGINEERING FOR GUIDANCE ON ANY APPLICATION PLANNING OVERHEAD OBSTRUCTION OF FOR VERTICAL CLEARANCES.



CLEARANCES



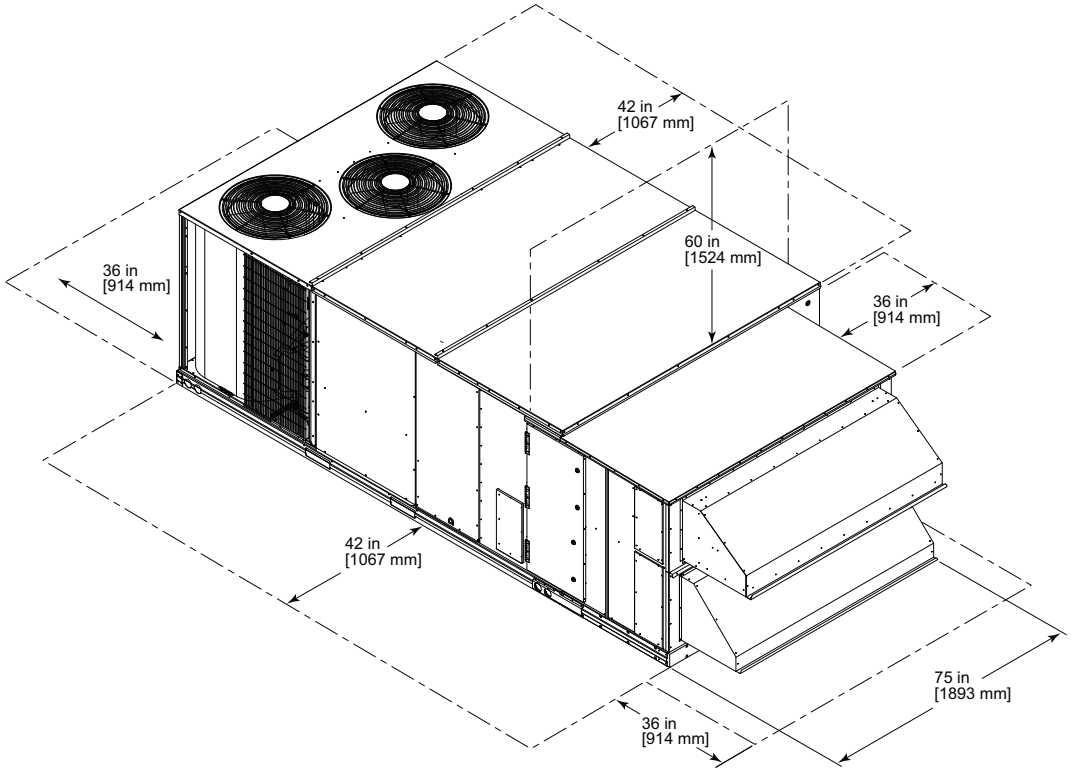


WARNING:
DO NOT LIFT UNIT THROUGH FORK LIFT OPENINGS IN UNIT BASERAIL. PER RIGGING LABEL INSTRUCTIONS, UNIT MUST BE LIFTED BY AN OVERHEAD LIFTING DEVICE

SHEET	DATE	SUPERCEDES			REV
2 OF 2	09/30/14	10/19/12	48HC 17 SINGLE ZONE ELECTRICAL COOLING WITH GAS HEAT AND ERV	50HE502608	E

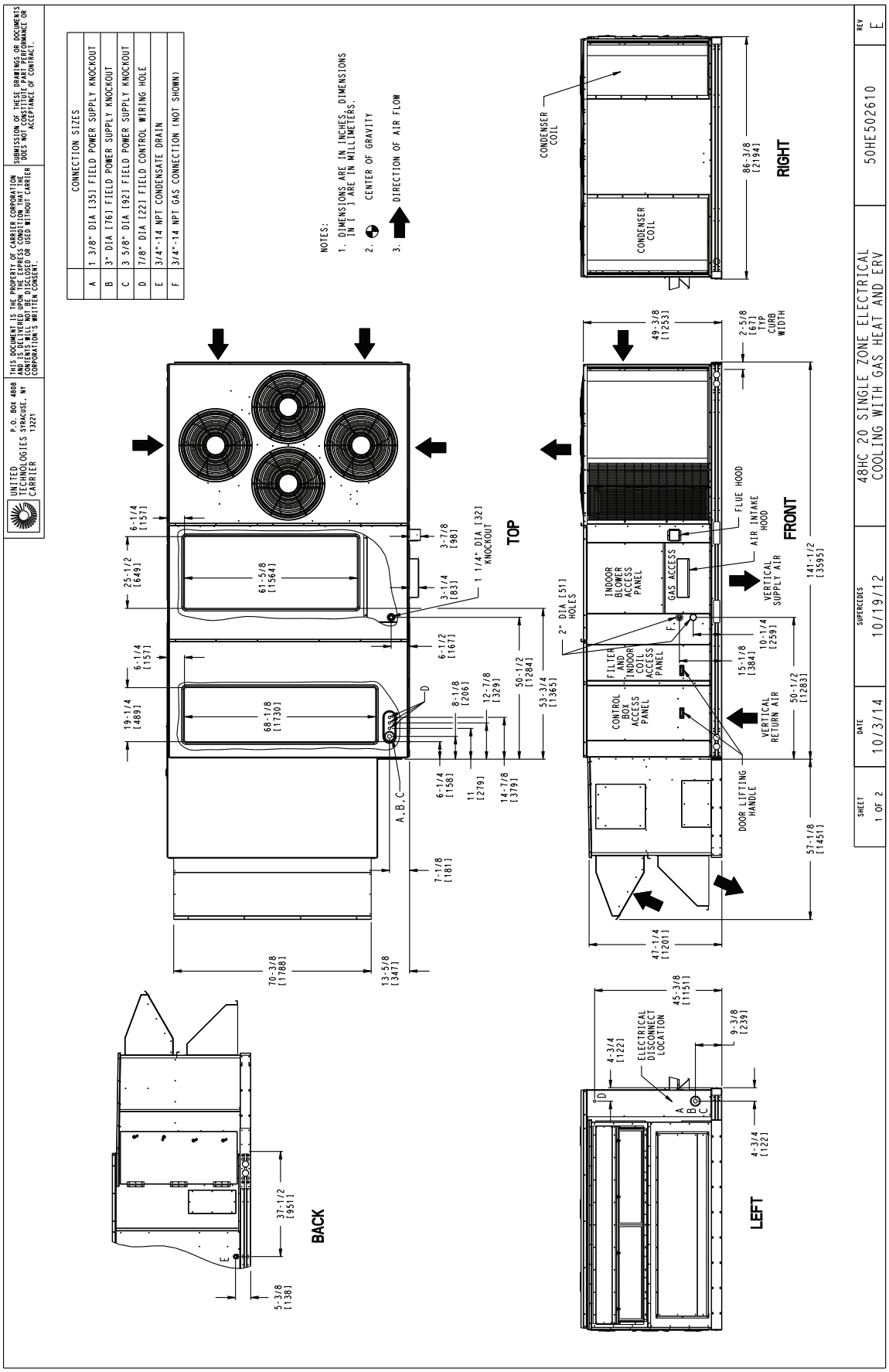
Base unit dimensions (cont)

48HC17 WITH EnergyX SYSTEM SERVICE CLEARANCES**

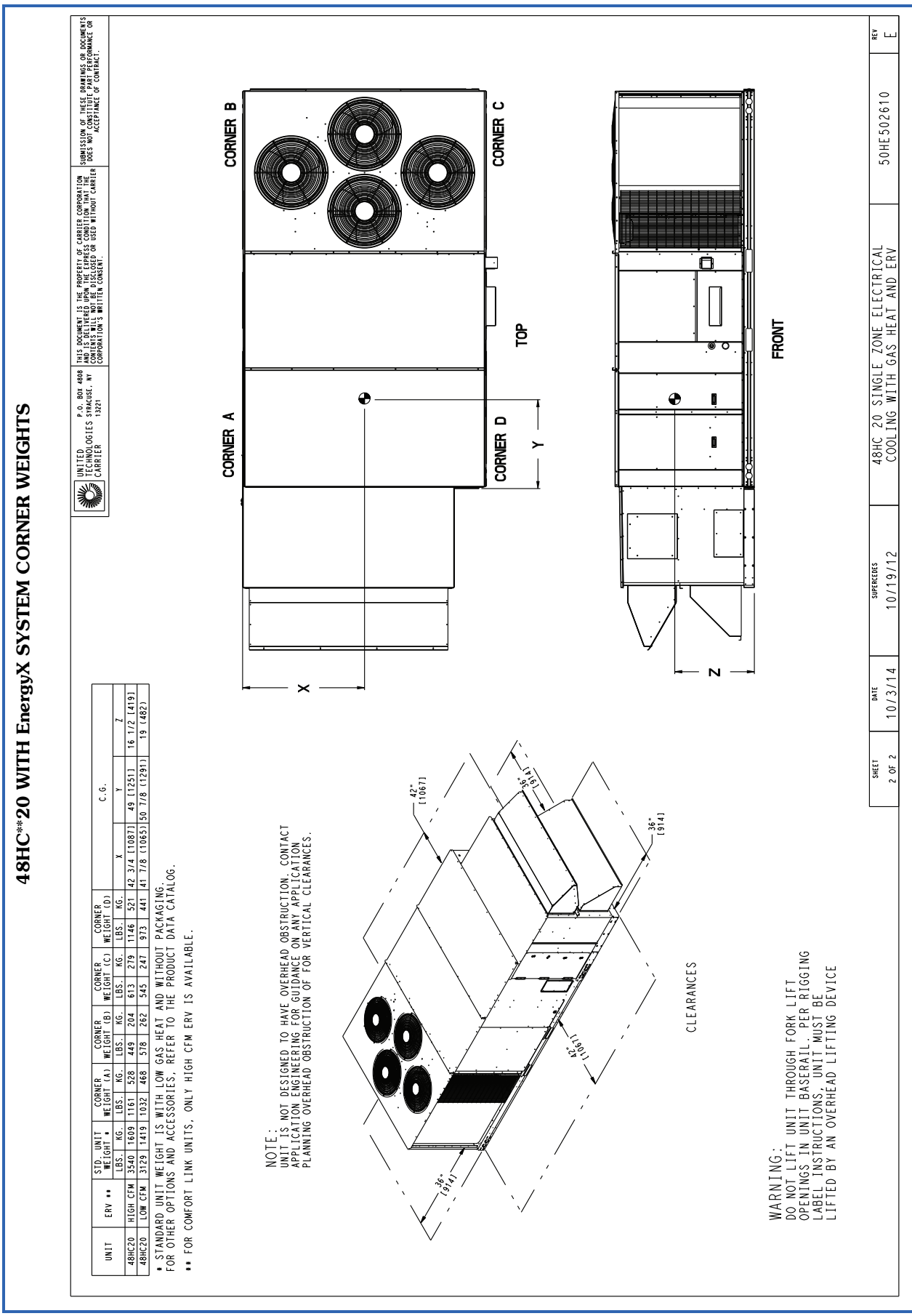


NOTE: Unit is not designed to have overhead obstruction. Contact Application Engineering for guidance on any application planning overhead obstruction or for vertical clearances.

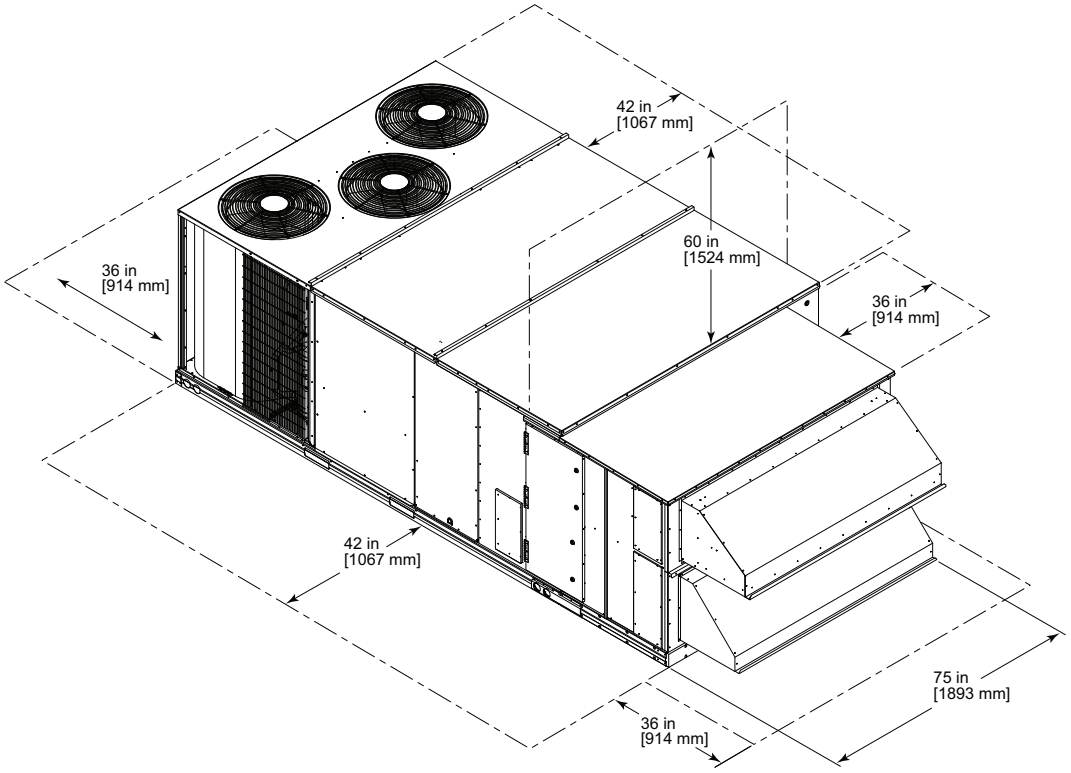
48HC**20 WITH EnergyX SYSTEM DIMENSIONS



Base unit dimensions (cont)



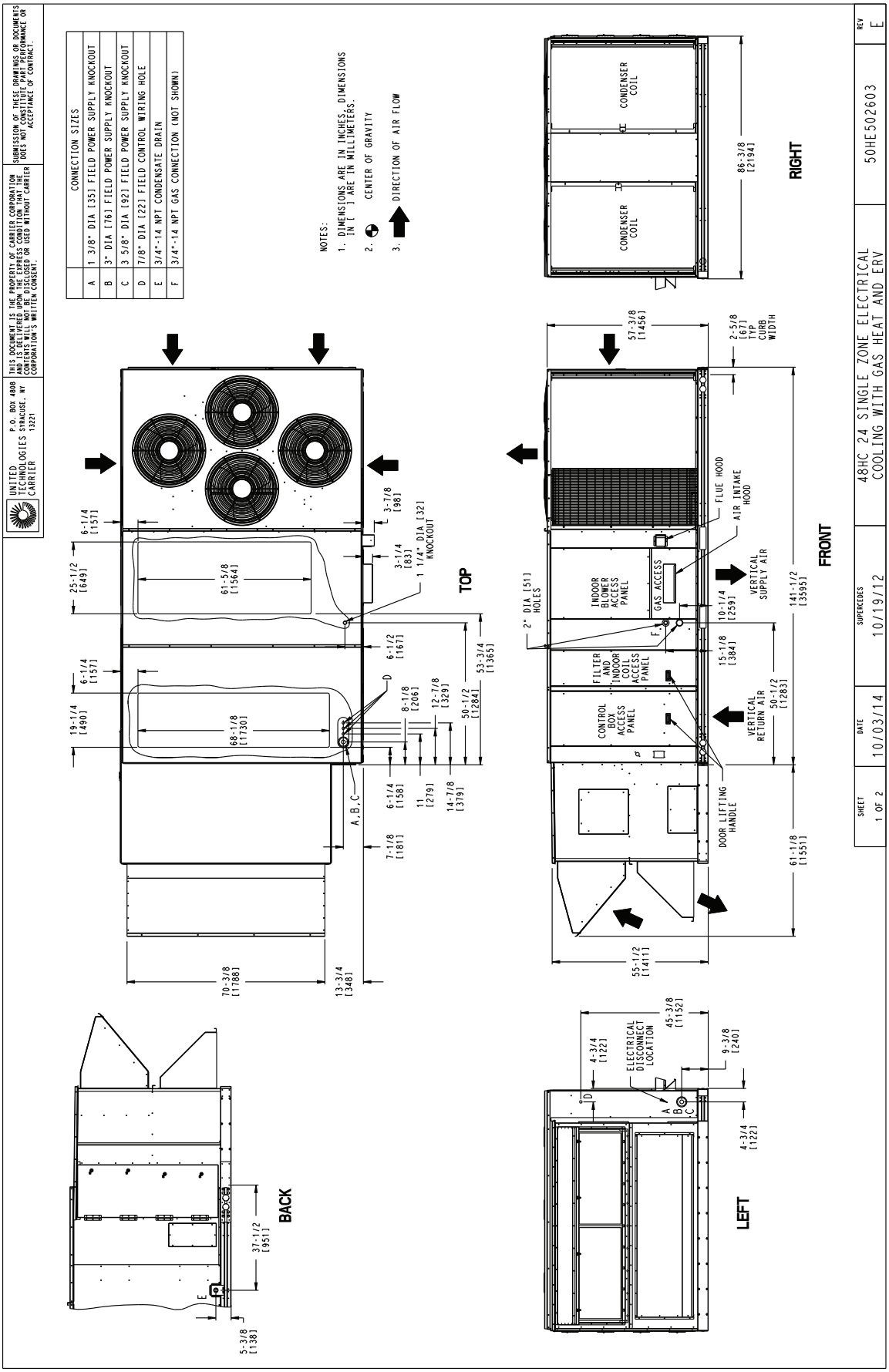
48HC**20 WITH EnergyX SYSTEM SERVICE CLEARANCES



NOTE: Unit is not designed to have overhead obstruction. Contact Application Engineering for guidance on any application planning overhead obstruction or for vertical clearances.

Base unit dimensions (cont)

48HC**24 WITH EnergyX SYSTEM DIMENSIONS



48HC**24 WITH EnergyX SYSTEM CORNER WEIGHTS

UNIT	ERV **	STD. UNIT WEIGHT *		CORNER WEIGHT (A)		CORNER WEIGHT (B)		CORNER WEIGHT (C)		CORNER WEIGHT (D)		C.G.		
		LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	X	Y	Z
48HC24	HIGH CFM	3895	1770	1358	617	582	264	586	267	1369	622	43 1/4 [1099]	42 3/8 [1076]	19 [483]
48HC24	LOW CFM	3542	1607	1189	539	633	287	587	266	1103	500	41 5/8 [1056]	49 1/8 [1249]	20 3/4 [529]

* STANDARD UNIT WEIGHT IS WITH LOW GAS HEAT AND WITHOUT PACKAGING.
FOR OTHER OPTIONS AND ACCESSORIES, REFER TO THE PRODUCT DATA CATALOG.

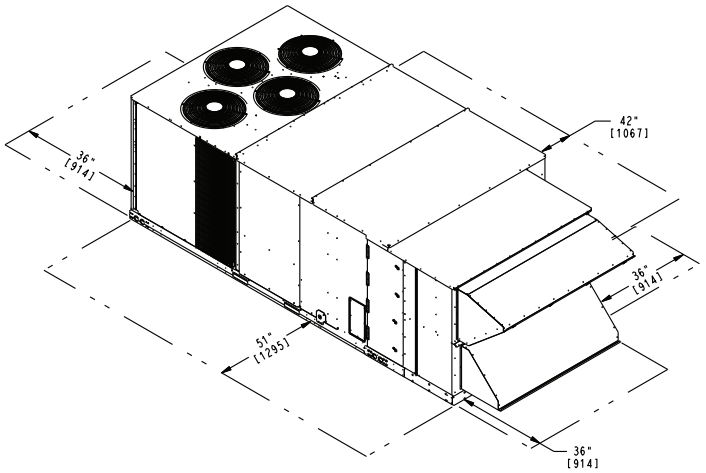
** FOR COMFORT LINK UNITS, ONLY HIGH CFM ERV IS AVAILABLE.

UNITED TECHNOLOGIES CARRIER P.O. BOX 4808 SYRACUSE, NY 13221

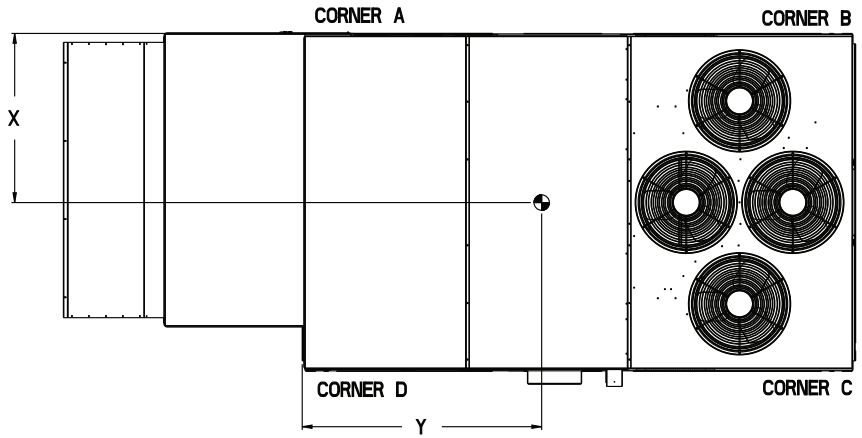
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SUBMISSION OF THESE DRAWINGS OR DOCUMENTS DOES NOT CONSTITUTE PART PERFORMANCE OR ACCEPTANCE OF CONTRACT.

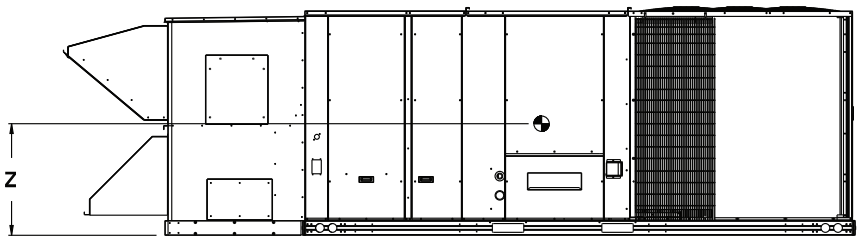
NOTE:
UNIT IS NOT DESIGNED TO HAVE OVERHEAD OBSTRUCTION. CONTACT APPLICATION ENGINEERING FOR GUIDANCE ON ANY APPLICATION PLANNING OVERHEAD OBSTRUCTION OF FOR VERTICAL CLEARANCES.



CLEARANCES



TOP



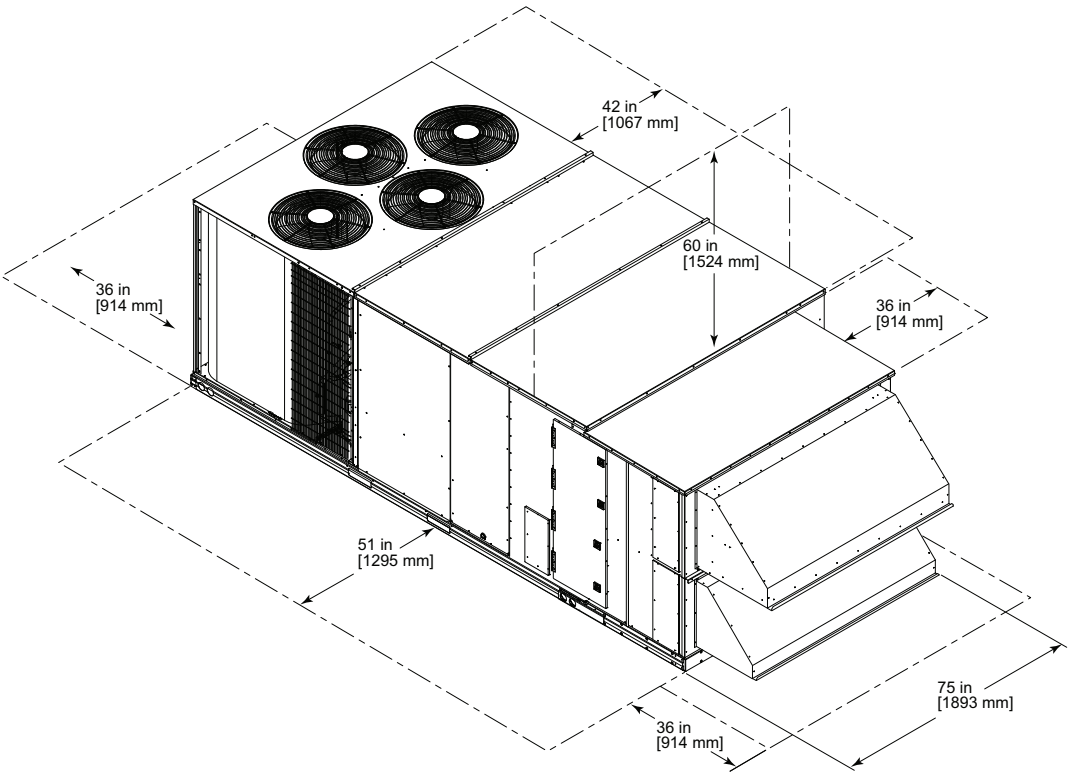
FRONT

WARNING:
DO NOT LIFT UNIT THROUGH FORK LIFT OPENINGS IN UNIT BASERAIL. PER RIGGING LABEL INSTRUCTIONS, UNIT MUST BE LIFTED BY AN OVERHEAD LIFTING DEVICE

SHEET	DATE	SUPERCEDES			REV
2 OF 2	10/03/14	10/19/12	48HC 24 SINGLE ZONE ELECTRICAL COOLING WITH GAS HEAT AND ERV	50HE502603	E

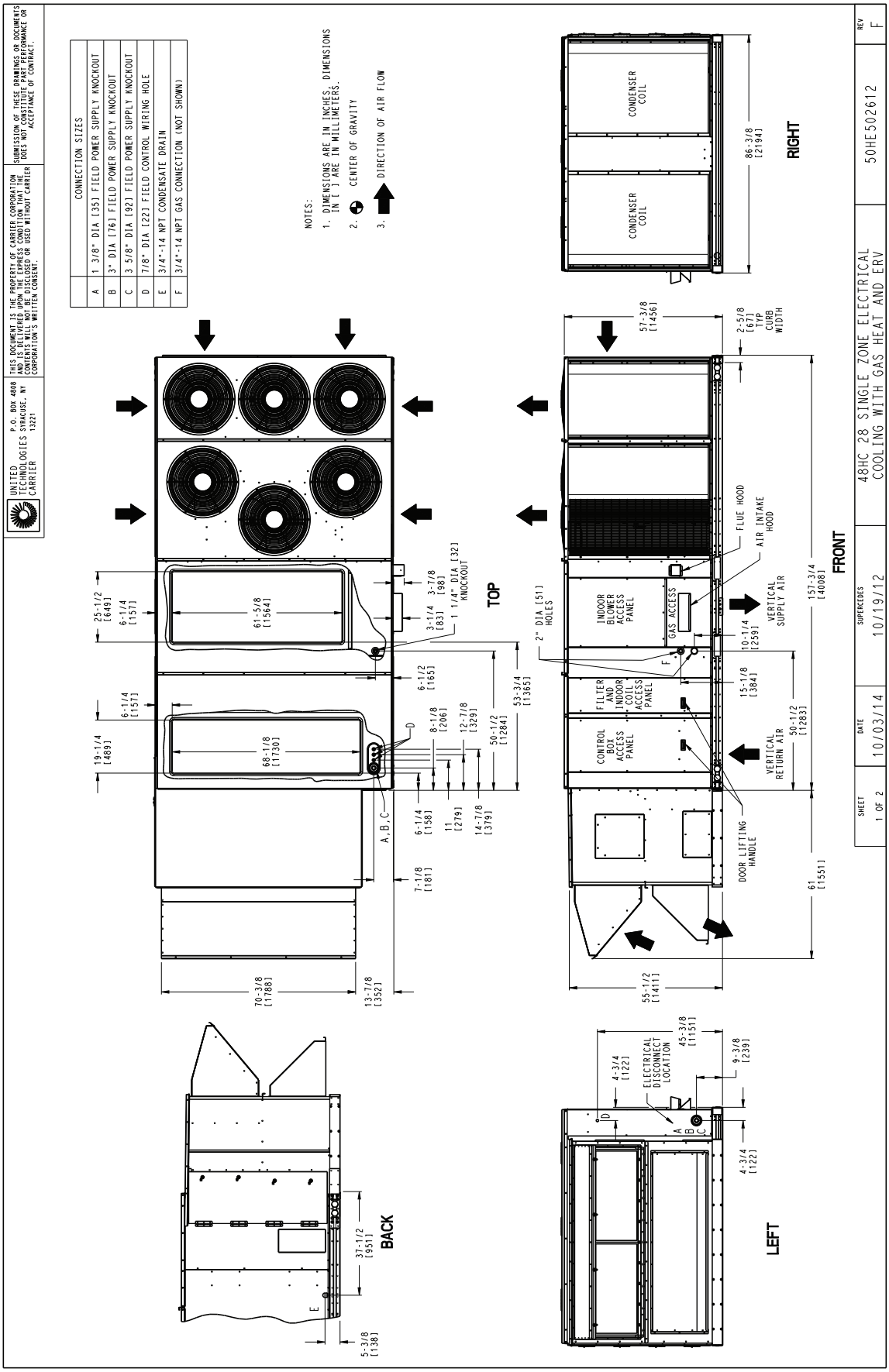
Base unit dimensions (cont)

48HC24 WITH EnergyX SYSTEM SERVICE CLEARANCES**



NOTE: Unit not designed to have overhead obstruction. Contact Application Engineering for guidance on any application planning overhead obstruction or for vertical clearances.

48HC**28 WITH EnergyX SYSTEM DIMENSIONS



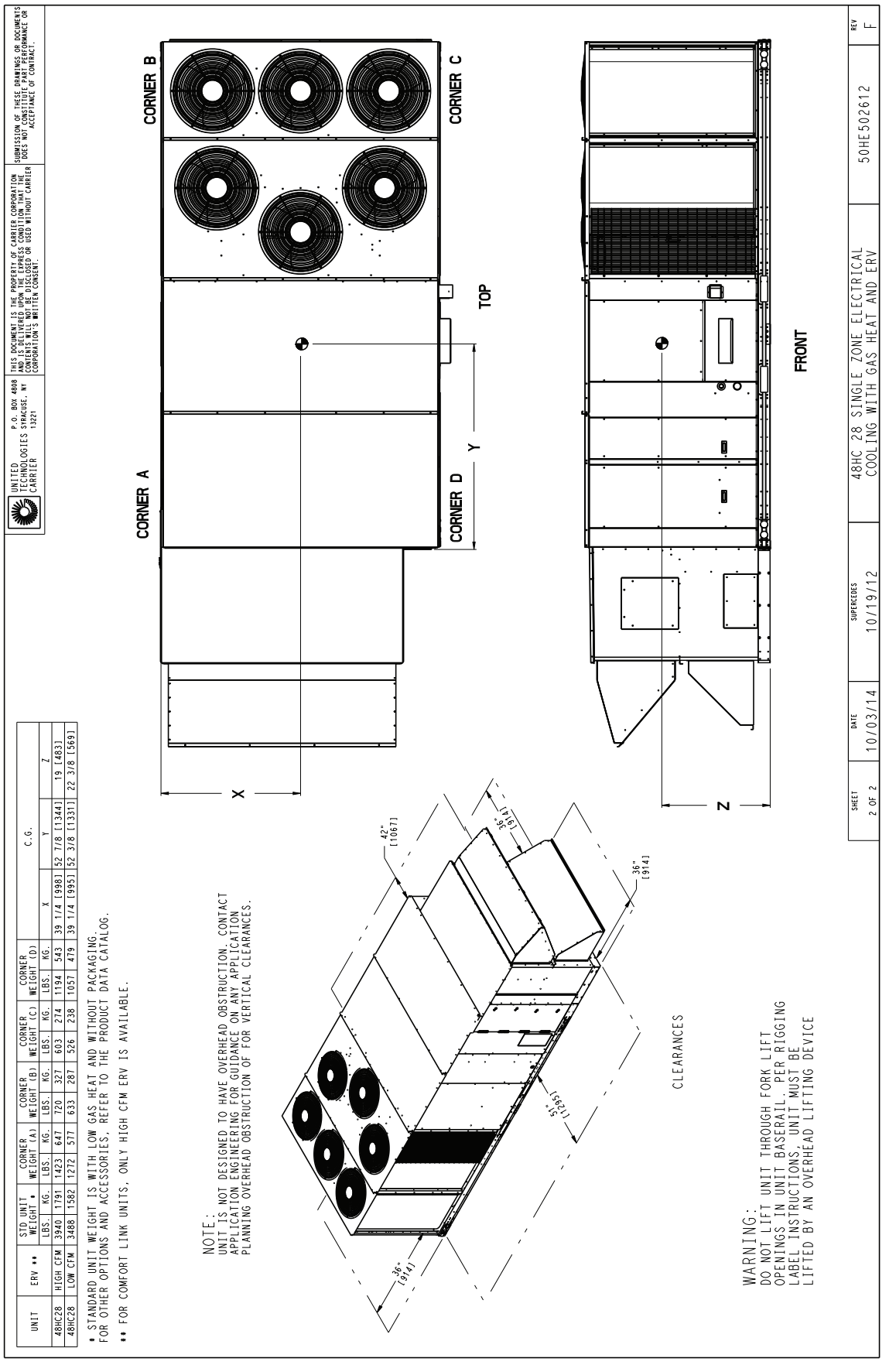
Base unit dimensions (cont)

48HC**28 WITH EnergyX SYSTEM CORNER WEIGHTS

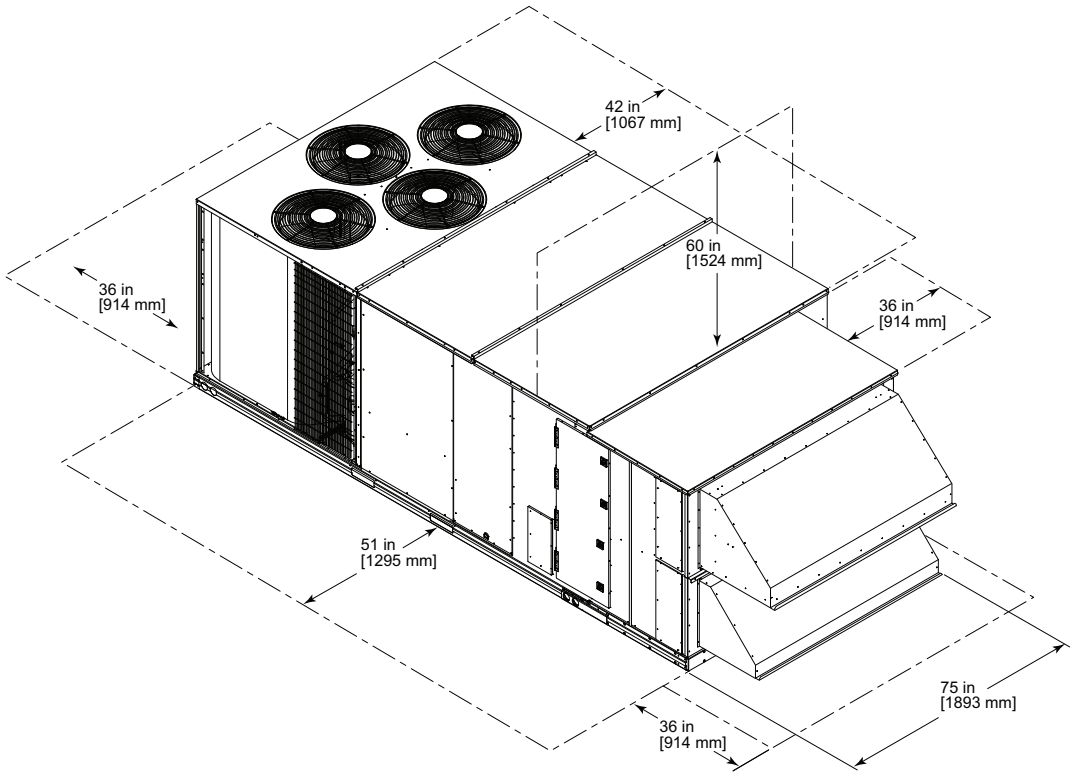
UNIT	ERV **	STD UNIT WEIGHT *		CORNER WEIGHT (A)		CORNER WEIGHT (B)		CORNER WEIGHT (C)		CORNER WEIGHT (D)		C.G.			
		LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	X		Y	Z
48HC28	HIGH CFM	3440	1791	1423	647	720	327	603	274	1194	543	39 1/4	[998]	52 7/8 [1344]	19 [483]
48HC28	LOW CFM	3488	1582	1272	577	633	287	526	238	1057	479	39 1/4	[995]	52 3/8 [1331]	22 3/8 [569]

* STANDARD UNIT WEIGHT IS WITH LOW GAS HEAT AND WITHOUT PACKAGING.
FOR OTHER OPTIONS AND ACCESSORIES, REFER TO THE PRODUCT DATA CATALOG.

** FOR COMFORT LINK UNITS, ONLY HIGH CFM ERV IS AVAILABLE.



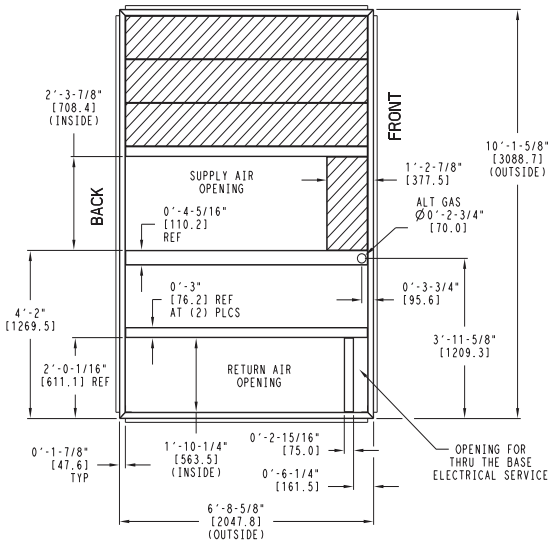
48HC**28 WITH EnergyX SYSTEM SERVICE CLEARANCES



NOTE: Unit not designed to have overhead obstruction. Contact Application Engineering for guidance on any application planning overhead obstruction or for vertical clearances.

Accessory dimensions

48HC**17 — ROOF CURB DIMENSIONS



UNIT SIZE	"A"	ROOF CURB ACCESSORY
17	1′-2" [356.0] 2′-0" [610.0]	CRRFCURB045A00 CRRFCURB046A00

NOTES:

1 ROOF CURB ACCESSORY IS SHIPPED UNASSEMBLED.

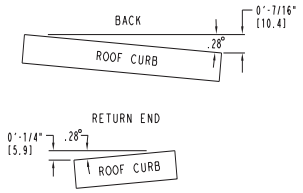
2 DIMENSIONS IN [ ] ARE IN MILLIMETERS.

3 ROOF CURB GALVANIZED STEEL.

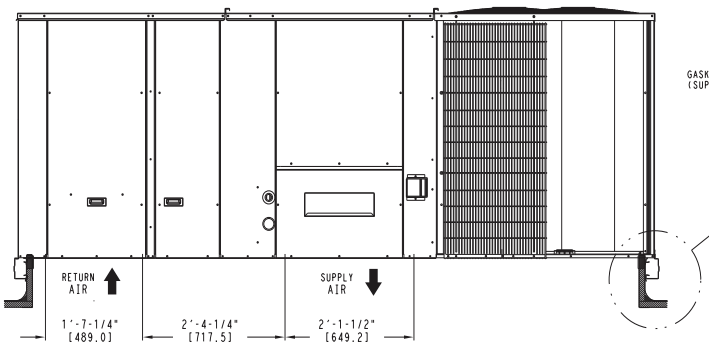
4 ATTACH DUCTWORK TO CURB (FLANGES ON DUCT REST ON CURB)

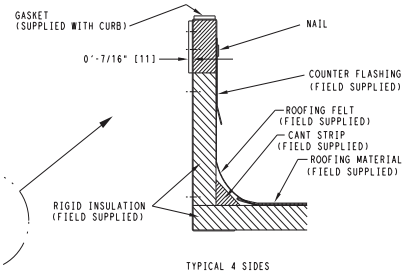
5 SERVICE CLEARANCE 4 ft ON EACH SIDE

DIRECTION OF AIR FLOW

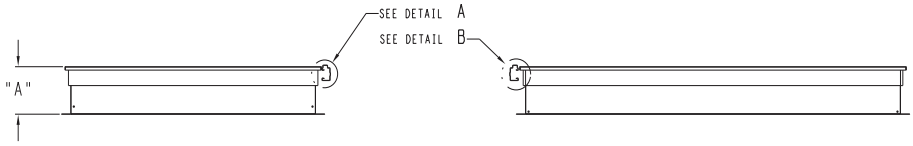


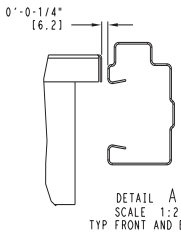
MAX CURB LEVELING TOLERANCES



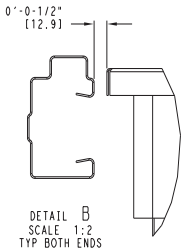


TYPICAL 4 SIDES

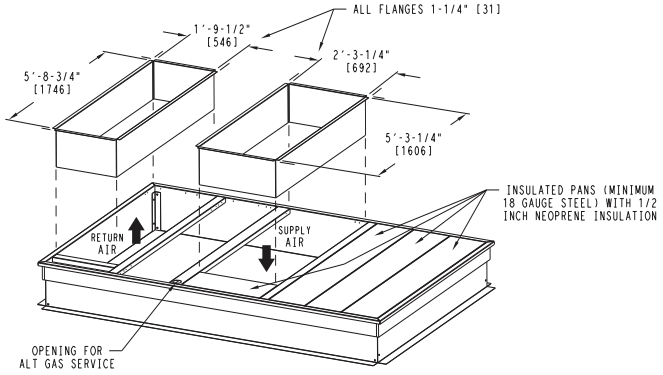




DETAIL A
SCALE 1:2
TYP FRONT AND BACK



DETAIL B
SCALE 1:2
TYP BOTH ENDS



48HC**20, 24 — ROOF CURB DIMENSIONS

UNIT SIZE	"A"	ROOF CURB ACCESSORY
20, 24	1′-2" [356.0] 2′-0" [610.0]	CRRFCURB047A00 CRRFCURB048A00

NOTES:

1 ROOF CURB ACCESSORY IS SHIPPED UNASSEMBLED.

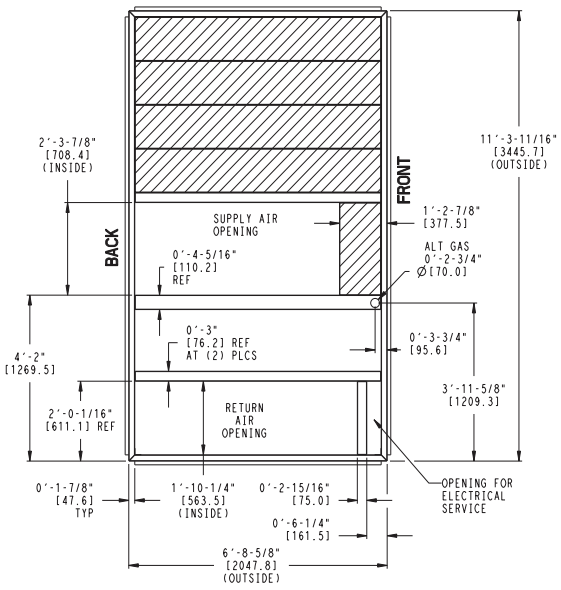
2 DIMENSIONS IN [ ] ARE IN MILLIMETERS.

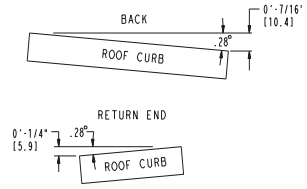
3 ROOF CURB GALVANIZED STEEL.

4 ATTACH DUCTWORK TO CURB (FLANGES ON DUCT REST ON CURB)

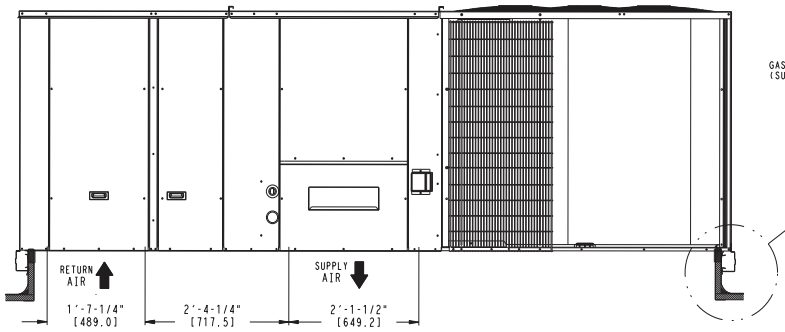
5 SERVICE CLEARANCE 4 ft ON EACH SIDE

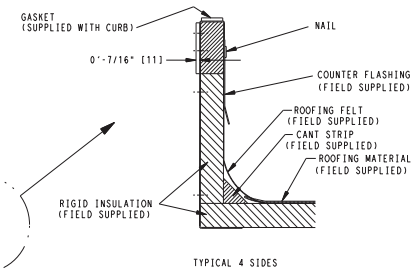
DIRECTION OF AIR FLOW



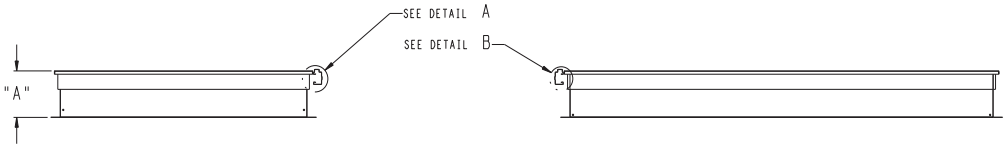


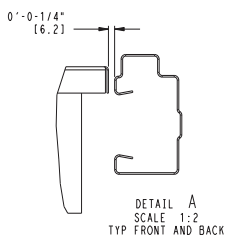
MAX CURB LEVELING TOLERANCES



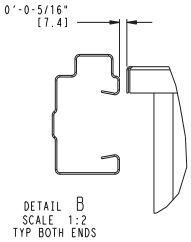


TYPICAL 4 SIDES

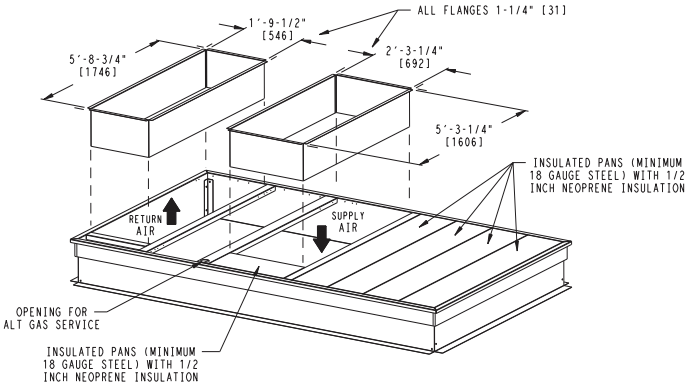




DETAIL A
SCALE 1:2
TYP FRONT AND BACK



DETAIL B
SCALE 1:2
TYP BOTH ENDS



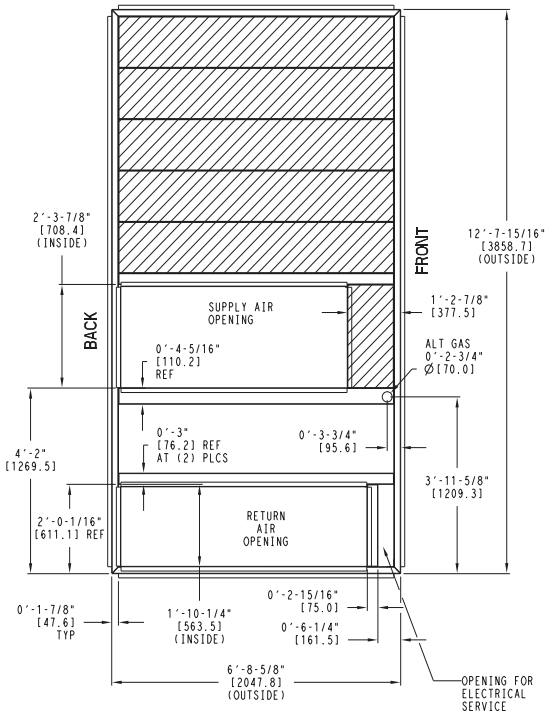
Accessory dimensions (cont)

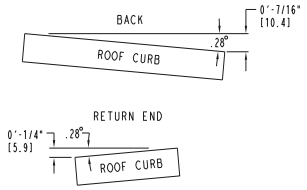
48HC**28 — ROOF CURB DIMENSIONS

UNIT SIZE	"A"	ROOF CURB ACCESSORY
28	1′-2" [356.0] 2′-0" [610.0]	CRRFCURB049A00 CRRFCURB050A00

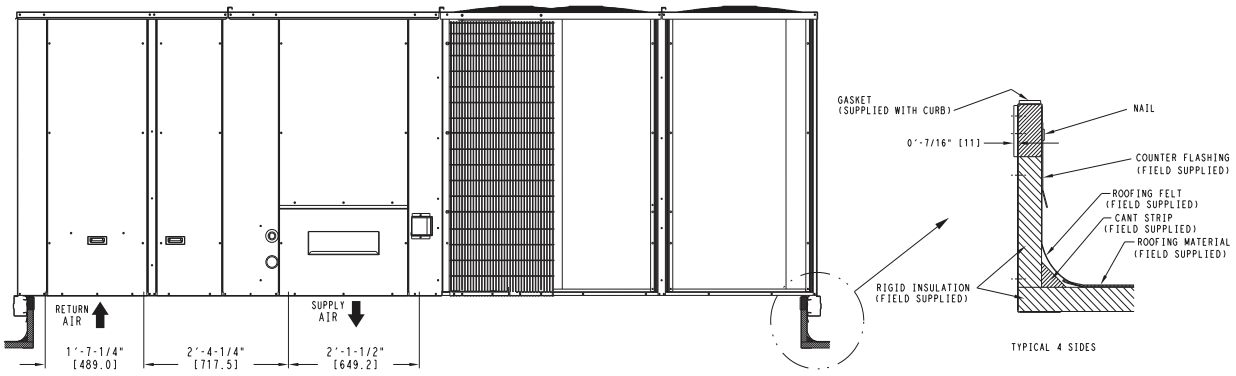
NOTES:
1 ROOF CURB ACCESSORY IS SHIPPED UNASSEMBLED.
2 BOLT HEADS TO BE ON INSIDE OF FLANGE. CLEARANCE IS [11] 0-0-7/16" TYP ALL CORNERS.
3 DIMENSIONS IN [ ] ARE IN MILLIMETERS.
4 ROOF CURB GALVANIZED STEEL.
5 ATTACH DUCTWORK TO CURB (FLANGES ON DUCT REST ON CURB)
6 SERVICE CLEARANCE 4 ft ON EACH SIDE
7 GAS SERVICE PLATE IS PART OF A SEPARATELY SHIPPED ACCESSORY PACKAGE.
8 GAS SERVICE PLATE CAN BE USED WITH EITHER ACCESSORY ROOFCURB.

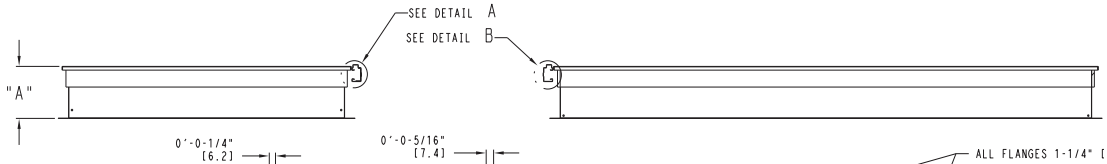
➡ DIRECTION OF AIR FLOW

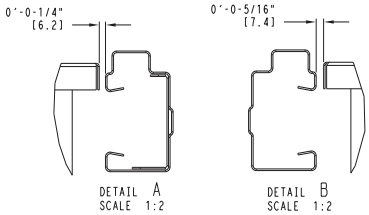


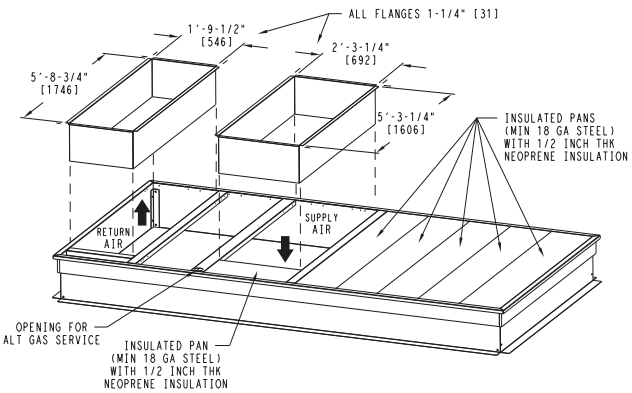


MAX CURB LEVELING TOLERANCES









Performance data

48HC*D17 — 15 TON — COOLING CAPACITIES

48HC17				AMBIENT TEMPERATURE (F)															
				85			95			105			115			125			
				EAT (db)			EAT (db)			EAT (db)			EAT (db)			EAT (db)			
				75	80	85	75	80	85	75	80	85	75	80	85	75	80	85	
4500 Cfm	EAT (wb)	58	THC	158.3	158.3	179.2	152.6	152.6	172.9	146.6	146.6	166.1	140.2	140.2	158.8	133.2	133.2	150.8	
			SHC	137.3	158.3	179.2	132.4	152.6	172.9	127.2	146.6	166.1	121.6	140.2	158.8	115.5	133.2	150.8	
		62	THC	166.8	166.8	169.0	159.5	159.5	165.6	151.8	151.8	161.9	143.6	143.6	157.9	134.9	134.9	153.4	
			SHC	123.1	146.1	169.0	119.7	142.6	165.6	116.1	139.0	161.9	112.3	135.1	157.9	108.2	130.8	153.4	
		67	THC	182.9	182.9	182.9	174.9	174.9	174.9	166.3	166.3	166.3	157.2	157.2	157.2	147.6	147.6	147.6	
			SHC	100.0	123.1	146.1	96.7	119.8	142.8	93.2	116.3	139.4	89.7	112.7	135.7	85.9	108.9	131.9	
		72	THC	200.5	200.5	200.5	191.6	191.6	191.6	182.2	182.2	182.2	172.2	172.2	172.2	161.7	161.7	161.7	
			SHC	76.1	99.5	122.8	72.9	96.2	119.5	69.5	92.8	116.1	66.0	89.3	112.5	62.4	85.6	108.8	
		76	THC	—	215.4	215.4	—	205.8	205.8	—	195.6	195.6	—	184.8	184.8	—	173.6	173.6	
			SHC	—	80.2	105.0	—	77.1	101.7	—	73.7	98.2	—	70.2	94.5	—	66.7	90.7	
5250 Cfm	EAT (wb)	58	THC	166.7	166.7	188.8	160.6	160.6	181.9	154.0	154.0	174.4	147.0	147.0	166.5	139.5	139.5	157.9	
			SHC	144.6	166.7	188.8	139.3	160.6	181.9	133.6	154.0	174.4	127.6	147.0	166.5	121.0	139.5	157.9	
		62	THC	172.0	172.0	185.1	164.3	164.3	181.2	156.3	156.3	177.0	147.8	147.8	172.4	139.6	139.6	164.3	
			SHC	132.5	158.8	185.1	128.9	155.1	181.2	125.0	151.0	177.0	120.9	146.6	172.4	114.9	139.6	164.3	
		67	THC	188.3	188.3	188.3	179.7	179.7	179.7	170.7	170.7	170.7	161.0	161.0	161.0	150.9	150.9	150.9	
			SHC	106.1	132.7	159.3	102.8	129.3	155.9	99.3	125.8	152.4	95.6	122.1	148.6	91.7	118.2	144.7	
		72	THC	206.1	206.1	206.1	196.7	196.7	196.7	186.7	186.7	186.7	176.2	176.2	176.2	165.3	165.3	165.3	
			SHC	78.8	105.6	132.5	75.5	102.3	129.1	72.1	98.8	125.6	68.5	95.2	121.9	64.8	91.4	118.0	
		76	THC	—	221.2	221.2	—	211.0	211.0	—	200.3	200.3	—	189.0	189.0	—	177.2	177.2	
			SHC	—	83.6	111.7	—	80.3	108.2	—	76.9	104.6	—	73.3	100.9	—	69.7	97.1	
6000 Cfm	EAT (wb)	58	THC	173.8	173.8	196.8	167.2	167.2	189.4	160.2	160.2	181.4	152.7	152.7	173.0	144.7	144.7	163.8	
			SHC	150.8	173.8	196.8	145.1	167.2	189.4	139.0	160.2	181.4	132.5	152.7	173.0	125.5	144.7	163.8	
		62	THC	176.3	176.3	199.5	168.5	168.5	194.9	160.5	160.5	188.9	152.9	152.9	179.9	144.8	144.8	170.4	
			SHC	140.9	170.2	199.5	136.9	165.9	194.9	132.1	160.5	188.9	125.8	152.9	179.9	119.2	144.8	170.4	
		67	THC	192.3	192.3	192.3	183.4	183.4	183.4	173.9	173.9	173.9	164.0	164.0	164.0	153.4	153.4	156.9	
			SHC	112.0	142.0	172.0	108.5	138.5	168.5	104.9	134.9	164.8	101.2	131.1	161.0	97.2	127.1	156.9	
		72	THC	210.4	210.4	210.4	200.6	200.6	200.6	190.2	190.2	190.2	179.3	179.3	179.3	167.9	167.9	167.9	
			SHC	81.2	111.4	141.7	77.9	108.0	138.2	74.4	104.5	134.6	70.7	100.8	130.8	67.0	96.9	126.9	
		76	THC	—	225.6	225.6	—	215.0	215.0	—	203.8	203.8	—	192.1	192.1	—	180.0	180.0	
			SHC	—	86.7	117.9	—	83.3	114.5	—	79.9	110.8	—	76.3	107.1	—	72.6	103.2	
6750 Cfm	EAT (wb)	58	THC	179.8	179.8	203.7	172.9	172.9	195.8	165.5	165.5	187.4	157.5	157.5	178.4	149.0	149.0	168.8	
			SHC	156.0	179.8	203.7	150.0	172.9	195.8	143.5	165.5	187.4	136.7	157.5	178.4	129.3	149.0	168.8	
		62	THC	180.5	180.5	210.7	173.0	173.0	203.6	165.6	165.6	194.9	157.7	157.7	185.5	149.1	149.1	175.5	
			SHC	147.6	179.2	210.7	142.4	173.0	203.6	136.3	165.6	194.9	129.8	157.7	185.5	122.8	149.1	175.5	
		67	THC	195.6	195.6	195.6	186.2	186.2	186.2	176.5	176.5	176.8	166.2	166.2	172.7	155.4	155.4	168.4	
			SHC	117.5	150.8	184.1	114.0	147.3	180.5	110.4	143.6	176.8	106.5	139.6	172.7	102.4	135.4	168.4	
		72	THC	213.8	213.8	213.8	203.6	203.6	203.6	192.9	192.9	192.9	181.6	181.6	181.6	169.9	169.9	169.9	
			SHC	83.5	117.0	150.5	80.1	113.5	147.0	76.5	109.9	143.3	72.8	106.1	139.4	69.1	102.3	135.5	
		76	THC	—	229.1	229.1	—	218.1	218.1	—	206.6	206.6	—	194.6	194.6	—	182.1	182.1	
			SHC	—	89.6	124.0	—	86.2	120.5	—	82.7	116.8	—	79.0	113.0	—	75.2	109.0	
7500 Cfm	EAT (wb)	58	THC	185.1	185.1	209.6	177.7	177.7	201.3	170.0	170.0	192.5	161.6	161.6	183.0	152.8	152.8	173.0	
			SHC	160.6	185.1	209.6	154.2	177.7	201.3	147.5	170.0	192.5	140.2	161.6	183.0	132.5	152.8	173.0	
		62	THC	185.2	185.2	218.0	177.9	177.9	209.3	170.1	170.1	200.2	161.8	161.8	190.4	152.9	152.9	179.9	
			SHC	152.5	185.2	218.0	146.4	177.9	209.3	140.0	170.1	200.2	133.2	161.8	190.4	125.8	152.9	179.9	
		67	THC	198.1	198.1	198.1	188.6	188.6	192.1	178.6	178.6	188.1	168.1	168.1	183.8	157.2	157.2	179.1	
			SHC	122.8	159.3	195.9	119.2	155.7	192.1	115.5	151.8	188.1	111.5	147.7	183.8	107.3	143.2	179.1	
		72	THC	216.6	216.6	216.6	206.1	206.1	206.1	195.1	195.1	195.1	183.5	183.5	183.5	171.6	171.6	171.6	
			SHC	85.6	122.3	159.0	82.2	118.8	155.5	78.6	115.2	151.7	74.9	111.3	147.8	71.1	107.4	143.8	
		76	THC	—	231.9	231.9	—	220.7	220.7	—	208.9	208.9	—	196.5	196.5	—	183.8	183.8	
			SHC	—	92.4	129.9	—	88.9	126.3	—	85.4	122.6	—	81.6	118.7	—	77.8	114.6	

LEGEND

— — Do Not Operate
Cfm — Cubic Feet Per Minute (Supply Air)
EAT (db) — Entering Air Temperature (Wet Bulb)
EAT (wb) — Entering Air Temperature (Wet Bulb)
SHC — Sensible Heat Capacity (1000 Btuh) Gross
THC — Total Heat Capacity (1000 Btuh) Gross

Performance data (cont)

48HC*D20 — 17.5 TON — COOLING CAPACITIES

48HC20				AMBIENT TEMPERATURE (F)															
				85			95			105			115			125			
				EAT (db)			EAT (db)			EAT (db)			EAT (db)			EAT (db)			
				75	80	85	75	80	85	75	80	85	75	80	85	75	80	85	
5250 Cfm	EAT (wb)	58	THC	185.1	185.1	209.2	178.7	178.7	201.9	171.8	171.8	194.1	164.5	164.5	185.8	156.7	156.7	177.0	
			SHC	161.1	185.1	209.2	155.4	178.7	201.9	149.4	171.8	194.1	143.1	164.5	185.8	136.3	156.7	177.0	
		62	THC	193.8	193.8	199.5	185.6	185.6	195.4	176.9	176.9	191.1	167.7	167.7	186.4	158.2	158.2	181.1	
			SHC	145.6	172.6	199.5	141.7	168.6	195.4	137.6	164.4	191.1	133.2	159.8	186.4	128.3	154.7	181.1	
		67	THC	212.2	212.2	212.2	203.3	203.3	203.3	193.8	193.8	193.8	183.8	183.8	183.8	173.1	173.1	173.1	
			SHC	119.0	146.0	173.1	115.3	142.3	169.4	111.4	138.4	165.4	107.3	134.3	161.3	103.0	130.0	157.0	
		72	THC	232.3	232.3	232.3	222.7	222.7	222.7	212.4	212.4	212.4	201.6	201.6	201.6	190.1	190.1	190.1	
			SHC	91.5	118.8	146.2	87.9	115.2	142.5	84.1	111.4	138.7	80.2	107.4	134.6	76.0	103.2	130.4	
		76	THC	—	249.5	249.5	—	239.2	239.2	—	228.2	228.2	—	216.6	216.6	—	204.3	204.3	
			SHC	—	96.7	125.3	—	93.2	121.7	—	89.5	117.9	—	85.6	113.8	—	81.5	109.5	
6125 Cfm	EAT (wb)	58	THC	194.7	194.7	220.0	187.8	187.8	212.2	180.4	180.4	203.8	172.5	172.5	194.9	164.1	164.1	185.5	
			SHC	169.4	194.7	220.0	163.3	187.8	212.2	156.9	180.4	203.8	150.1	172.5	194.9	142.8	164.1	185.5	
		62	THC	199.6	199.6	218.0	191.1	191.1	213.5	182.1	182.1	208.4	173.0	173.0	201.2	164.3	164.3	192.8	
			SHC	156.5	187.2	218.0	152.3	182.9	213.5	147.7	178.0	208.4	141.8	171.5	201.2	135.8	164.3	192.8	
		67	THC	218.0	218.0	218.0	208.7	208.7	208.7	198.7	198.7	198.7	188.2	188.2	188.2	177.1	177.1	177.1	
			SHC	126.2	157.4	188.6	122.4	153.6	184.7	118.4	149.6	180.7	114.3	145.4	176.5	109.9	141.0	172.1	
		72	THC	238.5	238.5	238.5	228.4	228.4	228.4	217.7	217.7	217.7	206.3	206.3	206.3	194.3	194.3	194.3	
			SHC	94.7	126.1	157.5	91.0	122.4	153.8	87.2	118.5	149.8	83.1	114.4	145.7	78.9	110.1	141.4	
		76	THC	—	255.9	255.9	—	245.1	245.1	—	233.6	233.6	—	221.4	221.4	—	208.5	208.5	
			SHC	—	100.7	133.3	—	97.1	129.6	—	93.3	125.6	—	89.3	121.5	—	85.1	117.1	
7000 Cfm	EAT (wb)	58	THC	202.7	202.7	229.1	195.4	195.4	220.8	187.5	187.5	211.9	179.2	179.2	202.5	170.3	170.3	192.4	
			SHC	176.4	202.7	229.1	170.0	195.4	220.8	163.1	187.5	211.9	155.9	179.2	202.5	148.1	170.3	192.4	
		62	THC	204.6	204.6	234.4	196.0	196.0	228.0	187.7	187.7	220.3	179.3	179.3	210.5	170.4	170.4	200.0	
			SHC	166.0	200.2	234.4	160.8	194.4	228.0	155.1	187.7	220.3	148.2	179.3	210.5	140.8	170.4	200.0	
		67	THC	222.5	222.5	222.5	212.8	212.8	212.8	202.4	202.4	202.4	191.5	191.5	191.5	180.0	180.0	186.4	
			SHC	133.0	168.2	203.4	129.2	164.3	199.5	125.1	160.3	195.4	120.9	156.0	191.0	116.4	151.4	186.4	
		72	THC	243.3	243.3	243.3	232.7	232.7	232.7	221.6	221.6	221.6	209.9	209.9	209.9	197.4	197.4	197.4	
			SHC	97.5	132.9	168.3	93.8	129.2	164.5	89.9	125.2	160.5	85.8	121.1	156.3	81.6	116.7	151.9	
		76	THC	—	260.8	260.8	—	249.6	249.6	—	237.7	237.7	—	225.1	225.1	—	211.7	211.7	
			SHC	—	104.4	140.8	—	100.7	137.0	—	96.9	133.0	—	92.8	128.8	—	88.5	124.4	
7875 Cfm	EAT (wb)	58	THC	209.6	209.6	236.8	201.8	201.8	228.1	193.6	193.6	218.8	184.8	184.8	208.9	175.5	175.5	198.3	
			SHC	182.3	209.6	236.8	175.6	201.8	228.1	168.4	193.6	218.8	160.8	184.8	208.9	152.7	175.5	198.3	
		62	THC	209.8	209.8	246.2	202.0	202.0	237.1	193.8	193.8	227.4	185.0	185.0	217.1	175.6	175.6	206.1	
			SHC	173.4	209.8	246.2	167.0	202.0	237.1	160.1	193.8	227.4	152.9	185.0	217.1	145.1	175.6	206.1	
		67	THC	226.1	226.1	226.1	216.0	216.0	216.0	205.4	205.4	209.4	194.2	194.2	204.8	182.4	182.4	199.9	
			SHC	139.6	178.6	217.7	135.6	174.7	213.7	131.5	170.5	209.4	127.1	166.0	204.8	122.5	161.2	199.9	
		72	THC	247.0	247.0	247.0	236.2	236.2	236.2	224.7	224.7	224.7	212.7	212.7	212.7	199.9	199.9	199.9	
			SHC	100.2	139.5	178.8	96.5	135.7	174.9	92.5	131.7	170.9	88.4	127.5	166.6	84.1	123.1	162.1	
		76	THC	—	264.7	264.7	—	253.1	253.1	—	240.9	240.9	—	227.9	227.9	—	—	—	
			SHC	—	107.9	148.1	—	104.2	144.3	—	100.2	140.2	—	96.1	135.9	—	—	—	
8750 Cfm	EAT (wb)	58	THC	215.4	215.4	243.4	207.3	207.3	234.3	198.7	198.7	224.6	189.6	189.6	214.2	179.9	179.9	203.2	
			SHC	187.4	215.4	243.4	180.3	207.3	234.3	172.9	198.7	224.6	164.9	189.6	214.2	156.5	179.9	203.2	
		62	THC	215.5	215.5	253.0	207.5	207.5	243.5	198.9	198.9	233.4	189.7	189.7	222.7	180.0	180.0	211.2	
			SHC	178.1	215.5	253.0	171.5	207.5	243.5	164.4	198.9	233.4	156.8	189.7	222.7	148.8	180.0	211.2	
		67	THC	228.9	228.9	231.5	218.7	218.7	227.3	207.8	207.8	222.8	196.4	196.4	217.9	184.5	184.5	212.6	
			SHC	145.8	188.6	231.5	141.8	184.5	227.3	137.5	180.1	222.8	133.0	175.5	217.9	128.2	170.4	212.6	
		72	THC	250.1	250.1	250.1	239.0	239.0	239.0	227.3	227.3	227.3	214.9	214.9	214.9	201.8	201.8	201.8	
			SHC	102.8	145.8	188.9	99.0	142.0	185.0	95.0	137.9	180.9	90.8	133.7	176.5	86.4	129.2	172.0	
		76	THC	—	267.8	267.8	—	256.0	256.0	—	243.5	243.5	—	230.2	230.2	—	—	—	
			SHC	—	111.2	155.2	—	107.4	151.3	—	103.5	147.1	—	99.3	142.8	—	—	—	

LEGEND

— — Do Not Operate
Cfm — Cubic Feet Per Minute (Supply Air)
EAT (db) — Entering Air Temperature (Wet Bulb)
EAT (wb) — Entering Air Temperature (Wet Bulb)
SHC — Sensible Heat Capacity (1000 Btuh) Gross
THC — Total Heat Capacity (1000 Btuh) Gross

48HC*D24 — 20 TON — COOLING CAPACITIES

48HC24				AMBIENT TEMPERATURE (F)															
				85			95			105			115			125			
				EAT (db)			EAT (db)			EAT (db)			EAT (db)			EAT (db)			
				75	80	85	75	80	85	75	80	85	75	80	85	75	80	85	
6000 Cfm	EAT (wb)	58	THC	214.4	214.4	242.5	207.0	207.0	234.2	199.0	199.0	225.1	190.2	190.2	215.2	180.6	180.6	204.3	
			SHC	186.3	214.4	242.5	179.9	207.0	234.2	173.0	199.0	225.1	165.3	190.2	215.2	157.0	180.6	204.3	
		62	THC	226.8	226.8	227.7	217.3	217.3	223.0	206.9	206.9	218.0	195.8	195.8	212.5	183.7	183.7	206.4	
			SHC	167.0	197.3	227.7	162.4	192.7	223.0	157.6	187.8	218.0	152.3	182.4	212.5	146.6	176.5	206.4	
		67	THC	248.4	248.4	248.4	237.9	237.9	237.9	226.6	226.6	226.6	214.3	214.3	214.3	201.0	201.0	201.0	
			SHC	136.5	167.1	197.6	132.2	162.7	193.2	127.5	158.0	188.4	122.5	152.9	183.4	117.2	147.6	178.0	
		72	THC	271.9	271.9	271.9	260.3	260.3	260.3	247.9	247.9	247.9	234.5	234.5	234.5	220.1	220.1	220.1	
			SHC	105.1	136.0	167.0	100.8	131.7	162.5	96.3	127.1	157.9	91.4	122.1	152.9	86.3	116.9	147.6	
		76	THC	—	291.7	291.7	—	279.2	279.2	—	265.7	265.7	—	251.3	251.3	—	235.8	235.8	
			SHC	—	110.7	143.7	—	106.5	139.5	—	102.0	134.7	—	97.2	129.7	—	92.1	124.3	
7000 Cfm	EAT (wb)	58	THC	225.8	225.8	255.3	217.8	217.8	246.3	209.1	209.1	236.5	199.6	199.6	225.7	189.2	189.2	214.0	
			SHC	196.2	225.8	255.3	189.3	217.8	246.3	181.7	209.1	236.5	173.4	199.6	225.7	164.4	189.2	214.0	
		62	THC	233.9	233.9	248.8	223.8	223.8	243.8	213.1	213.1	238.2	201.4	201.4	231.8	190.0	190.0	221.5	
			SHC	179.4	214.1	248.8	174.6	209.2	243.8	169.4	203.8	238.2	163.7	197.8	231.8	155.9	188.7	221.5	
		67	THC	255.7	255.7	255.7	244.6	244.6	244.6	232.6	232.6	232.6	219.6	219.6	219.6	205.7	205.7	205.7	
			SHC	144.7	179.7	214.8	140.2	175.2	210.2	135.4	170.4	205.4	130.3	165.2	200.2	124.9	159.8	194.7	
		72	THC	279.4	279.4	279.4	267.3	267.3	267.3	254.1	254.1	254.1	240.1	240.1	240.1	224.9	224.9	224.9	
			SHC	108.7	144.1	179.6	104.3	139.7	175.1	99.6	135.0	170.3	94.7	129.9	165.1	89.5	124.6	159.7	
		76	THC	—	299.4	299.4	—	286.2	286.2	—	272.1	272.1	—	256.9	256.9	—	240.7	240.7	
			SHC	—	115.3	152.9	—	110.9	148.2	—	106.3	143.3	—	101.3	138.0	—	96.1	132.6	
8000 Cfm	EAT (wb)	58	THC	235.3	235.3	266.2	226.8	226.8	256.5	217.5	217.5	246.0	207.4	207.4	234.5	196.3	196.3	222.0	
			SHC	204.5	235.3	266.2	197.1	226.8	256.5	189.0	217.5	246.0	180.2	207.4	234.5	170.6	196.3	222.0	
		62	THC	239.7	239.7	268.1	229.4	229.4	262.0	219.0	219.0	253.3	208.3	208.3	241.9	196.7	196.7	231.0	
			SHC	190.7	229.4	268.1	185.4	223.7	262.0	178.6	215.9	253.3	170.4	206.2	241.9	162.3	196.7	231.0	
		67	THC	261.3	261.3	261.3	249.6	249.6	249.6	237.1	237.1	237.1	223.6	223.6	223.6	209.2	209.2	210.6	
			SHC	152.3	191.8	231.2	147.7	187.1	226.6	142.9	182.2	221.6	137.7	177.0	216.3	132.2	171.4	210.6	
		72	THC	285.3	285.3	285.3	272.5	272.5	272.5	258.9	258.9	258.9	244.2	244.2	244.2	228.6	228.6	228.6	
			SHC	111.9	151.7	191.5	107.5	147.2	186.9	102.7	142.4	182.0	97.7	137.2	176.7	92.4	131.8	171.2	
		76	THC	—	305.4	305.4	—	291.6	291.6	—	276.8	276.8	—	261.2	261.2	—	244.4	244.4	
			SHC	—	119.4	161.0	—	114.9	156.2	—	110.1	151.2	—	105.1	146.0	—	99.8	140.4	
9000 Cfm	EAT (wb)	58	THC	243.5	243.5	275.4	234.5	234.5	265.2	224.6	224.6	254.0	213.9	213.9	241.9	202.3	202.3	228.8	
			SHC	211.6	243.5	275.4	203.8	234.5	265.2	195.2	224.6	254.0	185.9	213.9	241.9	175.8	202.3	228.8	
		62	THC	245.4	245.4	282.9	235.4	235.4	274.6	225.0	225.0	264.3	214.4	214.4	251.7	202.5	202.5	237.8	
			SHC	199.7	241.3	282.9	193.2	233.9	274.6	185.6	224.9	264.3	176.8	214.3	251.7	167.1	202.5	237.8	
		67	THC	265.6	265.6	265.6	253.6	253.6	253.6	240.7	240.7	240.7	226.8	226.8	231.8	212.0	212.0	225.8	
			SHC	159.6	203.3	247.1	154.9	198.6	242.3	150.0	193.6	237.3	144.7	188.3	231.8	139.0	182.4	225.8	
		72	THC	289.9	289.9	289.9	276.7	276.7	276.7	262.6	262.6	262.6	247.5	247.5	247.5	231.4	231.4	231.4	
			SHC	114.9	159.0	203.0	110.4	154.4	198.3	105.6	149.5	193.3	100.5	144.2	188.0	95.2	138.7	182.3	
		76	THC	—	310.1	310.1	—	295.8	295.8	—	280.6	280.6	—	264.4	264.4	—	247.3	247.3	
			SHC	—	123.2	168.9	—	118.6	164.1	—	113.8	159.0	—	108.7	153.6	—	103.4	147.9	
10000 Cfm	EAT (wb)	58	THC	250.4	250.4	283.2	240.9	240.9	272.5	230.7	230.7	260.9	219.5	219.5	248.2	207.3	207.3	234.5	
			SHC	217.7	250.4	283.2	209.4	240.9	272.5	200.5	230.7	260.9	190.7	219.5	248.2	180.2	207.3	234.5	
		62	THC	250.8	250.8	294.6	241.1	241.1	283.3	231.1	231.1	271.4	219.6	219.6	258.0	207.5	207.5	243.7	
			SHC	207.0	250.8	294.6	199.0	241.1	283.3	190.7	231.1	271.4	181.2	219.6	258.0	171.2	207.5	243.7	
		67	THC	269.2	269.2	269.2	256.8	256.8	257.6	243.5	243.5	252.3	229.4	229.4	246.4	214.3	214.3	240.0	
			SHC	166.6	214.5	262.5	161.9	209.7	257.6	156.8	204.5	252.3	151.3	198.9	246.4	145.5	192.8	240.0	
		72	THC	293.7	293.7	293.7	280.1	280.1	280.1	265.6	265.6	265.6	250.2	250.2	250.2	233.7	233.7	233.7	
			SHC	117.8	166.0	214.2	113.2	161.3	209.3	108.3	156.3	204.3	103.2	151.0	198.8	97.8	145.4	193.1	
		76	THC	—	313.9	313.9	—	299.3	299.3	—	283.7	283.7	—	267.1	267.1	—	249.6	249.6	
			SHC	—	126.8	176.5	—	122.2	171.6	—	117.3	166.5	—	112.1	161.0	—	106.7	155.1	

LEGEND

— — Do Not Operate
Cfm — Cubic Feet Per Minute (Supply Air)
EAT (db) — Entering Air Temperature (Wet Bulb)
EAT (wb) — Entering Air Temperature (Wet Bulb)
SHC — Sensible Heat Capacity (1000 Btuh) Gross
THC — Total Heat Capacity (1000 Btuh) Gross

Performance data (cont)

48HC*D28 — 25 TON — COOLING CAPACITIES

48HC28				AMBIENT TEMPERATURE (F)															
				85			95			105			115			125			
				EAT (db)			EAT (db)			EAT (db)			EAT (db)			EAT (db)			
				75	80	85	75	80	85	75	80	85	75	80	85	75	80	85	
7500 Cfm	EAT (wb)	58	THC	264.4	264.4	298.9	254.6	254.6	287.9	244.1	244.1	276.0	232.7	232.7	263.1	220.3	220.3	249.1	
			SHC	229.9	264.4	298.9	221.4	254.6	287.9	212.2	244.1	276.0	202.3	232.7	263.1	191.5	220.3	249.1	
		62	THC	278.7	278.7	282.4	266.3	266.3	276.4	252.8	252.8	269.8	238.5	238.5	262.4	223.9	223.9	251.3	
			SHC	206.8	244.6	282.4	200.9	238.7	276.4	194.6	232.2	269.8	187.7	225.0	262.4	178.7	215.0	251.3	
		67	THC	305.3	305.3	305.3	291.9	291.9	291.9	277.3	277.3	277.3	261.5	261.5	261.5	244.5	244.5	244.5	
			SHC	169.0	207.0	245.0	163.4	201.4	239.4	157.4	195.3	233.3	151.0	188.9	226.8	144.2	182.1	219.9	
		72	THC	334.0	334.0	334.0	319.4	319.4	319.4	303.6	303.6	303.6	286.5	286.5	286.5	268.1	268.1	268.1	
			SHC	129.9	168.5	207.1	124.5	163.0	201.5	118.7	157.1	195.5	112.5	150.8	189.2	106.0	144.2	182.3	
		76	THC	—	358.2	358.2	—	342.4	342.4	—	325.4	325.4	—	307.1	307.1	—	287.4	287.4	
			SHC	—	137.0	178.2	—	131.7	172.9	—	126.0	166.9	—	119.9	160.4	—	113.4	153.4	
8750 Cfm	EAT (wb)	58	THC	278.2	278.2	314.5	267.8	267.8	302.8	256.5	256.5	289.9	244.2	244.2	276.1	230.8	230.8	261.0	
			SHC	241.9	278.2	314.5	232.8	267.8	302.8	223.0	256.5	289.9	212.3	244.2	276.1	200.7	230.8	261.0	
		62	THC	287.2	287.2	308.3	274.3	274.3	301.5	260.8	260.8	291.7	247.0	247.0	280.9	232.0	232.0	269.1	
			SHC	222.1	265.2	308.3	215.7	258.6	301.5	207.7	249.7	291.7	199.0	240.0	280.9	189.7	229.4	269.1	
		67	THC	314.0	314.0	314.0	299.8	299.8	299.8	284.4	284.4	284.4	267.8	267.8	267.8	250.0	250.0	250.0	
			SHC	179.1	222.7	266.4	173.3	216.9	260.6	167.2	210.8	254.3	160.7	204.2	247.7	153.7	197.2	240.6	
		72	THC	343.0	343.0	343.0	327.7	327.7	327.7	311.1	311.1	311.1	293.1	293.1	293.1	273.8	273.8	273.8	
			SHC	134.3	178.5	222.6	128.8	172.9	216.9	122.9	166.9	210.8	116.6	160.4	204.3	109.9	153.6	197.3	
		76	THC	—	367.3	367.3	—	350.8	350.8	—	333.0	333.0	—	313.8	313.8	—	293.2	293.2	
			SHC	—	142.6	189.4	—	137.1	183.5	—	131.2	177.3	—	125.0	170.7	—	118.4	163.7	
10000 Cfm	EAT (wb)	58	THC	289.7	289.7	327.5	278.7	278.7	315.0	266.6	266.6	301.4	253.6	253.6	286.7	239.4	239.4	270.7	
			SHC	251.9	289.7	327.5	242.3	278.7	315.0	231.8	266.6	301.4	220.5	253.6	286.7	208.2	239.4	270.7	
		62	THC	294.6	294.6	329.6	282.2	282.2	319.7	268.7	268.7	309.1	254.1	254.1	298.4	239.7	239.7	281.4	
			SHC	234.7	282.1	329.6	226.8	273.3	319.7	218.4	263.7	309.1	209.7	254.1	298.4	197.9	239.7	281.4	
		67	THC	320.6	320.6	320.6	305.9	305.9	305.9	289.9	289.9	289.9	272.7	272.7	272.7	254.3	254.3	260.3	
			SHC	188.6	237.7	286.8	182.7	231.8	280.9	176.5	225.5	274.5	169.8	218.8	267.7	162.8	211.5	260.3	
		72	THC	350.0	350.0	350.0	334.0	334.0	334.0	316.8	316.8	316.8	298.2	298.2	298.2	278.3	278.3	278.3	
			SHC	138.4	187.9	237.5	132.8	182.2	231.7	126.8	176.1	225.5	120.4	169.6	218.8	113.6	162.6	211.7	
		76	THC	—	374.4	374.4	—	357.3	357.3	—	338.7	338.7	—	318.9	318.9	—	297.5	297.5	
			SHC	—	147.7	199.5	—	142.1	193.7	—	136.1	187.4	—	129.7	180.6	—	123.0	173.5	
11250 Cfm	EAT (wb)	58	THC	299.4	299.4	338.4	287.8	287.8	325.4	275.2	275.2	311.1	261.4	261.4	295.6	246.6	246.6	278.8	
			SHC	260.3	299.4	338.4	250.2	287.8	325.4	239.2	275.2	311.1	227.3	261.4	295.6	214.4	246.6	278.8	
		62	THC	302.2	302.2	346.0	289.3	289.3	335.7	275.5	275.5	323.5	262.1	262.1	307.7	246.8	246.8	289.8	
			SHC	244.8	295.4	346.0	236.7	286.2	335.7	227.5	275.5	323.5	216.4	262.1	307.7	203.8	246.8	289.8	
		67	THC	325.9	325.9	325.9	310.7	310.7	310.7	294.2	294.2	294.2	276.6	276.6	286.7	257.7	257.7	278.9	
			SHC	197.6	252.1	306.5	191.7	246.1	300.4	185.3	239.6	293.9	178.5	232.6	286.7	171.2	225.1	278.9	
		72	THC	355.5	355.5	355.5	339.1	339.1	339.1	321.3	321.3	321.3	302.2	302.2	302.2	281.8	281.8	281.8	
			SHC	142.1	197.0	251.8	136.4	191.2	245.9	130.4	185.0	239.6	123.9	178.3	232.8	117.1	171.3	225.5	
		76	THC	—	380.0	380.0	—	362.4	362.4	—	343.3	343.3	—	322.8	322.8	—	300.9	300.9	
			SHC	—	152.4	209.4	—	146.8	203.4	—	140.7	197.0	—	134.2	190.2	—	127.3	182.8	
12500 Cfm	EAT (wb)	58	THC	307.7	307.7	347.9	295.7	295.7	334.2	282.5	282.5	319.3	268.2	268.2	303.2	252.7	252.7	285.7	
			SHC	267.6	307.7	347.9	257.1	295.7	334.2	245.6	282.5	319.3	233.2	268.2	303.2	219.7	252.7	285.7	
		62	THC	308.4	308.4	362.2	295.9	295.9	347.4	283.1	283.1	332.4	268.4	268.4	315.2	252.8	252.8	296.9	
			SHC	254.6	308.4	362.2	244.4	295.9	347.4	233.8	283.1	332.4	221.7	268.4	315.2	208.8	252.8	296.9	
		67	THC	330.2	330.2	330.2	314.6	314.6	319.2	297.8	297.8	312.3	279.8	279.8	304.7	260.6	260.6	295.9	
			SHC	206.3	265.9	325.5	200.3	259.7	319.2	193.8	253.1	312.3	186.7	245.7	304.7	179.0	237.4	295.9	
		72	THC	360.1	360.1	360.1	343.2	343.2	343.2	325.0	325.0	325.0	305.4	305.4	305.4	284.6	284.6	284.6	
			SHC	145.7	205.7	265.7	139.9	199.8	259.7	133.8	193.5	253.3	127.3	186.8	246.3	120.4	179.7	238.9	
		76	THC	—	384.6	384.6	—	366.5	366.5	—	346.9	346.9	—	325.9	325.9	—	303.5	303.5	
			SHC	—	157.0	218.9	—	151.2	212.9	—	145.1	206.3	—	138.5	199.3	—	131.5	191.7	

LEGEND

— — Do Not Operate
Cfm — Cubic Feet Per Minute (Supply Air)
EAT (db) — Entering Air Temperature (Wet Bulb)
EAT (wb) — Entering Air Temperature (Wet Bulb)
SHC — Sensible Heat Capacity (1000 Btuh) Gross
THC — Total Heat Capacity (1000 Btuh) Gross

48HC*E17 COOLING CAPACITIES, SUBCOOLING MODE

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR - CFM								
		4,500			6,000			7,500		
		Air Entering Evaporator - Ewb (F)								
		72	67	62	72	67	62	72	67	62
75	TC	202.90	184.60	166.20	213.70	194.60	175.40	222.30	202.50	182.70
	SHC	91.90	112.40	132.90	106.10	126.40	146.80	117.50	137.70	158.00
	kW	10.19	10.12	9.78	10.51	10.19	9.95	10.61	10.36	10.12
85	TC	189.80	171.80	153.80	201.00	182.20	163.30	209.90	190.40	170.80
	SHC	75.90	101.00	126.20	91.20	116.30	141.30	103.40	128.40	153.50
	kW	11.57	11.49	11.15	11.88	11.56	11.32	11.98	11.73	11.49
95	TC	176.70	159.10	141.40	188.30	169.70	151.20	197.50	178.20	159.00
	SHC	59.80	89.70	119.60	76.20	106.10	135.90	89.40	119.20	149.00
	kW	12.87	12.81	12.47	13.20	12.88	12.64	13.30	13.05	12.81
105	TC	163.60	146.30	129.00	175.60	157.30	139.10	185.10	166.10	147.10
	SHC	43.80	78.40	112.90	61.30	95.90	130.40	75.30	109.90	144.40
	kW	14.05	14.00	13.65	14.39	14.07	13.82	14.40	14.24	14.00
115	TC	150.50	133.50	116.50	162.90	144.90	127.00	172.70	154.00	135.30
	SHC	27.70	67.00	106.30	46.40	85.70	125.00	61.30	100.60	133.40
	kW	15.44	15.36	15.02	15.75	15.43	15.19	15.85	15.60	15.36
125	TC	137.40	120.80	104.10	150.20	132.50	114.90	160.30	141.90	123.50
	SHC	11.70	55.70	99.60	31.40	75.50	112.90	47.30	91.30	123.00
	kW	16.77	16.71	16.37	17.10	16.78	16.54	17.20	16.95	16.71

48HC*E17 COOLING CAPACITIES, HOT GAS REHEAT MODE

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR - Ewb (F)								
		75 Dry Bulb 62.5 Wet Bulb (50% Relative)			75 Dry Bulb 64 Wet Bulb (56% Relative)			75 Dry Bulb 65.3 Wet Bulb (60% Relative)		
		Air Entering Evaporator - Cfm								
		4,500	6,000	7,500	4,500	6,000	7,500	4,500	6,000	7,500
80	TC	64.50	71.00	73.30	68.40	74.50	77.30	71.20	79.70	80.60
	SHC	12.60	24.90	36.80	6.80	13.70	23.90	-0.80	5.50	13.80
	kW	10.10	10.26	10.42	10.18	10.40	10.56	10.33	10.47	10.67
75	TC	66.60	73.10	75.60	70.50	76.60	79.50	73.20	80.80	82.90
	SHC	14.30	26.70	38.50	8.10	14.90	25.70	0.70	7.00	15.00
	kW	10.05	10.22	10.36	10.14	10.36	10.52	10.28	10.43	10.62
70	TC	68.70	75.10	77.40	72.50	78.60	81.40	75.20	82.80	84.90
	SHC	15.40	27.80	40.00	9.50	16.20	26.80	2.10	8.40	16.30
	kW	10.00	10.18	10.33	10.10	10.31	10.47	10.23	10.40	10.58
60	TC	72.80	79.30	81.60	76.70	82.80	85.70	79.40	86.90	88.80
	SHC	19.00	31.10	43.20	12.70	19.90	30.10	5.30	11.60	20.00
	kW	9.92	10.09	10.24	10.01	10.22	10.37	10.14	10.31	10.49
50	TC	76.80	83.40	85.70	80.80	86.90	89.70	83.50	90.90	92.80
	SHC	21.70	34.20	46.20	15.80	22.70	33.20	8.40	14.70	22.80
	kW	9.83	10.00	10.15	9.92	10.13	10.29	10.05	10.21	10.39
40	TC	80.90	87.30	89.60	84.90	90.80	93.60	87.40	94.80	96.70
	SHC	24.90	37.10	49.30	19.00	26.00	36.10	11.60	17.90	26.20
	kW	9.74	9.91	10.06	9.83	10.04	10.20	9.96	10.12	10.30

LEGEND

Edb — Entering Dry Bulb
Ewb — Entering Wet Bulb
kW — Kilowatts
SHC — Sensible Heat Capacity
TC — Total Capacity

Performance data (cont)

48HC*E20 COOLING CAPACITIES, SUBCOOLING MODE

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR - CFM								
		5250			7000			8750		
		Air Entering Evaporator - Ewb (F)								
		72	67	62	72	67	62	72	67	62
75	TC	232.00	211.30	190.60	242.40	221.00	199.70	250.70	228.90	207.00
	SHC	110.90	133.70	156.40	127.60	150.30	173.00	141.10	163.70	186.40
	kW	12.45	12.16	11.81	12.74	12.41	12.02	12.93	12.51	12.18
85	TC	215.90	195.70	175.50	226.00	205.20	184.40	234.20	212.80	191.50
	SHC	90.60	118.80	147.00	108.40	136.60	164.90	122.70	151.00	179.20
	kW	13.48	13.20	12.88	13.77	13.47	13.07	13.96	13.58	13.23
95	TC	199.70	180.00	160.30	209.70	189.40	169.10	217.60	196.80	176.10
	SHC	70.30	104.00	137.70	89.20	123.00	156.70	104.40	138.20	172.10
	kW	14.60	14.25	13.94	14.89	14.51	14.15	15.08	14.63	14.31
105	TC	183.60	164.50	145.20	193.30	173.50	153.80	201.00	180.80	160.60
	SHC	50.00	89.10	128.30	70.00	109.30	148.60	86.00	125.50	158.60
	kW	15.64	15.36	15.01	15.93	15.60	15.21	16.12	15.72	15.37
115	TC	167.50	148.80	130.10	176.90	157.70	138.50	184.50	164.80	145.10
	SHC	29.70	74.30	118.90	50.70	95.60	138.10	67.70	112.70	145.10
	kW	16.70	16.38	15.82	16.98	16.63	16.03	17.17	16.75	16.19
125	TC	151.40	133.20	115.00	160.60	141.90	123.10	167.90	148.80	129.70
	SHC	9.40	59.50	109.60	31.50	81.90	123.00	49.30	100.00	129.70
	kW	17.71	17.39	17.09	18.01	17.65	17.30	18.20	17.76	17.46

48HC*E20 COOLING CAPACITIES, HOT GAS REHEAT MODE

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR - Ewb (F)								
		75 Dry Bulb 62.5 Wet Bulb (50% Relative)			75 Dry Bulb 64 Wet Bulb (56% Relative)			75 Dry Bulb 65.3 Wet Bulb (60% Relative)		
		Air Entering Evaporator - Cfm								
		5,250	7,000	8,750	5,250	7,000	8,750	5,250	7,000	8,750
80	TC	67.80	71.30	74.10	70.50	74.80	79.80	73.30	78.20	82.40
	SHC	9.00	26.50	41.70	2.20	13.20	26.90	-5.20	2.90	13.80
	kW	11.65	11.75	11.87	11.82	11.90	11.98	11.93	12.10	12.19
75	TC	72.50	76.00	78.80	75.00	79.20	84.30	78.00	83.00	86.90
	SHC	13.40	30.90	46.10	6.50	18.00	31.30	-2.10	7.20	17.90
	kW	11.44	11.54	11.66	11.61	11.68	11.75	11.70	11.86	11.95
70	TC	77.10	80.60	83.40	79.50	83.90	88.90	82.40	87.30	91.10
	SHC	17.60	34.70	49.90	10.80	22.20	35.10	3.20	11.50	22.20
	kW	11.22	11.33	11.45	11.40	11.46	11.54	11.49	11.64	11.75
60	TC	86.30	89.90	92.70	88.80	93.20	98.20	91.70	96.60	100.50
	SHC	26.20	43.20	58.40	19.40	30.80	43.60	11.60	20.10	30.70
	kW	10.76	10.86	10.98	10.93	11.00	11.07	11.03	11.18	11.28
50	TC	95.50	99.10	101.90	98.00	102.40	107.40	101.00	106.00	109.80
	SHC	34.80	51.80	67.00	28.00	39.40	52.20	20.10	28.70	39.40
	kW	10.33	10.43	10.55	10.50	10.52	10.63	10.59	10.74	10.85
40	TC	104.80	108.40	111.20	107.30	111.70	116.60	110.30	115.30	119.10
	SHC	43.40	60.40	75.60	36.60	48.00	60.80	28.80	37.30	47.90
	kW	9.87	9.97	10.09	10.04	10.11	10.18	10.14	10.28	10.40

LEGEND

Edb — Entering Dry Bulb
Ewb — Entering Wet Bulb
kW — Kilowatts
SHC — Sensible Heat Capacity
TC — Total Capacity

48HC*E24 COOLING CAPACITIES, SUBCOOLING MODE

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR - CFM								
		6,000			8,000			10,000		
		Air Entering Evaporator - Ewb (F)								
		72	67	62	72	67	62	72	67	62
75	TC	281.60	256.50	231.30	293.10	267.00	240.90	302.30	275.40	248.60
	SHC	114.70	141.00	167.40	140.60	166.60	192.60	161.60	187.30	212.90
	kW	13.52	13.25	12.95	13.82	13.46	13.21	13.97	13.60	13.31
85	TC	261.30	236.90	212.40	272.10	247.70	221.30	280.70	254.60	228.50
	SHC	90.90	123.50	156.10	118.80	151.10	183.30	141.40	173.40	205.40
	kW	14.95	14.68	14.48	15.25	14.89	14.64	15.40	15.03	14.74
95	TC	241.10	217.20	193.40	251.10	226.40	201.70	259.20	233.80	208.40
	SHC	67.20	106.00	144.80	97.10	120.10	174.10	121.20	159.50	197.80
	kW	16.52	16.25	15.95	16.82	16.46	16.21	16.97	16.60	16.31
105	TC	220.80	197.50	174.40	230.20	206.20	182.20	237.70	213.00	188.40
	SHC	43.40	88.40	133.50	75.30	120.10	164.90	101.00	145.70	178.90
	kW	18.09	17.82	17.52	18.39	18.03	17.78	18.54	18.17	17.88
115	TC	200.50	178.00	155.50	209.20	185.90	162.60	216.20	192.20	168.70
	SHC	19.70	70.90	122.20	53.50	104.60	155.70	80.90	131.80	161.20
	kW	19.65	19.38	19.08	19.95	19.59	19.34	20.10	19.73	19.44
125	TC	180.20	158.40	136.50	188.20	165.60	143.00	194.70	171.40	148.20
	SHC	-4.10	53.40	110.80	31.70	89.10	142.20	60.70	118.00	145.10
	kW	20.59	20.32	20.02	20.89	20.53	20.28	21.04	20.67	20.38

48HC*E24 COOLING CAPACITIES, HOT GAS REHEAT MODE

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR - Ewb (F)								
		75 Dry Bulb 62.5 Wet Bulb (50% Relative)			75 Dry Bulb 64 Wet Bulb (56% Relative)			75 Dry Bulb 65.3 Wet Bulb (60% Relative)		
		Air Entering Evaporator - Cfm								
		6,000	8,000	10,000	6,000	8,000	10,000	6,000	8,000	10,000
80	TC	115.20	123.30	130.60	120.40	129.30	138.20	122.80	135.00	143.70
	SHC	40.80	58.30	76.10	32.30	45.50	60.40	20.10	34.30	48.00
	kW	13.24	13.32	13.39	13.43	13.57	13.65	13.49	13.68	13.74
75	TC	119.80	128.60	135.90	125.50	135.30	143.20	128.00	139.50	148.40
	SHC	45.60	62.80	82.10	37.00	49.80	65.20	24.30	38.70	52.60
	kW	13.05	13.10	13.17	13.21	13.35	13.43	13.27	13.46	13.52
70	TC	122.50	133.10	140.20	129.80	140.70	147.60	132.40	144.40	153.20
	SHC	49.80	76.00	86.10	41.10	54.30	69.20	28.80	41.40	56.80
	kW	12.80	12.87	12.94	12.98	13.12	13.20	13.04	13.23	13.29
60	TC	133.80	142.50	149.60	139.30	150.40	157.40	141.50	154.20	163.00
	SHC	58.60	76.00	95.00	50.20	63.50	78.10	37.80	52.10	65.90
	kW	12.34	12.42	12.49	12.53	12.67	12.75	12.59	12.78	12.84
50	TC	143.50	151.80	159.30	149.00	160.00	167.00	151.30	163.60	172.50
	SHC	67.70	84.80	103.80	59.10	72.40	87.00	46.70	61.00	74.90
	kW	11.88	11.95	12.03	12.07	12.21	12.29	12.13	12.32	12.38
40	TC	153.20	161.30	168.70	158.60	169.20	176.60	160.80	173.10	182.00
	SHC	76.50	93.60	111.60	68.00	81.50	95.80	55.80	69.80	84.00
	kW	11.42	11.49	11.56	11.60	11.74	11.82	11.66	11.85	11.91

LEGEND

Edb — Entering Dry Bulb
Ewb — Entering Wet Bulb
kW — Kilowatts
SHC — Sensible Heat Capacity
TC — Total Capacity

Performance data (cont)

48HC*E28 COOLING CAPACITIES, SUBCOOLING MODE

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR - CFM								
		7,500			10,000			12,500		
		Air Entering Evaporator - Ewb (F)								
		72	67	62	72	67	62	72	67	62
75	TC	351.30	319.50	287.80	370.40	337.30	304.10	385.80	351.50	317.20
	SHC	166.50	199.40	232.30	191.20	245.60	258.50	211.40	245.60	279.90
	kW	16.75	16.55	15.20	17.30	16.75	15.85	17.80	17.50	16.50
85	TC	327.50	296.40	265.30	346.10	313.60	281.20	361.10	327.50	294.00
	SHC	137.40	178.20	219.00	162.60	204.50	246.40	183.30	226.00	268.70
	kW	18.65	18.45	17.25	19.20	18.65	17.80	19.45	19.15	18.15
95	TC	303.70	273.30	242.90	321.80	290.00	258.30	336.40	303.50	270.70
	SHC	108.20	157.00	205.80	134.00	184.10	234.30	155.10	206.40	257.60
	kW	20.60	20.40	19.34	21.15	20.60	19.95	21.60	21.30	20.30
105	TC	279.90	250.20	220.40	297.50	266.40	235.30	311.70	279.50	247.40
	SHC	79.00	135.80	192.50	105.40	163.80	222.20	127.10	186.70	246.40
	kW	22.85	22.65	21.45	23.40	22.85	22.05	23.70	23.40	22.40
115	TC	256.20	227.10	198.00	273.20	242.80	212.40	287.00	255.50	224.10
	SHC	49.90	114.50	179.20	76.80	143.40	210.10	98.90	167.10	223.80
	kW	25.05	24.85	23.65	25.60	25.05	24.25	25.90	25.60	24.60
125	TC	232.40	203.90	175.50	248.90	219.20	189.50	262.30	231.50	200.80
	SHC	20.70	93.30	166.00	48.20	123.10	188.90	70.80	147.40	200.80
	kW	27.25	27.05	25.80	27.80	27.25	26.50	28.15	27.85	26.85

48HC*E28 COOLING CAPACITIES, HOT GAS REHEAT MODE

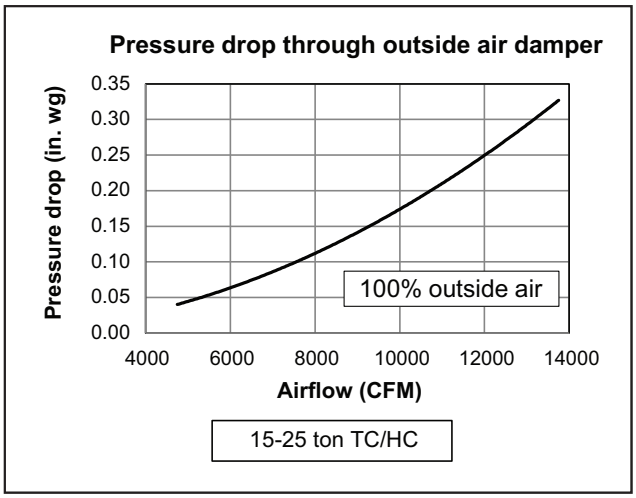
TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR - Ewb (F)								
		75 Dry Bulb 62.5 Wet Bulb (50% Relative)			75 Dry Bulb 64 Wet Bulb (56% Relative)			75 Dry Bulb 65.3 Wet Bulb (60% Relative)		
		Air Entering Evaporator - Cfm								
		7,500	10,000	12,500	7,500	10,000	12,500	7,500	10,000	12,500
80	TC	124.40	133.90	139.00	132.00	142.10	145.10	135.60	149.10	151.50
	SHC	37.60	60.70	82.20	27.80	45.40	65.80	17.50	34.20	50.10
	kW	15.83	15.90	16.00	15.97	16.13	16.16	16.11	16.31	16.38
75	TC	129.00	138.50	144.60	136.60	147.60	150.10	140.60	154.00	156.30
	SHC	47.10	70.60	92.10	37.30	55.30	75.70	27.00	43.70	60.00
	kW	15.77	15.83	15.94	15.91	16.07	16.10	16.05	16.25	16.32
70	TC	133.60	143.10	149.20	141.20	152.30	154.80	145.30	158.80	161.10
	SHC	57.30	80.70	102.20	47.50	65.40	85.80	37.20	53.90	70.10
	kW	15.68	15.75	15.86	15.83	16.00	16.04	15.88	16.08	16.15
60	TC	142.80	158.40	158.40	150.40	161.40	163.90	153.90	167.40	169.70
	SHC	76.50	121.40	121.40	66.70	84.60	105.00	56.40	73.10	89.30
	kW	15.54	15.60	15.71	15.68	15.84	15.87	15.82	16.02	16.09
50	TC	151.80	161.30	167.40	159.40	170.50	173.20	162.80	176.20	178.80
	SHC	94.10	117.50	139.00	84.30	102.20	122.60	74.00	90.70	106.90
	kW	15.40	15.47	15.58	15.54	15.68	15.71	15.66	15.86	15.93
40	TC	161.20	170.70	176.80	168.80	179.80	182.50	172.20	185.70	188.20
	SHC	114.10	137.60	159.10	104.30	122.30	142.70	94.00	110.70	127.00
	kW	15.24	15.31	15.42	15.39	15.55	15.58	15.53	15.73	15.80

LEGEND

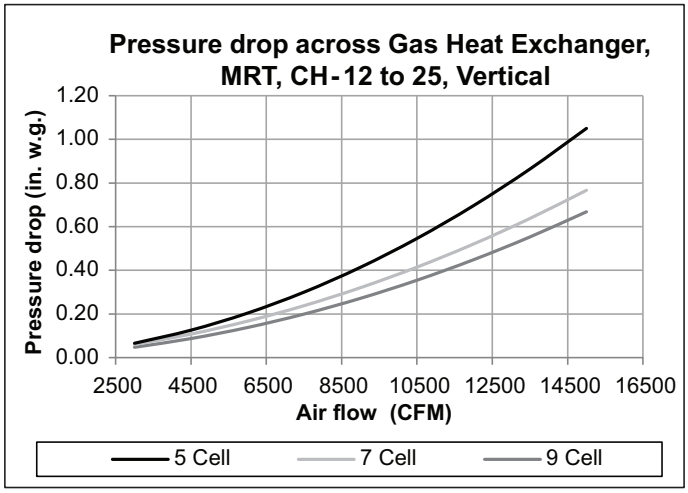
Edb — Entering Dry Bulb
Ewb — Entering Wet Bulb
kW — Kilowatts
SHC — Sensible Heat Capacity
TC — Total Capacity

ACCESSORY PRESSURE DROPS, BAROMETRIC RELIEF AND POWER EXHAUST PERFORMANCE (EXCLUDES EnergyX® SYSTEMS)

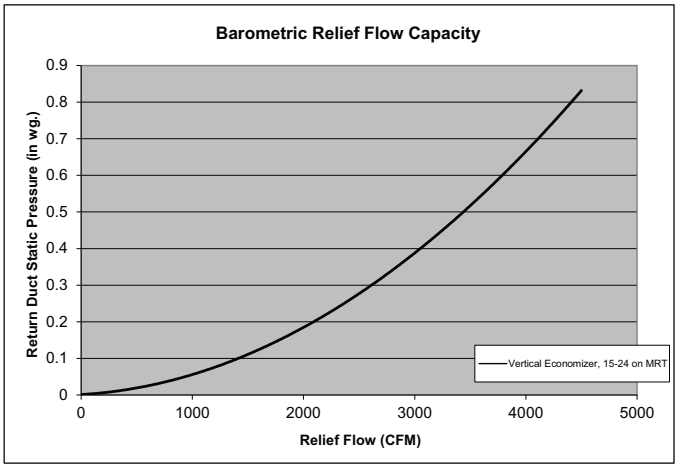
OUTSIDE AIR PRESSURE DROP



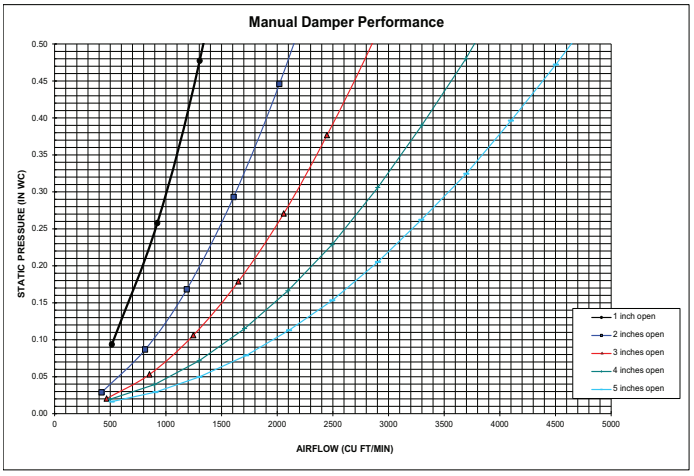
GAS HEAT EXCHANGER, CH-12 TO 25, VERTICAL SUPPLY PRESSURE DROP



BAROMETRIC RELIEF FLOW CAPACITY

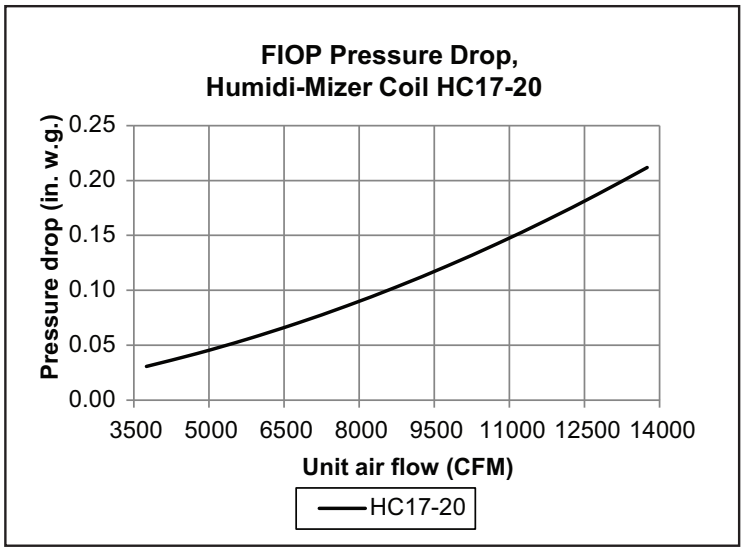


MANUAL DAMPER PERFORMANCE



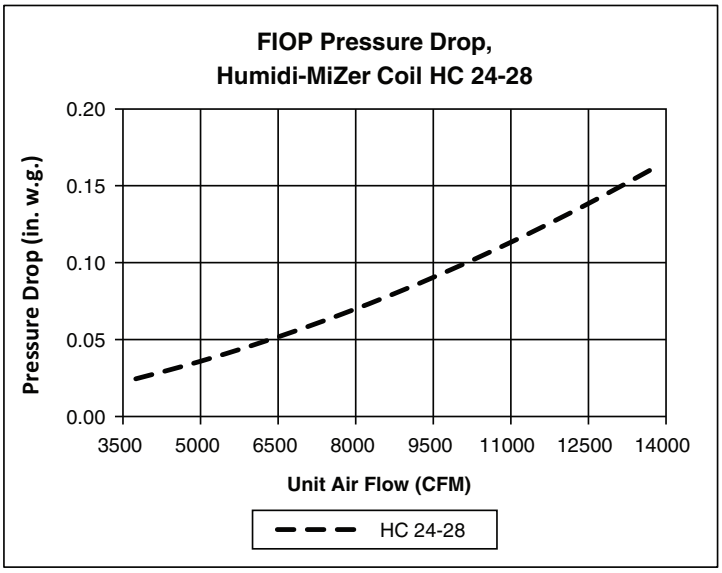
ACCESSORY PRESSURE DROPS, BAROMETRIC RELIEF AND POWER EXHAUST PERFORMANCE (EXCLUDES EnergyX® SYSTEMS) (cont)

PRESSURE DROP FOR HUMIDI-MIZER® COIL, SIZES 17, 20



15, 17.5 TONS											
CFM	3750	4750	5750	6750	7750	8750	9750	10750	11750	12750	13750
PRESSURE DROP (in. wg)	0.03	0.04	0.06	0.07	0.08	0.10	0.12	0.14	0.16	0.19	0.21

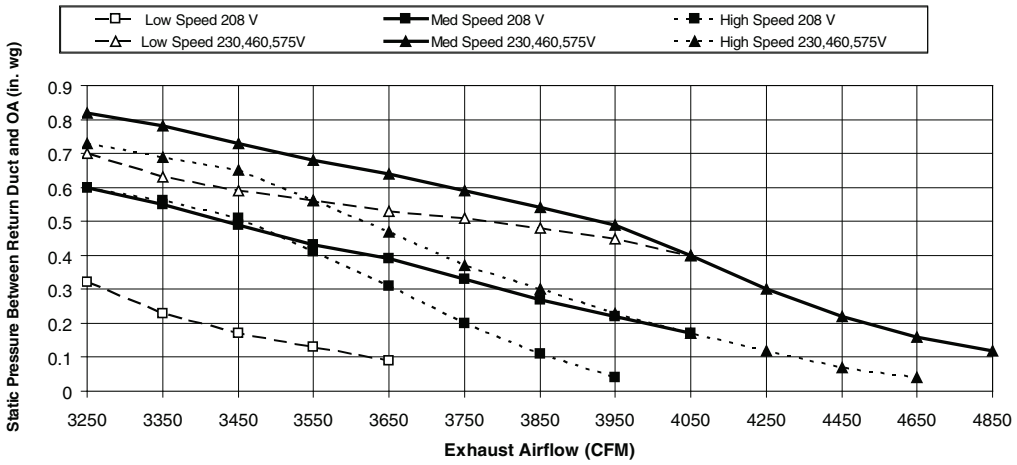
PRESSURE DROP FOR HUMIDI-MIZER COIL, SIZES 24, 28



20, 25 TONS											
CFM	3750	4750	5750	6750	7750	8750	9750	10750	11750	12750	13750
PRESSURE DROP (in. wg)	0.02	0.03	0.04	0.05	0.07	0.08	0.09	0.11	0.13	0.14	0.16

ACCESSORY PRESSURE DROPS, BAROMETRIC RELIEF AND POWER EXHAUST PERFORMANCE (EXCLUDES EnergyX SYSTEMS) (cont)

POWER EXHAUST FAN PERFORMANCE

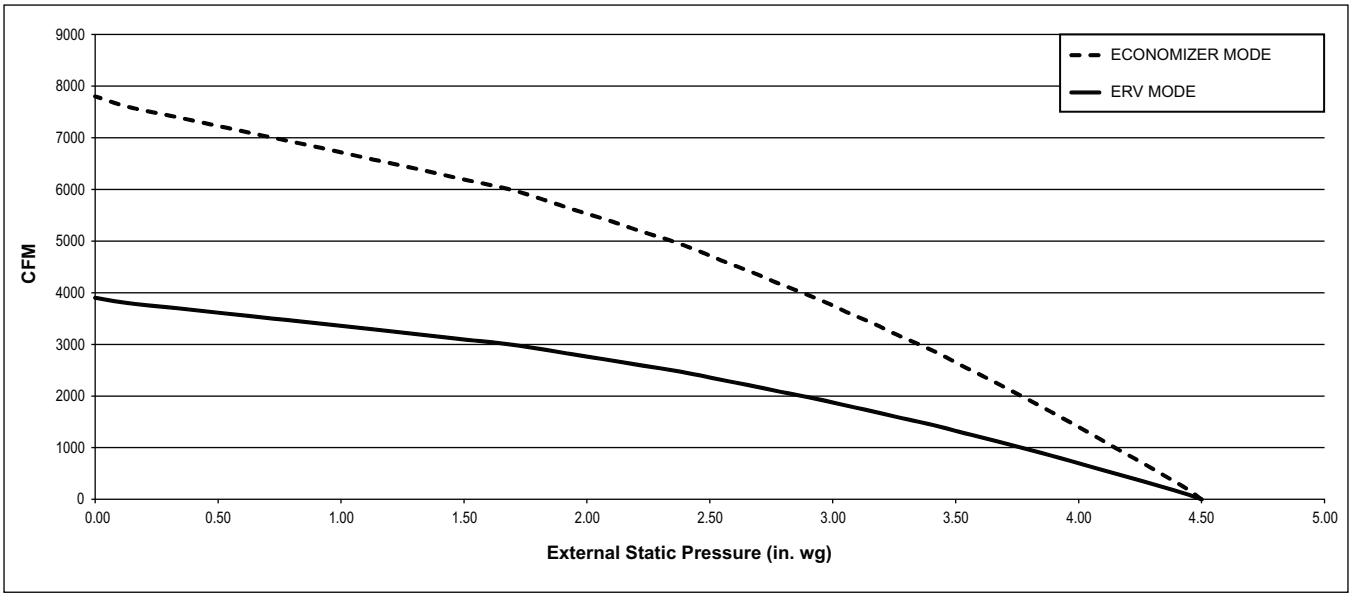


FAN PERFORMANCE — POWER EXHAUST

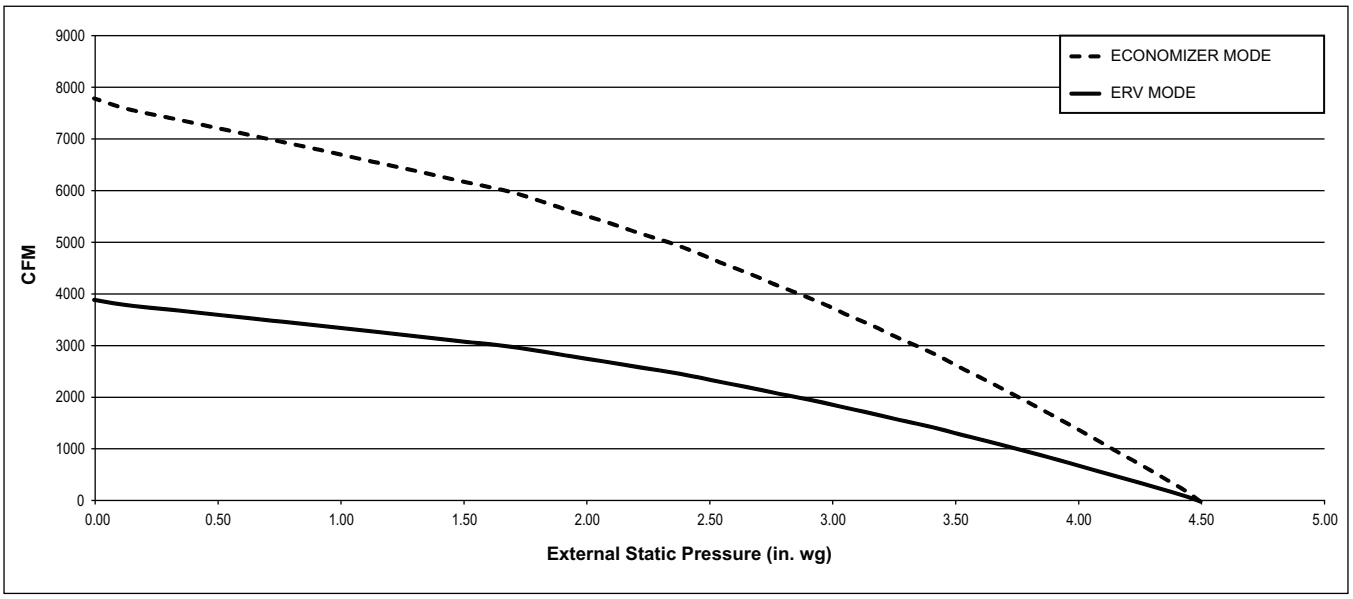
AIRFLOW	208V		230V/460V/575V	
	ESP	BHP	ESP	BHP
3,850	0.600	1.845	0.730	1.99
3,950	0.560	1.870	0.690	2.01
4,050	0.510	1.890	0.650	2.04
4,250	0.410	1.915	0.560	2.06
4,450	0.310	1.965	0.470	2.12
4,650	0.200	2.035	0.370	2.19
4,850	0.110	2.085	0.300	2.24
5,050	0.040	2.125	0.230	2.28
5,250	—	—	0.170	2.33
5,450	—	—	0.120	2.38
5,650	—	—	0.070	2.40
5,850	—	—	0.040	2.42

48HC UNITS WITH EnergyX SYSTEM — POWER EXHAUST PERFORMANCE

48HC**17 SUPPLY AND EXHAUST FAN PERFORMANCE CURVES

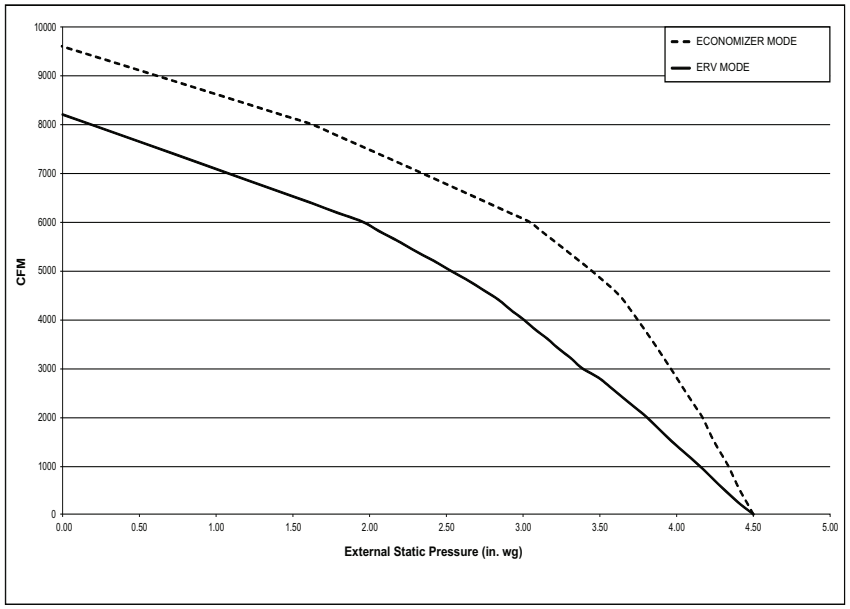


48HC**20 SUPPLY AND EXHAUST FAN PERFORMANCE CURVES

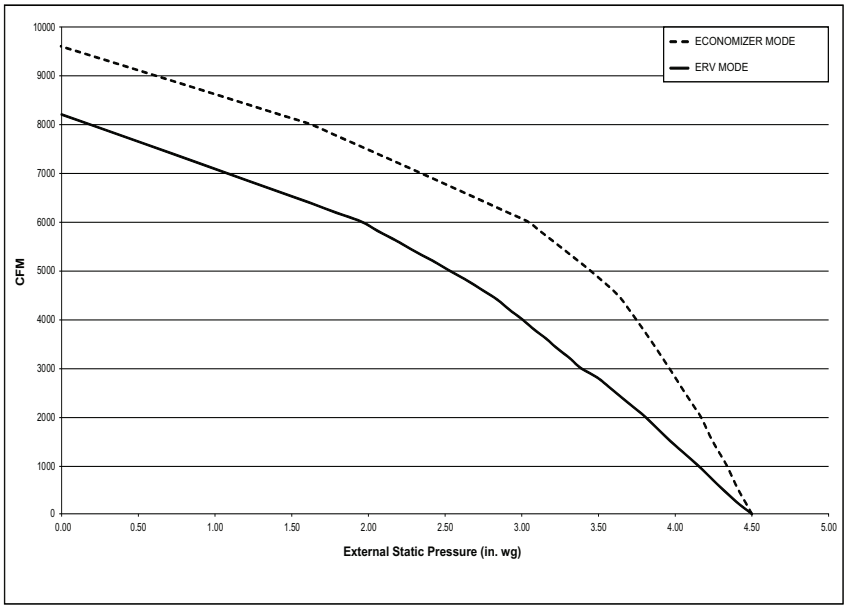


48HC UNITS WITH EnergyX SYSTEM — POWER EXHAUST PERFORMANCE (cont)

48HC**24 SUPPLY AND EXHAUST FAN PERFORMANCE CURVES



48HC**28 SUPPLY AND EXHAUST FAN PERFORMANCE CURVES



Fan data

GENERAL FAN PERFORMANCE NOTES:

1. Interpolation is permissible. Do not extrapolate.
2. External static pressure is the static pressure difference between the return duct and the supply duct plus the static pressure caused by any FIOPs or accessories.
3. Tabular data accounts for pressure loss due to clean filters, unit casing, and wet coils. Factory options and accessories may add static pressure losses. Selection software is available, through your salesperson, to help you select the best motor/drive combination for your application.
4. The Fan Performance tables offer motor/drive recommendations. In cases when two motor/drive combinations would work, Carrier recommended the lower horsepower option.
5. For information on the electrical properties of Carrier motors, please see the Electrical information section of this book.
6. For more information on the performance limits of Carrier motors, see the application data section of this book.
7. The EPACT (Energy Policy Act of 1992) regulates energy requirements for specific types of indoor fan motors. Motors regulated by EPACT include any general purpose, T-frame (three-digit, 143 and larger), single-speed, foot mounted, polyphase, squirrel cage induction motors of NEMA (National Electrical Manufacturers Association) design A and B, manufactured for use in the United States. Ranging from 1 to 200 Hp, these continuous-duty motors operate on 230 and 460 volt, 60 Hz power. If a motor does not fit into these specifications, the motor does not have to be replaced by an EPACT compliant energy-efficient motor. Variable-speed motors are exempt from EPACT compliance requirements.

48HC**17, 15 TON, VERTICAL SUPPLY/RETURN WITHOUT EnergyX® — FAN PERFORMANCE

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
4500	**494**	**0.77**	583	1.09	662	1.43	732	1.80	796	2.19
4900	522	0.93	605	1.27	681	1.64	750	2.03	813	2.44
5250	547	1.10	626	1.45	700	1.84	766	2.24	828	2.67
5650	577	1.32	651	1.68	721	2.09	786	2.51	846	2.96
6000	603	1.53	674	1.91	741	2.33	804	2.78	863	3.24
6400	634	1.81	701	2.20	765	2.64	826	3.10	883	3.59
6750	662	2.07	725	2.49	787	2.94	846	3.42	902	3.92
7150	694	2.42	754	2.85	813	3.31	869	3.81	923	4.33
7500	722	2.74	779	3.19	836	3.67	890	4.19	943	4.72

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
4500	856	2.60	911	3.02	963	3.46	*1012*	*3.92*	*1059*	*4.39*
4900	871	2.86	926	3.30	977	3.76	*1026*	*4.23*	*1072*	*4.72*
5250	885	3.11	939	3.57	990	4.05	*1038*	*4.54*	—	—
5650	903	3.43	956	3.91	1006	4.40	—	—	—	—
6000	918	3.72	971	4.22	*1020*	*4.73*	—	—	—	—
6400	937	4.09	988	4.61	—	—	—	—	—	—
6750	954	4.44	—	—	—	—	—	—	—	—
7150	975	4.87	—	—	—	—	—	—	—	—
7500	—	—	—	—	—	—	—	—	—	—

NOTES:

1. **Boldface** indicates field-supplied drive is required.
2. *Italics* requires high static drive package with different motor pulley.

Standard static 514-680 RPM, 2.9 BHP, max
Medium static 679-863 RPM, 3.7 BHP max
High static 826-1009 RPM, 4.9 BHP max

48HC**17, 15 TON, HORIZONTAL SUPPLY/RETURN WITHOUT EnergyX — FAN PERFORMANCE

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
4500	508	1.25	582	1.76	647	2.31	705	2.89	758	3.51
4900	540	1.51	610	2.05	672	2.64	729	3.26	781	3.91
5250	568	1.78	635	2.35	695	2.96	750	3.61	801	4.29
5650	600	2.13	664	2.73	723	3.37	776	4.05	825	4.76
6000	629	2.47	691	3.10	747	3.77	799	4.48	—	—
6400	663	2.91	721	3.57	776	4.28	—	—	—	—
6750	693	3.34	749	4.03	801	4.76	—	—	—	—
7150	727	3.88	781	4.61	—	—	—	—	—	—
7500	757	4.40	—	—	—	—	—	—	—	—

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
4500	807	4.16	852	4.83	—	—	—	—	—	—
4900	829	4.58	—	—	—	—	—	—	—	—
5250	—	—	—	—	—	—	—	—	—	—
5650	—	—	—	—	—	—	—	—	—	—
6000	—	—	—	—	—	—	—	—	—	—
6400	—	—	—	—	—	—	—	—	—	—
6750	—	—	—	—	—	—	—	—	—	—
7150	—	—	—	—	—	—	—	—	—	—
7500	—	—	—	—	—	—	—	—	—	—

NOTES:

1. **Boldface** indicates field-supplied drive is required.
2. *Italics* requires high static drive package with different motor pulley.

Standard static 514-680 RPM, 2.9 BHP, max
Medium static 614-780 RPM, 3.7 BHP max
High static 746-912 RPM, 4.9 BHP max

Fan data (cont)

48HC**20, 17.5 TON, VERTICAL SUPPLY/RETURN WITHOUT EnergyX — FAN PERFORMANCE

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
5250	**547**	**1.10**	626	1.45	700	1.84	766	2.24	828	2.67
5700	**581**	**1.35**	655	1.72	724	2.12	789	2.55	849	3.00
6150	**615**	**1.63**	684	2.02	750	2.44	812	2.90	871	3.37
6550	646	1.92	711	2.32	774	2.77	834	3.24	891	3.73
7000	682	2.28	743	2.71	803	3.17	860	3.66	915	4.17
7450	718	2.70	775	3.14	832	3.62	887	4.13	940	4.67
7900	755	3.16	809	3.62	863	4.12	915	4.65	966	5.21
8300	787	3.62	839	4.09	891	4.61	941	5.16	990	5.73
8750	825	4.18	874	4.68	923	5.22	971	5.78	1018	6.38

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
5250	885	3.11	939	3.57	990	4.05	1038	4.54	1084	5.04
5700	905	3.47	958	3.95	1008	4.45	1055	4.96	1100	5.48
6150	925	3.86	977	4.36	1026	4.88	1073	5.42	1118	5.96
6550	945	4.24	995	4.76	1043	5.30	1090	5.86	1134	6.42
7000	967	4.71	1017	5.26	1064	5.82	1109	6.39	—	—
7450	991	5.22	1039	5.79	1085	6.38	—	—	—	—
7900	1015	5.78	1062	6.38	—	—	—	—	—	—
8300	1038	6.33	—	—	—	—	—	—	—	—
8750	—	—	—	—	—	—	—	—	—	—

NOTE: **Boldface** indicates field-supplied drive is required.

Standard static 622-822 RPM, 3.7 BHP, max
Medium static 713-879 RPM, 4.9 BHP max
High static 882-1078 RPM, 208V (6.5 Max BHP) / 230V (6.9 Max BHP) / 460V (7.0 Max BHP) / 575V (8.3 Max BHP)
Operation point covered by high static drive. Confirm Max BHP coverage based on unit voltage selected.

48HC**20, 17.5 TON, HORIZONTAL SUPPLY/RETURN WITHOUT EnergyX — FAN PERFORMANCE

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
5250	568	1.78	635	2.35	695	2.96	750	3.61	801	4.29
5700	604	2.17	668	2.78	726	3.43	779	4.11	829	4.82
6150	642	2.63	702	3.27	758	3.95	809	4.67	857	5.42
6550	676	3.09	733	3.76	786	4.48	836	5.23	883	6.01
7000	714	3.67	769	4.38	820	5.14	868	5.92	913	6.74
7450	753	4.33	805	5.08	854	5.87	900	6.69	944	7.54
7900	792	5.06	841	5.85	888	6.68	933	7.54	—	—
8300	827	5.78	874	6.61	920	7.47	—	—	—	—
8750	867	6.69	912	7.55	—	—	—	—	—	—

CFM	Available External Static PressuAVAILABLE EXTERNAL STATIC PRESSURE (in. wg)re (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
5250	848	4.99	893	5.72	934	6.47	974	7.25	1012	8.05
5700	875	5.56	918	6.33	959	7.12	998	7.93	—	—
6150	902	6.20	944	7.00	985	7.83	—	—	—	—
6550	927	6.82	968	7.65	—	—	—	—	—	—
7000	955	7.58	—	—	—	—	—	—	—	—
7450	—	—	—	—	—	—	—	—	—	—
7900	—	—	—	—	—	—	—	—	—	—
8300	—	—	—	—	—	—	—	—	—	—
8750	—	—	—	—	—	—	—	—	—	—

NOTE: **Boldface** indicates field-supplied drive is required.

Standard static 622-822 RPM, 3.7 BHP, max
Medium static 713-879 RPM, 4.9 BHP max
High static 835-1021 RPM, 208V (6.5 Max BHP) / 230V (6.9 Max BHP) / 460V (7.0 Max BHP) / 575V (8.3 Max BHP)
Operation point covered by high static drive. Confirm Max BHP coverage based on unit voltage selected.

48HC**24, 20 TON, VERTICAL SUPPLY/RETURN WITHOUT EnergyX — FAN PERFORMANCE

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
6,000	**615**	**1.25**	690	1.56	757	1.89	819	2.22	875	2.57
6,500	**653**	**1.52**	725	1.87	789	2.21	848	2.57	903	2.94
7,000	692	1.85	760	2.21	822	2.58	879	2.96	932	3.35
7,500	731	2.21	796	2.60	856	3.00	911	3.40	963	3.81
8,000	771	2.63	833	3.04	890	3.47	944	3.89	994	4.33
8,500	812	3.10	871	3.54	926	3.98	977	4.43	1026	4.89
9,000	852	3.62	909	4.09	961	4.55	1011	5.03	1059	5.51
9,500	893	4.20	947	4.69	998	5.19	1046	5.69	1092	6.19
10,000	934	4.85	986	5.36	1035	5.88	1082	6.40	1126	6.93

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
6,000	928	2.92	978	3.28	1025	3.65	1071	4.03	1114	4.42
6,500	955	3.31	1003	3.69	1050	4.09	1094	4.49	1137	4.89
7,000	983	3.75	1030	4.15	1075	4.56	1119	4.98	1161	5.41
7,500	1011	4.23	1058	4.66	1102	5.09	1145	5.53	*1186*	*5.98*
8,000	1041	4.77	1087	5.21	1130	5.67	1171	6.13	—	—
8,500	1072	5.35	1116	5.82	1158	6.30	—	—	—	—
9,000	1104	6.00	1147	6.49	*1188*	*6.99*	—	—	—	—
9,500	1136	6.70	*1178*	*7.22*	—	—	—	—	—	—
10,000	1169	7.47	—	—	—	—	—	—	—	—

NOTES:

1. **Boldface** indicates field-supplied drive is required.
2. *Italics* requires high static drive package with different motor pulley.

Standard static 690-863 RPM; 208V (6.5 Max BHP) / 230V (6.9 Max BHP) / 460V (7.0 Max BHP) / 575 V (8.3 Max BHP)

Medium static 835-1021 RPM; 208V (6.5 Max BHP) / 230V (6.9 Max BHP) / 460V (7.0 Max BHP) / 575 V (8.3 Max BHP)

High static 941-1176 RPM; 208V (10.5 Max BHP) / 230V (11.9 Max BHP) / 460V (11.9 Max BHP) / 575 V (11.0 Max BHP)

48HC**24, 20 TON, HORIZONTAL SUPPLY/RETURN WITHOUT EnergyX — FAN PERFORMANCE

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
6,000	**633**	**1.92**	700	2.44	759	2.98	812	3.53	861	4.10
6,500	**674**	**2.34**	738	2.90	795	3.48	847	4.07	894	4.67
7,000	715	2.83	776	3.43	831	4.05	882	4.67	928	5.31
7,500	757	3.39	816	4.03	869	4.68	917	5.35	963	6.03
8,000	800	4.02	856	4.70	907	5.39	954	6.10	998	6.81
8,500	843	4.73	896	5.45	945	6.18	991	6.93	1034	7.68
9,000	886	5.52	937	6.28	984	7.06	1029	7.84	1071	8.63
9,500	929	6.40	978	7.21	1024	8.02	1067	8.84	—	—
10,000	973	7.38	1020	8.22	1064	9.08	—	—	—	—

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
6,000	907	4.68	949	5.27	990	5.88	1028	6.50	1064	7.13
6,500	939	5.29	981	5.92	1020	6.56	1058	7.21	1094	7.88
7,000	972	5.97	1013	6.63	1052	7.31	1089	8.00	—	—
7,500	1005	6.72	1046	7.42	1084	8.13	—	—	—	—
8,000	1040	7.54	1079	8.28	—	—	—	—	—	—
8,500	1075	8.45	—	—	—	—	—	—	—	—
9,000	—	—	—	—	—	—	—	—	—	—
9,500	—	—	—	—	—	—	—	—	—	—
10,000	—	—	—	—	—	—	—	—	—	—

NOTES:

1. **Boldface** indicates field-supplied drive is required.
2. UNDERSCORE: Operation point covered by mid static drive; Confirm Max BHP coverage based on the unit voltage selected.

Standard static 690-863 RPM; 208V (6.5 Max BHP) / 230V (6.9 Max BHP) / 460V (7.0 Max BHP) / 575 V (8.3 Max BHP)

Medium static 835-1021 RPM; 208V (6.5 Max BHP) / 230V (6.9 Max BHP) / 460V (7.0 Max BHP) / 575 V (8.3 Max BHP)

High static 941-1100 RPM; 208V (10.5 Max BHP) / 230V (11.9 Max BHP) / 460V (11.9 Max BHP) / 575 V (11.0 Max BHP)

Fan data (cont)

48HC**28, 25 TON, VERTICAL SUPPLY/RETURN WITHOUT EnergyX — FAN PERFORMANCE

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
7,500	731	2.21	796	2.60	856	3.00	911	3.40	963	3.81
8,150	783	2.76	844	3.19	901	3.61	954	4.05	1003	4.49
8,750	832	3.35	890	3.80	943	4.26	994	4.73	1042	5.19
9,400	885	4.08	940	4.57	991	5.06	1039	5.55	1085	6.05
10,000	934	4.85	986	5.36	1035	5.88	1082	6.40	1126	6.93
10,650	988	5.78	1038	6.33	1084	6.88	1129	7.44	1172	8.00
11,250	1038	6.74	1086	7.32	1130	7.91	1173	8.49	—	—
11,900	1093	7.91	1138	8.52	1181	9.14	—	—	—	—
12,500	1144	9.10	1187	9.74	—	—	—	—	—	—

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
7,500	1011	4.23	1058	4.66	1102	5.09	1145	5.53	*1186*	*5.98*
8,150	1050	4.94	1095	5.39	1138	5.85	*1180*	*6.32*	—	—
8,750	1088	5.67	1131	6.15	1173	6.64	—	—	—	—
9,400	1129	6.56	1172	7.07	—	—	—	—	—	—
10,000	1169	7.47	—	—	—	—	—	—	—	—
10,650	—	—	—	—	—	—	—	—	—	—
11,250	—	—	—	—	—	—	—	—	—	—
11,900	—	—	—	—	—	—	—	—	—	—
12,500	—	—	—	—	—	—	—	—	—	—

NOTES:
1. *Italics* requires high static drive package with different motor pulley.
2. UNDERSCORE: Operation point covered by mid static drive; Confirm Max BHP coverage based on the unit voltage selected.

Standard static 717-911 RPM, 4.9 BHP, max

Medium static 913-1116 RPM, 208V (6.5 Max BHP) / 230V (6.9 Max BHP) / 460V (7.0 Max BHP) / 575 V (8.3 Max BHP)

High static 941-1176 RPM, 208V (10.5 Max BHP) / 230V (11.9 Max BHP) / 460V (11.9 Max BHP) / 575 V (11.0 Max BHP)

48HC**28, 25 TON, HORIZONTAL SUPPLY/RETURN WITHOUT EnergyX — FAN PERFORMANCE

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
7,500	**757**	**3.39**	816	4.03	869	4.68	917	5.35	963	6.03
8,000	800	4.02	856	4.70	907	5.39	954	6.10	998	6.81
8,500	843	4.73	896	5.45	945	6.18	991	6.93	1034	7.68
9,000	886	5.52	937	6.28	984	7.06	1029	7.84	1071	8.63
9,500	929	6.40	978	7.21	1024	8.02	1067	8.84	—	—
10,000	973	7.38	1020	8.22	1064	9.08	—	—	—	—
10,500	1017	8.45	1062	9.33	—	—	—	—	—	—
11,000	1061	9.63	—	—	—	—	—	—	—	—
11,500	—	—	—	—	—	—	—	—	—	—

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
7,500	1005	6.72	1046	7.42	1084	8.13	—	—	—	—
8,000	1040	7.54	1079	8.28	—	—	—	—	—	—
8,500	1075	8.45	—	—	—	—	—	—	—	—
9,000	—	—	—	—	—	—	—	—	—	—
9,500	—	—	—	—	—	—	—	—	—	—
10,000	—	—	—	—	—	—	—	—	—	—
10,500	—	—	—	—	—	—	—	—	—	—
11,000	—	—	—	—	—	—	—	—	—	—
11,500	—	—	—	—	—	—	—	—	—	—

NOTE: **Boldface** indicates field-supplied drive is required.

Standard static 717-911 RPM, 4.9 BHP, max

Medium static 913-1116 RPM, 208V (6.5 Max BHP) / 230V (6.9 Max BHP) / 460V (7.0 Max BHP) / 575 V (8.3 Max BHP)

High static 941-1176 RPM, 208V (10.5 Max BHP) / 230V (11.9 Max BHP) / 460V (11.9 Max BHP) / 575 V (11.0 Max BHP)

48HC*D17, 15 TON WITH EnergyX, VERTICAL SUPPLY/RETURN — FAN PERFORMANCE

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
4500	**490**	**0.76**	575	1.07	653	1.41	724	1.79	791	2.19
4900	517	0.92	597	1.24	671	1.60	740	1.99	804	2.41
5250	541	1.08	618	1.42	688	1.79	754	2.19	817	2.62
5600	566	1.26	639	1.61	707	2.00	770	2.42	831	2.86
6000	595	1.49	664	1.86	729	2.27	790	2.70	848	3.15
6400	624	1.75	690	2.14	751	2.56	810	3.01	866	3.48
6750	650	2.00	713	2.41	772	2.84	829	3.30	883	3.79
7100	**676**	**2.27**	736	2.70	793	3.15	848	3.63	901	4.13
7500	706	2.62	763	3.06	**819**	**3.54**	871	4.03	922	4.55

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
4500	854	2.63	913	3.09	970	3.57	**1024**	**4.09**	**1077**	**4.62**
4900	**865**	**2.86**	923	3.33	978	3.83	**1031**	**4.35**	**1082**	**4.89**
5250	876	3.08	932	3.56	986	4.07	**1038**	**4.60**	—	—
5600	888	3.33	943	3.82	995	4.34	**1046**	**4.88**	—	—
6000	903	3.64	956	4.14	1008	4.67	—	—	—	—
6400	920	3.98	971	4.50	—	—	—	—	—	—
6750	935	4.30	986	4.83	—	—	—	—	—	—
7100	952	4.65	—	—	—	—	—	—	—	—
7500	—	—	—	—	—	—	—	—	—	—

NOTE: **Boldface** indicates field-supplied drive is required.

Standard static 514 — 680 RPM, 2.2 Max BHP
Medium static 679 — 863 RPM, 3.3 Max BHP
High static 826 — 1009 RPM, 4.9 Max BHP

48HCF*20, 17.5 TON WITH EnergyX, VERTICAL SUPPLY/RETURN — FAN PERFORMANCE

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
5250	**541**	**1.08**	**618**	**1.42**	688	1.79	754	2.19	817	2.62
5700	**573**	**1.31**	645	1.67	712	2.06	775	2.48	835	2.93
6100	**602**	**1.55**	670	1.93	734	2.34	795	2.77	852	3.23
6500	631	1.81	696	2.21	757	2.64	815	3.09	871	3.57
7000	668	2.19	729	2.61	787	3.06	843	3.53	896	4.03
7500	706	2.62	763	3.06	819	3.54	871	4.03	922	4.55
7900	736	3.00	791	3.47	844	3.96	895	4.47	944	5.00
8300	767	3.42	819	3.90	870	4.41	919	4.94	967	5.49
8750	801	3.94	852	4.44	900	4.97	948	5.52	993	6.09

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
5250	876	3.08	932	3.56	986	4.07	1038	4.60	**1088**	**5.15**
5700	892	3.40	946	3.90	998	4.42	1049	4.96	**1097**	**5.52**
6100	907	3.72	960	4.23	1011	4.76	1060	5.31	**1107**	**5.89**
6500	924	4.07	975	4.59	1025	5.13	1072	5.70	**1119**	**6.28**
7000	947	4.55	996	5.09	1044	5.65	**1090**	**6.23**	—	—
7500	971	5.08	1019	5.64	1064	6.22	—	—	—	—
7900	992	5.55	1038	6.13	—	—	—	—	—	—
8300	1013	6.06	—	—	—	—	—	—	—	—
8750	—	—	—	—	—	—	—	—	—	—

NOTE: **Boldface** indicates field-supplied drive is required.

Standard static 622 — 822 RPM, 3.3 Max BHP
Medium static 713 — 879 RPM, 4.9 Max BHP
High static 882 — 1078 RPM, 6.5 Max BHP

Fan data (cont)

48HC*D24, 20 TON WITH EnergyX, VERTICAL SUPPLY/RETURN — FAN PERFORMANCE

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
6,000	**605**	**1.48**	**674**	**1.77**	738	2.08	798	2.41	854	2.74
6,500	**644**	**1.82**	709	2.14	770	2.47	827	2.81	881	3.17
7,000	**683**	**2.22**	744	2.56	802	2.91	857	3.28	908	3.65
7,500	722	2.68	781	3.04	836	3.41	888	3.80	938	4.19
8,000	762	3.20	818	3.58	870	3.97	920	4.38	968	4.79
8,500	803	3.78	855	4.19	905	4.60	953	5.02	999	5.46
9,000	843	4.43	893	4.86	941	5.30	987	5.74	1032	6.19
9,500	884	5.15	932	5.61	978	6.06	1022	6.53	1065	7.01
10,000	925	5.95	970	6.43	1015	6.91	1057	7.40	1098	7.89

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
6,000	907	3.10	958	3.46	1006	3.84	1052	4.23	1097	4.63
6,500	932	3.54	981	3.92	1027	4.31	1073	4.72	1116	5.14
7,000	958	4.04	1005	4.43	1051	4.84	1094	5.27	1137	5.70
7,500	985	4.59	1031	5.01	1075	5.44	1118	5.87	1159	6.32
8,000	1014	5.21	1058	5.65	1101	6.09	1142	6.55	—	—
8,500	1044	5.90	1087	6.35	1128	6.82	1168	7.29	—	—
9,000	1075	6.66	1116	7.13	1156	7.61	—	—	—	—
9,500	1106	7.49	1146	7.98	—	—	—	—	—	—
10,000	1139	8.40	—	—	—	—	—	—	—	—

NOTE: **Boldface** indicates field-supplied drive is required.

Standard static 690 — 863 RPM, 4.9 Max BHP
Medium static 835 — 1021 RPM, 6.5 Max BHP
High static 941 — 1176 RPM, 8.7 Max BHP

48HC*D28 25 TON, WITH EnergyX, VERTICAL SUPPLY/RETURN — FAN PERFORMANCE

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
7,500	**713**	**2.25**	778	2.61	838	2.97	894	3.36	946	3.76
8,000	752	2.68	814	3.06	871	3.44	925	3.85	976	4.26
8,500	791	3.17	850	3.56	905	3.97	957	4.39	1006	4.83
9,000	831	3.71	887	4.12	939	4.55	989	4.99	1037	5.45
9,500	870	4.31	924	4.75	974	5.19	1023	5.66	1069	6.13
10,000	910	4.83	961	5.43	1010	5.90	1057	6.38	1102	6.87
10,500	950	5.70	999	6.18	1046	6.67	1091	7.17	1135	7.69
11,000	990	6.50	1037	7.01	1083	7.52	1126	8.04	1168	8.57
11,500	1030	7.38	1076	7.90	1119	8.43	—	—	—	—
12,000	1070	8.33	—	—	—	—	—	—	—	—
12,500	—	—	—	—	—	—	—	—	—	—

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
7,500	996	4.17	1044	4.60	1089	5.05	1133	5.51	1175	5.98
8,000	1024	4.70	1071	5.14	1115	5.60	1158	6.07	—	—
8,500	1053	5.27	1098	5.74	1141	6.21	—	—	—	—
9,000	1083	5.91	1127	6.39	1169	6.88	—	—	—	—
9,500	1113	6.61	1156	7.11	—	—	—	—	—	—
10,000	1145	7.38	—	—	—	—	—	—	—	—
10,500	—	—	—	—	—	—	—	—	—	—
11,000	—	—	—	—	—	—	—	—	—	—
11,500	—	—	—	—	—	—	—	—	—	—
12,000	—	—	—	—	—	—	—	—	—	—
12,500	—	—	—	—	—	—	—	—	—	—

NOTE: **Boldface** indicates field-supplied drive is required.

Standard static 717 — 911 RPM, 4.9 Max BHP 2.2
Medium static 913 — 1116 RPM, 6.5 Max BHP
High static 941 — 1176 RPM, 8.7 Max BHP

PULLEY ADJUSTMENT, VERTICAL

48HC UNIT		MOTOR/DRIVE COMBO	MOTOR PULLEY TURNS OPEN										
			0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
17	3 phase	Standard Static	680	663	647	630	614	597	580	564	547	531	514
		Medium Static	863	845	826	808	789	771	753	734	716	697	679
		High Static	1009	991	972	954	936	918	899	881	863	844	826
20	3 phase	Standard Static	822	802	782	762	742	722	702	682	662	642	622
		Medium Static	879	862	846	829	813	796	779	763	746	730	713
		High Static	1078	1058	1039	1019	1000	980	960	941	921	902	882
24	3 phase	Standard Static	863	846	828	811	794	777	759	742	725	707	690
		Medium Static	1021	1002	984	965	947	928	909	891	872	854	835
		High Static	1176	1153	1129	1106	1082	1059	1035	1012	988	965	941
28	3 phase	Standard Static	911	892	872	853	833	814	795	775	756	736	717
		Medium Static	1116	1096	1075	1055	1035	1015	994	974	954	933	913
		High Static	1176	1153	1129	1106	1082	1059	1035	1012	988	965	941

Factory setting

PULLEY ADJUSTMENT, HORIZONTAL

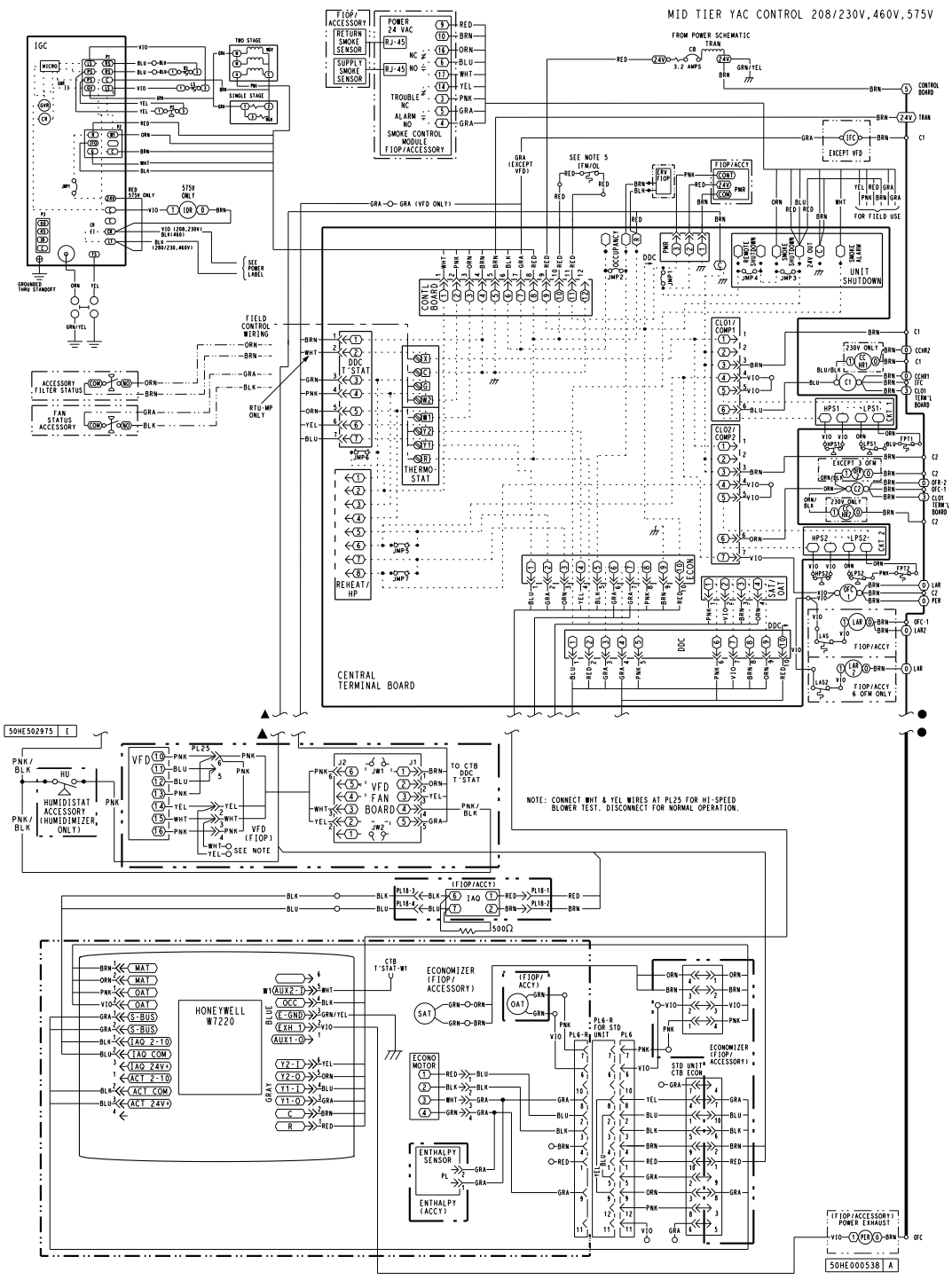
48HC UNIT		MOTOR/DRIVE COMBO	MOTOR PULLEY TURNS OPEN										
			0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
17	3 phase	Standard Static	680	663	647	630	614	597	580	564	547	531	514
		Medium Static	780	763	747	730	714	697	680	664	647	631	614
		High Static	912	895	879	862	846	829	812	796	779	763	746
20	3 phase	Standard Static	822	802	782	762	742	722	702	682	662	642	622
		Medium Static	879	862	846	829	813	796	779	763	746	730	713
		High Static	1021	1002	984	965	947	928	909	891	872	854	835
24	3 phase	Standard Static	863	846	828	811	794	777	759	742	725	707	690
		Medium Static	1021	1002	984	965	947	928	909	891	872	854	835
		High Static	1176	1153	1129	1106	1082	1059	1035	1012	988	965	941
28	3 phase	*Standard Static	791	777	762	748	733	719	705	690	676	661	647
		Medium Static	923	906	889	873	856	839	822	805	789	772	755
		High Static	1107	1087	1067	1047	1027	1007	986	966	946	926	906

* Standard Static drive is only for 50 series, for 48 series use a field-supplied drive.

Factory setting

Typical wiring diagram

48HC 17-24 ELECTRO-MECHANICAL CONTROL WIRING DIAGRAMS

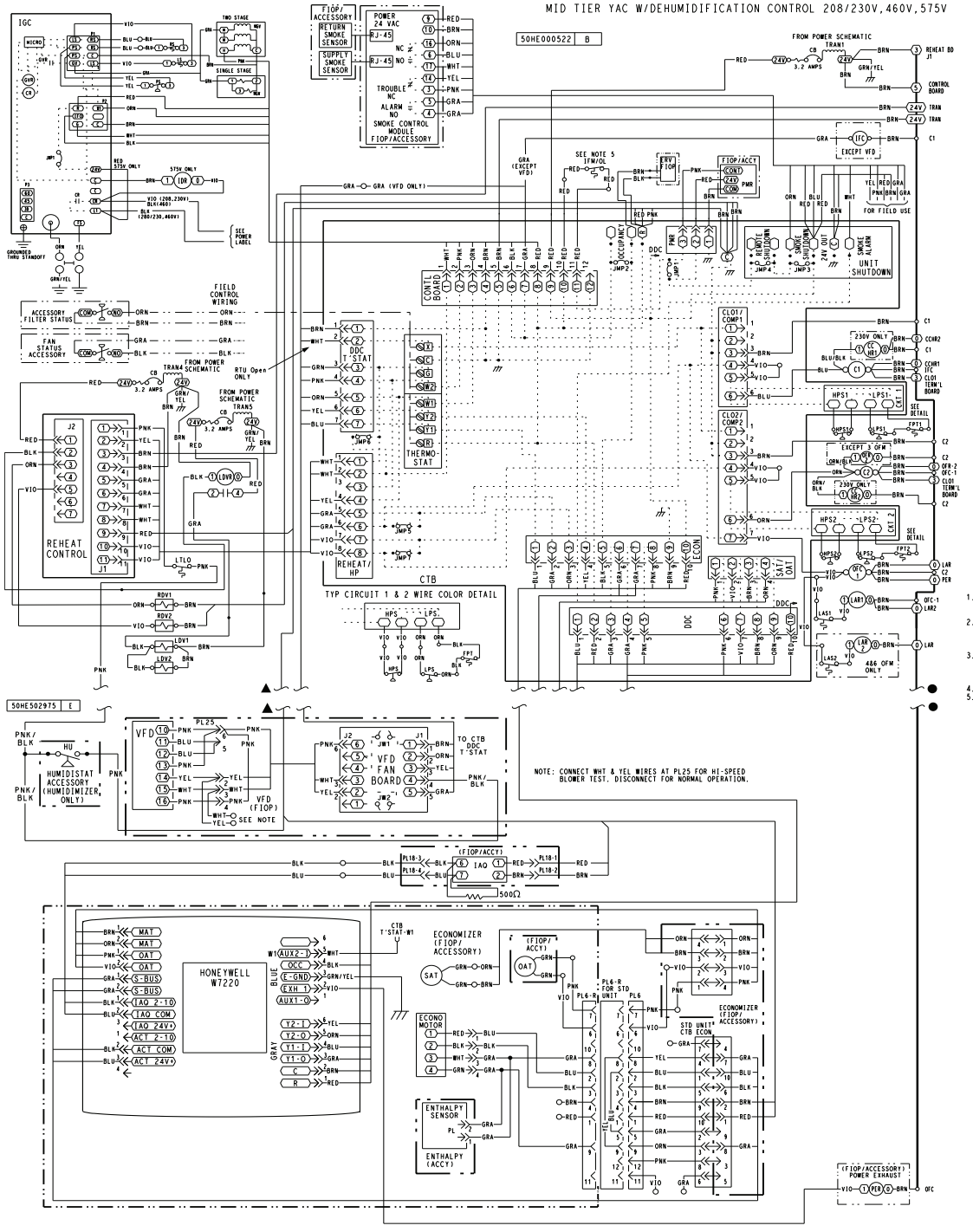


C	CONTACTOR,COMPRESSOR
CAP	CAPACITOR
CB	CIRCUIT BREAKER
CCH	CRANKCASE HEATER
CCHR	CRANKCASE HEATER RELAY
CCN	CARRIER COMFORT NETWORK
CMP SAFE	COMPRESSOR SAFFETY
COFS	CONDENSATE OVERFLOW SWITCH
COMP	COMPRESSOR MOTOR
CTB	CENTRAL TERMINAL BOARD
DDC	DIRECT DIGITAL CONTROL
ERV	ENERGY RECOVERY VENTILATOR
FIOP	FACTORY INSTALLED OPTION
FSD	FIRE SHUT DOWN
FU	FUSE
GND	GROUND
GVR	GAS VALVE RELAY
HPS	HIGH PRESSURE SWITCH
HS	HALL EFFECT SENSOR
I	IGNITOR
IAQ	INDOOR AIR QUALITY SENSORS
IDM	INDUCED DRAFT MOTOR
IDR	INDUCED DRAFT RELAY
IFC	INDOOR FAN CONTACTOR
IFM	INDOOR FAN MOTOR
IGC	INTEGRATED GAS CONTROL
IRH	INDOOR RELATIVE HUMIDITY
LA	LOW AMBIENT LOCKOUT
LAR	LOW AMBIENT RELAY
LAS	LOW AMBIENT SWITCH
LOOP PWR	CURRENT LOOP POWER
LPS	LOW PRESSURE SWITCH
LSM	LIMIT SWITCH (MANUAL RESET)
MGV	MAIN GAS VALVE
OAQ	OUTDOOR AIR QUALITY
OAT	OUTDOOR AIR TEMP. SENSOR
OFC	OUTDOOR FAN CONTACTOR
OFM	OUTDOOR FAN MOTOR
OFR	OUTDOOR FAN RELAY
OFTB	OUTDOOR FAN TERMINAL BLOCK
OLR	OVERLOAD RELAY
PER	POWER EXHAUST RELAY
PL	PLUG ASSEMBLY
POT	POTENTIOMETER
PWR	PHASE MONITOR RELAY
QT	QUADRUPLE TERMINAL
R	RELAY
RAT	RETURN AIR TEMP. SEN
RMT OCC	REMOTE OCCUPANCY
RS	ROLLOUT SWITCH
RTPF	ROUND TUBE PLATE FIN CONDENSER COIL
SAT	SUPPLY AIR TEMP. SENSOR
SEN	SENSOR
SET	SET POINT OFFSET
SFS	SUPPLY FAN STATUS
TDR	TIME DELAY RELAY
TRAN	TRANSFORMER
VFD	VARIABLE FREQUENCY DRIVE

NOTES

1. IF ANY OF THE ORIGINAL WIRE FURNISHED MUST BE REPLACED, IT MUST BE REPLACED WITH TYPE 90 C WIRE OR ITS EQUIVALENT.
2. COMPRESSOR AND FAN MOTORS ARE THERMALLY PROTECTED. THREE PHASE MOTORS ARE PROTECTED AGAINST PRIMARY SINGLE PHASING CONDITIONS.
3. 208/230V UNIT TRAN IS WIRED FOR 230V UNIT. IF UNIT IS TO BE RUN WITH 208V POWER SUPPLY DISCONNECT BLK WIRE FROM 230V TAP AND CONNECT TO 200V TAP.
4. USE COPPER CONDUCTOR ONLY.
5. IFM OL IS NOT USED ON ALL MODELS, IF NOT USED, THEN RED LEADS ARE CONNECTED TOGETHER.

48HC 17-24 ELECTRO-MECHANICAL CONTROL WIRING DIAGRAM WITH OPTIONAL HUMIDI-MIZER® SYSTEM



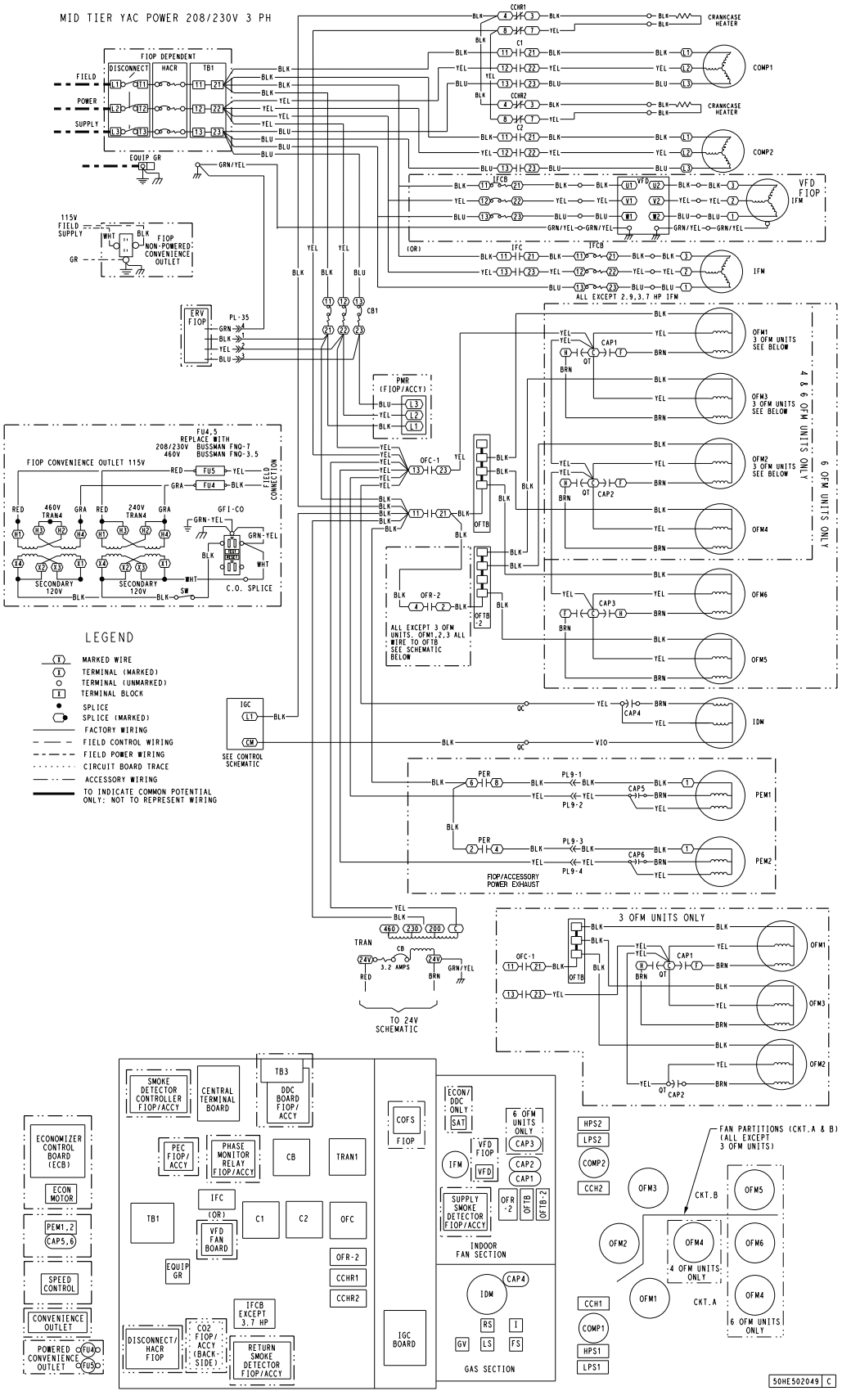
C	CONTACTOR,COMPRESSOR
CAP	CAPACITOR
CB	CIRCUIT BREAKER
CCH	CRANKCASE HEATER
CCHR	CRANKCASE HEATER RELAY
CCN	CARRIER COMFORT NETWORK
CMP SAFE	COMPRESSOR SAFFETY
COFS	CONDENSATE OVERFLOW SWITCH
COMP	COMPRESSOR MOTOR
CTB	CENTRAL TERMINAL BOARD
DDC	DIRECT DIGITAL CONTROL
ERV	ENERGY RECOVERY VENTILATOR
FIOP	FACTORY INSTALLED OPTION
FPT	FREEZE PROTECTION THERMOSTAT
FSD	FIRE SHUT DOWN
FU	FUSE
GND	GROUND
GVR	GAS VALVE RELAY
HPS	HIGH PRESSURE SWITCH
HS	HALL EFFECT SENSOR
I	IGNITOR
IAQ	INDOOR AIR QUALITY SENSORS
IDM	INDUCED DRAFT MOTOR
IDR	INDUCED DRAFT RELAY
IFC	INDOOR FAN CONTACTOR
IFM	INDOOR FAN MOTOR
IGC	INTEGRATED GAS CONTROL
IRH	INDOOR RELATIVE HUMIDITY
LA	LOW AMBIENT LOCKOUT
LAR	LOW AMBIENT RELAY
LAS	LOW AMBIENT SWITCH
LDV	LIQUID DIVERTER VALVE (3-WAY)
LDVR	LIQUID DIVERTER VALVE RELAY
LOOP PWR	CURRENT LOOP POWER
LPS	LOW PRESSURE SWITCH
LSM	LIMIT SWITCH (MANUAL RESET)
MGV	MAIN GAS VALVE
OAQ	OUTDOOR AIR QUALITY
OAT	OUTDOOR AIR TEMP. SENSOR
OFC	OUTDOOR FAN CONTACTOR
OFM	OUTDOOR FAN MOTOR
OFR	OUTDOOR FAN RELAY
OFTB	OUTDOOR FAN TERMINAL BLOCK
OLR	OVERLOAD RELAY
PER	POWER EXHAUST RELAY
PL	PLUG ASSEMBLY
POT	POTENTIOMETER
PWR	PHASE MONITOR RELAY
QT	QUADRUPLE TERMINAL
R	RELAY
RAT	RETURN AIR TEMP. SEN
RDV	REHEAT DISCHARGE VALVE
RMT OCC	REMOTE OCCUPANCY
RS	ROLLOUT SWITCH
RTPF	ROUND TUBE PLATE FIN
	CONDENSER COIL
SAT	SUPPLY AIR TEMP. SENSOR
SEN	SENSOR
SET	SET POINT OFFSET
SFS	SUPPLY FAN STATUS
TDR	TIME DELAY RELAY
TRAN	TRANSFORMER
VFD	VARIABLE FREQUENCY DRIVE

NOTES

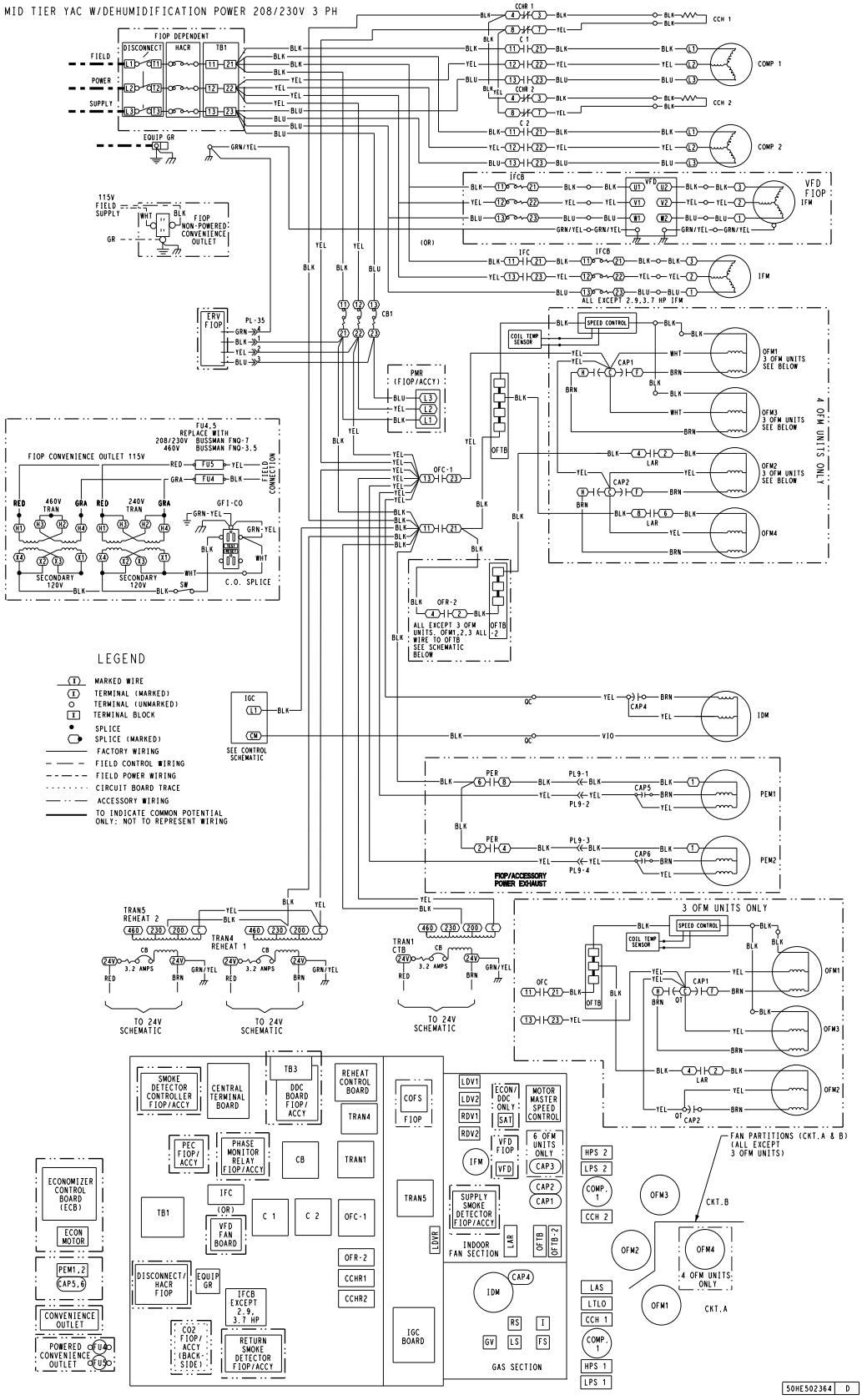
1. IF ANY OF THE ORIGINAL WIRE FURNISHED MUST BE REPLACED, IT MUST BE REPLACED WITH TYPE 90 C WIRE OR ITS EQUIVALENT.
2. COMPRESSOR AND FAN MOTORS ARE THERMALLY PROTECTED. THREE PHASE MOTORS ARE PROTECTED AGAINST PRIMARY SINGLE PHASING CONDITIONS.
3. 208/230V UNIT TRAN IS WIRED FOR 230V UNIT. IF UNIT IS TO BE RUN WITH 208V POWER SUPPLY DISCONNECT BLK WIRE FROM 230V TAP AND CONNECT TO 200V TAP.
4. USE COPPER CONDUCTOR ONLY.
5. IFM OL IS NOT USED ON ALL MODELS. WHEN NOT USED, RED LEADS ARE CONNECTED TOGETHER.

Typical wiring diagram (cont)

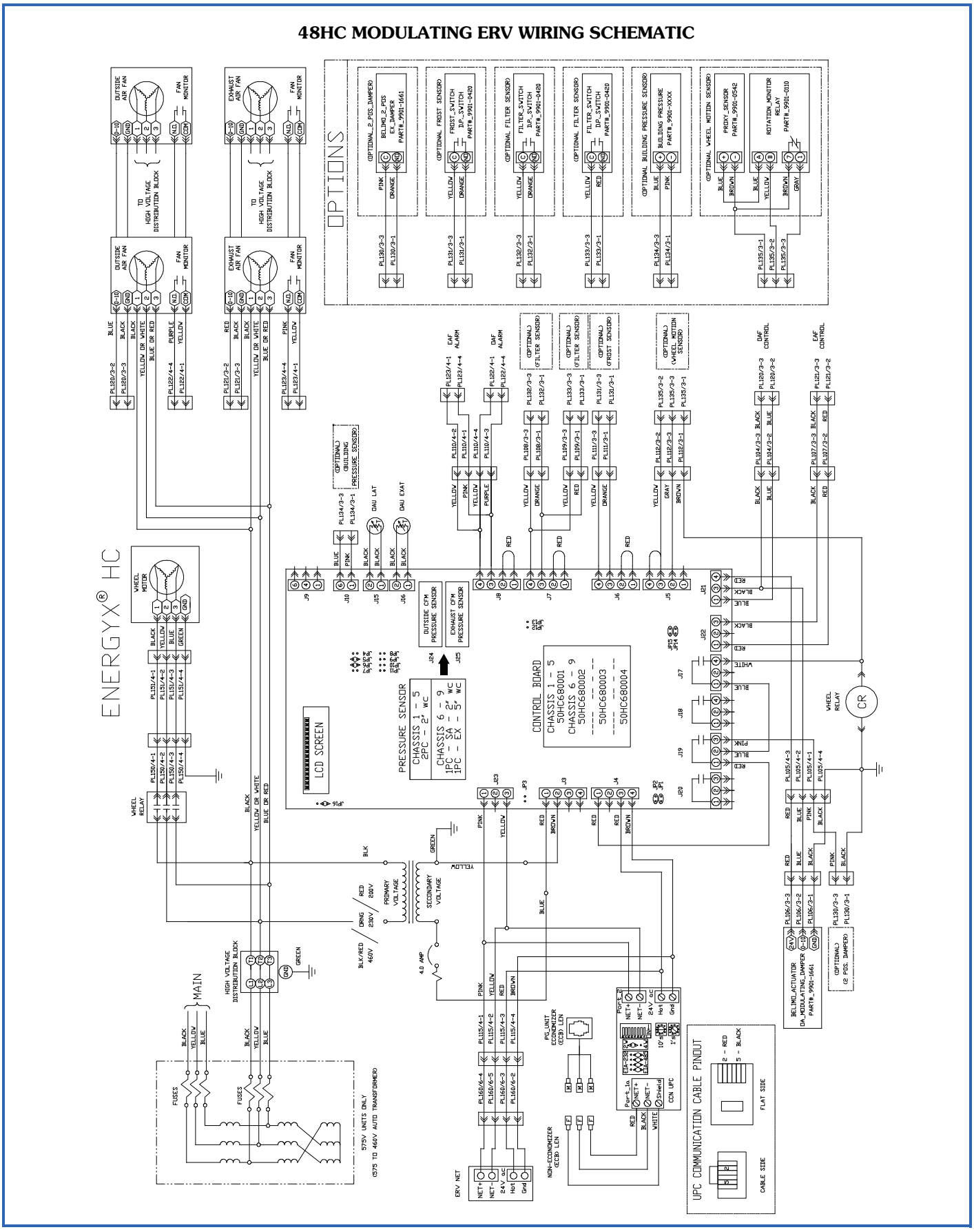
48HC 17-24 TYPICAL POWER WIRING DIAGRAM, 208/230V SHOWN



48HC 17-24 TYPICAL POWER WIRING DIAGRAM WITH OPTIONAL HUMIDI-MIZER® SYSTEM, 208/230V SHOWN



Typical wiring diagram (cont)



Electrical data

48HC**17-28 COOLING ELECTRICAL DATA — WITHOUT EnergyX® ERV

48HC UNIT SIZE	V-Ph-Hz	VOLTAGE RANGE		COMP 1		COMP 2		OFM (EA)		IFM			COMBUSTION FAN MOTOR	POWER EXHAUST	
		MIN	MAX	RLA	LRA	RLA	LRA	WATTS	FLA	TYPE	EFFCY AT FULL LOAD	FLA	FLA	KIT QTY	FLA (EA KIT)
17	208-3-60	187	253	25.0	164	25.0	164	350	1.5	STD	81.3%	7.5	0.52	2	5.9
										MED	87.0%	10.6			
										HIGH	82.9%	13.6			
	230-3-60	187	253	25.0	164	25.0	164	350	1.5	STD	81.3%	7.5	0.52	2	5.9
										MED	87.0%	10.6			
										HIGH	82.9%	12.7			
	460-3-60	414	506	12.8	100	12.8	100	277	0.9	STD	81.3%	3.4	0.3	2	3.1
										MED	87.0%	5.3			
										HIGH	82.9%	6.4			
	575-3-60	518	633	9.6	78	9.6	48	397	0.6	STD	81.1%	2.8	0.24	2	2.4
										MED	81.1%	2.8			
										HIGH	83.6%	5.6			
20	208-3-60	187	253	27.6	191	25.0	164	350	1.5	STD	83.8%	10.2	0.52	2	5.9
										MED	82.9%	13.6			
										HIGH-HE	89.5%	17.1			
	230-3-60	187	253	27.6	191	25.0	164	350	1.5	STD	83.8%	10.2	0.52	2	5.9
										MED	82.9%	12.7			
										HIGH-HE	89.5%	17.1			
	460-3-60	414	506	12.8	100	12.2	100	277	0.9	STD	83.8%	4.8	0.3	2	3.1
										MED	82.9%	6.4			
										HIGH-HE	89.5%	8.6			
	575-3-60	518	633	9.6	78	9.0	78	397	0.6	STD	81.1%	2.8	0.24	2	2.4
										MED	83.6%	5.6			
										HIGH-HE	89.5%	7.6			
24	208-3-60	187	253	28.2	239	28.2	239	350	1.5	STD	89.5%	17.1	0.52	2	5.9
										MED-HE	89.5%	17.1			
										HIGH-HE	91.7%	28.5			
	230-3-60	187	253	28.2	239	28.2	239	350	1.5	STD	89.5%	17.1	0.52	2	5.9
										MED-HE	89.5%	17.1			
										HIGH-HE	91.7%	28.5			
	460-3-60	414	506	14.7	130	14.7	130	277	0.9	STD	89.5%	8.6	0.3	2	3.1
										MED-HE	89.5%	8.6			
										HIGH-HE	91.7%	14.3			
	575-3-60	518	633	11.3	94	11.3	94	397	0.6	STD	83.6%	5.6	0.24	2	2.4
										MED-HE	89.5%	7.6			
										HIGH-HE	91.7%	9.5			
28	208-3-60	187	253	48.1	245	33.9	240	350	1.5	STD	82.9%	13.6	0.52	2	5.9
										MED-HE	89.5%	17.1			
										HIGH-HE	91.7%	28.5			
	230-3-60	187	253	48.1	245	33.9	240	350	1.5	STD	82.9%	12.7	0.52	2	5.9
										MED-HE	89.5%	17.1			
										HIGH-HE	91.7%	28.5			
	460-3-60	414	506	18.6	125	16.0	140	277	0.9	STD	82.9%	6.4	0.3	2	3.1
										MED-HE	89.5%	8.6			
										HIGH-HE	91.7%	14.3			
	575-3-60	518	633	14.7	100	12.9	108	397	0.6	STD	83.6%	5.6	0.24	2	2.4
										MED-HE	89.5%	7.6			
										HIGH-HE	91.7%	9.5			

LEGEND

EA — Each
FLA — Full Load Amps
HIGH-HE — High-High Efficiency
IFM — Indoor (Evaporator) Fan Motor
LRA — Locked Rotor Amps
MED-HE — Medium-High Efficiency
OFM — Outdoor Fan Motor
RLA — Rated Load Amps

NOTE: Refer to Packaged Rooftop Builder (Selection Software) for additional electrical data specific to EnergyX units.

Electrical data (cont)

48HC**17-28 WITH TWO-SPEED BLOWER COOLING ELECTRICAL DATA — WITHOUT EnergyX® ERV

48HC UNIT SIZE	V-Ph-Hz	VOLTAGE RANGE MIN	VOLTAGE RANGE MAX	COMP 1 RLA	COMP 1 LRA	COMP 2 RLA	COMP 2 LRA	OFM (EA) WATTS	OFM (EA) FLA	IFM TYPE	IFM EFFCY AT FULL LOAD	IFM FLA	COMBUSTION FAN MOTOR FLA	POWER EXHAUST KIT QTY	POWER EXHAUST FLA (EA KIT)
17	208-3-60	187	253	25.0	164	25.0	164	350	1.5	STD	85.0%	8.6	0.52	2	5.9
										MED	81.5%	10.8			
										HIGH	83.6%	13.6			
	230-3-60	187	253	25.0	164	25.0	164	350	1.5	STD	85.0%	7.8	0.52	2	5.9
										MED	81.5%	9.8			
										HIGH	83.6%	12.7			
	460-3-60	414	506	12.8	100	12.8	100	277	0.9	STD	85.0%	3.8	0.3	2	3.1
										MED	81.5%	4.9			
										HIGH	83.6%	6.4			
	575-3-60	518	633	9.6	78	9.6	78	397	0.6	STD	81.1%	4.5	0.24	2	2.4
										MED	81.1%	4.5			
										HIGH	83.6%	6.2			
20	208-3-60	187	253	27.6	191	25.0	164	350	1.5	STD	81.5%	10.8	0.52	2	5.9
										MED	83.6%	13.6			
										HIGH	89.5%	17.1			
	230-3-60	187	253	27.6	191	25.0	164	350	1.5	STD	81.5%	9.8	0.52	2	5.9
										MED	83.6%	12.7			
										HIGH	89.5%	17.1			
	460-3-60	414	506	12.8	100	12.2	100	277	0.9	STD	81.5%	4.9	0.3	2	3.1
										MED	83.6%	6.4			
										HIGH	89.5%	8.6			
	575-3-60	518	633	9.6	78	9.0	78	397	0.6	STD	81.1%	4.5	0.24	2	2.4
										MED	83.6%	6.2			
										HIGH	89.5%	7.6			
24	208-3-60	187	253	28.2	239	28.2	239	350	1.5	STD	83.6%	13.6	0.52	2	5.9
										MED	89.5%	17.1			
										HIGH	91.7%	28.5			
	230-3-60	187	253	28.2	239	28.2	239	350	1.5	STD	83.6%	12.7	0.52	2	5.9
										MED	89.5%	17.1			
										HIGH	91.7%	28.5			
	460-3-60	414	506	14.7	130	14.7	130	277	0.9	STD	83.6%	6.4	0.3	2	3.1
										MED	89.5%	8.6			
										HIGH	91.7%	14.3			
	575-3-60	518	633	11.3	94	11.3	94	397	0.6	STD	83.6%	6.2	0.24	2	2.4
										MED	89.5%	7.6			
										HIGH	91.7%	9.5			
28	208-3-60	187	253	48.1	245	33.9	240	350	1.5	STD	83.6%	13.6	0.52	2	5.9
										MED	89.5%	17.1			
										HIGH	91.7%	28.5			
	230-3-60	187	253	48.1	245	33.9	240	350	1.5	STD	83.6%	12.7	0.52	2	5.9
										MED	89.5%	17.1			
										HIGH	91.7%	28.5			
	460-3-60	414	506	18.6	125	16.0	140	277	0.9	STD	83.6%	6.4	0.3	2	3.1
										MED	89.5%	8.6			
										HIGH	91.7%	14.3			
	575-3-60	518	633	14.7	100	12.9	108	397	0.6	STD	83.6%	6.2	0.24	2	2.4
										MED	89.5%	7.6			
										HIGH	91.7%	9.5			

LEGEND

EA — Each
FLA — Full Load Amps
HIGH-HE — High-High Efficiency
IFM — Indoor (Evaporator) Fan Motor
LRA — Locked Rotor Amps
MED-HE — Medium-High Efficiency
OFM — Outdoor Fan Motor
RLA — Rated Load Amps

NOTE: Refer to Packaged Rooftop Builder (Selection Software) for additional electrical data specific to EnergyX units.

48HC**17-28 MCA MOCP ELECTRICAL DATA — WITHOUT EnergyX ERV

48HC UNIT TYPE	NOM. V-Ph-Hz	IFM TYPE	NO CONVENIENCE OUTLET OR UNPOWERED CONVENIENCE OUTLET								WITH POWERED CONVENIENCE OUTLET							
			NO POWERED EXHAUST				WITH POWERED EXHAUST (POWERED FROM UNIT)				NO POWERED EXHAUST				WITH POWERED EXHAUST (POWERED FROM UNIT)			
			MCA	HACR BRKR	DISC. SIZE		MCA	HACR BRKR	DISC. SIZE		MCA	HACR BRKR	DISC. SIZE		MCA	HACR BRKR	DISC. SIZE	
					FLA	LRA			FLA	LRA			FLA	LRA			FLA	LRA
17	208/230-3-60	STD	68.3	90	71	393	80.1	100	85	413	73.1	90	77	398	84.9	100	90	68.3
		MED	71.4	90	75	423	83.2	100	88	443	76.2	100	80	428	88.0	100	94	71.4
		HIGH	74.4	90	78/77	425	86.2	100	92/91	445	79.2	100	84/83	430	91.0	100	97/96	74.4
	460-3-60	STD	34.9	45	36	234	41.1	50	44	246	37.1	45	39	236	43.3	50	46	34.9
		MED	36.8	45	39	249	43.0	50	46	261	39.0	50	41	251	45.2	50	48	36.8
		HIGH	37.9	50	40	250	44.1	50	47	262	40.1	50	42	252	46.3	50	50	37.9
	575-3-60	STD	26.2	30	27	184	31.0	40	33	192	27.9	35	29	186	32.7	40	35	26.2
		MED	26.2	30	27	184	31.0	40	33	192	27.9	35	29	186	32.7	40	35	26.2
		HIGH	29.0	35	31	198	33.8	40	36	206	30.7	40	33	200	35.5	45	38	29.0
20	208/230-3-60	STD	75.7	100	79	440	87.5	100	93	460	80.5	100	85	445	92.3	100	98	75.7
		MED	79.1	100	83/82	455	90.9	100	97/96	475	83.9	100	89/88	460	95.7	110	102/101	79.1
		HIGH-HE	82.6	100	87	451	94.4	110	101	471	87.4	100	93	456	99.2	125	106	82.6
	460-3-60	STD	36.6	45	38	245	42.8	50	46	257	38.8	50	41	247	45.0	50	48	36.6
		MED	38.2	50	40	252	44.4	50	47	264	40.4	50	43	254	46.6	50	50	38.2
		HIGH-HE	40.4	50	43	250	46.6	50	50	262	42.6	50	45	252	48.8	60	52	40.4
	575-3-60	STD	26.2	30	27	186	31.0	40	33	194	27.9	35	29	188	32.7	40	35	26.2
		MED	29.0	35	31	200	33.8	40	36	208	30.7	40	33	202	35.5	45	38	29.0
		HIGH-HE	31.0	40	33	198	35.8	45	38	206	32.7	40	35	200	37.5	45	40	31.0
24	208/230-3-60	STD	86.6	100	91	574	98.4	125	105	594	91.4	100	97	579	103.2	125	111	86.6
		MED-HE	86.6	100	91	574	98.4	125	105	594	91.4	100	97	579	103.2	125	111	86.6
		HIGH-HE	98.0	125	105	653	109.8	125	118	673	102.8	125	110	658	114.6	125	124	98.0
	460-3-60	STD	45.3	50	48	310	51.5	60	55	322	47.5	60	50	312	53.7	60	58	45.3
		MED-HE	45.3	50	48	310	51.5	60	55	322	47.5	60	50	312	53.7	60	58	45.3
		HIGH-HE	51.0	60	54	350	57.2	70	62	362	53.2	60	57	352	59.4	70	64	51.0
	575-3-60	STD	33.4	40	35	232	38.2	45	41	240	35.1	45	37	234	39.9	50	43	33.4
		MED-HE	35.4	45	37	230	40.2	50	43	238	37.1	45	39	232	41.9	50	45	35.4
		HIGH-HE	37.3	45	40	257	42.1	50	45	265	39.0	50	42	259	43.8	50	47	37.3
28	208/230-3-60	STD	116.6	150	120/119	591	128.4	175/175	134/133	611	121.4	150/150	126/125	596	133.2	175/175	139/138	116.6
		MED-HE	120.1	150	124	587	131.9	175	138	607	124.9	150	130	592	136.7	175	143	120.1
		HIGH-HE	131.5	175	137	666	143.3	175	151	686	136.3	175	143	671	148.1	175	157	131.5
	460-3-60	STD	51.1	60	53	321	57.3	70	60	333	53.3	60	56	323	59.5	70	63	51.1
		MED-HE	53.3	60	56	319	59.5	70	63	331	55.5	70	58	321	61.7	80	66	53.3
		HIGH-HE	59.0	70	62	359	65.2	80	70	371	61.2	70	65	361	67.4	80	72	59.0
	575-3-60	STD	40.5	50	42	256	45.3	50	48	264	42.2	50	44	258	47.0	60	50	40.5
		MED-HE	42.5	50	45	254	47.3	60	50	262	44.2	50	47	256	49.0	60	52	42.5
		HIGH-HE	44.4	50	47	281	49.2	60	52	289	46.1	60	49	283	50.9	60	54	44.4

LEGEND

BRKR — Circuit Breaker
DISC — Disconnect
FLA — Full Load Amps
HACR — Heating Air-conditioning And Refrigeration
IFM — Indoor Fan Motor
LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps
RLA — Rated Load Amps

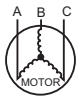
NOTES:

1. Refer to Packaged Rooftop Builder (Selection Software) for additional electrical data specific to EnergyX units.
2. In compliance with NEC requirements for multimotor and combination load equipment (refer to NEC Articles 430 and 440), the overcurrent protective device for the unit shall be fuse or HACR breaker. Canadian units may be fuse or circuit breaker.
3. For 208/230 v units, where one value is shown it is the same for either 208 or 230 volts.
4. Unbalanced 3-Phase Supply Voltage

   Never operate a motor where a phase imbalance in supply voltage is greater than 2%. Use the following formula to determine the percentage of voltage imbalance.

$$\% \text{ Voltage Imbalance} = 100 \times \frac{\text{max voltage deviation from average voltage}}{\text{average voltage}}$$

Example: Supply voltage is 230-3-60



AB = 224 v
BC = 231 v
AC = 226 v

$$\text{Average Voltage} = \frac{(224 + 231 + 226)}{3} = \frac{681}{3} = 227$$

Determine maximum deviation from average voltage.
(AB) 227-224 = 3 v
(BC) 231-227 = 4 v
(AC) 227-226 = 1 v
Maximum deviation is 4 v.
Determine percent of voltage imbalance.

$$\% \text{ Voltage Imbalance} = 100 \times \frac{4}{227} = 1.78\%$$

This amount of phase imbalance is satisfactory as it is below the maximum allowable 2%.

IMPORTANT: If the supply voltage phase imbalance is more than 2%, contact your local electric utility company immediately.

General — The sequence below describes the sequence of operation for an electro-mechanical unit with and without a factory-installed EconoMi$er® IV and X (called "economizer" in this sequence). For information regarding a direct digital controller, see the start-up, operations, and troubleshooting manual for the applicable controller.

Electro-Mechanical Units with No Economizer

Cooling (Single Speed Indoor Fan Motor) — When the thermostat calls for cooling, terminals G and Y1 are energized. As a result, the indoor-fan contactor (IFC) and the compressor contactor (C1) are energized, causing the indoor-fan motor (IFM), compressor #1, and outdoor fan to start. If the unit has 2 stages of cooling, the thermostat will additionally energize Y2. The Y2 signal will energize compressor contactor #2 (C2), causing compressor #2 to start. Regardless of the number of stages, the outdoor-fan motor runs continuously while unit is cooling.

Cooling (2-speed indoor fan motor) — Per ASHRAE 90.1-2016 standards during the first stage of cooling operation the VFD will adjust the fan motor to provide 66% of the total cfm established for the unit. When a call for the second stage of cooling is required, the VFD will allow the total cfm established for the unit (100%).

Heating

NOTE: WeatherMaster® units have either 1 or 2 stages of gas heat.

When the thermostat calls for heating, power is sent to W on the Integrated Gas Controller (IGC) board. An LED (light-emitting diode) on the IGC board turns on and remains on during normal operation. A check is made to ensure that the roll-out switch and limit switch are closed. If the check was successful, the induced-draft motor is energized, and when its speed is satisfactory, as proven by the flue gas pressure switch, the ignition activation period begins. The burners will ignite within 5 seconds. If the burners do not light, there is a 22-second delay before another 5-second attempt. This sequence is repeated for 15 minutes or until the burners light. If, after the 15 minutes, the burners still have not lit, heating is locked out. To reset the control, break 24 V power to the thermostat.

When ignition occurs, the IGC board will continue to monitor the condition of the roll-out switch, the limit switches, the flue gas pressure switch, as well as the flame sensor. 45 seconds after ignition occurs, assuming the unit is controlled through a room thermostat set for fan auto, the indoor-fan motor will energize (and the outdoor-air dampers will open to their minimum position). If, for some reason, the over-temperature limit opens prior to the start of the indoor fan blower, the unit will shorten the 45-second delay to 5 seconds less than the time from initiation of heat to when the limit tripped. Gas will not be interrupted to the burners and heating will continue. Once the fan-on delay has been modified, it will not change back to 45 seconds until power is reset to the control. On units with 2 stages of heat, when additional heat is required, W2 closes and initiates power to the second stage of the main gas valve. When the thermostat is satisfied, W1 and W2 open and the gas valve closes, interrupting the flow of gas to the main burners. If the call for W1 lasted less than 1 minute, the heating cycle will not terminate until 1 minute after W1 became active. If the unit is controlled through a room thermostat set for fan auto, the indoor-fan motor will continue to operate for an additional 45 seconds then stop. If the over-temperature limit opens after the indoor motor is stopped, but within 10 minutes of W1 becoming inactive, on the next cycle the time will be extended by 15 seconds. The maximum delay is 3 minutes. Once modified, the fan off delay will not change back to 45 seconds unless power is reset to the control. An LED indicator is provided on the IGC to monitor operation.

Electro-Mechanical Units with Factory-Installed Economi$er Cooling (Single Speed Indoor Fan Motor, Non-EnergyX units)

Cooling — When free cooling is not available, the compressors will be controlled by the zone thermostat. When free cooling is available, the outdoor-air damper is modulated by the EconoMi$er IV and X control to provide a 50°F (10°C) to 55°F (13°C) mixed-air temperature into the zone. As the mixed air temperature fluctuates above 55°F (13°C) or below 50°F (10°C) dampers will be modulated (open or close) to bring the mixed-air temperature back within control. If mechanical cooling is utilized with free cooling, the outdoor-air damper will maintain its current position at the time the compressor is started. If the increase in cooling capacity causes the mixed-air temperature to drop below 45°F (7°C), then the outdoor-air damper position will be decreased to the minimum position. If the mixed-air temperature continues to fall, the outdoor-air damper will close. Control returns to normal once the mixed-air temperature rises above 48°F (9°C). The power exhaust fans will be energized and de-energized, if installed, as the outdoor-air damper opens and closes.

If field-installed accessory CO_2 sensors are connected to the EconoMi$er IV and X control, a demand controlled ventilation strategy will begin to operate. As the CO_2 level in the zone increases above the CO_2 set-point, the minimum position of the damper will be increased proportionally. As the CO_2 level decreases because of the increase in fresh air, the outdoor-air damper will be proportionally closed. For EconoMi$er IV and X operation, there must be a thermostat call for the fan (G). If the unit is occupied and the fan is on, the damper will operate at minimum position. Otherwise, the damper will be closed.

When the EconoMi$er IV and X control is in the occupied mode and a call for cooling exists (Y1 on the thermostat), the control will first check for indoor fan operation. If the fan is not on, then cooling will not be activated. If the fan is on, then the control will open the EconoMi$er IV and X damper to the minimum position.

On the initial power to the EconoMi$er IV and X control, it will take the damper up to 2 $^1/_2$ minutes before it begins to position itself. After the initial power-up, further changes in damper position can take up to 30 seconds to initiate. Damper movement from full closed to full open (or vice versa) will take between 1 $^1/_2$ and 2 $^1/_2$ minutes. If free cooling can be used as determined from the appropriate changeover command (switch, dry bulb, enthalpy curve, differential dry bulb, or differential enthalpy), then the control will modulate the dampers open to maintain the

mixed-air temperature set-point at 50°F (10°C) to 55°F (13°C). If there is a further demand for cooling (cooling second stage - Y2 is energized), then the control will bring on compressor stage 1 to maintain the mixed-air temperature set-point. The EconoMi$er IV and X damper will be open at maximum position.

2-Speed Note: When operating in ventilation mode only, the indoor fan motor will automatically adjust to 66% of the total cfm established.

Heating — The sequence of operation for the heating is the same as an electro-mechanical unit with no economizer. The only difference is how the economizer acts. The economizer will stay at the Economizer Minimum Position while the evaporator fan is operating. The outdoor-air damper is closed when the indoor fan is not operating. Refer to Service and Maintenance Manual for further details.

Optional Humidi-MiZer® Dehumidification System —

Units with the factory equipped Humidi-MiZer system option are capable of providing multiple modes of improved dehumidification as a variation of the normal cooling cycle. The Humidi-MiZer system option includes additional valves in the liquid line and discharge line of each refrigerant circuit, a small reheat condenser coil downstream of the evaporator, and Motormaster® variable-speed control of some or all outdoor fans. Operation of the revised refrigerant circuit for each mode is described below.

The Humidi-MiZer system provides three sub-modes of operation: Cool, Reheat1, and Reheat2.

Cool mode — Provides a normal ratio of Sensible and Latent Cooling effect from the evaporator coil.

Reheat1 — Provides increased Latent Cooling while slightly reducing the Sensible Cooling effect.

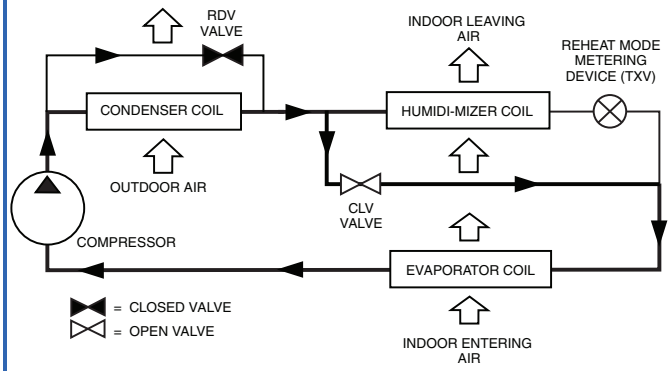
Reheat2 — Provides normal Latent Cooling but with null or minimum Sensible Cooling effect delivered to the space.

The Reheat1 and Reheat2 modes are available when the unit is not in a Heating mode and when the Low Ambient Lockout switch is closed.

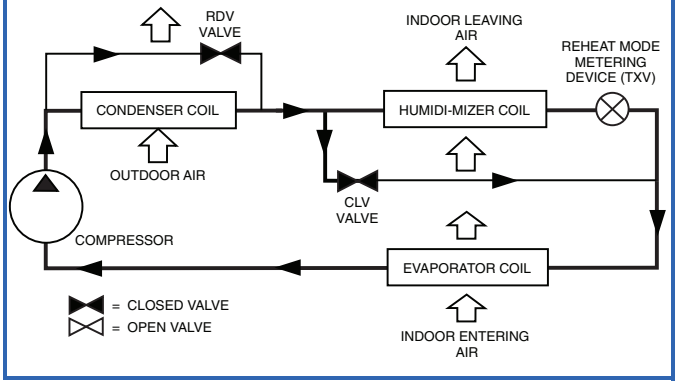
The figures on this page depict piping for single stage cooling units.

RTU Open Controller (Factory Option) — For details on operating 48HC units equipped with the factory-installed RTU Open controller option refer to Factory Installed RTU Open Multi-Protocol Controller Controls, Start-Up, Operation and Troubleshooting manual.

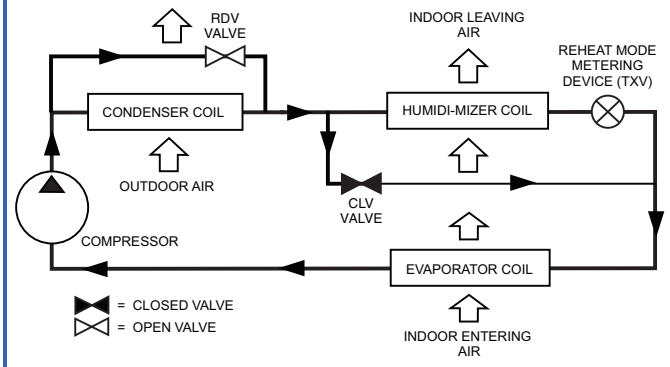
NORMAL COOLING MODE — HUMIDI-MIZER SYSTEM WITH SINGLE STAGE COOLING



SUBCOOLING MODE (REHEAT 1) — HUMIDI-MIZER SYSTEM WITH SINGLE STAGE COOLING



HOT GAS REHEAT MODE (REHEAT2) — HUMIDI-MIZER SYSTEM WITH SINGLE STAGE COOLING



Application data

Minimum Operating Ambient Temperature (Cooling) — In mechanical cooling mode, your Carrier rooftop unit can safely operate down to an outdoor ambient temperature of 35°F (2°C). It is possible to provide cooling at lower outdoor ambient temperatures by using less outside air, economizers, and/or accessory low ambient kits.

Maximum Operating Ambient Temperature (Cooling) — The maximum operating ambient temperature for cooling mode is 125°F (52°C). While cooling operation above 125°F (52°C) may be possible, it could cause either a reduction in performance, reliability, or a protective action by the unit's internal safety devices.

Minimum Mixed Air Temperature (Heating) — Using the factory settings, the minimum temperatures for the mixed air (the combined temperature of the warm return air and the cold outdoor air) entering the dimpled, gas heat exchangers are shown in the table below.

MINIMUM MIXED AIR TEMPERATURE

ALUMINIZED	STAINLESS STEEL
50°F (10°C) Continuous	40°F (4°C) Continuous
45°F (7°C) Intermittent	35°F (2°C) Intermittent

Operating at lower mixed-air temperatures may be possible, if a field-supplied, outdoor air thermostat initiates both heat stages when the temperature is less than the minimum temperatures listed above. Please contact your local Carrier representative for assistance.

Minimum and Maximum Airflow (Heating and Cooling) — To maintain safe and reliable operation of your rooftop, operate within the heating airflow limits during heating mode and cooling airflow limits during cooling mode. Operating above the max may cause blow-off, undesired airflow noise, or airflow related problems with the rooftop unit. Operating below the min may cause problems with coil freeze-up and unsafe heating operation. Heating and cooling limitations differ when evaluating operating CFM, the minimum value is the HIGHER of the cooling and heating minimum CFM values published on page 5 and the maximum value is the LOWER of the cooling and heating minimum values published on page 5.

Heating-To-Cooling Changeover — Your unit will automatically change from heating to cooling mode when using a thermostat with an auto-changeover feature.

Airflow — All units are draw-though in cooling mode and blow-through in heating mode.

Outdoor Air Application Strategies — Economizers reduce operating expenses and compressor run time by providing a free source of cooling and a means of ventilation to match application changing needs. In fact, they should be considered for most applications. Also, consider the various economizer control methods and their benefits, as well as sensors required to accomplish your application goals. Please contact your local Carrier representative for assistance.

Motor Limits, Break Horsepower (BHP) — Due to internal design of Carrier units, the air path, and specially designed motors, the full horsepower (maximum continuous BHP) band, as listed in the Fan Performance tables, can be used with the utmost confidence. There is no need for extra safety factors, as Carrier motors are designed and rigorously tested to use the entire, listed BHP range without either nuisance tripping or premature motor failure.

Propane Heating — Propane has different physical qualities than natural gas. As a result, propane requires different fuel to air mixture. To optimize the fuel/air mixture for propane, Carrier sells different burner orifices in an easy to install accessory kit. To select the correct burner orifices or determine the heat capacity for a propane application, use either the selection software, or the unit's service manual.

High Altitude Heating — High altitudes have less oxygen, which affects the fuel/air mixture in heat exchangers. In order to maintain a proper fuel/air mixture, heat exchangers operating in altitudes above 2000 ft (610 m) require different orifices. To select the correct burner orifices or determine the heat capacity for a high altitude application, use either the selection software, or the unit's service manual.

High altitudes have less oxygen, which means heat exchangers need less fuel. The new gas orifices in this field-installed kit make the necessary adjustment for high altitude applications. They restore the optimal fuel to air mixture and maintain healthy combustion on altitudes above 2000 ft (610 m).

NOTE: Typical natural gas heating value ranges from 975 to 1050 Btu/ft^3 at sea level nationally. The heating value goes down approximately 1.7% per every thousand feet elevation. Standard factory orifices can typically be used up to 2000 ft (610 m) elevation without any operational issues.

The optional Carrier economizer can adequately cool your space by bringing in fresh, cool outside air. In fact, when so equipped, accessory low-ambient kit may not be necessary. In low ambient conditions, unless the outdoor air is excessively humid or contaminated, economizer-based "free cooling" is the preferred less costly and energy conscious method. In low ambient applications where outside air might not be desired (such as contaminated or excessively humid outdoor environments), your Carrier rooftop can operate to ambient temperatures down to –20°F (–29°C) using the recommended accessory Motormaster® low ambient controller.

Sizing a Rooftop — Bigger isn't necessarily better. While an air conditioner needs to have enough capacity to meet the design loads, it doesn't need excess capacity. In fact, excess capacity typically results in very poor part load performance and humidity control.

Using higher design temperatures than ASHRAE recommends for your location, adding "safety factors" to the calculated load, are all signs of oversizing air conditioners. Oversizing the air conditioner leads to poor humidity control, reduced efficiency, higher utility bills, larger indoor temperature swings, excessive noise, and increased wear and tear on the air conditioner.

Rather than oversizing an air conditioner, engineers should "right-size" or even slightly undersize air conditioners. Correctly sizing an air conditioner controls humidity better; promotes efficiency; reduces utility bills; extends equipment life, and maintains even, comfortable temperatures. Please contact your local Carrier representative for assistance.

Low Ambient Applications — The optional Carrier economizer can adequately cool your space by bringing in fresh, cool outside air. In fact, when so equipped, accessory low-ambient kit may not be necessary. In low ambient conditions, unless the outdoor air is excessively humid or contaminated, economizer-based "free cooling" is the preferred less costly and energy conscious method. In low ambient applications where outside air might not be desired (such as contaminated or excessively humid outdoor environments), your Carrier rooftop can operate to ambient temperatures down to –20°F (–29°C) using the recommended accessory Motormaster® low ambient controller.

Staged Air Volume (SAV™) System with VFD Controller (2-Stage Cooling Models Only) — Carrier's staged air volume (SAV) system saves energy and installation time by utilizing a variable frequency drive (VFD) to automatically adjust the indoor fan motor speed in sequence with the units cooling operation. Per ASHRAE 90.1-2016 and IECC-2015, during the first stage of cooling operation the VFD will adjust the fan motor to provide two-thirds of the total cfm established for the unit. When a call for the second stage of cooling is required, the VFD will allow the total cfm for the unit established (100%). During the heating mode the VFD will allow total design cfm (100%) operation and during the ventilation mode the VFD will allow operation to two-thirds of total cfm.

Compared to single speed indoor fan motor systems, Carrier's SAV system can save substantial energy, 25%+, versus single speed indoor fan motor systems.

IMPORTANT: Data based on .10 ($/kWh) in an office application utilizing Carrier's HAP 4.6 simulation software program.

The VFD used in Carrier's SAV system has soft start capabilities to slowly ramp up the speeds, thus eliminating any high inrush air volume during initial start-up. It also has internal over current protection for the fan motor and a field installed display kit that allows adjustment and in depth diagnostics of the VFD.

This SAV system is available on models with 2-stage cooling operation.The SAV system is very flexible for initial fan performance set up and adjustment. The standard factory shipped VFD is pre-programmed to automatically stage the fan speed between the first and second stage of cooling. The unit fan performance static pressure and cfm can be easily adjusted using the traditional means of pulley adjustments. The other means to adjust the unit static and cfm performance is to utilize the field-installed display kit and adjust the frequency and voltage in the VFD to required performance requirements. In either case, once set up, the VFD will automatically adjust the speed between the cooling stage operations.

48HC STAGED AIR VOLUME (SAV) — VARIABLE FREQUENCY DRIVE (VFD) HP RATING

UNIT SIZE	STATIC OPTION	VOLTAGE	VFD HP
17	STD	208/230	3.0
		460	3.0
		575	5.0
	MED	208/230	3.0
		460	5.0
		575	5.0
	HIGH	208/230	7.5
		460	
		575	
20	STD	208/230	3.0
		460	5.0
		575	5.0
	MED	208/230	7.5
		460	
		575	
	HIGH	208/230	7.5
		460	
		575	
24	STD	208/230/460/575	7.5
	MED	208/230/460/575	7.5
	HIGH	208/230/460/575	7.5
28	STD	208/230/460/575	7.5
	MED	208/230/460/575	7.5
	HIGH	208/230/460/575	7.5

Optional EnergyX® Energy Recovery Ventilator (ERV) Application Data

When selecting the WeatherMaster® Series Unit and EnergyX system to use on a given application, it is strongly recommended that the Carrier Packaged RTU Builder (PRB) Selection Software be used. This is because there are a number of variables which become complex when manual calculations are performed, but can easily be accounted for in a computer operation. Most specifically, the AHRI certified ratings use Standard CFM values, but due to real world operation, variances in altitude and air density are very important. The Carrier PRB software uses altitude corrected airflows (ACFM).

See Carrier's Packaged Rooftop Builder selection software for automated calculation of unit selection and Combined Efficiency Factor (CEF) values.

Typical Energy Recovery unit selection involves the following steps:

1. Determine the zone cooling and heating requirements at the design conditions.
2. Select Energy Recovery unit based on desired outdoor airflow rate.

NOTE: It is recommended that the outdoor airflow and exhaust airflow rates be designed at the same or close to the same value. If the difference between the two airflows becomes large enough, the energy recovery unit's cooling capacity, heating capacity and overall efficiency will be negatively impacted.

3. Calculate the Energy Recovery unit's leaving air conditions and unit capacities based on the outside airflow rate, temperature (db and wb) and exhaust

airflow rate and temperatures (db and wb) at the design temperatures and maximum ventilation rate.

4. Subtract the Energy Recovery unit's cooling and heating capacities from the design zone requirements. The value that remains is the necessary design size of the rooftop unit.
5. Use the Energy Recovery unit's leaving air temperatures (db and wb) as the ventilation air temperatures entering the rooftop unit to be mixed with the return air before passing through the rooftop unit's evaporator.
6. After selecting the desired Energy Recovery unit and rooftop unit, use AHRI's Guideline V to calculate the Combine Efficiency Factor (system EER). Additional information on Energy Recovery capacity calculations and leaving air temperature calculations can be found in the two AHRI documents below:

AHRI Guideline V — Calculating the efficiency of energy recovery ventilation and its effect on efficiency and sizing of building HVAC systems

AHRI Standard 1060 — Performance rating of air-to-air heat exchangers for energy recovery ventilation equipment

AirXchange[1] Energy Recovery Cassette — UL certified, AHRI listed, silica gel enthalpy desiccant, wheels greater than 25-in. diameter are segmented for easy cleaning, washable with detergent and water, 5 year standard limited warranty.

EnergyX Operation — Energy recovery wheels rotate between the incoming outdoor airstream and the building exhaust airstream. As the wheel rotates, it transfers heat and moisture from one airstream to the other. Result = outdoor air is pre-conditioned, significantly reducing the capacity and energy needed from the mechanical HVAC system.

1. AirXchange is a registered trademark of AirXchange, Inc.

EnergyX Factory Installed Accessories

Economizer option — Allows true modulating economizer capability when OA is suitable for free cooling

- operates as a true wheel bypass damper
- uses stop/jog operation for wheel
- required when using CO_2 sensor for DCV operation

Frost control option — Uses exhaust air to defrost the wheel when necessary.

EnergyX System *Comfort*Link V5 integrated controls — All ERV configuration, setup and troubleshooting is done via *Comfort*Link controls.

- Modulating OA ventilation damper
- New "Outside Air Unit" points table
- New control functions for accessory devices:
  - Cold air tempering kit
  - Exhaust fan building pressure control
  - 2-position exhaust damper

EnergyX Field-Installed Accessories

Horizontal Roofcurb Adapters — Used when horizontal supply and/or return is desired.

Motor Status Indicator Accessory — Monitors wheel, supply and exhaust motors and provides indication if not operating.

Filter Status Indicator Accessory — Monitors static pressure across supply and exhaust filters and provides indication when filters become clogged.

Motorized Exhaust Damper Accessory — Replaces the standard barometric exhaust damper blades with motorized (open/shut) damper.

Application/Selection Option — Selection software by Carrier saves time by performing many of the steps above. Contact your Carrier sales representative for assistance.

Guide specifications

"Masterformat" as published by the Construction Specification Institute. Please feel free to copy this specification directly into your building spec.

WeatherMaster® Gas Heat/Electric Cooling Packaged Rooftop

HVAC guide specifications

Size range: **15 to 25 Nominal Tons**

Carrier Model Number: **48HC*17-28**

Part 1 — (23 06 80) Schedules for decentralized HVAC equipment

1.01 (23 06 80.13) Decentralized Unitary HVAC Equipment Schedule

A. (23 06 80.13.A.) Rooftop unit (RTU) schedule

Schedule is per the project specification requirements.

Part 2 — (23 07 16) HVAC equipment insulation

2.01 (23 07 16.13) Decentralized, Rooftop Units:

A. (23 07 16.13.A.) Evaporator fan compartment:

1. Interior cabinet surfaces shall be insulated with a minimum $^1/_2$-in. thick, minimum 1 $^1/_2$-lb density, flexible fiberglass insulation bonded with a phenolic binder, neoprene coated on the air side.
2. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
3. Unit internal insulation linings shall be resistant to mold growth in accordance with "mold growth and humidity" test in ASTM C1338, G21, and UL 181 or comparable test method. Air stream surfaces shall be evaluated in accordance with the "Erosion Test" in UL 181, as part of ASTM C1071.

B. (23 07 16.13.B.) Gas heat compartment:

1. Aluminum foil-faced fiberglass insulation shall be used.
2. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.

Part 3 — (23 09 13) Instrumentation and control devices for HVAC

3.01 (23 09 13.23) Sensors and Transmitters

A. (23 09 13.23.A.) Thermostats

1. Thermostat must
   a. energize both "W" and "G" when calling for heat.
   b. have capability to energize 2 different stages of cooling, and 2 different stages of heating.
   c. include capability for occupancy scheduling.

Part 4 — (23 09 23) Direct-digital control system for HVAC

4.01 (23 09 23.13) Decentralized, Rooftop Units:

A. (23 09 23.13.A.) PremierLink™ controller

1. Shall be ASHRAE 62 compliant.
2. Shall accept 18-32 VAC input power.
3. Shall have an operating temperature range from –40°F (–40°C) to 158°F (70°C), 10% to 95% RH (non-condensing).
4. Shall include an integrated economizer controller to support an economizer with 4 to 20 mA actuator input and no microprocessor controller.
5. Controller shall accept the following inputs: space temperature, setpoint adjustment, outdoor air temperature, indoor air quality, outdoor air quality, indoor relative humidity, compressor lock-out, fire shutdown, enthalpy, fan status, remote time clock/door switch.
6. Shall accept a CO_2 sensor in the conditioned space, and be Demand Controlled Ventilation (DCV) ready.
7. Shall provide the following outputs: economizer, fan, cooling stage 1, cooling stage 2, heat stage 1, heat stage 2, heat stage 3/exhaust/ reversing valve/ dehumidify/ occupied.
8. Unit shall provide surge protection for the controller through a circuit breaker.
9. Shall be Internet capable, and communicate at a Baud rate of 38.4K or faster.
10. Shall have an LED display independently showing the status of activity on the communication bus, and processor operation.
11. Shall include an EIA-485 protocol communication port, an access port for connection of either a computer or a Carrier technician tool, an EIA-485 port for network communication to intelligent space sensors and displays, and a port to connect an optional LonWorks[1] plug-in communications card.
12. Shall have built-in Carrier Comfort Network® (CCN) protocol, and be compatible with other CCN devices, including *Comfort*Link and ComfortVIEW™ controllers.
13. Shall have built-in support for Carrier technician tool.
14. Software upgrades will be accomplished by local download. Software upgrades through chip replacements are not allowed.
15. Shall be shock resistant in all planes to 5G peak, 11ms during operation, and 100G peak, 11ms during storage.
16. Shall be vibration resistant in all planes to 1.5G at 20-300 Hz.

1. LonWorks is a registered trademark of Echelon Corporation.

17. Shall support a bus length of 4000 ft (1219 m) max, 60 devices per 1000 ft (305 m) section, and 1 RS-485 repeater per 1000 ft (305 m) sections.

B. (23 09 23.13.B.) RTU Open protocol, direct digital controller:

1. Shall be ASHRAE 62 compliant.
2. Shall accept 18-30VAC, 50-60Hz, and consume 15VA or less power.
3. Shall have an operating temperature range from –40°F (–40°C) to 130°F (54°C), 10% to 90% RH (non-condensing).
4. Shall include built-in protocol for BACnet[1] (MS/TP and PTP modes), Modbus[2] (RTU and ASCII), Johnson N2 and LonWorks. LonWorks Echelon processor required for all Lon applications shall be contained in separate communication board.
5. Shall allow access of up to 62 network variables (SNVT). Shall be compatible with all open controllers.
6. Baud rate Controller shall be selectable using a dip switch.
7. Shall have an LED display independently showing the status of serial communication, running, errors, power, all digital outputs, and all analog inputs.
8. Shall accept the following inputs: space temperature, setpoint adjustment, outdoor air temperature, indoor air quality, outdoor air quality, compressor lock-out, fire shutdown, enthalpy switch, and fan status / filter status / humidity / remote occupancy.
9. Shall provide the following outputs: economizer, variable frequency drive, fan, cooling stage 1, cooling stage 2, heat stage 1, heat stage 2, exhaust reversing valve/high fan speed.
10. Shall have built-in surge protection circuitry through solid-state polyswitches. Polyswitches shall be used on incoming power and network connections. Polyswitches will return to normal when the "trip" condition clears.
11. Shall have a battery backup capable of a minimum of 10,000 hours of data and time clock retention during power outages.
12. Shall have built-in support for Carrier technician tool.
13. Shall include an RS-485 protocol communication port, an access port for connection of either a computer or a Carrier technician tool, an RS-485 port for network communication to intelligent space sensors and displays, and a port to connect an optional LonWorks communications card.
14. Software upgrades will be accomplished by either local or remote download. No software upgrades through chip replacements are allowed.

C. (23 09 23.13.C.) *Comfort*Link Unit Controls shall contain:

1. Four button detailed English scrolling marquee display.
2. CCN (Carrier Comfort Network®) capable.
3. Unit control with standard suction pressure transducers and condensing temperature thermistors.
4. Shall provide a 5°F (2°C) temperature difference between cooling and heating set points to meet ASHRAE 90.1-2016 Energy Standard.
5. Shall provide and display a current alarm list and an alarm history list.
6. Service run test capability.
7. Shall accept input from a CO_2 sensor (both indoor and outdoor).
8. Configurable alarm light shall be provided which activates when certain types of alarms occur.
9. Compressor minimum run time (3 minutes) and minimum off time (5 minutes) are provided.
10. Service diagnostic mode.
11. Economizer control (optional).
12. Control multiple capacity stages.
13. Unit shall be complete with self-contained low voltage control circuit.
14. Unit shall have 0°F low ambient cooling operation.

Part 5 — (23 09 33) Electric and electronic control system for HVAC

5.01 (23 09 33.13) Decentralized, rooftop units

A. (23 09 33.13.A) General:

1. Shall be complete with self-contained low-voltage control circuit protected by a resettable circuit breaker on the 24-v transformer side. Transformer shall have 75VA capability.
2. Shall utilize color-coded wiring.
3. Shall include a central control terminal board to conveniently and safely provide connection points for vital control functions such as: smoke detectors, phase monitor, economizer, thermostat, DDC control options, loss of charge, freeze switch, high pressure switches.
4. The heat exchanger shall be controlled by an integrated gas controller (IGC) microprocessor. See heat exchanger section of this specification.
5. Unit shall include a minimum of one 8-pin screw terminal connection board for connection of control wiring.

1. BACnet is a registered trademark of ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers).
2. Modbus is a registered trademark of Schneider Electric.

B. (23 09 33.13.B) Safeties:

1. Compressor over-temperature, over-current.
2. Low-pressure switch.
   a. Units with 2 compressors shall have different sized connectors for the circuit 1 and circuit 2 loss of charge switches. They shall physically prevent the cross-wiring of the safety switches between circuits 1 and 2.
   b. Loss of charge switch shall use different color wire than the high pressure switch. The purpose is to assist the installer and service technician to correctly wire and/or troubleshoot the rooftop unit.
3. High-pressure switch.
   a. Units with 2 compressors shall have different sized connectors for the circuit 1 and circuit 2 high pressure switches. They shall physically prevent the cross-wiring of the safety switches between circuits 1 and 2.
   b. High-pressure switch shall use different color wire than the low-pressure switch. The purpose is to assist the installer and service technician to correctly wire and/or troubleshoot the rooftop unit.
4. Automatic reset, motor thermal overload protector.
5. Heating section shall be provided with the following minimum protections.
   a. High-temperature limit switches.
   b. Induced draft motor speed sensor.
   c. Flame rollout switch.
   d. Flame proving controls.

Part 6 — (23 09 93) Sequence of operations for HVAC controls

6.01 (23 09 93.13) Decentralized, Rooftop Units:

(23 09 93.13.A) INSERT SEQUENCE OF OPERATION

Part 7 — (23 40 13) Panel air filters

7.01 (23 40 13 13) Decentralized rooftop units:

A. (23 40 13 13.A) Standard filter section

1. Shall consist of factory-installed, low velocity, throwaway 2-in. thick fiberglass filters of commercially available sizes.
2. Unit shall use only one filter size. Multiple sizes are not acceptable.
3. Filters shall be accessible through a dedicated, weather tight access panel.
4. 4-in. filter capabilities shall be capable with pre-engineered and approved Carrier filter track field-installed accessory. This kit requires field furnished filters.

Part 8 — (23 81 19) Self-contained air conditioners

8.01 (23 81 19.13) Medium-Capacity Self-Contained Air Conditioners (48HC**17-28)

A. (23 81 19.13.A) General

1. Outdoor, rooftop mounted, electrically controlled, heating and cooling unit utilizing hermetic scroll compressor(s) for cooling duty and gas combustion for heating duty.
2. Factory assembled, single piece heating and cooling rooftop unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, and special features required prior to field start-up.
3. Unit shall use Puron® R-410A refrigerant.
4. Unit shall be installed in accordance with the manufacturer's instructions.
5. Unit must be selected and installed in compliance with local, state, and federal codes.

B. (23 81 19.13.B.) Quality Assurance

1. Unit meets ASHRAE 90.1-2016 and IECC[1]-2015 minimum efficiency requirements.
2. Units are ENERGY STAR[2] certified where sizes are required.
3. Unit shall be rated in accordance with AHRI Standard 340/360.
4. Unit shall be designed to conform to ASHRAE 15.
5. Unit shall be ETL-tested and certified in accordance with ANSI Z21.47 Standards and ETL-listed and certified under Canadian standards as a total package for safety requirements.
6. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
7. Unit internal insulation linings shall be resistant to mold growth in accordance with "mold growth and humidity" test in ASTM C1338, G21, and UL 181 or comparable test method. Air stream surfaces shall be evaluated in accordance with the "Erosion Test" in UL 181, as part of ASTM C1071.
8. Unit casing shall be capable of withstanding 500-hour salt spray exposure per ASTM B117 (scribed specimen).
9. Roof curb shall be designed to conform to NRCA Standards.
10. Unit shall be subjected to a completely automated run test on the assembly line. The data for each unit will be stored at the factory, and must be available upon request.

1. IECC is a registered trademark of the International Code Council, Inc.
2. Energy Star is registered trademark of the United States Department of Energy.

Guide specifications (cont)

11. Unit shall be designed in accordance with UL Standard 1995, ETL listed including tested to withstand rain.
12. Unit shall be constructed to prevent intrusion of snow and tested to prevent snow intrusion into the control box up to 40 mph.
13. Unit shake tested to assurance level 1, ASTM D4169 to ensure shipping reliability.
14. High-Efficiency Motors listed shall meet section 313 of the Energy Independence and Security Act of 2007 (EISA 2007).

C. (23 81 19.13.C) Delivery, storage, and handling

1. Unit shall be stored and handled per manufacturer's recommendations.
2. Lifted by crane requires either shipping top panel or spreader bars.
3. Unit shall only be stored or positioned in the upright position.

D. (23 81 19.13.D) Project conditions

As specified in the contract.

E. (23 81 19.13.E) Operating characteristics

1. Unit shall be capable of starting and running at 125°F (52°C) ambient outdoor temperature, meeting maximum load criteria of AHRI Standard 340/360 at ± 10% voltage.
2. Compressor with standard controls shall be capable of operation from 35°F (2°C), ambient outdoor temperatures. Accessory kits are necessary if mechanically cooling at ambient temperatures below 35°F (2°C).
3. Unit shall discharge supply air vertically as shown on contract drawings.
4. Unit shall be factory configured and ordered for vertical supply and return configurations.
5. Unit shall be factory furnished for either vertical or horizontal configuration without the use of special conversion kits. No field conversion is possible.

F. (23 81 19.13.F) Electrical Requirements

Main power supply voltage, phase, and frequency must match those required by the manufacturer.

G. (23 81 19.13.G) Unit Cabinet

1. Unit cabinet shall be constructed of galvanized steel, and shall be bonderized and coated with a pre-painted baked enamel finish on all externally exposed surfaces.
2. Unit cabinet exterior paint shall be: film thickness, (dry) 0.003 inches minimum, gloss (per ASTM D523, 60°F): 60, Hardness: H-2H Pencil hardness.
3. Evaporator fan compartment interior cabinet insulation shall conform to AHRI Standards 340/360 minimum exterior sweat criteria. Interior surfaces shall be insulated with a minimum $^1/_2$-in. thick, 1 lb density, flexible fiberglass insulation, neoprene coated on the air side. Aluminum foil-faced fiberglass insulation shall be used in the heat compartment.
4. Unit internal insulation linings shall be resistant to mold growth in accordance with "mold growth and humidity" test in ASTM C1338, G21, and UL 181 or comparable test method. Air stream surfaces shall be evaluated in accordance with the "Erosion Test" in UL 181, as part of ASTM C1071.
5. Base of unit shall have a minimum of four locations for factory thru-the-base gas and electrical connections (factory-installed or field-installed) standard. Connections shall be internal to the cabinet to protect from environmental issues.
6. Base Rail:
   a. Unit shall have base rails on a minimum of 2 sides.
   b. Holes shall be provided in the base rails for rigging shackles to facilitate maneuvering and overhead rigging.
   c. Holes shall be provided in the base rail for moving the rooftop by fork truck.
   d. Base rail shall be a minimum of 16 gauge thickness.
7. Condensate pan and connections:
   a. Shall be a sloped condensate drain pan made of a non-corrosive material.
   b. Shall comply with ASHRAE Standard 62.
   c. Shall use a $^3/_4$-in. 14 NPT drain connection at the end of the drain pan. Connection shall be made per manufacturer's recommendations.
8. Top panel:

   Shall be a multi-piece top panel linked with water tight flanges and interlocking systems.
9. Gas Connections:
   a. All gas piping connecting to unit gas valve shall enter the unit cabinet at a single location on side of unit (horizontal plane).
   b. Thru-the-base capability
      1) Standard unit shall have a thru-the-base gas-line location using a raised, embossed portion of the unit basepan.
      2) Optional, factory-approved, water-tight connection method must be used for thru-the-base gas connections.
      3) No basepan penetration, other than those authorized by the manufacturer, is permitted.

10. Electrical Connections:
    a. All unit power wiring shall enter unit cabinet at a single, factory-prepared, knockout location.
    b. Thru-the-base capability
        1) Thru-the-base provisions/connections are available as standard with every unit. When bottom connections are required, field furnished couplings are required.
        2) No basepan penetration, other than those authorized by the manufacturer, is permitted.
11. Component Access Panels (standard):
    a. Cabinet panels shall be easily removable for servicing.
    b. Unit shall have one factory installed, tool-less, removable, filter access panel.
    c. Panels covering control box and filters shall have molded composite handles while the blower access door shall have an integrated flange for easy removal.
    d. Handles shall be UV modified, composite, permanently attached, and recessed into the panel.
    e. Screws on the vertical portion of all removable access panel shall engage into heat resistant, molded composite collars.
    f. Collars shall be removable and easily replaceable using manufacturer recommended parts.

H. (23 81 19.13.H.) Gas Heat
1. General:
    a. Heat exchanger shall be an induced draft design. Positive pressure heat exchanger designs shall not be allowed.
    b. Shall incorporate a direct-spark ignition system and redundant main gas valve.
    c. Gas supply pressure at the inlet to the rooftop unit gas valve must match that required by the manufacturer.
2. The heat exchanger shall be controlled by an integrated gas controller (IGC) microprocessor.
    a. IGC board shall notify users of fault using an LED (light-emitting diode).
    b. IGC board shall contain algorithms that modify evaporator-fan operation to prevent future cycling on high temperature limit switch.
    c. Unit shall be equipped with anti-cycle protection with one short cycle on unit flame rollout switch or 4 continuous short cycles on the high temperature limit switch. Fault indication shall be made using an LED.
3. Standard Heat Exchanger Construction:
    a. Heat exchanger shall be of the tubular-section type constructed of a minimum of 20-gauge steel coated with a nominal 1.2 mil aluminum-silicone alloy for corrosion resistance.
    b. Burners shall be of the in-shot type constructed of aluminum-coated steel.
    c. Burners shall incorporate orifices for rated heat output up to 2000 ft (610 m) elevation. Additional accessory kits may be required for applications above 2000 ft (610 m) elevation, depending on local gas supply conditions.
    d. Each heat exchanger tube shall contain multiple dimples for increased heating effectiveness.
4. Optional Stainless Steel Heat Exchanger Construction:
    a. Use energy saving, direct-spark ignition system.
    b. Use a redundant main gas valve.
    c. Burners shall be of the in-shot type constructed of aluminum-coated steel.
    d. All gas piping shall enter the unit cabinet at a single location on side of unit (horizontal plane).
    e. The optional stainless steel heat exchanger shall be of the tubular-section type, constructed of a minimum of 20-gauge type 409 stainless steel.
    f. Type 409 stainless steel shall be used in heat exchanger tubes and vestibule plate.
    g. Complete stainless steel heat exchanger allows for greater application flexibility.
5. Induced Draft Combustion Motor and Blower:
    a. Shall be a direct-drive, single inlet, forward-curved centrifugal type.
    b. Shall be made from steel with a corrosion-resistant finish.
    c. Shall have permanently lubricated sealed bearings.
    d. Shall have inherent thermal overload protection.
    e. Shall have an automatic reset feature.

I. (23 81 19.13.I.) Coils
1. Standard Aluminum Fin/Copper Tube Coils:
    a. Standard evaporator and condenser coils shall have aluminum lanced plate fins mechanically bonded to seamless internally grooved copper tubes with all joints brazed.
    b. Evaporator coils shall be leak tested to 150 psig, pressure tested to 450 psig, and qualified to UL 1995 burst test at 1775 psig.
    c. Condenser coils shall be leak tested to 150 psig, pressure tested to 650 psig, and qualified to UL 1995 burst test at 1980 psig.

2. Optional Pre-coated aluminum-fin condenser coils:
   a. Shall have a durable epoxy-phenolic coating to provide protection in mildly corrosive coastal environments.
   b. Coating shall be applied to the aluminum fin stock prior to the fin stamping process to create an inert barrier between the aluminum fin and copper tube.
   c. Epoxy-phenolic barrier shall minimize galvanic action between dissimilar metals.
   d. Corrosion durability of fin stock shall be confirmed through testing to be no less than 1000 hours salt spray per ASTM B117-90.
   e. Corrosion durability of fin stock shall be confirmed through testing to have no visible corrosion after 48 hour immersion in a room temperature solution of 5% salt, 1% acetic acid.
   f. Fin stock coating shall pass 2000 hours of the following: one week exposure in the prohesion chamber followed by one week of accelerated ultraviolet light testing. Prohesion chamber: the solution shall contain 3.5% sodium chloride and 0.35% ammonium sulfate. The exposure cycle is one hour of salt fog application at ambient followed by one hour drying at 95°F (35°C).
3. Optional Copper-fin evaporator and condenser coils:
   a. Shall be constructed of copper fins mechanically bonded to copper tubes and copper tube sheets.
   b. Galvanized steel tube sheets shall not be acceptable.
   c. A polymer strip shall prevent coil assembly from contacting the sheet metal coil pan to minimize potential for galvanic corrosion between coil and pan.
4. Optional E-coated aluminum-fin evaporator and condenser coils:
   a. Shall have a flexible epoxy polymer coating uniformly applied to all coil surface areas without material bridging between fins.
   b. Coating process shall ensure complete coil encapsulation of tubes, fins and headers.
   c. Color shall be high gloss black with gloss per ASTM D523-89.
   d. Uniform dry film thickness from 0.8 to 1.2 mil on all surface areas including fin edges.
   e. Superior hardness characteristics of 2H per ASTM D3363-92A and cross-hatch adhesion of 4B-5B per ASTM D3359-93.
   f. Impact resistance shall be up to 160 in.-lb (ASTM D2794-93).
   g. Humidity and water immersion resistance shall be up to minimum 1000 and 250 hours respectively (ASTM D224-92 and ASTM D870-92).
   h. Corrosion durability shall be confirmed through testing to be no less than 6000 hours salt spray per ASTM B117-90.
5. Optional E-coated aluminum-fin, aluminum tube condenser coils:
   a. Shall have a flexible epoxy polymer coating uniformly applied to all coil external surface areas without material bridging between fins or louvers.
   b. Coating process shall ensure complete coil encapsulation, including all exposed fin edges.
   c. E-coat thickness of 0.8 to 1.2 mil with top coat having a uniform dry film thickness from 1.0 to 2.0 mil on all external coil surface areas, including fin edges, shall be provided.
   d. Shall have superior hardness characteristics of 2H per ASTM D3363-00 and cross-hatch adhesion of 4B-5B per ASTM D3359-02.
   e. Shall have superior impact resistance with no cracking, chipping or peeling per NSF/ANSI 51-2002 Method 10.2.

J. (23 81 19.13.J) Refrigerant components
1. Refrigerant circuit shall include the following control, safety, and maintenance features:
   a. Thermostatic Expansion Valve (TXV) shall help provide optimum performance across the entire operating range. Shall contain removable power element to allow change out of power element and bulb without removing the valve body.
   b. Refrigerant filter drier.
   c. Service gauge connections on suction and discharge lines.
   d. Pressure gauge access through a specially designed access screen on the side of the unit.
2. Compressors:
   a. Unit shall use fully hermetic, scroll compressor for each independent refrigeration circuit.
   b. Models shall be available with 2 compressor/2-stage cooling.
   c. Compressor motors shall be cooled by refrigerant gas passing through motor windings.
   d. Compressors shall be internally protected from high discharge temperature conditions.
   e. Compressors shall be protected from an over-temperature and over-amperage conditions by an internal, motor overload device.
   f. Compressor shall be factory mounted on rubber grommets.

g. Compressor motors shall have internal line break thermal, current overload and high pressure differential protection.

h. Crankcase heaters shall not be required for normal operating range, unless provided by the factory.

K. (23 81 19.13.K) Filter section

1. Filters access is specified in the unit cabinet section of this specification.
2. Filters shall be held in place by a preformed slide out filter tray, facilitating easy removal and installation.
3. Shall consist of factory-installed, low velocity, throw-away 2-in. thick fiberglass filters.
4. Filters shall be standard, commercially available sizes.
5. Only one size filter per unit is allowed.
6. 4-in. filter capability is possible with a field-installed pre-engineered slide out filter track accessory. 4-in. filters are field furnished.

L. (23 81 19.13.L) Evaporator fan and motor

1. Evaporator fan motor:
   a. Shall have inherent automatic-reset thermal overload protection or circuit breaker.
   b. Shall have a maximum continuous bhp rating for continuous duty operation; no safety factors above that rating shall be required.
2. Belt-driven evaporator fan:
   a. Belt drive shall include an adjustable-pitch motor pulley and belt break protection system.
   b. Shall use rigid pillow block bearing system with lubricate fittings at are accessible or lubrication line.
   c. Blower fan shall be double-inlet type with forward-curved blades.
   d. Shall be constructed from steel with a corrosion resistant finish and dynamically balanced.

M. (23 81 19.13.M) Condenser Fans and Motors

1. Condenser fan motors:
   a. Shall be a totally enclosed motor.
   b. Shall use permanently lubricated bearings.
   c. Shall have inherent thermal overload protection with an automatic reset feature.
   d. Shall use a shaft down design on all sizes.
2. Condenser fans:
   a. Shall be a direct driven propeller type fan.
   b. Shall have aluminum blades riveted to corrosion resistant steel spiders and shall be dynamically balanced.

N. (23 81 19.13.) Special Features Options and Accessories

1. EnergyX® and Economizer
   a. System Description:
      1) One-piece EnergyX (Energy Recovery Ventilation) unit is an electrically controlled ventilation air pre-conditioner utilizing an AHRI 1060 certified Energy Recovery Cassette to reduce the cooling and heating loads placed on the primary HVAC unit by untreated outdoor air. Building exhaust air shall be introduced to the EnergyX unit through ductwork. Unit shall be designed as a factory-installed option to be used with WeatherMaster® 48HC units for use in vertical return applications only.
      2) Quality Assurance:
         a) Unit shall be designed in accordance with UL Standard 1995.
         b) Energy Recovery unit shall be ETL tested and certified.
         c) Rooftop unit and Energy Recovery unit shall be ETL certified as one single system.
         d) Roof curb or curb extension shall be designed to conform to NRCA Standards.
         e) Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
         f) Unit casing shall be capable of withstanding ASTM No. 141 (Method 6061) 500-hour salt spray test.
         g) Unit shall contain AHRI 1060 certified Energy Recovery Cassette.
         h) Unit shall leakage rates shall be capable of meeting ASHRAE Standard 62.1 requirements for use of class-2 exhaust with class-1 ventilation air.
   b. Products:
      Equipment (Standard): The EnergyX unit shall be a factory assembled, single piece unit. Contained within the unit enclosure shall be all factory wiring with a single, predetermined point of power input and a single point of 24-volt control wiring.
   c. Unit Cabinet:
      1) Unit cabinet shall be constructed of galvanized steel coated with a pre-painted baked enamel finish.
      2) All models shall have hoods installed over outside air intake and exhaust openings. Outside air hood shall have aluminum water entrainment filters.
      3) All models have 1-in., 2 pound density fiberglass insulation.
      4) Hinged access doors with compression latches shall be provided on all units for access to fans and filters. Hinged doors

shall be provided with at least one handle capable of being locked.
5) Exhaust air stream shall have back-draft dampers to prevent air penetration during off cycles.
6) Holes shall be provided in the base rails for rigging shackles to facilitate overhead rigging.

d. Blowers:
1) Blowers shall be direct drive with variable speed motors.
2) Blower wheel shall be made of steel with a corrosion resistant finish. It shall be dynamically balanced, double-inlet type with backward-curved blades.
3) Blower shall be mounted on neoprene vibration isolation pads.
4) Motor shall be high efficiency and have thermal overload protection.

e. Filter Section:

Standard filter section shall accept commercially available, 2-in. pleated filter(s).

f. Controls and Safeties:

The EnergyX® unit shall operate in conjunction with rooftop unit fan.

g. Electrical Requirements:

All unit power wiring shall enter unit cabinet at a single location.

h. Energy Recovery Cassette:
1) The energy recovery media shall have a minimum of 70% effectiveness at nominal unit airflow.
2) Energy wheel performance shall be AHRI Standard 1060 Certified and bear the AHRI Certified Product Seal.
3) The energy recovery cassette shall be an UL Recognized component for electrical and fire safety.
4) The wheel shall be coated with silica gel desiccant, permanently bonded without the use of binders or adhesives.
5) Coated wheels shall be washable with detergent or alkaline coil cleaner and water.
6) The silica gel shall not dissolve or deliquesce in the presence of water or high humidity.
7) The substrate shall be made of a lightweight polymer and shall not degrade or require additional coatings for application in coastal environments.
8) The wheel polymer layers shall be wound continuously with one flat and one structured layer in an ideal parallel plate geometry providing laminar flow and minimum pressure drop.
9) The polymer layers shall be captured in a stainless steel wheel frame or aluminum and stainless steel segment frames that provide a rigid and self-supporting matrix.
10) Energy recovery wheels greater than 19 inches in diameter shall be provided with removable wheel segments.
11) Wheel frame shall be a welded hub, spoke and rim assembly of stainless, plated, and or coated steel and shall be self supporting without the wheel segments in place.
12) Wheel segments shall be removable without the use of tools to facilitate maintenance and cleaning.
13) Wheel rim shall be continuous rolled stainless steel and the wheel shall be connected to the shaft by means of taper locks.
14) Wheel bearings shall provide an L-10 life of 400,000 hours.
15) Drive belts of stretch urethane shall be provided for wheel rim drive without the need for external tensioners or adjustment.

i. Supply and Exhaust Air Frost Control Option:
1) Factory-installed frost protection module shall sense pressure differential across the energy recovery cassette.
2) Supply blower shall be shut-off if the pressure differential across the energy recovery cassette exceeds an adjustable set point. Blower shall remain off for an adjustable time period.
3) Exhaust blower and wheel shall remain in operation in order to remove any frost build-up on the wheel.

j. EnergyX Maintenance Indicator Package:

A factory-installed switch shall monitor EnergyX blowers and wheel motor amp draw and send a signal to field-supplied 24-v indicator upon amperage surge that maintenance required.

k. Filter Maintenance Indicator:

A factory-installed differential pressure switch shall measure pressure drop across the outside air filter and activate a field-supplied 24-v indicator when airflow is restricted. It shall not interrupt EnergyX operation. Switch set point shall be adjustable.

l. EnergyX Free Cooling with Enthalpy and Stop/Jog Control:
1) An enthalpy sensor shall prevent the wheel from rotating if the outside air conditions are acceptable for free cooling. Both exhaust and supply blowers will remain on.
2) Stop-Jog-Control shall energize the wheel periodically during the free cooling operation of the EnergyX® to prevent dirt build-up on the wheel.

m. Economizer Option:
   1) The economizer shall be integrated in the energy recovery module and shall allow air to bypass the energy recovery wheel for free cooling and fail safe operation. Tilting wheel mechanisms shall not be allowed.
   2) The economizer damper shall be motorized with factory installed, 24-volt Belimo actuator.
   3) The EnergyX unit shall be capable of using the economizer in a free cooling operation.
   4) The economizer shall utilize enthalpy sensor controls when in the economizer mode.

n. CO_2 Sensor:
   1) The modulating airflow energy recovery unit shall be capable of incorporating a CO_2 sensor for use with Demand Controlled Ventilation.
   2) The CO_2 sensor shall connect to the base rooftop unit's digital controller.
   3) The modulating airflow energy recovery unit shall use at a minimum, a high and low CFM airflow set point when a CO_2 sensor is used.

o. Roof Curb Extension Accessory For Use with EnergyX Units:
   1) The energy recovery module shall us the standard rooftop unit rooftop curb.
   2) Rooftop extensions, support rails or other devices that come in contact with the roof surface to support the energy recovery module shall not be allowed.
   3) A horizontal adapter curb shall be used to convert vertical return air applications into horizontal return air applications. The supply airflow shall be convertible via the base rooftop unit operation and restrictions.

2. Staged Air Volume System (SAV™) for 2-stage cooling models only:
   a. Evaporator Fan Motor:
      1) Shall have permanently lubricated bearings.
      2) Shall have a maximum continuous bhp rating for continuous duty operation; no safety factors above that rating.
      3) Shall be Variable Frequency duty and 2-speed control.
      4) Shall contain motor shaft grounding ring to prevent electrical bearing fluting damage by safely diverting harmful shaft voltages and bearing currents to ground.
3. Variable Frequency Drive (VFD). Only available on 2-speed indoor fan motor option (SAV):
   a. Factory-supplied VFDs qualify, through ABB for a 12-month warranty from date of commissioning or 18 months from date of sale, whichever occurs first.
   b. Shall be installed inside the unit cabinet, mounted, wired and tested.
   c. Shall contain Electromagnetic Interference (EMI) frequency protection.
   d. Insulated Gate Bi-Polar Transistors (IGBT) used to produce the output pulse width modulated (PWM) waveform, allowing for quiet motor operation.
   e. Self diagnostics with fault and power code LED indicator. Field accessory Display Kit available for further diagnostics and special setup applications.
   f. RS485 capability standard.
   g. Electronic thermal overload protection.
   h. 5% swinging chokes for harmonic reduction and improved power factor.
   i. All printed circuit boards shall be conformal coated.
4. Integrated EconoMi$er® IV, EconoMi$er 2, and EconoMi$er X low leak rate models. (Factory-installed on 3-phase models only. Field installed on all 3 and 1-phase models):
   a. Integrated, gear driven opposing modulating blade design type capable of simultaneous economizer and compressor operation.
   b. Independent modules for vertical or horizontal return configuration shall be available. Vertical return modules shall be available as a factory-installed option.
   c. Damper blades shall be galvanized steel with composite gears. Plastic or composite blades on intake or return shall not be acceptable.
   d. Shall include all hardware and controls to provide free cooling with outdoor air when temperature and/or humidity are below setpoints.
   e. Shall be equipped with gear driven dampers for both the outdoor ventilation air and the return air for positive air stream control.
   f. Low leak rate models shall be equipped with dampers not to exceed 2% leakage at 1 in. wg pressure differential.
   g. Economizer controller on EconoMi$er IV models shall be Honeywell W7212 that provides:
      1) Combined minimum and DCV maximum damper position potentiometers with compressor staging relay.
      2) Functions with solid state analog enthalpy or dry bulb changeover control sensing.
      3) LED indicators for: when free cooling is available, when module is in DCV mode, when exhaust fan contact is closed.

h. Economizer controller on EconoMi$er® X models shall be the Honeywell W7220 that provides:
   1) 2-line LCD interface screen for setup, configuration and troubleshooting.
   2) On-board Fault Detection and Diagnostics (FDD) that senses and alerts when the economizer is not operating properly, per California Title 24.
   3) Sensor failure loss of communication identification.
   4) Automatic sensor detection.
   5) Capabilities for use with multiple-speed indoor fan systems.
   6) Utilize digital sensors: Dry bulb and Enthalpy.

i. Economizer controller on EconoMi$er 2 models with PremierLink™ controller shall be 4-20mA design and controlled by the PremierLink controller. PremierLink does not comply with California Title 24 Fault Detection and Diagnostic (FDD) requirements.

j. Economizer controller on EconoMi$er 2 models with RTU Open controller shall be a 4-20mA design controlled directly by the RTU Open controller. RTU Open controller meets California Title 24 Fault Detection and Diagnostic (FDD) requirements.

k. Shall be capable of introducing up to 100% outdoor air.

l. Shall be equipped with a barometric relief damper capable of relieving up to 100% return air and contain seals that meet ASHRAE 90.1-2016 and IECC-2015 requirements.

m. Shall be designed to close damper(s) during loss-of-power situations with spring return built into motor.

n. Dry bulb outdoor air temperature sensor shall be provided as standard. Enthalpy sensor is also available on factory-installed only. Outdoor air sensor setpoint shall be adjustable and shall range from 40 to 100°F (4 to 38°C). Additional sensor options shall be available as accessories.

o. The economizer controller shall also provide control of an accessory power exhaust unit function. Factory set at 100%, with a range of 0% to 100%.

p. The economizer shall maintain minimum airflow into the building during occupied period and provide design ventilation rate for full occupancy.

q. Dampers shall be completely closed when the unit is in the unoccupied mode.

r. Economizer controller shall accept a 2-10 Vdc CO_2 sensor input for IAQ/DCV control. In this mode, dampers shall modulate the outdoor air damper to provide ventilation based on the sensor input.

s. Compressor lockout temperature on W7220 is adjustable from –45°F to 80°F, set at a factory default of 32°F. Others shall open at 35°F (2°C) and close at 50°F (10°C).

t. Actuator shall be direct coupled to economizer gear. No linkage arms or control rods shall be acceptable.

u. Economizer controller shall provide indications when in free cooling mode, in the DCV mode, or the exhaust fan contact is closed.

5. Integrated EconoMi$er2, and EconoMi$er X Ultra Low Leak rate models. (Factory-installed on 3-phase models only. Field-installed on all 3 and 1-phase models):
   a. Integrated, gear driven opposing modulating blade design type capable of simultaneous economizer and compressor operation.
   b. Independent modules for vertical or horizontal return configuration shall be available. Vertical return modules shall be available as a factory-installed option.
   c. Damper blades shall be galvanized steel with composite gears. Plastic or composite blades on intake or return shall not be acceptable.
   d. Shall include all hardware and controls to provide free cooling with outdoor air when temperature and/or humidity are below setpoints.
   e. Shall be equipped with gear driven dampers for both the outdoor ventilation air and the return air for positive air stream control.
   f. Ultra Low Leak design meets California Title 24 section 140.4 and, ASHRAE 90.1-2016 and IECC-2015 requirements for 4 cfm per sq. ft. on the outside air dampers and 10 cfm per sq. ft. on the return dampers.
   g. Economizer controller on EconoMi$er X models shall be the Honeywell W7220 that provides:
      1) 2-line LCD interface screen for setup, configuration and troubleshooting.
      2) On-board Fault Detection and Diagnostics (FDD) that senses and alerts when the economizer is not operating properly, per California Title 24.
      3) Sensor failure loss of communication identification.
      4) Automatic sensor detection.
      5) Capabilities for use with multiple-speed indoor fan systems.
      6) Utilize digital sensors: Dry bulb and Enthalpy.
   h. Economizer controller on EconoMi$er® 2 models with RTU Open controller shall be a 4-20mA design controlled directly by the RTU Open controller. RTU Open controller

meets California Title 24 Fault Detection and Diagnostic (FDD) requirements.

i. Shall be capable of introducing up to 100% outdoor air.

j. Shall be equipped with a barometric relief damper capable of relieving up to 100% return air and contain seals that meet ASHRAE 90.1-2016 and IECC-2015 requirements.

k. Shall be designed to close damper(s) during loss-of-power situations with spring return built into motor.

l. Dry bulb outdoor air temperature sensor shall be provided as standard. Enthalpy sensor is also available on factory-installed only. Outdoor air sensor setpoint shall be adjustable and shall range from 40 to 100°F (4 to 38°C). Additional sensor options shall be available as accessories.

m. The economizer controller shall also provide control of an accessory power exhaust unit function. Factory set at 100%, with a range of 0% to 100%.

n. The economizer shall maintain minimum airflow into the building during occupied period and provide design ventilation rate for full occupancy.

o. Dampers shall be completely closed when the unit is in the unoccupied mode.

p. Economizer controller shall accept a 2-10 Vdc CO_2 sensor input for IAQ/DCV control. In this mode, dampers shall modulate the outdoor air damper to provide ventilation based on the sensor input.

q. Compressor lockout temperature on W7220 is adjustable from –45°F to 80°F, set at a factory default of 32°F. Others shall open at 35°F (2°C) and closes at 50°F (10°C).

r. Actuator shall be direct coupled to economizer gear. No linkage arms or control rods shall be acceptable.

s. Economizer controller shall provide indications when in free cooling mode, in the DCV mode, or the exhaust fan contact is closed.

6. Two-Position Damper:
   a. Damper shall be a Two-Position Damper. Damper travel shall be from the full closed position to the field adjustable %–open setpoint.
   b. Damper shall include adjustable damper travel from 25% to 100% (full open).
   c. Damper shall include single or dual blade, gear driven dampers and actuator motor.
   d. Actuator shall be direct coupled to damper gear. No linkage arms or control rods shall be acceptable.
   e. Damper will admit up to 100% outdoor air for applicable rooftop units.
   f. Damper shall close upon indoor (evaporator) fan shutoff and/or loss of power.
   g. The damper actuator shall plug into the rooftop unit's wiring harness plug. No hard wiring shall be required.
   h. Outside air hood shall include aluminum water entrainment filter.
   i. Not available with Staged Air Volume (SAV™) models.
7. Manual Damper:
   a. Manual damper package shall consist of damper, air inlet screen, and rain hood which can be preset to admit up to 25% outdoor air for year round ventilation.
   b. Not available with Staged Air Volume (SAV) models.
8. Humidi-MiZer® Adaptive Dehumidification System:
   a. The Humidi-MiZer Adaptive Dehumidification System shall be factory-installed and shall provide greater dehumidification of the occupied space by two modes of dehumidification operations in addition to its normal design cooling mode:
      1) Subcooling mode further sub cools the hot liquid refrigerant leaving the condenser coil when both temperature and humidity in the space are not satisfied.
      2) Hot gas reheat mode shall mix a portion of the hot gas from the discharge of the compressor with the hot liquid refrigerant leaving the condenser coil to create a two-phase heat transfer in the system, resulting in a neutral leaving air temperature when only humidity in the space is not satisfied.
      3) Includes head pressure controller.
9. Head Pressure Control Package (Motormaster®):
   a. Controller shall control coil head pressure by condenser-fan speed modulation or condenser-fan cycling and wind baffles.
   b. Shall consist of solid-state control and condenser-coil temperature sensor to maintain condensing temperature at outdoor ambient temperatures between 90°F (32°C) and 110°F (43°C) at outdoor ambient temperatures down to 0°F (–18°C).
10. Low Ambient Controller (Factory-installed only):
    a. Controller shall control coil head pressure by condenser-fan speed modulation or condenser-fan cycling and wind baffles.
    b. Shall consist of solid-state control and condenser-coil temperature sensor to maintain condensing temperature between 90°F (32°C)

and 110°F (43°C) at outdoor ambient temperatures down to 0°F (–18°C).

11. Propane Conversion Kit:

    Package shall contain all the necessary hardware and instructions to convert a standard natural gas unit for use with liquefied propane. Kits shall be available for elevations from 0 up to 14,000 ft (4,276 m).

12. Condenser Coil Hail Guard Assembly:
    a. Shall protect against damage from hail.
    b. Shall be of louvered style.

13. Unit-Mounted, Non-Fused Disconnect Switch:
    a. Switch shall be factory-installed, internally mounted.
    b. National Electric Code (NEC) and UL or ETL approved non-fused switch shall provide unit power shutoff.
    c. Shall be accessible from outside the unit.
    d. Shall provide local shutdown and lockout capability.
    e. Sized only for the unit as ordered from the factory. Does not accommodate field-installed devices.

14. HACR Breaker:
    a. These manual reset devices provide overload and short circuit protection for the unit. Factory wired and mounted with the units, with access cover to help provide environmental protection. On 575V applications, HACR breaker can only be used with WYE power distribution systems. Use on Delta power distribution systems is prohibited.
    b. Sized only for the unit as ordered from the factory. Does not accommodate field-installed devices.

15. Convenience Outlet:
    a. Powered convenience outlet. (Not available on single phase models):
        1) Outlet shall be powered from main line power to the rooftop unit.
        2) Outlet shall be powered from line side or load side of disconnect by installing contractor, as required by code. If outlet is powered from load side of disconnect, unit electrical ratings shall be UL certified and rated for additional outlet amperage.
        3) Outlet shall be factory-installed and internally mounted with easily accessible 115-v female receptacle.
        4) Outlet shall include 15 amp GFI receptacles with independent fuse protection.
        5) Voltage required to operate convenience outlet shall be provided by a factory-installed step down transformer.
        6) Outlet shall be accessible from outside the unit.
        7) Outlet shall include a field-installed "Wet in Use" cover.
    b. Non-powered convenience outlet.
        1) Outlet shall be powered from a separate 115-120v power source.
        2) A transformer shall not be included.
        3) Outlet shall be factory-installed and internally mounted with easily accessible 115-v female receptacle.
        4) Outlet shall include 15 amp GFI receptacles.
        5) Outlet shall be accessible from outside the unit.
        6) Outlet shall include a field-installed "Wet in Use" cover.

16. Flue Discharge Deflector:
    a. Flue discharge deflector shall direct unit exhaust vertically instead of horizontally.
    b. Deflector shall be defined as a "natural draft" device by the National Fuel and Gas (NFG) code.

17. Fan/Filter Status Switch:
    a. Switch shall provide status of indoor evaporator fan (ON/OFF) or filter (CLEAN/DIRTY).
    b. Status shall be displayed either over communication bus (when used with direct digital controls) or with an indicator light at the thermostat.

18. Centrifugal Propeller Power Exhaust:
    a. Power exhaust shall be used in conjunction with an integrated economizer.
    b. Independent modules for vertical or horizontal return configurations shall be available.
    c. Horizontal power exhaust is shall be mounted in return ductwork.
    d. Power exhaust shall be controlled by economizer controller operation. Exhaust fans shall be energized when dampers open past the 0-100% adjustable setpoint on the economizer control.

19. Roof Curbs (Vertical):
    a. Full perimeter roof curb with exhaust capability providing separate air streams for energy recovery from the exhaust air without supply air contamination.
    b. Formed galvanized steel with wood nailer strip and shall be capable of supporting entire unit weight.
    c. Permits installation and securing of ductwork to curb prior to mounting unit on the curb.

20. Adapter Curb (Vertical):
    a. Full perimeter – fully assembled and welded roof curb with exhaust capability providing separate air streams for energy recovery from the exhaust air without supply air contamination.

b. Formed galvanized steel with wood nailer strip and shall be capable of supporting entire unit weight.

c. Permits installation of new 48HC 17-28 models to past Carrier design curb models: DP, DR, HJ, TM, and TJ. (Not for 48TJE024-028 models.) Check with Carrier sales expert of further details and information.

21. High Altitude Gas Conversion Kit:

    Package shall contain all the necessary hardware and instructions to convert a standard natural gas unit to operate from 3,000 to 10,000 ft (914 to 3048 m) elevation and 10,001 to 14,000 ft (3049 to 4267 m) elevation.

22. Outdoor Air Enthalpy Sensor:

    The outdoor air enthalpy sensor shall be used to provide single enthalpy control. When used in conjunction with a return air enthalpy sensor, the unit will provide differential enthalpy control. The sensor allows the unit to determine if outside air is suitable for free cooling.

23. Return Air Enthalpy Sensor:

    The return air enthalpy sensor shall be used in conjunction with an outdoor air enthalpy sensor to provide differential enthalpy control.

24. Indoor Air Quality (CO_2) Sensor:

    a. Shall be able to provide demand ventilation indoor air quality (IAQ) control.

    b. The IAQ sensor shall be available in duct mount, wall mount, or wall mount with LED display. The setpoint shall have adjustment capability.

25. Smoke Detectors:

    a. Shall be a Four-Wire Controller and Detector.

    b. Shall be environmental compensated with differential sensing for reliable, stable, and drift-free sensitivity.

    c. Shall use magnet-activated test/reset sensor switches.

    d. Shall have tool-less connection terminal access.

    e. Shall have a recessed momentary switch for testing and resetting the detector.

    f. Controller shall include:

        1) One set of normally open alarm initiation contacts for connection to an initiating device circuit on a fire alarm control panel.
        2) Two Form-C auxiliary alarm relays for interface with rooftop unit or other equipment.
        3) One Form-C supervision (trouble) relay to control the operation of the Trouble LED on a remote test/reset station.
        4) Capable of direct connection to two individual detector modules.
        5) Can be wired to up to 14 other duct smoke detectors for multiple fan shutdown applications

26. Horn/Strobe Annunciator:

    a. Provides an audible/visual signaling device for use with factory-installed option or field-installed accessory smoke detectors.

    b. Requires installation of a field-supplied 24-v transformer suitable for 4.2 VA (AC) or 3.0 VA (DC) per horn/strobe accessory.

    c. Requires field-supplied electrical box, North American 1-gang box, 2-in (51 mm) x 4-in (102 mm).

    d. Shall have a clear colored lens.

27. Winter Start Kit:

    a. Shall contain a bypass device around the low pressure switch.

    b. Shall be required when mechanical cooling is required down to 25°F (–4°C).

    c. Shall not be required to operate on an economizer when below an outdoor ambient of 40°F (4°C).

28. Time Guard:

    a. Shall prevent compressor short cycling by providing a 5-minute delay (±2 minutes) before restarting a compressor after shutdown for any reason.

    b. One device shall be required per compressor.

29. Barometric Hood (Horizontal Economizer Applications):

    Shall be required when a horizontal economizer and barometric relief are required. Barometric relief damper must be installed in the return air (horizontal) duct work. This hood provides weather protection.

30. Display Kit for Variable Frequency Drive:

    a. Kit allows the ability to access the VFD controller programs to provide special setup capabilities and diagnostics.

    b. Kit contains display module and communication cable.

    c. Display Kit can be permanently installed in the unit or used on any SAV™ system VFD controller as needed.

31. Condensate Overflow Switch:

    a. This sensor and related controller monitors the condensate level in the drain pan and shuts down compression operation when overflow conditions occur. It includes:

        1) Indicator light - solid red (more than 10 seconds on water contact - compressors disabled), blinking red (sensor disconnected).
        2) 10 second delay to break - eliminates nuisance trips from splashing or waves

Guide specifications (cont)

in pan (sensor needs 10 seconds of constant water contact before tripping).

3) Disables the compressor(s) operation when condensate plug is detected, but still allows fans to run for Economizer.

32. Hinged Access Panels:
    a. Shall provide easy access through integrated quarter turn latches.
    b. Shall be on major panels of – filter, control box, fan motor and compressor.
33. Foil Faced Insulation:

    Throughout unit cabinet air stream, non-fibrous and cleanable foil faced insulation is used.
34. California OSHPD Seismic Certification Label:
    a. Units meet the seismic capacity requirements of the International Code Council Evaluation Service (ICC-ES) document AC156 (Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems) and per International Building Code (IBC 2009) at an SDS (g) value of 2.00 z/h=1.0, Ip=1.5 and certified by independent structural engineers.
    b. Units shall include a certification label that meets the CA OSHPD Special Seismic Certification pre-approval labeling requirements on the external chassis of the unit.
    c. OSHPD not available on units with factory installed Humidi-MiZer, HACR breaker, MCHX coils, low ambient controls, hail-guards, or EnergyX.

Manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligations.

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Replaces: 48HC-17-28-03PD

CREST COMMERCIAL CONDENSING BOILER

Submittal Sheet

Lochinvar®
HIGH EFFICIENCY BOILERS & WATER HEATERS

MODELS FB 0751 - FB 6001

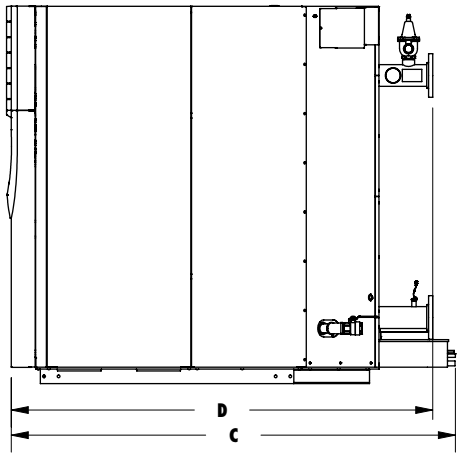
AHRI CERTIFIED™ www.ahridirectory.org

FBN-Sub-11

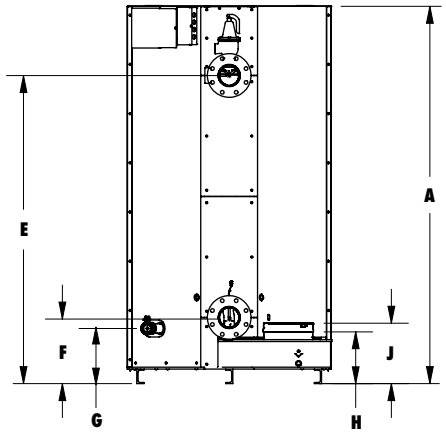
Job Name: _____ Location: _____ Contractor: _____ Type Gas: _____

Engineer: _____ Model #: _____ Agent/Wholesaler: _____ Equipment Tag(s): _____

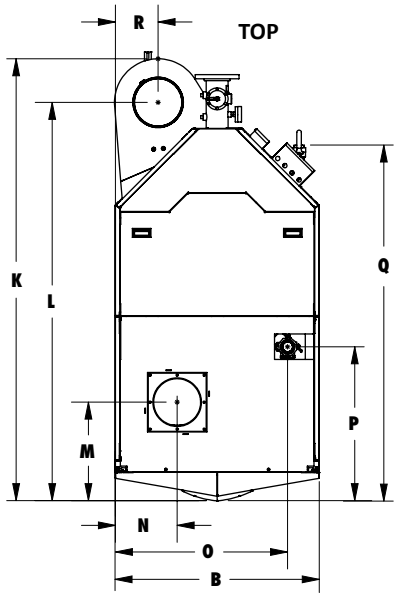
SIDE



BACK



TOP



JOB NOTES:

Notes:

* *Insert "N" for natural gas, "L" for LP gas models and "D" for dual fuel.*

- *Indoor installation only.*
- *Low NOx Operation.*
- *Lochinvar should be consulted before selecting a boiler for installations having unusual piping and pickup requirements, such as intermittent system operation, extensive piping systems, etc.*
- *The ratings have been determined under the provisions governing forced draft burners.*
- *The Net AHRI water ratings shown are based on a piping and pickup allowance of 1.15.*

Model Number	Input MBH Min	Input MBH Max	Thermal %	Gross Output MBH	Net AHRI Rating MBH	Turn-down	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R	Gas Conn.	Water Inlet / Outlet	Air Intake	Vent Size	Oper. Weight (with water)	Ship. Weight (lbs.)
○ FB*0751	50	750	96.2%	722	628	15:1	78″	30″	55-1/2″	57-5/8″	66-1/8″	11-7/8″	11-3/8″	11-1/4″	12-1/2″	55″	51″	13″	8-3/4″	26-3/4″	23-3/4″	49-1/2″	7-3/8″	1-1/4″	3″	6″	6″	1,768	1,560
○ FB*1001	50	999	96.2%	961	836	20:1	78″	30″	56-1/2″	57-5/8″	66-1/8″	11-7/8″	11-3/8″	11-1/4″	12-1/2″	56″	51″	13″	8-3/4″	26-3/4″	23-1/8″	49-1/2″	6-1/2″	1-1/4″	3″	6″	6″	1,838	1,596
○ FB*1251	62.5	1,250	96.2%	1,203	1,046	20:1	78″	30″	56-1/2″	57-3/4″	66-1/8″	11-7/8″	11-3/8″	11-1/4″	12-1/2″	56″	51-3/8″	13″	8-3/4″	26-3/4″	21-5/8″	49-1/2″	6-1/2″	1-1/2″	3″	6″	8″	1,975	1,648
○ FB*1501	60	1,500	96.2%	1,443	1,255	25:1	78″	30″	67-3/4″	68″	65-3/8″	12-3/8″	11-3/8″	11-1/4″	12-1/2″	67-1/4″	62-3/8″	15-7/8″	9″	26-7/8″	27-7/8″	59-1/4″	5-1/8″	1-1/2″	4″	8″	8″	2,307	1,961
○ FB*1751	70	1,750	96.2%	1,684	1,464	25:1	78″	30″	66-1/4″	68″	65-3/8″	12-3/8″	11-3/8″	11-1/4″	12-1/2″	65-3/4″	61-1/2″	15-7/8″	9″	27″	27-1/8″	58-3/4″	5-1/8″	1-1/2″	4″	8″	8″	2,458	2,017
○ FB*2001	80	1,999	96.2%	1,923	1,672	25:1	78″	30″	66-1/2″	68″	65-3/8″	12-3/8″	11-3/8″	11-1/4″	12-1/2″	66″	61-1/2″	15-7/8″	9″	27″	26-3/4″	58-3/4″	5-1/8″	1-1/2″	4″	8″	8″	2,570	2,087
○ FB*2501	125	2,500	96%	2,400	2,087	20:1	77-3/4″	35″	83-3/4″	83-3/4″	63-3/4″	13-1/2″	11-1/4″	10-1/2″	12-1/4″	83-1/4″	76-1/4″	19-3/4″	9-1/4″	28-3/4″	32″	71″	7-1/4″	2″	4″	8″	9″	3,600	2,577
○ FB*3001	150	3,000	96%	2,883	2,507	20:1	77-3/4″	35″	83-3/4″	83-3/4″	63-3/4″	13-1/2″	11-1/4″	10-1/2″	12-1/4″	83-1/4″	76-1/4″	19-3/4″	9-1/4″	28-3/4″	32″	71″	7-1/4″	2″	4″	10″	10″	3,900	2,881
○ FB*3501	175	3,500	96%	3,364	2,925	20:1	77-3/4″	42″	91-1/2″	86-3/4″	63-1/2″	13-1/4″	11-1/2″	10-3/4″	12-1/2″	91″	82″	20-1/4″	12-3/4″	35-1/2″	31-3/4″	73-1/4″	8-3/4″	2″	4″	10″	10″	4,600	3,218
○ FB*4001	333.3	3,999	96%	3,843	3,342	12:1	77-3/4″	45-1/2″	103-1/2″	99″	63-1/2″	13-3/4″	11-1/2″	10-3/4″	12-1/2″	103″	94″	24-3/4″	13-1/2″	39-1/2″	42-1/4″	85-1/4″	10-1/2″	2-1/2″	4″	12″	12″	5,200	3,805
○ FB*5001	499.9	4,999	96%	4,804	4,177	10:1	77-3/4″	46-1/2″	102-1/4″	99-1/2″	63-1/2″	15″	11-1/2″	10-3/4″	12-1/2″	101-3/4″	92-1/2″	22″	14″	39-3/4″	39-1/2″	84″	9″	2-1/2″	6″	14″	14″	5,900	4,101
○ FB*6001	600	6,000	96%	5,766	5,014	10:1	77-3/4″	50″	102-3/4″	99-3/4″	63-1/4″	14-3/4″	11-1/2″	10-3/4″	12-1/2″	102-1/2″	93-1/4″	20″	15-3/4″	43-1/2″	36-1/2″	83-3/4″	9-1/4″	3″	6″	14″	14″	6,900	4,711

Information subject to change without notice. Dimensions shown are approximate and should not be used for construction purposes.

CREST®
CONDENSING BOILER



ENERGY STAR 0751-2001

Codes & Registrations

- ANSI Z21.13/CSA Certified
- ASME Certified, "H" Stamp / National Board
- California Code Compliant
- Canadian Registration Number (CRN)
- CSD1 / Factory Mutual / GE Gap Compliant
- South Coast Air Quality Management District Qualified & Energy Star Rated (FB 0751-2001)

Smart Touch™ Features

CON·X·US Remote Connect

SMART TOUCH Touchscreen Operating Control

Full-Color 8" Touchscreen LCD Display

Built-in Cascading Sequencer for up to 8 Boilers
- › Built-in Redundancy
- › Cascade Multiple Sized Boilers
- › Lead/Lag Cascade
- › Efficiency Optimized Cascade

Front-End Loading Capability with Copper-Fin II® and Power-Fin® Boilers

Building Management System Integration with 0-10 VDC Input

BACnet MSTP Communications

Outdoor Reset Control with Outdoor Air Sensor

Password Security

Domestic Hot Water Prioritization
- › DHW tank piped with priority in the boiler loop
- › DHW tank piped as a zone in the system with the pumps controlled by the Smart System
- › DHW Modulation Limiting
- › Separately Adjustable SH/DHW Switching Times

Low Water Flow Safety Control & Indication

Inlet & Outlet Temperature Readout

Freeze Protection

Service Reminder

Time Clock

Data Logging
- › Hours Running, Space Heating
- › Hours Running, Domestic Hot Water
- › Hours Running, Modulation Rate
- › Ignition Attempts
- › Last 10 Lockouts

Programmable System Efficiency Optimizers
- › Night Setback
- › Anti-Cycling
- › Outdoor Air Reset Curve
- › Ramp Delay
- › Boost Temperature & Time
- › Modulation Factor Control

Three Pump Control
- › System Pump
- › Boiler Pump
- › Domestic Hot Water Pump

High-Voltage Terminal Strip
- › 120V/1PH/60Hz Power Supply (FB 0751-2001)
- › 208V/3PH/60Hz Power Supply (FB 2501-3501)
- › 480V/3PH/60Hz Power Supply (FB 4001-6001)
- › System Pump, Boiler Pump and DHW Pump Power

Low-Voltage Terminal Strip
- › 24 VAC Auxiliary Device Relay
- › Auxiliary Proving Switch Contacts
- › Alarm on Any Failure Contacts
- › Runtime Contacts
- › DHW Thermostat Contacts
- › Unit Enable/Disable Contacts
- › System Sensor Contacts
- › DHW Tank Sensor Contacts
- › Outdoor Air Sensor Contacts
- › Cascade Contacts
- › 0-10 VDC BMS External Control Contact
- › 0-10 VDC Variable Speed Boiler Pump Control Contact

Standard Features

- Proof of Closure Valve (FB 6001)
- Modulating Burner with up to 25:1 Turndown
- Direct-Spark Ignition
- Low NOx Operation
- Sealed Combustion
- Air Inlet Filter
- Low Gas Pressure Operation
- **Vertical and Horizontal Direct Venting**
  - › Direct Vent up to 100 Feet
  - › PVC, CPVC, Polypropylene or AL29-4C (FB 0751-4001)
  - › AL29-4C (FB 0751-6001)
- ASME "H" Stamped Heat Exchanger
- 316L Stainless Steel Fire Tubes
- 160 psi Working Pressure
- On/Off Switch
- Adjustable High Limit with Manual Reset
- Low Water Cutoff with Manual Reset & Test
- High & Low Gas Pressure Switches w/Manual Reset
- Low Air Pressure Switches
- Condensate Trap w/Blocked Drain Switch
- Drain Valve
- System Sensor
- Outdoor Air Sensor
- Inlet & Outlet Temperature Sensors
- High-Voltage Terminal Strip
- Low-Voltage Terminal Strip
- Downstream Gas Test Cocks
- 50 psi ASME Relief Valve
- Temperature & Pressure Gauge
- Zero Clearances to Combustible Materials
- High Altitude Models Available
- 10-Year Limited Warranty (See Warranty for Details)
- 1-Year Warranty on Parts (See Warranty for Details)

Optional Equipment

- ☐ Alarm on Any Failure
- ASME Relief Valve Option:
  ☐ 75 psi ☐ 100 psi ☐ 125 psi ☐ 150 psi
- ☐ BMS Gateway - BACnet IP or LonWorks
- ☐ Condensate Neutralization Kit
- ☐ Common Vent Kits Damper
- ☐ Modbus Communication
- ☐ Motorized Isolation Valve
- ☐ O_2 Feedback
- ☐ Variable Speed Boiler Pump
- ☐ Wireless Outdoor Temperature Sensor

Electrical Transformer Options (Shipped Loose):
- › FB 0751-2001
  - ☐ 208V/3PH/60Hz → 120V/1PH/60Hz
  - ☐ 480V/3PH/60Hz → 120V/1PH/60Hz
  - ☐ 600V/3PH/60Hz → 120V/1PH/60Hz
- › FB 2501-3501
  - ☐ 480V/3PH/60Hz → 208V/3PH/60Hz
  - ☐ 600V/3PH/60Hz → 208V/3PH/60Hz
- › FB 4001-6001
  - ☐ 208V/3PH/60Hz → 480V/3PH/60Hz
  - ☐ 600V/3PH/60Hz → 480V/3PH/60Hz

Lochinvar®
HIGH EFFICIENCY BOILERS & WATER HEATERS

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Lebanon, Tennessee 37090
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Lochinvar.com

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KNIGHT XL COMMERCIAL BOILER

Submittal Sheet **KBX-Sub-07**

KNIGHT XL COMMERCIAL CONDENSING HEATING BOILERS

Job Name: _____ Model No. _____

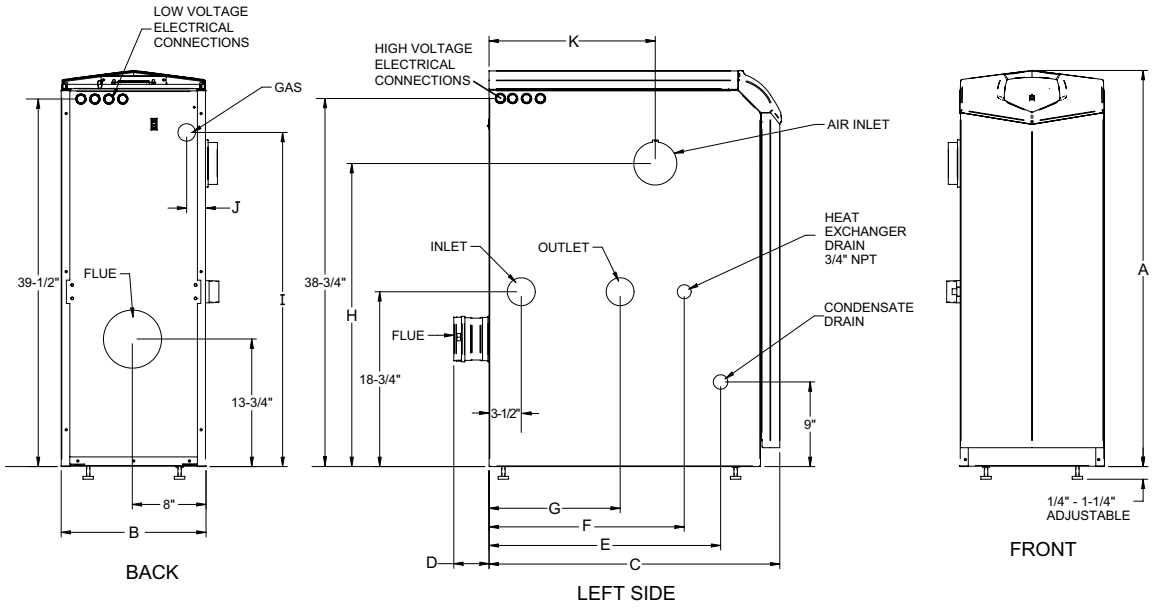
Location: _____ Type Gas: _____

Engineer: _____ Equipment Tag(s):

Wholesaler: _____ _____

Contractor: _____ _____

NOTES:



Knight XL Heating Boiler

Dimensions and Specifications

	Model No.	Input Min MBH	Input Max MBH	Thermal Eff.	Gross Output MBH	Net AHRI Rating MBH	A	B	C	D	E	F	G	H	I	J	K	Gas Conn.	Water Conn.	Air Inlet	Vent Size	Ship Wt. (lbs.)
○	KBN400	80	399	94.0%	376	327	42-1/2″	15-1/2″	27-3/4″	3-3/4″	20-3/4″	21″	14″	34″	34″	2″	18-3/4″	1″	1-1/2″	4″	4″	280
○	KBN501	100	500	94.0%	470	409	42-1/2″	15-1/2″	31-1/2″	3-3/4″	25-1/2″	21″	14″	32-1/2″	36″	2″	18″	1″	1-1/2″	4″	4″	310
✓	KBN601	120	600	94.0%	564	490	42-1/2″	15-1/2″	36-1/4″	3-3/4″	25″	21″	14″	36″	32-3/4″	5-1/2″	19-1/2″	1″	2″	4″	4″	340
○	KBN701	140	700	94.0%	658	572	42-1/2″	15-1/2″	40-1/4″	3-3/4″	29″	23″	17″	36″	32-3/4″	3-1/4″	23-1/2″	1″	2″	4″	6″	370
○	KBN801	160	800	94.0%	752	654	42-1/2″	15-1/2″	45-1/4″	3-3/4″	33-1/4″	23″	17″	36″	32-3/4″	3-1/4″	27-3/4″	1″	2″	4″	6″	405

Notes:

- *Indoor installation only. All information subject to change. Change "N" to "L" for LP gas models.*
- *The Net AHRI Water Ratings shown are based on a piping and pickup allowance of 1.15.*
- *Lochinvar should be consulted before selecting a boiler for installations having unusual piping and pickup requirements, such as intermittent system operation, extensive piping systems, etc.*
- *The ratings have been determined under the provisions governing forced draft burners.*

KNIGHT® COMMERCIAL BOILER XL



Standard Features

- **› 94% Thermal Efficiency**
- **› Modulating Burner with 5:1 Turndown**
  - › Direct-Spark Ignition
  - › Low NOx Operation
  - › Sealed Combustion
  - › Low Gas Pressure Operation
- **› ASME Stainless Steel Heat Exchanger**
  - › ASME Certified, "H" Stamped Gasketless HEX
  - › 160 psi Working Pressure
  - › 50 psi ASME Relief Valve
  - › Highly efficient, condensing design
- **› Vertical & Horizontal Direct-Vent**
  - › Category IV venting up to 100 feet
  - › PVC, CPVC, Polypropylene or AL29-4C Venting up to 100 Feet
  - › Factory Supplied Sidewall Vent Termination
- **› Smart System Control**
- **› Other Features**
  - › On/Off Switch
  - › Adjustable High Limit w/ Manual Reset
  - › Automatic Reset High Limit
  - › Flow Switch
  - › Flue Temperature Sensor
  - › Low Air Pressure Switch
  - › Temperature & Pressure Gauge
  - › Adjustable Leveling Legs
  - › Condensate Trap
  - › Zero Clearances to Combustible Material
  - › 10 Year Limited Warranty (See Warranty)

Smart System Features

- **› SMART SYSTEM Digital Operating Control**
  - › Multi-Color Graphic LCD Display w/Navigation Dial
- **› Three Reset Temperature Inputs with curves for three set point temperature inputs**
- **› Built in Cascading Sequencer for up to 8 Boilers**
  - › Multiple Size Boiler Cascade
  - › Lead Lag
  - › Efficiency Optimization
- **› Outdoor Reset Control with Outdoor Air Sensor**
- **› Programmable System Efficiency Optimizers**
  - › Night Setback
  - › DHW Night Setback
  - › Anti-Cycling
  - › Outdoor Air Reset Curve
  - › Ramp Delay
  - › Boost Temperature & Time
- **› Three Pump Control**
  - › System Pump w/Parameter for Continuous Operation
  - › Boiler Pump With Variable Speed Pump Control*
  - › Domestic Hot Water Pump
- **› Domestic Hot Water Prioritization**
  - › DHW tank piped with priority in the boiler loop
  - › DHW tank piped as a zone in the system with the pumps controlled by the Smart System
- **› DHW Modulation Limiting**
  - › Separately Adjustable SH/DHW Switching Times*
- **› Building Management System Integration**
  - › 0-10VDC Input to Control Modulation or Set Point
  - › 0-10VDC Input Signal from Variable Speed System Pump*
  - › 0-10VDC Modulation Rate Output
  - › 0-10VDC Input to Enable/Disable call for heat
  - › Access to BMS Settings through Display
- **› High Voltage Terminal Strip**
  - › 120 VAC / 60 Hertz / 1 Phase Power Supply
  - › Three sets of Pump Contacts with Pump Relays
- **› Low Voltage Terminal Strip**
  - › 24 VAC Device Relay
  - › Proving Switch Contacts
  - › Flow Switch Contacts
  - › Alarm on Any Failure Contacts
  - › Runtime Contacts
  - › DHW Thermostat Contacts
  - › 3 Space Heat Thermostat Contacts
  - › System Sensor Contacts
  - › DHW Tank Sensor Contacts
  - › Outdoor Air Sensor Contacts
  - › Cascade Contacts
  - › 0-10 VDC BMS External Control Contact
  - › 0-10 VDC Boiler Rate Output Contacts
  - › 0-10 VDC Variable Speed System Pump Signal Input
  - › 0-10 VDC Signal to Control Variable Speed Boiler Pump
  - › Modbus Contacts
- **› Time Clock**
- **› Data Logging**
  - › Hours Running, Space Heating
  - › Hours Running, Domestic Hot Water
  - › Ignition Attempts
  - › Last 10 Lockouts
- **› Other Features**
  - › Low Water Flow Safety Control & Indication
  - › Password Security
  - › Inlet & Outlet Temperature Readout
  - › Customizable Freeze Protection Parameters
  - › Custom Maintenance Reminder with Contractor Info

*Exclusive feature, available only from Lochinvar

Optional Equipment

- ☐ Alarm Bell
- ☐ Condensate Neutralization Kit
- ☐ Concentric Vent Kit (KB400-KB601)
- ☐ BMS Gateway to LON or BacNet IP
- ☐ BACnet MSTP Communication
- ☐ High & Low Gas Pressure Switches w/ Manual Reset (KB501-KB801)
- ☐ MODBUS Communication
- ☐ Multi Temperature Loop Control
- ☐ Low Water Cutoff w/Manual Reset & Test
- ☑ Boiler Circulation Pump
- ☐ Variable Speed Boiler Pump
- ☐ SMART SYSTEM PC Software
- ☐ Stainless Steel Vent Kits (KB701-KB801)
- ☐ Stack Frame
- ☐ 30 psi ASME Relief Valve
- ☐ 75 psi ASME Relief Valve
- ☐ 100 psi ASME Relief Valve
- ☐ 125 psi ASME Relief Valve
- ☐ 150 psi ASME Relief Valve

Firing Codes

- ☐ M9 Standard Construction
- ☐ M7 California Code
- ☐ M13 CSD1 / FM / GE Gap (KB501-KB801)

Venting Options

- ☐ Direct Vent Vertical
- ☐ Direct Vent Horizontal
- ☐ Vertical Vent with Sidewall Air Intake
- ☐ Sidewall Vent with Rooftop Air Intake
- ☐ Vertical Vent with Optional Room Air
- ☐ Sidewall Vent with Optional Room Air

Lochinvar® HIGH EFFICIENCY BOILERS & WATER HEATERS

Lochinvar, LLC
300 Maddox Simpson Parkway
Lebanon, Tennessee 37090
P: 615.889.8900 / F: 615.547.1000
Lochinvar.com

AHRI CERTIFIED

ASME H

11/17—Printed in U.S.A.

PUMP RECOMMENDATION

Lochinvar®
HIGH EFFICIENCY BOILERS & WATER HEATERS

FOR KNIGHT XL BOILERS
400 — 801 MBH

PUMP-Rec-14 Rev F

JOB NAME: _____ ENGINEER: _____ AGENT/ WHOLESALER: _____

LOCATION: _____ CONTRACTOR: _____ EQUIPMENT TAG(S): _____

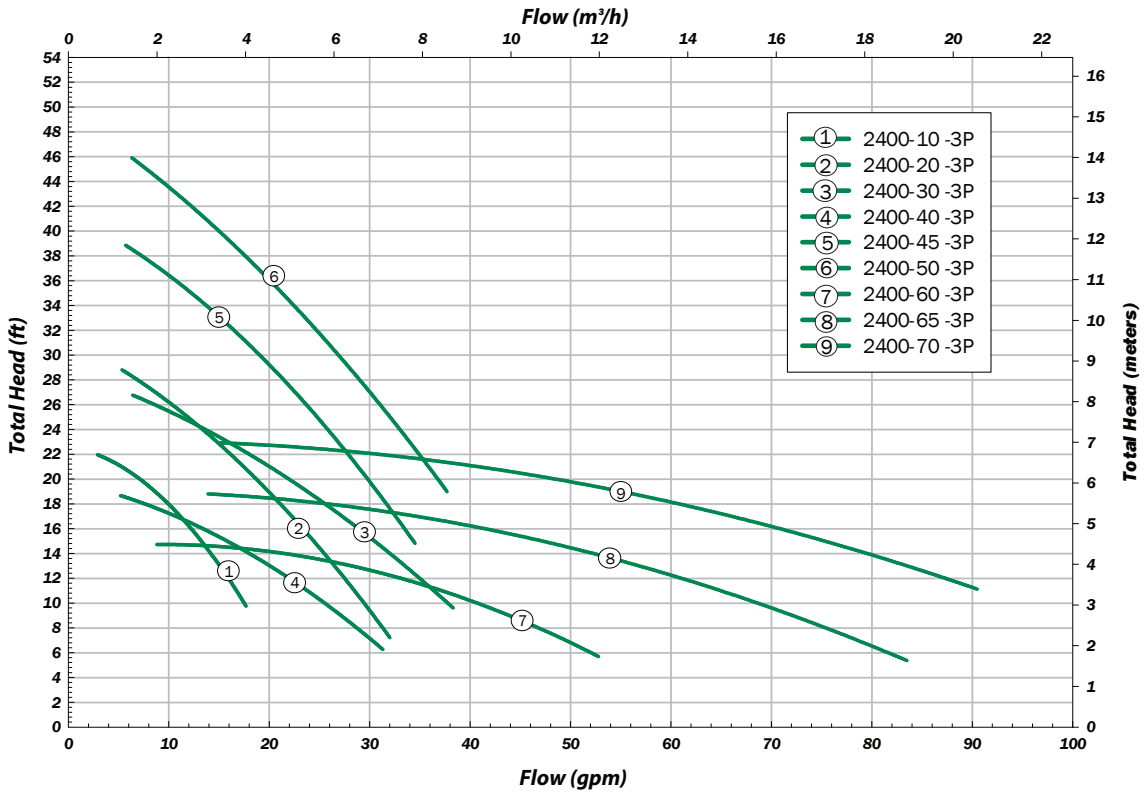
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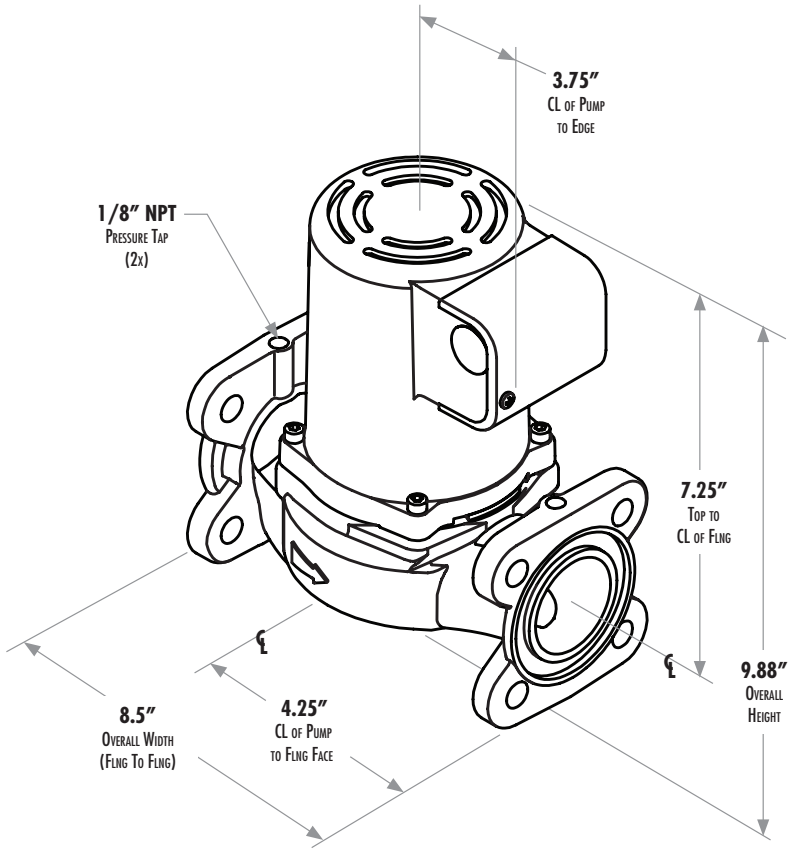
PUMP SPECIFICATIONS

ELEC. RATINGS	MAX POWER	RATED CURRENT	MAX LOAD	MAX PRESSURE	MAX TEMP.	VOLUTE MAT'L	FLANGE SIZE	VENDOR/ PROD. SERIES
115V 60 HZ/1 PH	1/2 HP	1.7 A	5 A	150 PSI	225°F	CAST IRON	2"	TACO/ 2400-70

INSTALLATION SPECIFICATIONS

MODEL NO.	PLANNED FLOW RATE	MAX FLOW RATE	PLANNED TEMP. RISE	TOTAL SYSTEM HEAD LOSS





Technical Manual

ClassMate®

Single Package Vertical Unit

Models CMD, CMP and CMS



AIREDALE

MODINE
Always Innovating. Always Improving.

AIR 2-104.3 • November, 2019

Modine is located in Racine, Wisconsin, and is one of the world's leading manufacturers of heat pump and air conditioning systems for schools. Our reputation for product excellence has been earned through innovative design, our use of the highest quality controls, engineering selections of component parts, and the highest quality manufacturing and assembly of all products.

State-of-the-art test facilities reflect Modine's commitment to the latest design and manufacturing technology to maintain leadership in the production of systems of unsurpassed quality and reliability.

In addition to creating a healthier and safer learning environment for our children, many of the features in Modine products are unique, and the range of systems available offer schools a variety of options.

Overview

The supplied product shall be a self-contained air conditioning unit in three possible configurations: Split Fan Coil Operation, DX Cooling Operation, Heat Pump Heating and Cooling Operation. The unit may employ options for electric, hot water, or steam (plenum mount only) heating. The unit shall be floor-mounted and vertically sized to allow the supply air to be ducted or supplied through a high level plenum. All access and maintenance shall be through the front of the unit.

The unit shall be engineered to provide one stage of free cooling and two stages of mechanical cooling. A third dehumidification stage of mechanical cooling may be used when using a humidity sensor. Heat pump units shall also offer two stages of mechanical heating with automatic defrost control.

The unit shall be constructed in accordance with UL & CSA standards with a label affixed to the unit listing the product code under which it is registered. Unit performance shall be tested in accordance with AHRI 390.

Table of Contents

Model Identification 3
Standard Features 4-5
Base Unit Selection 5-7
Options - Factory Installed 8
Accessories - Field Installed 9
Side Trim Pieces 10
Airflow Paths 11
Supply Air Arrangement
Plenum 12
Duct Shroud 13
Performance Data 14
Technical Data 15
Sequence of Operations 16-18
Control Strategy 19-21
Unit Arrangement
General Arrangement 22-23
Base Unit Dimensional Data 24-27
Standard Wall Sleeve / Louver Dimensions and Mounting 28-29
Rear Extension / Wall Sleeve / Louver Dimensions and Mounting 30-31

MODINE HAS A CONTINUOUS PRODUCT IMPROVEMENT PROGRAM AND THEREFORE RESERVES THE RIGHT TO CHANGE DESIGN AND SPECIFICATIONS WITHOUT NOTICE.

ClassMate® - Model Nomenclature

1,2	3	4,5	6	7	8	9	10	11	12	13	14	15,16	17
PT	UC	MBH	SV	G	CC	VC	FL	CS	DS	DO	HP	HO	-

1,2 - Product Type (PT)
CM - Classmate®

3 - Unit Configuration (UC)
D - DX Cooling
P - HP Heating & Cooling
S - Split Fan Coil Unit

4,5 - Nominal Capacity (MBH)
24 - 24,000 Btu/Hr
36 - 36,000 Btu/Hr
48 - 48,000 Btu/Hr
60 - 60,000 Btu/Hr

6 - Supply Voltage (SV)
A - 115/60/1
B - 208/60/1
C - 230/60/1
D - 208/60/3
E - 230/60/3
F - 460/60/3
H - 277/60/1

7 - Generation (G)
A - First Generation
B - Second Generation

8 - Control Code (CC)
M - Modine Control System
F - Factory Installed Free Issue
B - By Others - Field Installed

9 - Ventilation Configuration (VC)
CMD & CMP
- A - Economizer
- B - Economizer with OA Damper
- C - ERV with OA Damper
- D - ERV with OA Damper & Economizer
- E - ERV with OA & RA Damper & Economizer
- Z - Return Air Only

CMS - No Exhaust
- A - Economizer
- B - Economizer with OA Damper
- Z - Return Air Only

CMS - Gravity Damper
- F - Economizer
- G - Economizer with OA Damper
- H - ERV with OA Damper
- J - ERV with OA Damper & Economizer
- K - ERV with OA & RA Damper & Economizer

CMS -Powered Exhaust
- L - Economizer
- M - Economizer with OA Damper
- H - ERV with OA Damper
- N - ERV with OA Damper & Economizer
- P - ERV with OA & RA Damper & Economizer

10 - Filters (FL)
A - MERV 8
B - MERV 11
C - MERV 13
D - MERV 16

11 - Case Construction (CS)
A - 20Ga (Standard)
B - 16Ga
S - STUDY Package 20Ga

12 - Door Mounted Stat (DS)
N - None
V - Vertical Stat
H - Horizontal Stat

13 - Door Mounted Other (DO)
N - None
K - Key Over-ride
S - Occupancy Sensor
L - Indicator Light
T - Twist Timer

14 - HGRH & Pump Option (HP)
N - None
A - HGRH Coil
B - HGRH Coil & Condensate Pump
C - Condensate Pump

15,16 - Heating Option (HO)
00 - None
02 - 2 kW (1-stage)
03 - 3 kW (1-state)
04 - 4 kW (1-stage)
05 - 5 kW (1-stage)
06 - 6 kW (1-stage)
07 - 7.5 kW (1-stage)
08 - 8 kW (1-stage)
09 - 9 kW (1-stage)
10 - 10 kW (2-stage)
12 - 12 kW (2-stage)
15 - 15 kW (2-stage)
18 - 18 kW (2-stage)
20 - 20 kW (2-stage)
81 - 1R HW (1/2") - Bottom Conn.
82 - 1R HW (3/4") - Bottom Conn.
83 - 2R HW (1/2") - Bottom Conn.
84 - 2R HW (3/4") - Bottom Conn.
91 - 1R HW (1/2") - Top Conn.
92 - 1R HW (3/4") - Top Conn.
93 - 2R HW (1/2") - Top Conn.
94 - 2R HW (3/4") - Top Conn.

17 - N/A
Reserved for future use

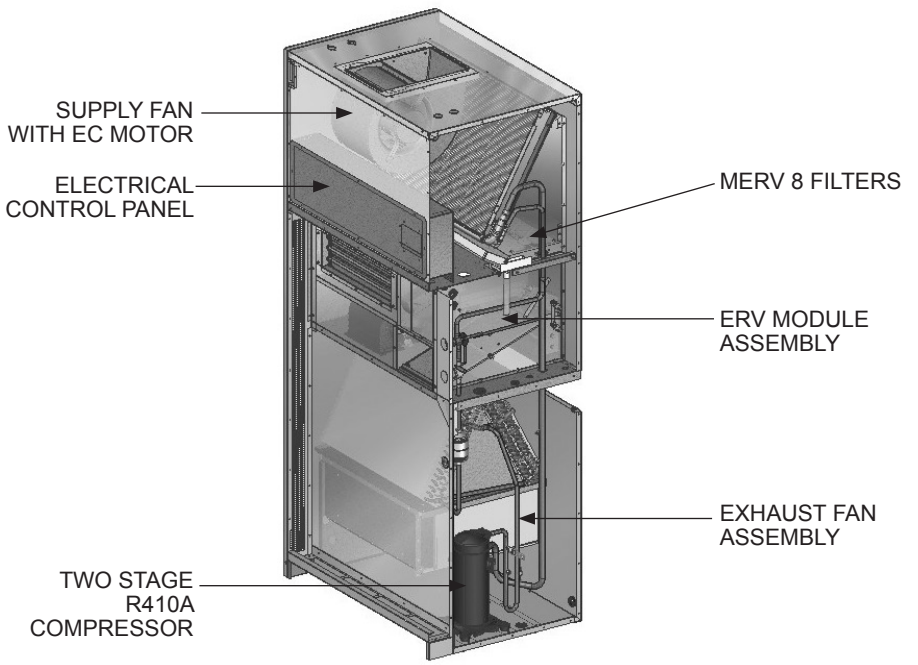
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General Description – ClassMate® Unit



View from front of unit. Parts of casing and sheet metal components removed for ease of viewing.

Cabinet
The cabinet shall be constructed from aluminized steel with 20 gauge panels (16 gauge optional), degreased and coated with electrostatically applied baked-on polyester powder paint. The standard color shall be beige with a hammertone textured finish. Additional colors are available from manufacturers color chart. The paint finish shall be easily cleanable and hard wearing to give maximum protection. The cabinet shall be double-wall insulated with acoustic foam insulation containing no fibrous materials.

The cabinet insulation is 1-inch thick, acoustic Hushcloth Polyester/Polyurethane foam with density of 2-pounds per cubic foot containing no fibrous materials. The foam insulation shall have a fire rating of UL94HF-1. Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2010. Unit shall employ 20 gauge aluminized steel full double wall construction on interior right and left hand sides.

Access to all components shall be through the front of the unit only.

Return air openings shall be integrated into the cabinet sides and front bottom base of unit with excess face area to allow installation of unit against one adjacent wall if required. A condensate connection stub shall also be provided internally at the rear of the unit for connection to the field installed building condensate drain.

Access Door
An access door is factory installed on the front of the unit. Door shall be fully insulated to provide for superior noise deadening at front of unit. Door shall employ heavy duty plunger hinges with a spring-loaded pin to allow for easy removal, if required. Door is secured with two (2) key locks. Door swing designed to turn into itself allowing side of the unit to be installed directly against a wall in the corner of a room.

Compressor
A two stage hermetic scroll compressor is mounted on four (4) vibration absorbers for quiet operation. Equipped with a crankcase heater to guard against liquid flood-back conditions and the elimination of oil foaming upon start-up. Two-stage compressor shall contain an internal unloading mechanism to provide capacity control and enable part load efficiencies to be increased. An internal overload protector shall protect the compressor against excessive motor temperatures and currents.

Indoor Coil
Patented micro-channel CF™ evaporator coil designed for maximum heat transfer with minimum footprint and pressure drop. Quick draining evaporator coil designed, tested and fabricated by unit ventilator manufacturer for optimal airflow and heat transfer specific to the unit. Coil is fitted to non-corrosive stainless steel drain trays.

Outdoor Coil
Enhanced, high-efficiency, cross rifled coil designed, tested and fabricated by unit ventilator manufacturer for optimal airflow and heat transfer specific to the unit. Coil is fitted to non-corrosive stainless steel drain trays.

Indoor Fan Assembly
The indoor fan assembly consists of one blower located inside a teardrop housing assembly engineered specifically for optimal airflow with low noise and minimal power consumption. Blower is powered by electronically commutated motor (ECM). The DC motor features brushless, permanently lubricated ball bearing construction for maintenance free operation. A wide range of programmable speeds and torque characteristics is possible for ultra-high-efficiency and superior acoustics. The ECM provides constant airflow by automatically adjusting the speed if the external static pressure changes.

Outdoor Fan Assembly (Powered Exhaust)
The outdoor fan assembly consists of one backward curved plug fan with centrifugal blower wheels powered by electronically commutated motor (ECM). The DC motor features brushless, permanently lubricated ball bearing construction for maintenance free operation. A wide range of programmable speeds and torque characteristics is possible for ultra-high-efficiency and low audible noise. Fan design capable of overcoming external static pressures from outdoor air rear extensions and supply air ductwork or plenums. Fans are sized such that powered exhaust shall be integral to the unit to prevent over pressurization of the space when the unit is introducing outside air. Capable of exhausting 100% equivalent of the fresh air intake of the unit.

Control Panel
The panel is located at top of the unit behind the front door for direct, centrally located access to controller, class II controls transformer (24V), and all necessary contactors, relays, and circuit breakers. Control panel shall swing away from unit case to facilitate easy access to posterior indoor blower, coil, and heating options.

All components located in the panel shall be clearly marked for easy identification. All terminal blocks and wires shall be individually numbered. Individually numbered terminal blocks and wires are to match job-specific wiring diagrams. All electrical wires in the control panel will run in an enclosed trough. Wiring outside the control panel to be contained in a protective sleeve. All controls and wiring is factory installed in a clean, organized arrangement.

Supply and exhaust fan decks, compressor, damper assembly, economizer, and energy wheel assembly (if applicable) wiring includes plugs local to the assembly allowing for quick wiring disconnection when the component requires removal for service.

Disconnect Switch
A power disconnect switch sized for the full load amperage of the unit is located on the control panel. Allows the unit to be disconnected from the power supply prior to any maintenance. In the off position the switch can be locked out.

BASE UNIT SELECTION

Digit 3: Unit Configuration (UC)

D = Direct Expansion Cooling
The refrigeration system utilizes HFC-R410A and contains a factory fitted thermal expansion device and a filter drier. Fitted with automatic reset high and low-pressure cut-out switches and a sight glass is included for system observation.

P = Heat Pump Heating and Cooling
The heat pump system utilizes HFC-R410A and is fitted with dual thermal expansion devices and a reversing valve to enable the unit to operate in either cooling or heat pump mode. Factory mounted outdoor coil stat allows defrosting of the outside coil when in heat pump mode. Fitted with automatic reset high-pressure and low-pressure cut-out switches and a sight glass for system observation.

S = Split Fan Coil
The refrigeration system utilizes HFC-R410A and contains a factory fitted thermal expansion device and a filter drier. Fitted with automatic reset high and low-pressure cut-out switches and a sight glass is included for system observation.

Digit 8: Control Code (CC)

M = Modine Control System
The unit is fitted with a programmable microprocessor controller provided by the unit manufacturer mounted outside the air stream in the control panel. The controller is designed specifically for operating the unit in its most energy efficient manner using pre-engineered control strategies. The microprocessor determines mode of operation based on the factory installed return air, supply air, and outdoor air temperature sensors. The controller also modifies minimum damper position to compensate for specific modes of operation and appropriate fan speed.

The factory microprocessor controller includes a time clock card for units where time functions, night and weekend setback, etc. are not transmitted from a building management system or remote central time clock. The tiem clock shall have a full 7-day schedule and calendar function incorporated. The 7-day schedule shall have two adjustable occupied/unoccupied periods per day. The calendar function shall allow 20 calendar periods (start date / stop date = 1 period).

F = Factory Installed Free Issue
The unit is fitted in the factory with a controller, and temperature sensors provided by others. The controller provided by others will be required to operate in a similar fashion to Modine Control Systems (same inputs and outputs will be required). Modine will provide coordination with the controls contractor. The controls contractor will be responsible for appropriate sequence of operations. A wiring diagram agreed upon by Modine and the Controls Contractor will be required before the units can be released to production.

B = By Others - Field Installed
The unit controller and temperature sensors are provided by others and mounted in the field. The controller provided by others will be required to operate in a similar fashion to Modine Control Systems (same inputs and outputs will be required). The controls contractor will be responsible for appropriate sequence of operations. A wiring diagram will be installed within the unit, but will reflect a generic controller.

Digit 9: Ventilation Configuration (VC)

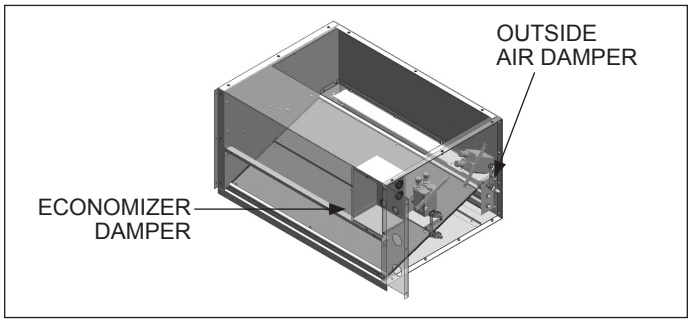
N = None

A, F, L = Economizer Ventilation
Single-blade damper using a central single shaft attached to a single actuator allowing for complete balance of the return, outside, and exhaust air streams. Capable of full modulation allowing any mixture of outside air and return air to be possible. Will allow for 100% of the units airflow to be taken from the outside during conditions allowing for full economizer savings. Damper blade edges lined with rubber gasket to prevent air infiltration in full recirculation or full economizer operation. Complete damper assembly slides out of unit on rails allowing for the damper assembly to be removed through the front of the unit if it requires service. Electrical and control wiring to damper assembly includes quick disconnect plug local to assembly.

Low voltage modulating damper actuator operates damper and is spring-return, fail safe. When power is cut to actuator, damper actuator will force damper blade closed to outside air.

B, G, M = Economizer Ventilation with Outside Air Damper
Standard economizer operation except with additional outside air damper and actuator provided for protection from outdoor elements when unit is not in use (See Figure 6.1).

Figure 6.1 - Ventilation Configuration Digits: B, G, M



C, H = Exhaust Recover Ventilation (ERV) with OA Damper
Energy recovery ventilation (ERV) provided within the unit through an enthalpy transfer wheel mounted in an insulated cassette frame complete with seals, drive motor, and belt. The rotary wheel is coated with silica gel desiccant and is sized to handle a maximum of 500 cfm of outside air. The entire assembly shall be a UL tested component. Performance shall be certified in accordance with the ASHRAE Standard 84 method of test and AHRI Rating Standard of 1060.

ERV section employs dual electronically commutated ventilation fans to ensure precise control of airflow through energy wheel and provide optimal wheel frost protection as required.

Separate outside air damper with actuator provided for protection from outdoor elements when unit is not in use.

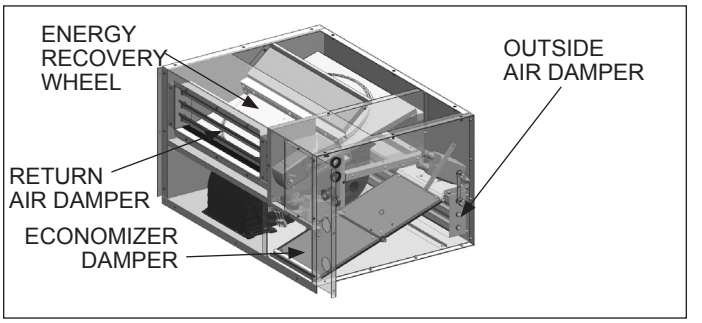
Complete energy recovery ventilator installed on rails to allow the entire assembly to be slid out of the unit for service. Electrical and control wiring to damper assembly includes quick disconnect plugs local to assembly.

The Heat Recovery Wheel can be disabled to provide 500 cfm of outside air in economizer mode.

D, J, N = Exhaust Recovery Ventilation (ERV) with Outside Air Damper and Economizer (Only available when Digit 8 = Modine Control Systems)
Standard ERV operation except with the addition of an economizer damper and actuator. This option enables enhanced economizer functionality allowing up to 75% volume of outside air during free cooling applications.

E, K, P = Exhaust Recovery Ventilation (ERV) with Outside air Damper, Economizer and Return Air Damper (Only available when Digit 8 = Modine Control Systems)
Standard ERV operation except with the addition of an economizer damper with actuator and return air damper with actuator. This option enables further enhanced economizer functionality by closing off return air allowing up to 100% volume of outside air during free cooling applications (See Figure 6.2).

Figure 6.2 - Ventilation Configuration Digits: E, K, P



Digit 10: Filters (FL)

Minimum Efficiency Reporting Value (MERV) corresponding to the MERV value shown below when evaluated per ASHRAE standard 52.2. Arrestance and Dust Spot Efficiency ratings are based on the ASHRAE 52.1 - 1992 test method.

A = MERV 8
2" thick radial pleated disposable cotton and synthetic blend filters.

B = MERV 11
2" thick and utilize 14.3 pleats per foot. Electrostatically enhanced pleated filter shall be constructed from 100% Synthetic media. 99% Arrestance and 35-40% Dust Spot Efficiency.

C = MERV 13
2" thick and utilize 17.5 pleats per foot. Filter shall be constructed from 100% Synthetic media and be LEED/Green compliant. 99% Arrestance and 70-80% Dust Spot Efficiency.

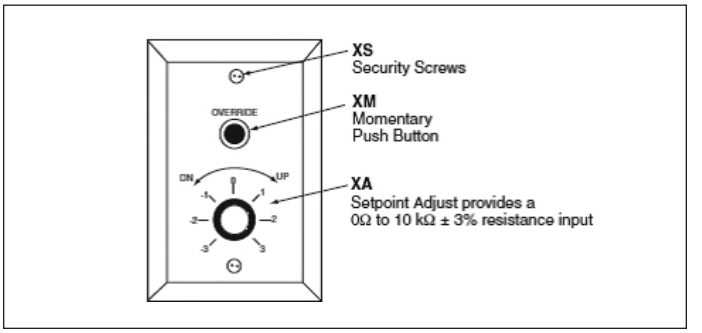
D = MERV 16
2" thick and incorporate a Mini-Pleat design. Filter shall incorporate a durable plastic frame and be constructed with no metal components. 95% evaporated Di-Octyl Phthalate (DOP) Tested Efficiency (Military Standard 282).

Digit 12: Door Mounted Stat (DS)

N = None

V = Vertical Stat
For units fitted with Modine Control Systems. A stainless steel flush-mount thermistor sensor with insulated back provides for +/- 3º setpoint adjustment and momentary push button override. Sensor is wall mounted remote from the unit or mounted on the front door of the unit, 48" above the finished floor (48" AFF only if no floor stand selected) (See Figure 6.3).

Figure 6.3 - Temperature Sensor



H = Horizontal Stat (Digital Thermostat)
Digital thermostat with (or without) humidity sensing used in conjunction with Modine Control Systems. Displays current room temperature, cooling/heating setpoint, current room humidity level, humidity setpoint, current time and day, current occupied mode, and the unit's compressor and fan speeds. The display will also display a remote alarm from the Microprocessor Control. Thermostat allows for occupied temperature and humidity setpoint adjustment (when selected). The allowable setpoint adjustment range can be limited by the Microprocessor Control. Thermostat allows for occupied override activation allowing user to select the amount of time the unit is to remain in the override state. Thermostat is mounted on the front door of the unit, 48" above the finished floor(48" AFF only if no floor stand selected) (See Figure 7.1).

Figure 7.1 - Digital Thermostat



Digit 13: Door Mounted Other (DO)

N = None

K = Key Override Switch
Key operated override switch mounted on the front of the unit sends a timed override signal to the Factory Microprocessor Control system. The time the unit will remain in occupied mode when the override key has been operated can be adjusted using the User Interface Display Module.

S = Occupancy Sensor
A passive infrared sensor mounted on the exterior of the unit controls the unit's occupancy mode based on changes in infrared energy (moving body heat) within the coverage area. The occupancy sensor shall utilize a dense wide angle lens, covering up to 2000 sq. ft. of walking motion and 1000 sq. ft. of desktop motion. If the sensor detects movement in the coverage area when the unit is in unoccupied mode, the unit shall switch to occupied mode. If the sensor detects no movement in the coverage area for a predetermined amount of time (adjustable) while the unit is in occupied mode, the unit shall switch to unoccupied mode or standby mode.

L = Indicator Light
A factory mounted Amber signal light shall illuminate upon alarm or fault signal from factory microprocessor control.

T = Twist Timer
The unit shall be provided with a manually adjustable 6 hour timer located on the exterior door of the unit which enables the unit for the specified time period.

Digit 14: HGRH & Pump Option (HP)

N = None

A = Hot Gas Reheat (HGRH) Coil
Required when utilizing the dehumidification cycle on units without hot water heating. Unit is equipped with a reclaim valve and a second condenser coil (reheat coil). When the unit enters the dehumidification mode, the unit will reclaims the heat of rejection to maintain dry bulb temperature and reduce the need for an auxiliary heat source.

B = Hot Gas Reheat Coil & Condensate Pump
Unit is equipped with a Hot Gas Reheat Coil and Condensate Pump.

C = Condensate Pump
Unit is equipped with a Condensate Pump.

Digit 15,16: Heating Option (HO)

N = None

Electric Heating
Unit is equipped with electric resistance heating elements controlled in one or two stages, factory mounted downstream of the evaporator coil. A manual thermal protection and automatic thermal protection switch is included.

02 = 2 kW (1-stage)	***09 = 9 kW (1-stage)***
03 = 3 kW (1-stage)	***10 = 10 kW (2-stage)***
04 = 4 kW (1-stage)	***12 = 12 kW (2-stage)***
05 = 5 kW (1-stage)	***15 = 15 kW (2-stage)***
06 = 6 kW (1-stage)	***18 = 18 kW (2-stage)***
08 = 8 kW (1-stage)	***20 = 20 kW (2-stage)***

Hot Water Heating
Unit is equipped with a hot water heating coil integral to the unit mounted in the reheat position relative to the evaporator coil. The coil is manufactured from refrigeration quality copper tubing mechanically bonded onto aluminum fins. Coil is fitted with both an air bleed and a drain valve with hose bib.

81 = 1 Row Hot Water Coil (1/2") - Bottom Connection
82 = 1 Row Hot Water Coil (3/4") - Bottom Connection
83 = 2 Row Hot Water Coil (1/2") - Bottom Connection
84 = 2 Row Hot Water Coil (3/4") - Bottom connection
91 = 1 Row Hot Water Coil (1/2") - Top Connection
92 = 1 Row Hot Water Coil (3/4") - Top Connection
93 = 2 Row Hot Water Coil (1/2") - Top Connection
94 = 2 Row Hot Water Coil (3/4") - Top Connection

Steam Coil Heating (Plenum Mounted)
Field installed plenum including a factory mounted steam heating coil. The coil is manufactured from refrigeration quality copper tubing mechanically bonded onto aluminum fins. Capacity control shall be achieved by either a field installed solenoid or modulating valve.

Factory Mounted Options

BACnet Network Card
The factory Microprocessor Control includes a plug-in card allowing for complete compatibility with an MS/TP BACnet control system.

LonWorks Network Card
The factory Microprocessor Control includes a plug-in card allowing for complete compatibility with FT-10 LonWorks control system.

Coil Freeze Protection
An automatic reset freeze protection bulb and capillary tube mounted on the discharge side of the coil to prevent any freezing of the coil assembly. When the sensor detects a freeze up condition it will force the damper to close off the outside air, force the heating control valve open and prevent the unit supply fan from running.

CO_2 Sensor
The CO_2 sensor mounted in the interior return air passage of the unit to provide demand ventilation. When the level of CO_2 rises over a predetermined setpoint, the sensor shall proportionally adjust the minimum damper position to allow larger quantities of outside air into the room.

Condensate Pump
The unit is equipped with a condensate pump including an ABS plastic tank with built-in flow check valve and safety switch.

Condensate Pan Float Switch
The unit shall be fitted with a float switch mounted on the condensate pan to stop the cooling function should the condensate rise to a predetermined level.

Dirty Filter Switch
The unit is provided with an internally mounted pressure switch to detect pressure drop across the filters and indicate dirty or clogged filters.

Fire Detection
A liquid element fire detection device mounted in the return air stream prevents the unit from operating if the return air temperature should rise above the adjustable high limit setting.

Head Pressure Transducer
Available on units with the Modine Control System, the transducer is installed on liquid line to maintain sufficient head pressure (setpoint is user adjustable), providing required Hot Gas Reheat capacity through condenser fan modulation.

Phase Failure Relay
The unit is be provided with an internally mounted phase measurement relay to monitor the 3-phase power supply for phase sequence, phase failure, asymmetry, under voltage and overvoltage.

Smoke Detector
Mounted in the return air stream, if smoke is present the unit will be shut down automatically.

Room Sensor with Offset and Override
For units fitted with the Modine Control System, a stainless steel flush-mount thermistor sensor with insulated back provides for +/- 3° setpoint adjustment and momentary push button override. Sensor is wall mounted remote from the unit.

Digital Wallstat
Digital thermostat used in conjuction with the Modine Control System displays current room temperature, cooling/heating setpoint, and current occupied mode. The display will also display a remote alarm from the Microprocessor Control. Thermostat allows for occupied temperature setpoint adjustment. The allowable setpoint adjustment range can be limited by the Microprocessor Control. Thermostat allows for occupied override activation allowing user to select the amount of time the unit is to remain in the override state. Thermostat is wall mounted remote from the unit.

Compressor Acousic Wrap
For improved sound attenuation, a compressor casing consisting of 18oz. PVC barrier laminated to 1/2 inch non-woven polyester. Casing includes integral 4 inch foil backed fiberglass heat shield for use with crankcase heater. Compressor base consists of 2lb EVA barrier with embedded 1/4 inch layered closed cell foam. Cover is easily removable for service.

Display Module
The user interface for Modine Control System displays status of controllers inputs and outputs, allows for occupied/unoccupied setpoint changes, displays servce settings, allows adjustment of control parameters, and is used for troubleshooting the unit. Display Module also available as a field installed accessory. (This is required to change any factory setpoints if it is not receiving a signal from a BMS system).

Hot Water Control Valve, and Valve Package (Unit Mounted, Factory Installed)
Capacity control is achieved by either a two or three way modulating valve or a two position valve. The valve package can include factory piped circuit setter, manual shut off valves, strainer, and PT ports (when selected).

Field Installed Accessories

Hot Water Heating Coil, Control Valve, and Valve Package (Plenum Mounted)
Field installed plenum including a factory mounted hot water heating coil. Capacity control shall be achieved by either a two or three way modulating valve or a two position valve. The coil can include factory piped circuit setter, manual shut off valves, strainer, drain with hose bib and PT ports (when selected).

Steam Coil (Plenum Mounted)
Field installed plenum including a factory mounted steam heating coil. The coil is manufactured from refrigeration quality copper tubing mechanically bonded onto aluminum fins. Capacity control shall be achieved by either a field installed solenoid or modulating valve.

Remote Temperature Sensor
For units fitted with the Modine Control System. A stainless steel flush-mount thermistor sensor with insulated back provides for +/- 3º setpoint adjustment and momentary push button override. Sensor is wall mounted remote from the unit (See Figure 6.3).

Digital Thermostat (Temperature Only)
Digital thermostat used in conjunction with the Modine Control System displays current room temperature, cooling/heating setpoint, current time and day, current occupied mode, and the unit's compressor and fan speeds. The display will also display a remote alarm from the Microprocessor Control. Thermostat allows for occupied temperature setpoint adjustment. The allowable setpoint adjustment range can be limited by the Microprocessor Control. Thermostat allows for occupied override activation allowing user to select the amount of time the unit is to remain in the override state. Thermostat is wall mounted remote from the unit (See Figure 7.1).

Digital Thermostat with Humidity Sensor
Same functionality as digital thermostat, except with the addition of humidity sensing capability, and humidity setpoint adjustments (See Figure 7.1).

Floor Stand
Fully enclosed floor stand manufactured from heavy duty sheet metal, painted and finished to match the unit color. This accessory will be valuable in matching up the airflow openings in the back of the unit to the existing wall openings in lieu of using a Rear Extension.

Wall Sleeve
The wall sleeve is constructed from galvanized steel. The sleeve is provided by Airedale and insulated by the installing contractor with foil back insulation. Availabe 8"-14".

Louver
An outdoor louver shall be furnished by Airedale and be suitable for masonry, glass or panel wall ocnstruction. Two louver styles are available: AMCA rated and non-AMCA rated. Louvers shall be availabe in the following materials:

- Aluminum with clear anodized finish
- Aluminum with baked enamel finish, customer selected from manufacturer's standard louver color chart

Duct Flange
A 3" duct flange is factory installed installed to allow for easy installation of a supply air duct to the unit or plenum.

Spare Filters
Up to three spare sets of filters are supplied with the unit.

Duct Shroud
Three sided duct shroud field mounted on top of the unit for extending the cabinet through the ceiling/soffit. Field trimmed by the installing contractor to suit the ceiling height. Finished and painted to match the unit. Available sizes from 14" to 50" in 6" increments.

Plenum
Acoustic foam lined discharge plenum mounted on top of the unit allowing for supply air to discharge from the unit. Finished and painted to match the unit. Plenums can be supplied with aluminum grills with a clear anodized finish when discharging to the space. Plenums available in the following configurations:

- No Discharge (field cut openings)
- Top Discharge
- Front Discharge
- Front and 1 Side Discharge
- Front and 2 Sides Discharge

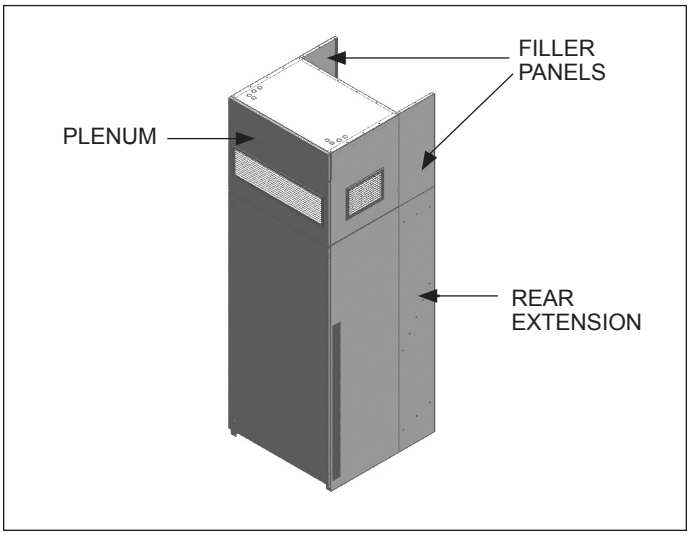
Acoustic Plenum
Discharge plenum mounted on top of the unit allowing for supply air to discharge through the top only. Fitted with acoustic shelf and lined with acoustic foam to minimize noise levels. Finished and painted to match the unit. Plenums can be supplied with aluminum grills with a clear anodized finish when discharging to the space.Plenums available in following configurations:

- Front Discharge
- Front and 1 Side Discharge
- Front and 2 Sides Discharge

Rear Extension
Where site conditions do not permit the use of the standard locations for outside air intake and exhaust air discharge, an insulated outside air rear extension can be supplied for site installation between the back of the unit and the outside wall by the installing contractor. Painted and finished to match the unit.

Filler Panels
Rear filler panels are supplied for rear extensions used in conjunction with a plenum or duct shroud to fill the gap between the rear of the plenum/shroud and above the rear extension. Painted and finished to match the unit (See Figure 9.1)

Figure 9.1 - Rear Filler Panels



Side Trim Pieces

Trim pieces are available to aesthetically finish the installation where walls, floors or ceilings to not allow for a seamless and clean installation. Available in 90", 93" (size 60 units only), 120" and 150" heights. Flat 4' x 8' sheets also available. Painted and finished to match the unit (See Figures 10.1-10.4).

Figure 10.1 - 6" Flat with (1) Hanger Strip

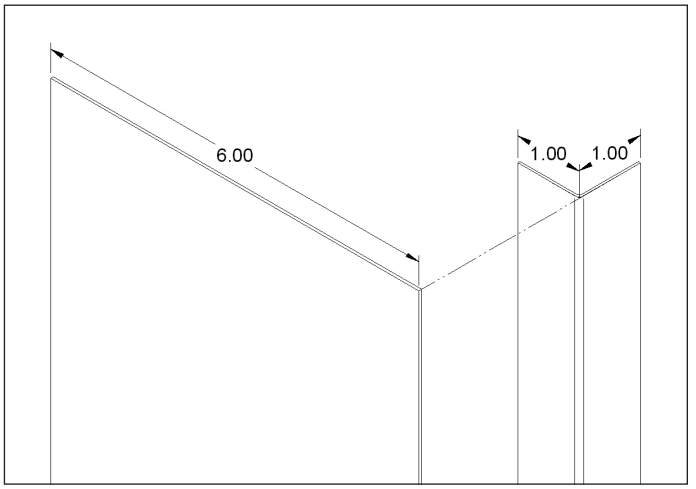


Figure 10.2 - 6" x 2" Angle

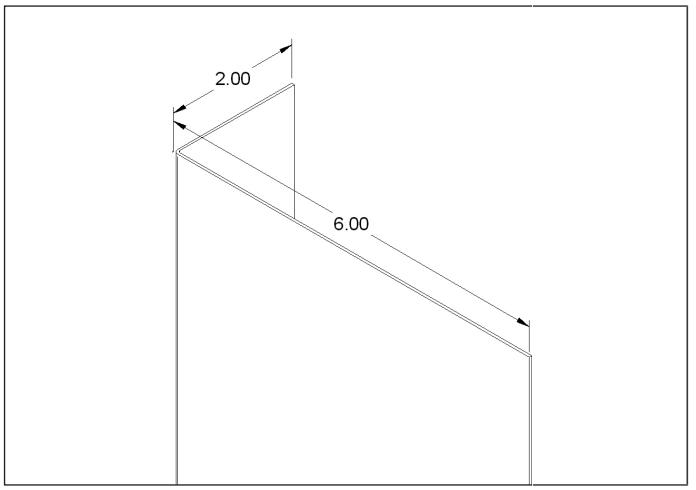


Figure 10.3 - 6" x 2" "C" with (2) Hanger Strips

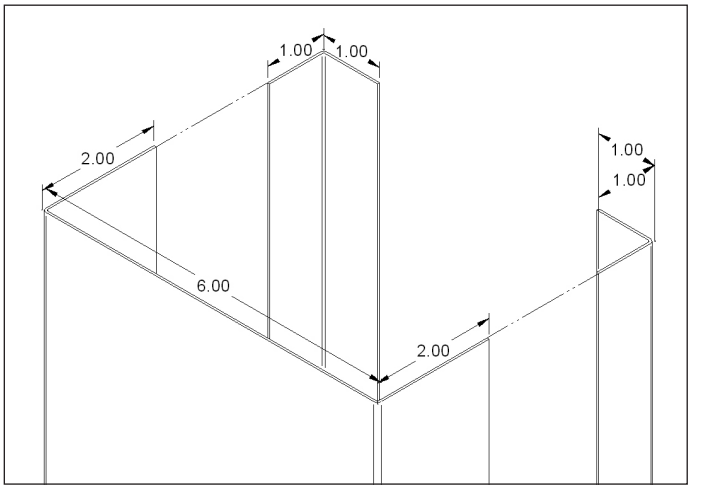
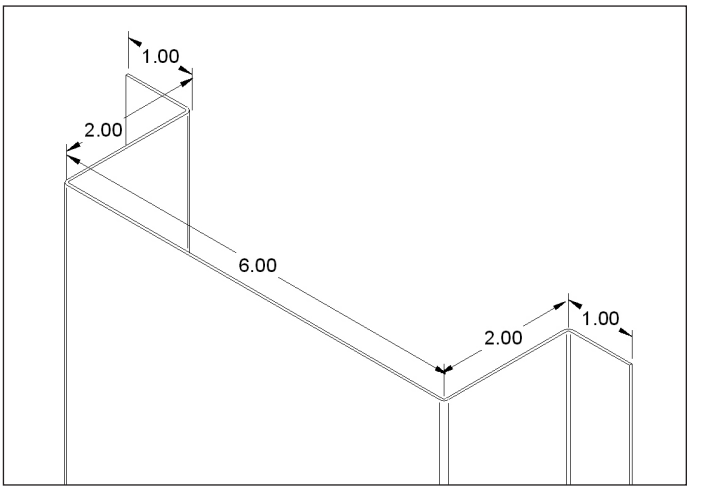


Figure 10.4 - 6" x 2" Hat with 1" Flanges



Economizer Damper
(Figures 11.1 - 11.5)

The economizer damper is controlled via a 0-10vDC control signal. A single-blade damper using a central single shaft is attached to a single actuator allowing for complete balance of the return, outside, and exhaust air streams. Capable of full modulation allowing any mixture of outside air and return air to be possible (see Figures 11.1, 11.2, 11.4 & 11.5). Will allow for 100% of the units airflow to be taken from the outside during conditions allowing for free cooling operation (see Figure 11.3).

See **CONTROL STRATEGY** section for economizer damper operation details.

Figure 11.1 - 100% Recirculation, Cooling

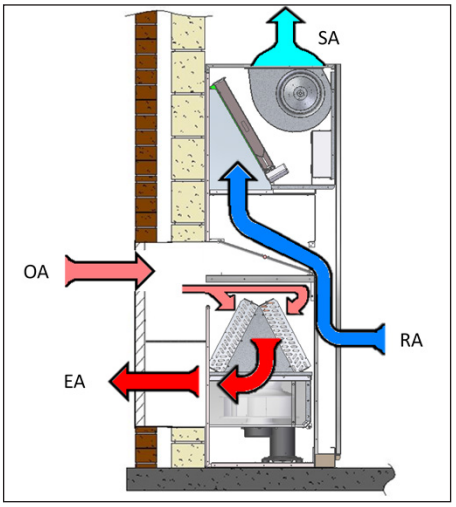


Figure 11.2 - 100% Recirculation, Heating

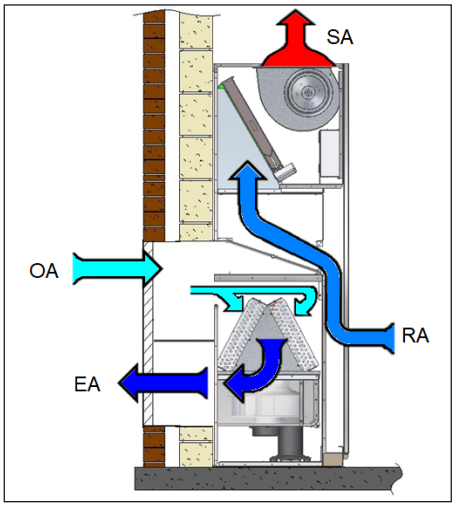


Figure 11.3 - Free Cooling

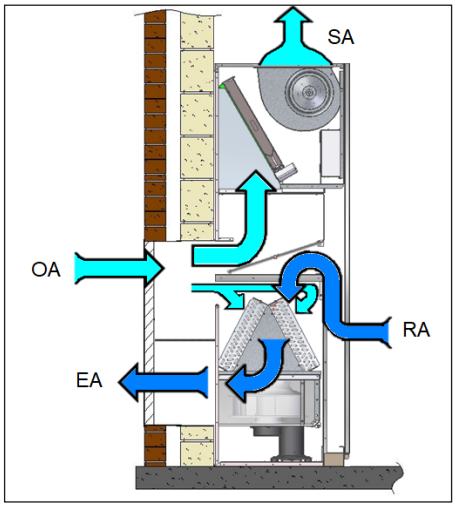


Figure 11.4 - Mixed Outside Air and Return Air, Cooling

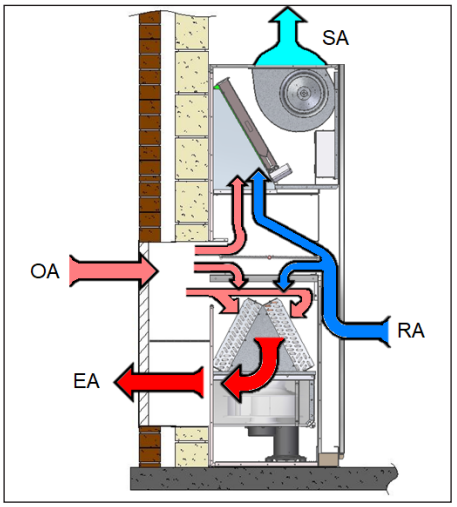
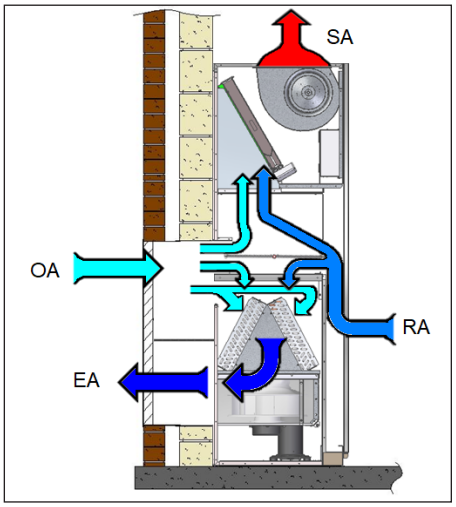


Figure 11.5 - Mixed Outside Air and Return Air, Heating



Energy Recovery Wheel
(Figures 11.6 & 11.7)

For units equipped with an Energy Recovery Wheel (ERW), the wheel rotates through the outside air and return air streams, transfering hot or cool return air to the unconditioned outside air. This allows the outside air to be preconditioned, which reduces the cooling or heating demand of the unit to maintain the setpoint temperature in the room.

See **CONTROL STRATEGY** section for energy recovery wheel operation details.

Figure 11.6 - 100% Recirculation with Wheel, Cooling

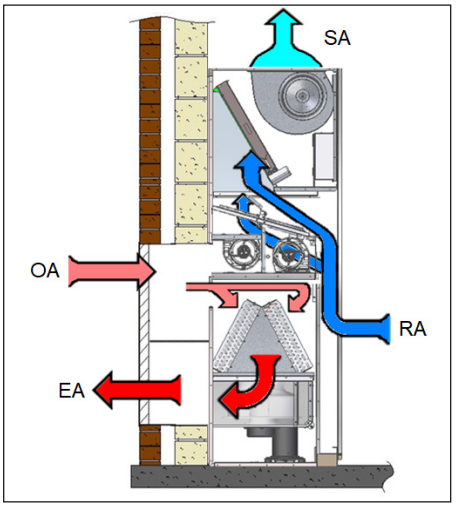
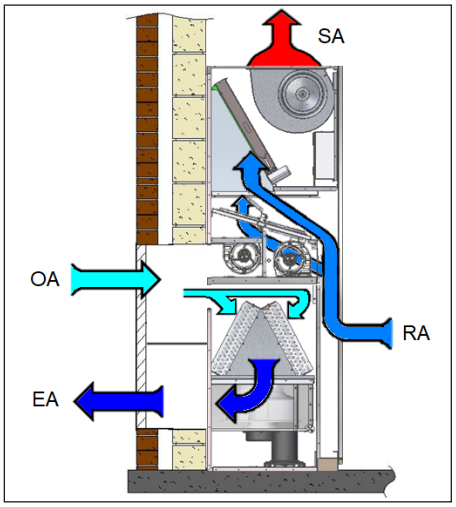


Figure 11.7 - 100% Recirculation with Wheel, Heating



Typical Supply Air Arrangements

Figure 12.1 - Three-way Discharge Plenum

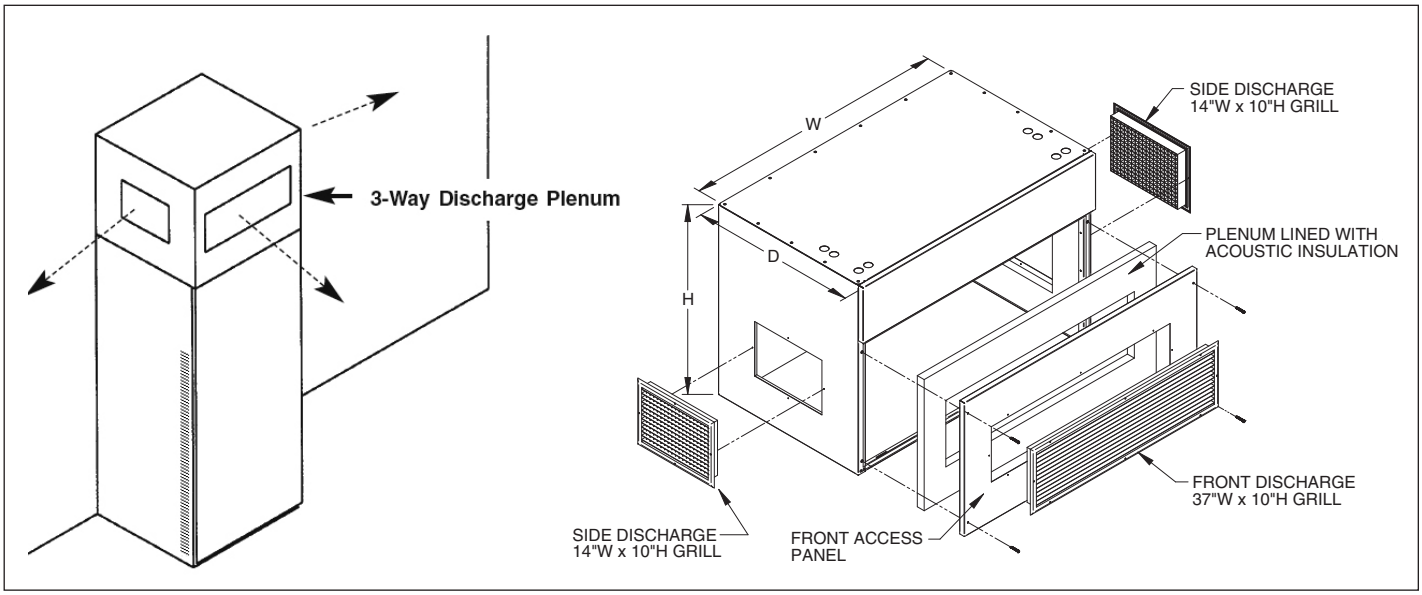


Figure 12.2 - Top Discharge Plenum

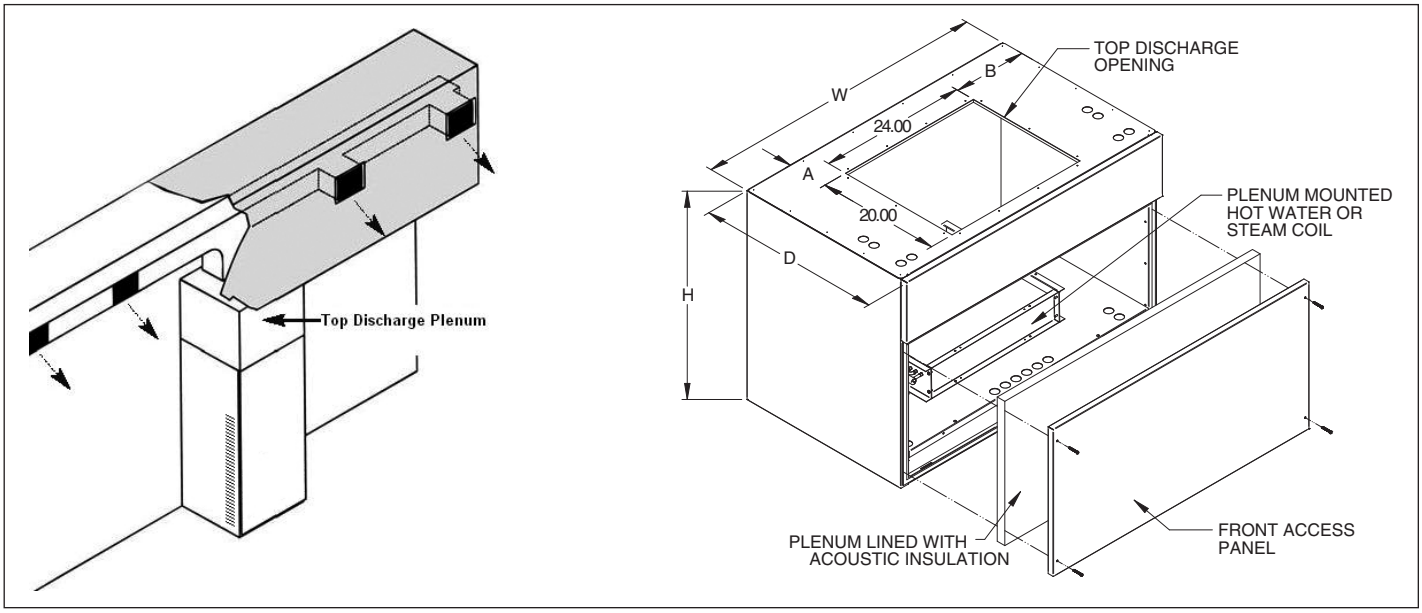


Table 12.1 - Discharge Plenum Dimensions

Model Size	Dimensions (inches)		
	W	D	H
24/36	42.00	30.00	12" to 48" (2" increments)
48/60	48.00	30.00	

Duct Shroud

Figure 12.1 - Duct Shroud

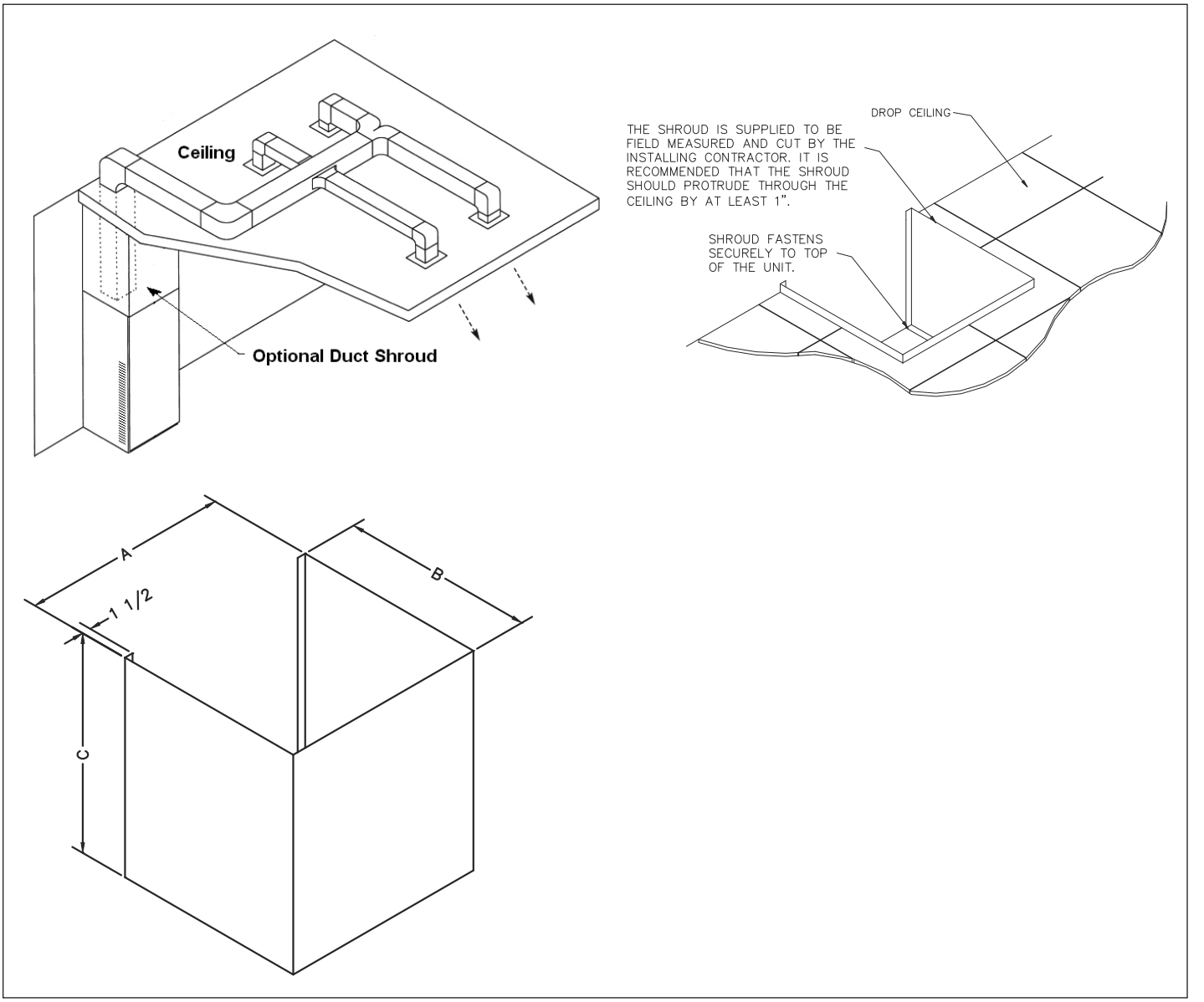


Table 12.1 - Duct Shroud Dimensions

Model Size	Dimensions (inches)		
	A	B	C
24/36	42.00	30.00	14" to 50" (6" increments)
48/60	48.00	30.00	

Table 13.1 - Performance Data - CMD

CMD (Rated in accordance with AHRI 390)	Units	24	36	48	60
Full Load Cooling (80/67˚F Air On, 95/75˚F Outdoor)					
Total Cooling	MBH	24.4	34.0	46.8	57.0
Sensible Cooling	MBH	17.5	24.3	31.5	41.1
EER	MBH/KW	12.1	11.0	11.6	11.0
Rated Airflow	CFM	800	1100	1500	1800
Part Load Cooling (80/67˚F Air On, 80/67˚F Outdoor)					
Total Cooling	MBH	17.1	27.3	37.1	45.5
Sensible Cooling	MBH	11.1	19.3	24.9	32.5
IPLV	MBH/KW	14.1	14.4	16.1	15.0
Rated Airflow	CFM	600	800	1100	1500

Table 13.2 - Performance Data - CMP

CMP (Rated in accordance with AHRI 390)	Units	24	36	48	60
Full Load Cooling (80/67˚F Air On, 95/75˚F Outdoor)					
Total Cooling	MBH	22.0	34.0	45.2	57.0
Sensible Cooling	MBH	17.0	24.3	32.2	41.0
EER	MBH/KW	11.2	11.0	11.0	11.0
Rated Airflow	CFM	800	1100	1500	1800
Full Load Heating (70/60˚F Air On, 47/43˚F Outdoor)					
Total Heating	MBH	20.9	32.8	47.2	54.0
COP	W/W	3.4	3.7	4.0	3.5
Rated Airflow	CFM	800	1100	1500	1800
Part Load Cooling (80/67˚F Air On, 80/67˚F Outdoor)					
Total Cooling	MBH	18.0	28.3	36.8	45.5
Sensible Cooling	MBH	14.6	19.3	26.0	32.5
IPLV	MBH/KW	15.6	14.4	15.4	15.0
Rated Airflow	CFM	600	800	1100	1500
Part Load Heating (70/60˚F Air On, 62/56.5˚F Outdoor)					
Total Heating	MBH	19.0	28.5	42.7	47.0
COP	W/W	4.6	4.2	4.4	4.4
Rated Airflow	CFM	600	800	1100	1500

Table 13.3 - Performance Data - ENERGY RECOVERY WHEEL (OPTIONAL)

ENERGY RECOVERY WHEEL (optional)		DATA SHOWN FOR ALL UNITS			
Outdoor Air Volume	CFM	200	300	400	500
Total Capacity Recovered (Cooling) ①	MBH	8.6	11.6	13.8	15.2
Measured Cooling Effectiveness	%	76.3	68.8	61.5	54.3
Total Capacity Recovered (Heating) ②	MBH	7.6	10.5	12.7	14.3
Measured Heating Effectiveness	%	78.8	72.3	65.9	59.4

① Cooling capacity based on: Room 75/63˚F Dry/Wet Bulb, Ambient 95/78˚F Dry/Wet Bulb.
② Heating capacity based on: Room 70/58.5˚F Dry/Wet Bulb, Ambient 35/33˚F Dry/Wet Bulb.

Table 14.1 - Technical Data - CMD & CMP

UNIT SIZE			24	36	48	60
DIMENSIONS – (H x W x D)		IN	90 X 42 X 30		90 X 48 X 30	93 X 48 X 30
INDOOR (Evaporator) COIL - Face Area		IN^2	720	720	863	863
OUTDOOR (Condenser) COIL - Face Area		IN^2	952	952	1156	1360
SUPPLY FAN			Direct Drive Centrifugal			
Fan Quantity			1	1	1	1
Motor Size (Qty 1)		HP	3/4	3/4	3/4	3/4
Motor Type			Electronically Commutated Motor (ECM)			
Indoor Coil Airflow		CFM	800	1,100	1,500	1,800
Rated/Max External Static Pressure		IN.Wg	0.10/0.50	0.15/0.50	0.20/0.50	0.20/0.50
EXHAUST FAN			Backward Curved Motorized Impellor			
Fan Quantity			1	1	1	1
OutdoorCoil Airflow		CFM	2,100	2,100	2,800	2,800
Motor Type			Electronically Commutated Motor (ECM)			
Max Room Exhaust Airflow		CFM	800	1,100	1,500	1,800
Rated/Max External Static Pressure		IN.Wg	0.10/0.50	0.15/0.50	0.20/0.50	0.20/0.50
COMPRESSOR			Copeland Scroll ULTRATECH			
Stages			0, 67%, 100%			
Refrigerant Type			HFC-R410A			
UNIT WEIGHT						
Operating Weight ①		LBS.	753	753	850	890
FILTER			MERV 8,11,13,16			
Quantity			2	2	2	2
Dimensions		IN	16 x 25	16 x 25	20 x 25	20 x 25
ELECTRIC HEATING (optional)						
Electric Heating Capacity		KW	20	20	20	20
Stages			2	2	2	2
HOT WATER HEATING (optional)						
Factory Installed - 1 row	Heating Capacity - 3/6 GPM ②	MBH	70/82	74/88	82/101	87/111
	Water Pressure Drop - 3/6 GPM	PSI	0.37/1.23	0.37/1.23	0.37/1.23	0.37/1.23
Factory Installed - 2 row	Heating Capacity - 3/6 GPM ②	MBH	94/106	101/118	113/139	122/158
	Water Pressure Drop - 3/6 GPM	PSI	0.75/2.50	0.75/2.5	0.88/2.94	0.88/2.94
Plenum Mounted - 1 row	Heating Capacity - 3/6 GPM ②	MBH	71/83	78/94	82/102	84/106
	Water Pressure Drop - 3/6 GPM	PSI	0.66/2.48	0.66/2.48	0.66/2.48	0.66/2.48
Plenum Mounted - 2 row	Heating Capacity - 3/6 GPM ②	MBH	93/107	104/126	109/139	111/146
	Water Pressure Drop - 3/6 GPM	PSI	0.33/1.26	0.33/1.26	0.33/1.26	0.33/1.26
STEAM HEATING (optional)						
Plenum Mount	1 Row Heating Capacity - 2/5 psig ②	MBH	93/97	103/108	116/122	124/131

① Operating Weight based on unit equipped with Standard Economizer, 20 Gauge casing, Hot Gas Reheat Coil, and 1-Row Hot Water Heating Coil.

② Hot water/steam heating capacity based on an Air On 33˚F (24MBH), 38˚F (36MBH), 47˚F (4Ton), and 51˚F (5 Ton). The Air On based on 450 CFM outside air at 0˚F and 70˚F room ambient for 24 MBH unit, and 500 CFM outside air at 0˚F and 70˚F room ambient for 36, 48, and 60 MBH unit. For Hot Water: Entering water temperature 180˚F, and water flow rate of 3 and 6 GPM. For Steam: Steam pressure of 2 and 5 psig.

Sequence of Operation - CMD

CMD – Cooling Only

The CMD cooling only unit is designed to maintain the desired setpoint temperature within a conditioned space by switching and modulating via the programmable microprocessor, controlling the unit in one of four occupied modes:

1. Free Cooling – using outside air
2. DX Cooling Stage 1 – mechanical cooling with 67% compressor, low speed supply fan, minimum fresh air
3. DX Cooling Stage 2 – mechanical cooling with 100% compressor, high speed supply fan, minimum fresh air
4. Heating (optional) – room return air and minimum fresh air

These modes are switched based on the following parameters: return air temperature, supply air temperature and the ambient air temperature.

Free Cooling

If the return air temperature is higher than the occupied setpoint and if the ambient air temperature is low enough to satisfy the cooling load in the occupied space, the microprocessor controller will signal the fresh air economizer damper. This will automatically modulate between 0-100% and the conditioned space temperature will be maintained by full fresh air or “free cooling”. During free cooling the outdoor fan will operate at reduced speed to match supply air volume.

On units equipped with energy recovery but no economizer, energy wheel is de-energized and outdoor air ventilation fan is 100% energized to allow up to 500cfm of outdoor air.

On units equipped with energy recovery and economizer but with no return air damper, energy wheel is de-energized and outdoor air ventilation fan is 100% energized. Economizer damper will automatically modulate between 0-100% allowing up to 75% free cooling to maintain conditioned space temperature.

On units equipped with energy recovery and economizer and return air damper, energy wheel is de-energized and outdoor air ventilation fan is 100% energized. Economizer damper and return air damper will automatically modulate between 0-100% allowing up to 100% free cooling to maintain conditioned space temperature.

The free cooling mode of operation leads to much reduced running time for the compressor leading to cost and equipment savings.

Mechanical Cooling (All Stages)

If the return air temperature is higher than the occupied setpoint and if the ambient air temperature is high enough the unit will call for mechanical DX cooling. The microprocessor controller will determine which stage of mechanical cooling is most efficient to handle the cooling load based on the return air, supply air, and ambient air temperatures, and pre-engineered control strategies. The microprocessor controller will then place the unit in one of the two stages of mechanical cooling.

1. Stage one utilizes 67% compressor capacity and a low speed supply fan
2. Stage two utilizes 100% compressor capacity and a high speed supply fan

Ventilation

During occupied cooling or heating modes, economizer damper or outdoor air ventilation fan can be set to achieve the necessary amount of outside air to be introduced prior to being conditioned, thus satisfying minimum ventilation code requirements.

Hot Gas Reheat (Optional)

During a call for dehumidification from return air humidity sensor, HGRH valve is opened and unit enters second stage of mechanical cooling. Outdoor air fan may modulate to maintain proper reheat capacity.

HGRH valve will close when return air humidity falls below setpoint or when other modes of cooling are required.

Heating (Optional)

As standard, this unit is not fitted with any heating capability; however, optional electric, hot water or steam heating may be provided and will be energized if the return air temperature falls below the occupied setpoint.

Sequence of Operation - CMP

CMP – Cooling & Heating

The CMP heat pump unit is designed to maintain the desired setpoint temperature within a conditioned space by switching and modulating via the programmable microprocessor, controlling the unit in one of seven occupied modes:

1. Free Cooling – using outside air
2. DX Cooling Stage 1 – mechanical cooling with 67% compressor, low speed fan, minimum fresh air
3. DX Cooling Stage 2 – mechanical cooling with 100% compressor, high speed fan, minimum fresh air
4. DX Heating Stage 1 – reverse cycle with 67% compressor, low speed supply fan, and minimum fresh air
5. DX Heating Stage 2 – reverse cycle with 67% compressor, high speed supply fan, and minimum fresh air
6. DX Heating Stage 3 – reverse cycle with 100% compressor, high speed supply fan, and minimum fresh air
7. Heating (optional) – room return air and minimum fresh air

These modes are switched based on the following parameters: return air temperature, supply air temperature and the ambient air temperature.

Free Cooling

If the return air temperature is higher than the occupied setpoint and if the ambient air temperature is low enough to satisfy the cooling load in the occupied space, the microprocessor controller will signal the fresh air economizer damper. This will automatically modulate between 0-100% and the conditioned space temperature will be maintained by full fresh air or “free cooling”. During free cooling the outdoor fan will operate at reduced speed to match supply air volume.

On units equipped with energy recovery but no economizer, energy wheel is de-energized and outdoor air ventilation fan is 100% energized to allow up to 500cfm of outdoor air.

On units equipped with energy recovery and economizer but with no return air damper, energy wheel is de-energized and outdoor air ventilation fan is 100% energized. Economizer damper will automatically modulate between 0-100% allowing up to 75% free cooling to maintain conditioned space temperature.

On units equipped with energy recovery and economizer and return air damper, energy wheel is de-energized and outdoor air ventilation fan is 100% energized. Economizer damper and return air damper will automatically modulate between 0-100% allowing up to 100% free cooling to maintain conditioned space temperature.

The free cooling mode of operation leads to much reduced running time for the compressor leading to cost and equipment savings.

Ventilation

During occupied cooling or heating modes, economizer damper or outdoor air ventilation fan can be set to achieve the necessary amount of outside air to be introduced prior to being conditioned, thus satisfying minimum ventilation code requirements.

Mechanical Cooling (All Stages)

If the return air temperature is higher than the occupied setpoint and if the ambient air temperature is high enough the unit will call for mechanical DX cooling. The microprocessor controller will determine which stage of mechanical cooling is most efficient to handle the cooling load based on the return air, supply air, and ambient air temperatures, and pre-engineered control strategies. The microprocessor controller will then place the unit in one of the three stages of mechanical cooling.

1. Stage one utilizes 67% compressor capacity and a low speed supply fan
2. Stage two utilizes 100% compressor capacity and a high speed supply fan.

Heating (All Stages)

If the return air temperature is below the setpoint and the ambient air temperature is high enough, the microprocessor controller will de-energize the reversing valve allowing the unit to operate in the reverse cycle DX heating mode. The microprocessor controller will also determine which stage of DX heating is most efficient to handle the heating load based on pre-engineered control strategies and the return air, supply air, and ambient air temperatures. The microprocessor controller will then place the unit in one of two DX heating stages of operation.

1. DX Heating Stage 1 – utilizes 67% compressor capacity and a low speed supply fan
2. DX Heating Stage 2 – utilizes 67% compressor capacity and a high speed supply fan
2. DX Heating Stage 3 – utilizes 100% compressor capacity and high speed supply fan.
3. Optional hot water, steam, or first stage of electric heat.

Note: if electric heat is capable of two stages, the second stage will be utilized for emergency backup only.

During periods of operation in low ambient temperature, the unit will periodically enter into a defrost mode to remove the frost build up on the coil acting as the evaporator. The microprocessor controller will de-energize the outdoor fan and energize the reversing valve allowing the unit to operate in the cooling mode using hot refrigerant to melt the frost build up. Defrost cycle will end when outdoor coil sensor is satisfied or when microprocessor defrost time limit expires, whichever comes first. An alternate heating source e.g. optional electric or hot water heating should be provided and will be energized to offset the cooling effect of the defrost cycle.

Hot Gas Reheat (Optional)

During a call for dehumidification from return air humidity sensor, HGRH valve is opened and unit enters second stage of mechanical cooling. Outdoor air fan may modulate to maintain proper reheat capacity.

HGRH valve will close when return air humidity falls below setpoint or when other modes of cooling are required.

Sequence of Operation - CMS

CMD – Cooling Only

The CMD cooling only unit is designed to maintain the desired setpoint temperature within a conditioned space by switching and modulating via the programmable microprocessor, controlling the unit in one of five occupied modes:

1. Free Cooling – using outside air
2. DX Cooling Stage 1 – mechanical cooling with compressor, low speed supply fan, minimum fresh air
3. DX Cooling Stage 2 – mechanical cooling with compressor, high speed supply fan, minimum fresh air
4. Heating (optional) – room return air and minimum fresh air

These modes are switched based on the following parameters: return air temperature, supply air temperature and the ambient air temperature.

Free Cooling

If the return air temperature is higher than the occupied setpoint and if the ambient air temperature is low enough to satisfy the cooling load in the occupied space, the microprocessor controller will signal the fresh air economizer damper. This will automatically modulate between 0-100% and the conditioned space temperature will be maintained by full fresh air or “free cooling”. During free cooling the outdoor fan will operate at reduced speed to match supply air volume.

On units equipped with energy recovery but no economizer, energy wheel is de-energized and outdoor air ventilation fan is 100% energized to allow up to 500cfm of outdoor air.

On units equipped with energy recovery and economizer but with no return air damper, energy wheel is de-energized and outdoor air ventilation fan is 100% energized. Economizer damper will automatically modulate between 0-100% allowing up to 75% free cooling to maintain conditioned space temperature.

On units equipped with energy recovery and economizer and return air damper, energy wheel is de-energized and outdoor air ventilation fan is 100% energized. Economizer damper and return air damper will automatically modulate between 0-100% allowing up to 100% free cooling to maintain conditioned space temperature.

The free cooling mode of operation leads to much reduced running time for the compressor leading to cost and equipment savings.

Mechanical Cooling (All Stages)

If the return air temperature is higher than the occupied setpoint and if the ambient air temperature is high enough the unit will call for mechanical DX cooling. The microprocessor controller will determine which stage of mechanical cooling is most efficient to handle the cooling load based on the return air, supply air, and ambient air temperatures, and pre-engineered control strategies. The microprocessor controller will then place the unit in one of the three stages of mechanical cooling.

1. Stage one utilizes compressor and a low speed supply fan
2. Stage two utilizes compressor and a high speed supply fan

Ventilation

During occupied cooling or heating modes, economizer damper or outdoor air ventilation fan can be set to achieve the necessary amount of outside air to be introduced prior to being conditioned, thus satisfying minimum ventilation code requirements.

Heating (Optional)

As standard, this unit is not fitted with any heating capability; however, optional electric, hot water or steam heating may be provided and will be energized if the return air temperature falls below the occupied setpoint.

The unit shall be either a heat pump or cooling only unit. When cooling only, the compressor will energize only for a call for cooling in both occupied and unoccupied mode. The defrost settings & outdoor coil sensor shall be disabled. First and second stage heat will either be electric, hot water or steam.

Occupied and Unoccupied Modes: The digital input shall accept a dry contact (volt free) signal from a central time clock or building management system. Closed equals occupied, open equals unoccupied. Standard time clock module will override the digital input (user selectable).

Fan

Occupied
The fan will run continuously during occupied mode. The supply fan will run at low speed during ventilation, economizer (free) cooling, stage one cooling/heating and dehumidification. The supply fan will run at high speed during stage two cooling/heating, stage three heating and when optional hot water, steam or electric heat is active.

Unoccupied
During unoccupied modes the fan will energize on a call for cooling or heating based on the return air temperature.

Compressor – CMD & CMP Only

Occupied
The compressor will energize on a call for cooling when the control temperature is higher than the cooling setpoint and if the outdoor air temperature is too high to allow free cooling. The control output, for units with a 2-stage compressor, shall have 2 stages:

Stage 1: Compressor 67%, Fan Low (Compressor Stage 1 on, Compressor Stage 2 off, Fan High off)

Stage 2: Compressor 100%, Fan High (Compressor Stage 1 off, Compressor Stage 2 on, Fan High on)

The compressor shall shut down if the HP-LP switch or float switch opens, or if the indoor freeze protection sensor falls below setpoint.

Unoccupied
The compressor will energize if there is a call for cooling or heating (CMP only) based on if the control temperature is above the cooling setpoint or below the heating setpoint (CMP only).

Compressor – CMS

Occupied
The compressor will energize on a call for cooling when the control temperature is higher than the cooling setpoint and if the outdoor air temperature is too high to allow free cooling. The control output, for units with a 2-stage compressor, shall have 2 stages:

Stage 1: Compressor on, Fan Low (Compressor Stage 1 on, Fan High off)

Stage 2: Compressor on, Fan High (Compressor Stage 1 on, Fan High on)

The compressor shall shut down if the HP-LP switch or float switch opens, or if the indoor freeze protection sensor falls below setpoint.

Unoccupied
The compressor will energize if there is a call for cooling based on if the control temperature is above the cooling setpoint.

Reversing Valve – CMP Only

Occupied
The reversing valve will energize when in cooling mode and will stay energized until the unit goes into heating mode. Reversing valve shall also be energized during a coil defrost cycle (see **Defrost Mode**).

Unoccupied
The reversing valve will energize and de-energize when there is a call for cooling or heating based on if the control temperature is above the cooling setpoint or below the heating setpoint. Reversing valve shall also be energized during a coil defrost cycle (see **Defrost Mode**).

Electric Heat

Occupied
The electric heat will energize on a call for heating when the control temperature is lower than the heating setpoint. For cooling only units both stage 1 and stage 2 of electric heat can be used when there is a call for heating. For heat pump units stage 2 of electric heat is energized only when the heat pump compressor is locked out.

Unoccupied
The electric heat will energize on a call for heating when the ctonrol temperature is lower than the heating setpoint.

Emergency Heat

Occupied
The emergency heat will energize only when there is a call for heating and the compressor cannot operate (f the HP-LP switch or float switch opens, or if the indoor coil freeze protection sensor falls below setpoint). Emergency heat will be based on the control temperature.

Unoccupied
The emergency heat will energize only when there is a call for heating and the compressor cannot operate (f the HP-LP switch or float switch opens, or if the indoor coil freeze protection sensor falls below setpoint). Emergency heat will be based on the control temperature.

Energy Recovery Wheel

Occupied
The energy recovery wheel will energize when the unit is in occupied mode. The wheel will de-energize if the outside temperature is warmer than the room and heat is needed, or if the outside air temperature is cooler than the room and cooling is needed.

If the outdoor air is cooler than the return air and an economizer cooling demand is present, the wheel will de-energize and free cooling will be energized.

Unoccupied
The energy recover wheel will be off.

Outdoor Fan – CMD & CMP Only

The outdoor fan shall be controlled via a 0-10vDC control signal. The fan will be off when the supply fan is off. The fan shall run in low speed when the supply fan is in low speed (Fan High off). The fan shall be in high speed when the indoor fan is in high speed (Fan High on) or when the compressor is at 100% (Compressor Stage 2 on). The outdoor fan will be off when the unit is in defrost mode (CMP only). The fan will run at a low speed when the unit is in free cooling mode.

Outdoor Fan (Exhaust Fan) – CMS

The outdoor fan shall be controlled via a 0-10vDC control signal. The fan will be off when the supply fan is off. The fan shall operate proportionally from an adjustable minimum speed to an adjustable maximum speed based on the position of the economizer damper. The fan will run at a low speed when the unit is in free cooling mode.

Economizer Damper

Occupied
The economizer damper shall be controlled via a 0-10vDC control signal. The damper will open to the adjustable minimum position when the unit is in occupied mode. The minimum position is determined by the required ventilation required for the occupied space. If there is a call for cooling and the outside temperature is below the cooling setpoint the economizer damper will modulate open towards free cooling operation. If free cooling cannot maintain the space cooling demand, DX cooling will be energized and the damper will return to its minimum position. If the supply air temperature cannot be maintained at minimum position, the damper shall fully closed (unless supplied with hot water heating). When the outdoor temperature is below the adjustable outdoor temperature setpoint, economizer cooling will be disabled.

Unoccupied
The damper will be closed.

CO_2 Option

The CO_2 sensor will be mounted in the return air stream and used to measure space CO_2 levels. When the level of CO_2 rises over a predetermined setpoint, the sensor proportionally adjusts the minimum damper position to allow larger quantities of outside air into the room.

Hot Water / Steam Valve

Occupied
The hot water / steam valve shall be controlled via a 2-10vDC control signal. The valve will open if the control temperature is lower than the heating setpoint. The valve will modulate based on demand. If the supply air temperature exceeds the user defined maximum supply air temperature, the valve shall modulate closed to maintain maximum supply air temperature. If the supply air temperature falls below the user defined minimum supply air temperature, the valve shall modulate open to maintain minimum supply air temperature.

Unoccupied
During unoccupied mode the call for hot water / steam heat will be based upon the return air temperature. If heating is not required, the valve will remain closed unless the outside air temperature is below the unoccupied heat override setpoint which would cause the valve to open. If the indoor coil freeze protection trips, the valve shall spring open.

Return Air Sensor

This sensor is used to control the unit during occupied and unoccupied modes. Sensor is mounted in the return air stream. Should the sensor fail, the unit will go to full heating mode. If hot water or steam is installed, the valve will open. If the unit is equipped with an economizer damper, the damper will close.

Supply Air Sensor

This sensor is used to monitor supply air temperature to maintain the supply air setpoint in cooling and heating modes. Sensor is mounted in supply fan. If the unit is equipped with plenum mounted heat the sensor will be mounted in the plenum after the heating coil. Should the sensor fail, the unit will continue to run but the economizer will close.

Outside Air Sensor

This sensor is used to enable economizer control, determine if free cooling is acceptable, and ensure supply air is tempered correctly. Sensor is mounted in incoming outdoor air stream. Should the sensor fail, the unit will continue to run but economizer functions and electric heat will be disabled.

Indoor Coil Freeze Protection

This sensor is used to monitor the temperature of the indoor coil. If the coil temperature falls below the indoor coil temperature setpoint, the compressor, electric heat, economizer damper, and energy wheel will be disabled. The supply fan will remain energized to raise the indoor coil temperature. If the unit is equipped with hot water / steam heat, the valve shall spring open.

Outdoor Coil Sensor – CMP Only

This sensor is used to monitor the temperature of the outdoor coil. If the coil temperature falls below the coil defrost temperature setpoint, the unit shall run a coil defrost cycle. Should the sensor fail, the compressor will be locked out and alarm generated.

Defrost Mode – CMP Only

Defrost mode is enabled when the compressor runs in heat pump mode for a predetermined amount of time and the outdoor coil temperature sensor is below the coil defrost temperature setpoint. When enabled, the reversing valve and first stage of electric heat are energized and the condenser fan de-energizes. Unit will remain in defrost mode until outdoor coil temperature has risen to a predetermined setpoint, or a user specified time has elapsed.

Condensate Float Switch Option

The condensate float switch is used to monitor condensate levels in the evaporator coil drain pan. Should the float switch trip, the unit will continue to run but cooling will be disabled.

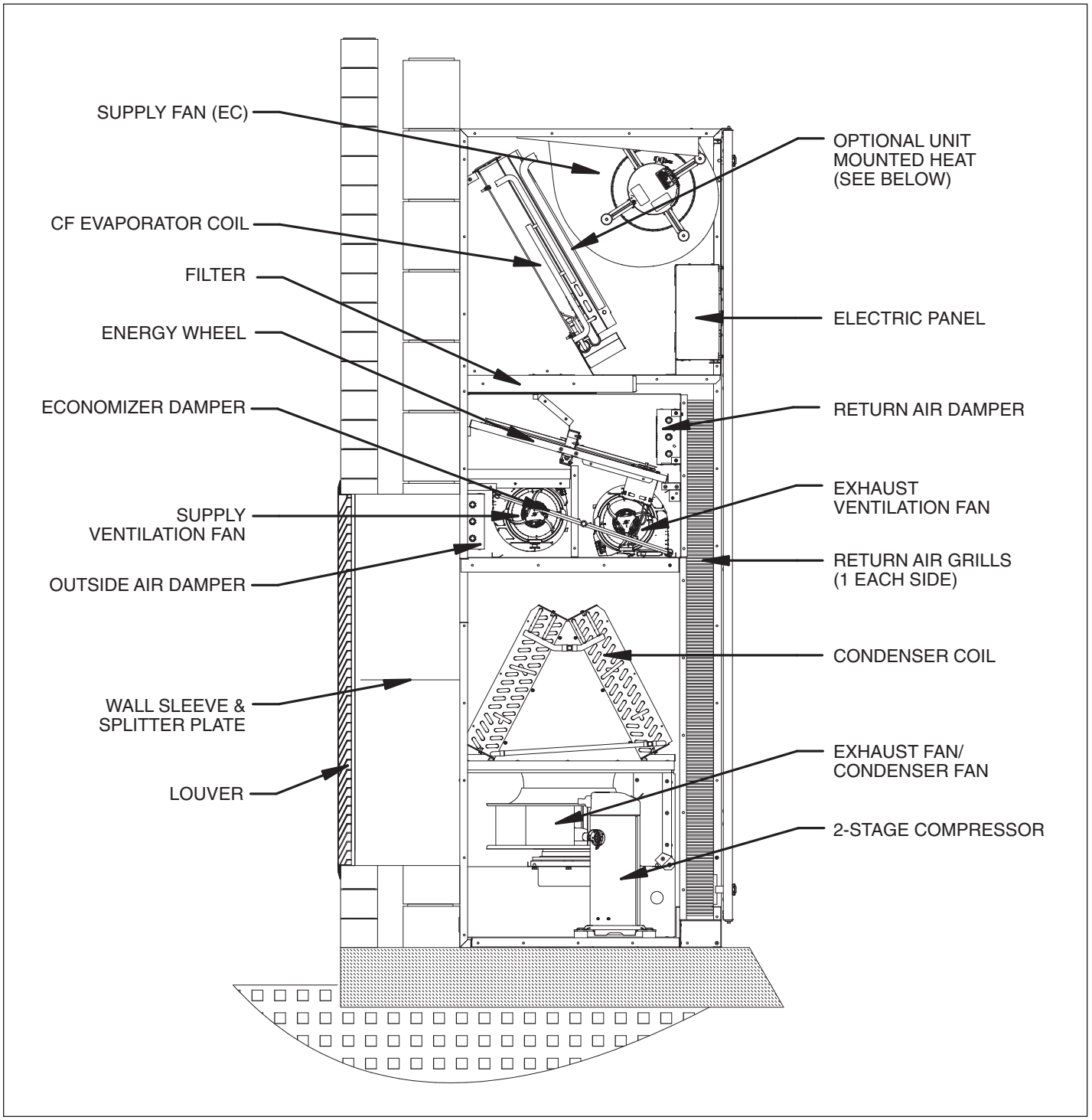
Fan Status Option

The unit shall be provided with an internally mounted sensor to monitor the status of the supply fan and outdoor fan. The digitial input is normally closed during operation. If the contact goes open during a call for fan, the compressor, electric heat, economizer damper, and energy wheel will be disabled.

Dehumidification (Hot Gas Reheat) – CMD & CMP Only

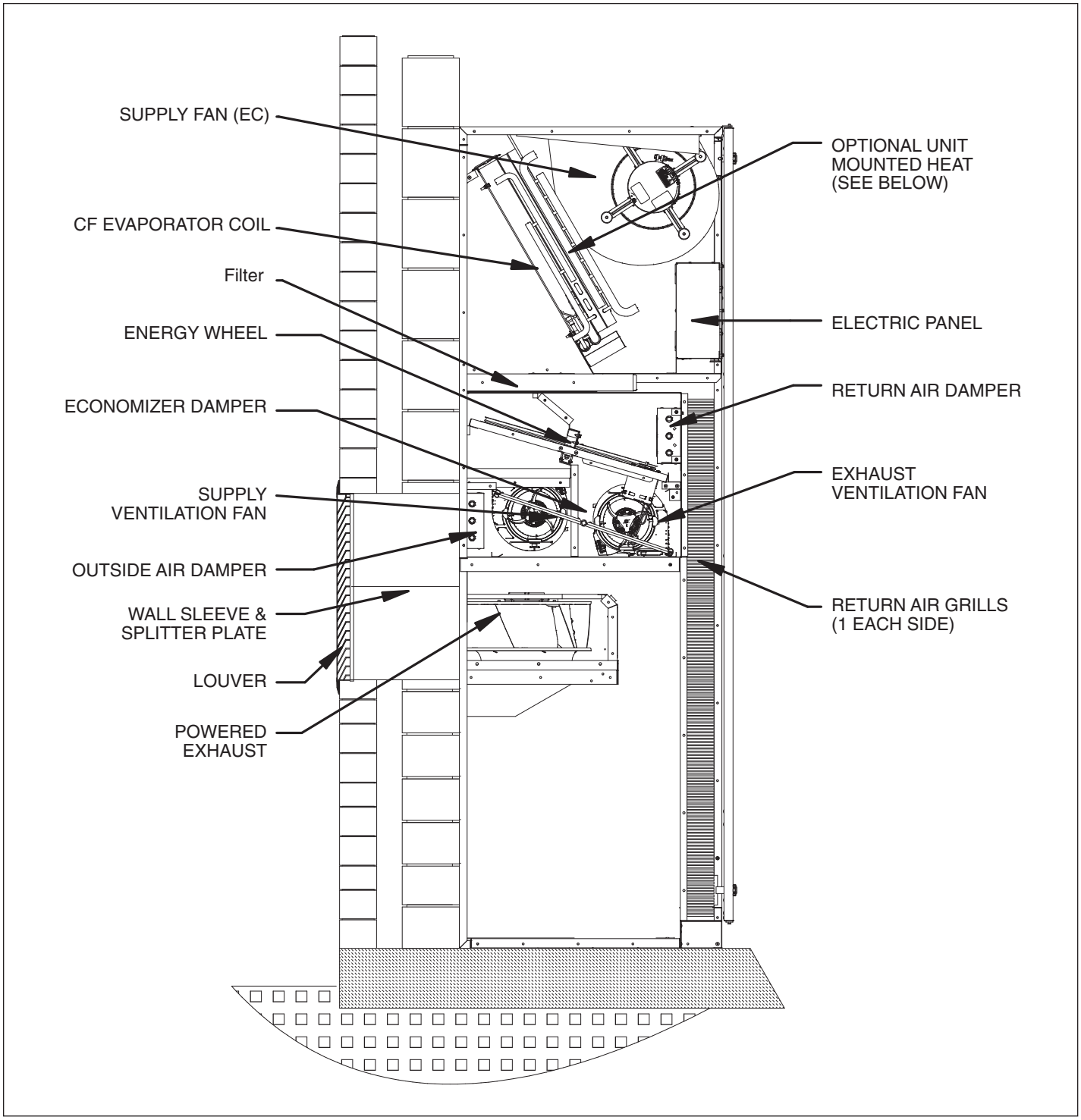
The unit shall go into dehumidification mode when the room is occupied and the humidity goes above the humidity setpoint (user adjustable). This will energize the compressor and the hot gas reheat solenoid (if supplied). If the dry bulb temperature falls below the cooling setpoint by a predetermined temperature range, dehumidification mode shall stop. If cooling is required during dehumidification, the hot gas reheat solenoid shall be de-energized. If the unit has a two-stage compressor, it runs at full capacity during dehumidification mode.

Figure 22.1 - General Arrangement - CMD and CMP



Unit shown with optional unit mounted heat, energy recovery wheel ventilation configuration with economizer damper, wall sleeve and louver. For project-specific general arrangement, contact your local sales representative for submittal data.

Figure 23.1 - General Arrangement - CMS



Unit shown with optional unit mounted heat, energy recovery wheel ventilation configuration with economizer damper, powered exhaust, wall sleeve and louver. For project-specific general arrangement, contact your local sales representative for submittal data.

Figure 24.1 - Dimensional Data - Base Unit CMD and CMP 24-48 MBH

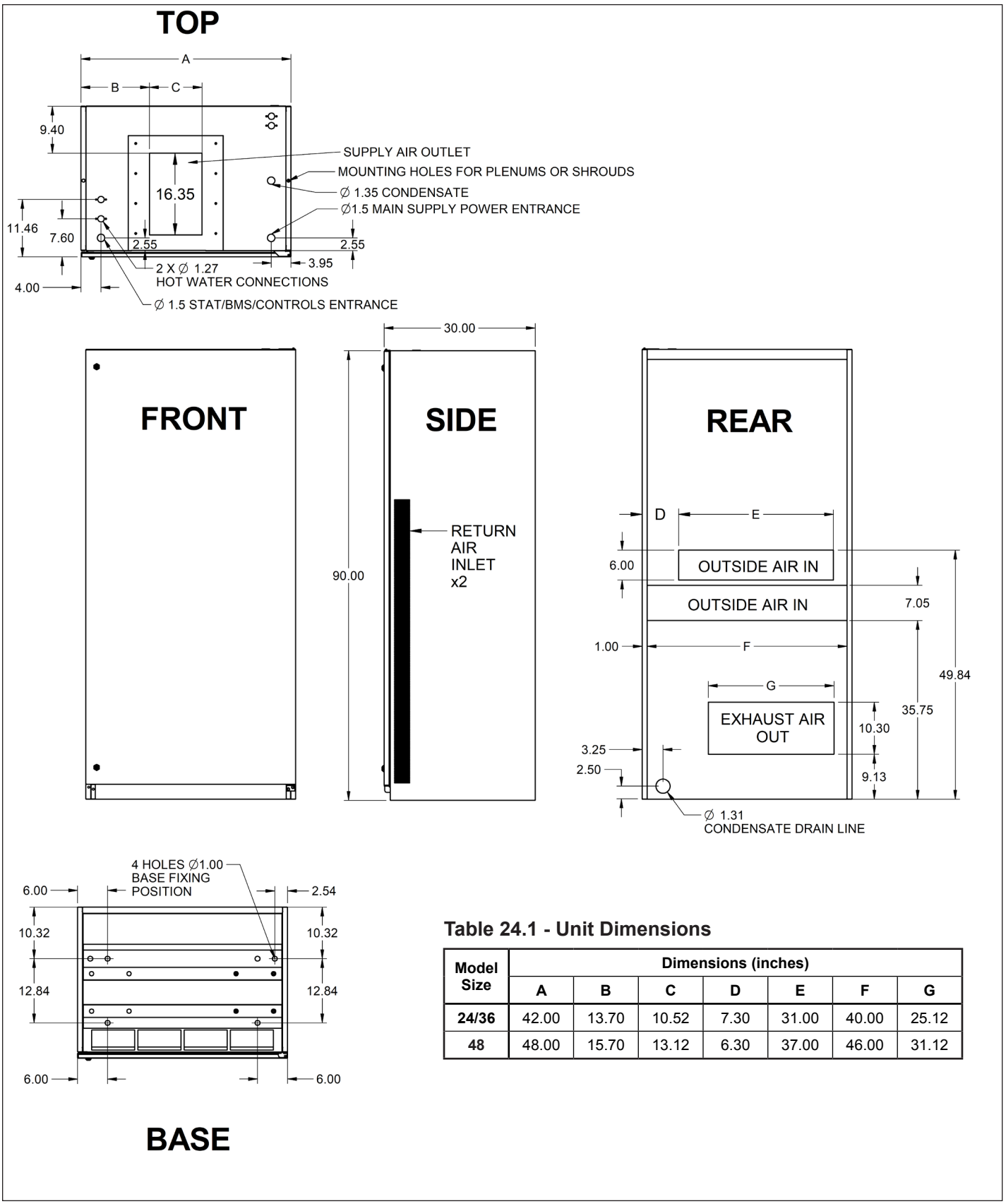


Table 24.1 - Unit Dimensions

Model Size	Dimensions (inches)						
	A	B	C	D	E	F	G
24/36	42.00	13.70	10.52	7.30	31.00	40.00	25.12
48	48.00	15.70	13.12	6.30	37.00	46.00	31.12

Figure 25.1 - Dimensional Data - Base Unit CMD and CMP 60 MBH

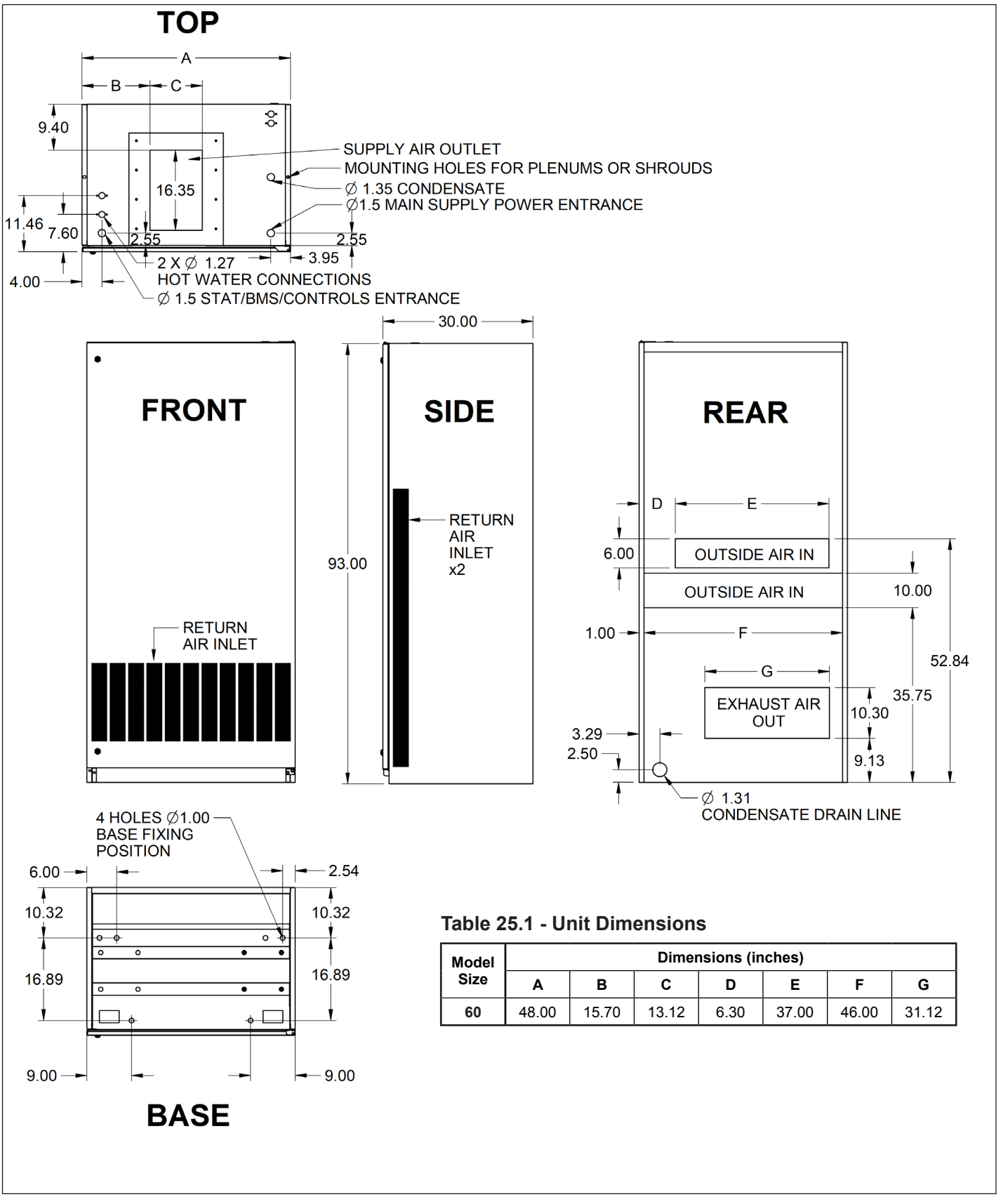


Table 25.1 - Unit Dimensions

Model Size	Dimensions (inches)						
	A	B	C	D	E	F	G
60	48.00	15.70	13.12	6.30	37.00	46.00	31.12

Figure 26.1 - Dimensional Data - Base Unit CMS

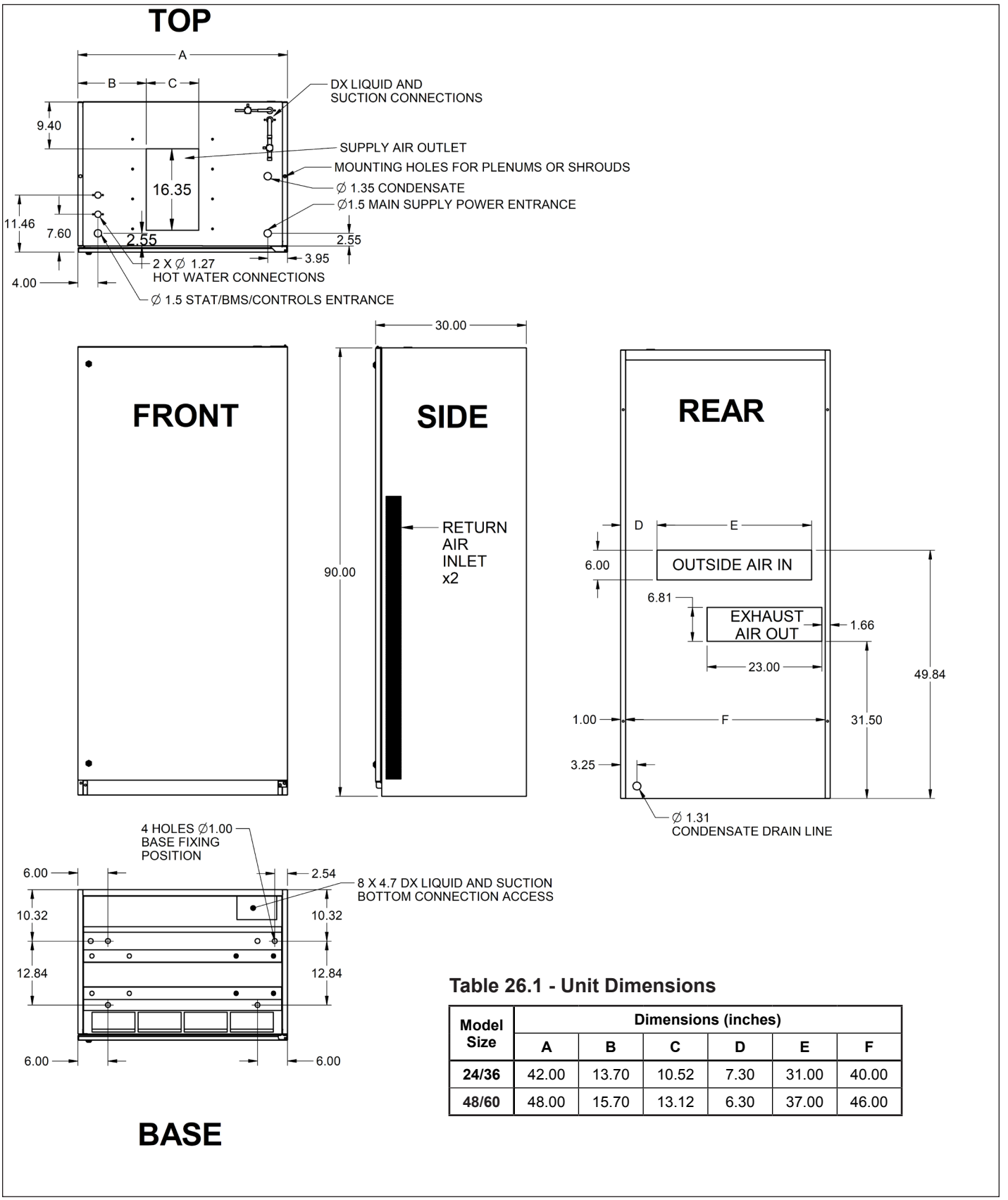
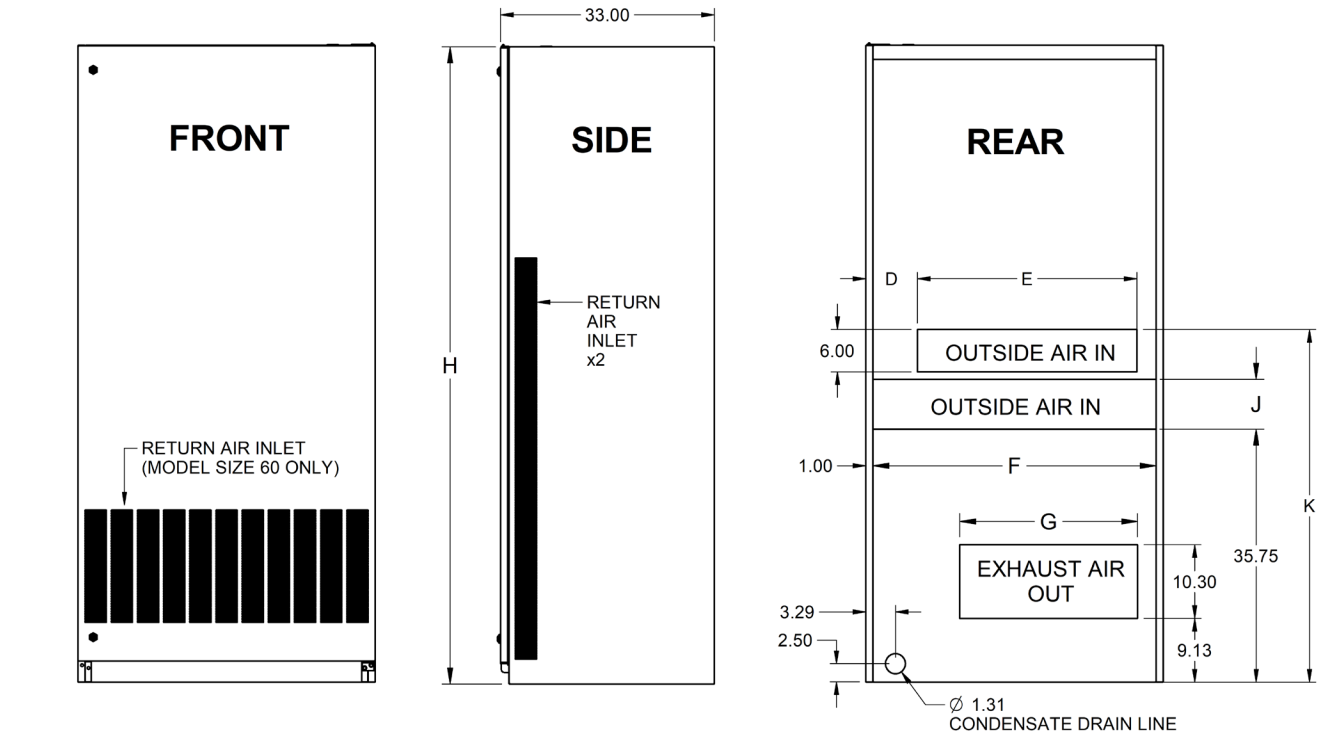
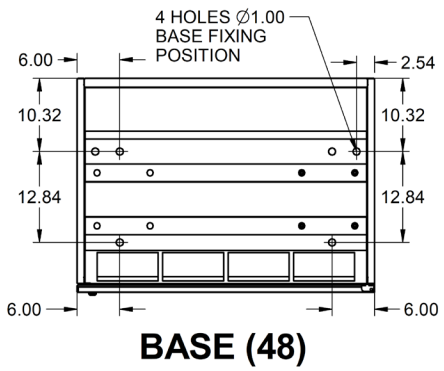


Table 26.1 - Unit Dimensions

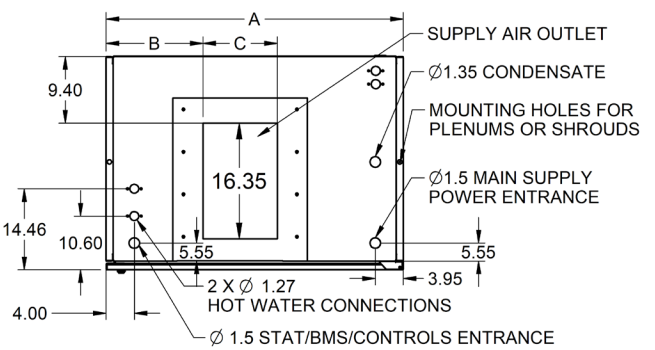
Model Size	Dimensions (inches)					
	A	B	C	D	E	F
24/36	42.00	13.70	10.52	7.30	31.00	40.00
48/60	48.00	15.70	13.12	6.30	37.00	46.00

Figure 27.1 - Dimensional Data - Base Unit CMD and CMP 48-60 MBH with STUDY Package

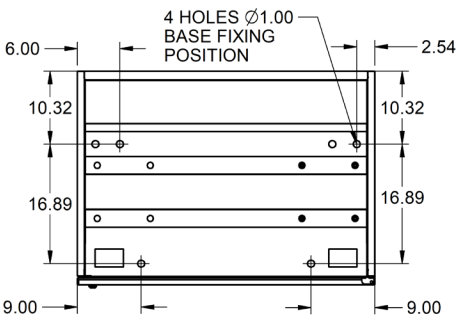




BASE (48)



TOP



BASE (60)

Table 27.1 - Unit Dimensions

Model Size	Dimensions (inches)									
	A	B	C	D	E	F	G	H	J	K
48	48.00	15.70	13.12	6.30	37.00	46.00	31.12	90.00	7.05	49.84
60	48.00	15.70	13.12	6.30	37.00	46.00	31.12	93.00	10.00	52.84

Standard Wall Sleeve and Louver Dimensions and Mounting - CMD and CMP

Figure 28.1 - Standard Arrangement

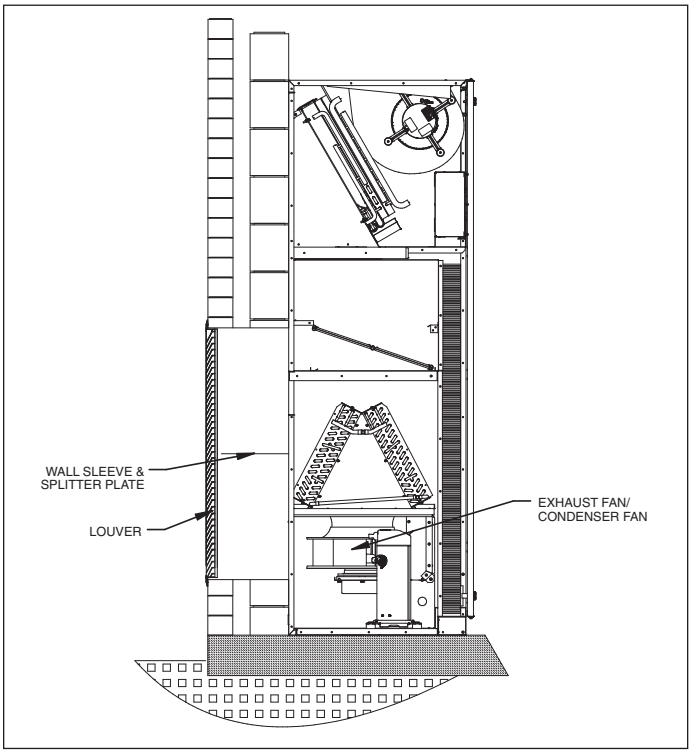


Figure 28.2 - Standard Single Louver

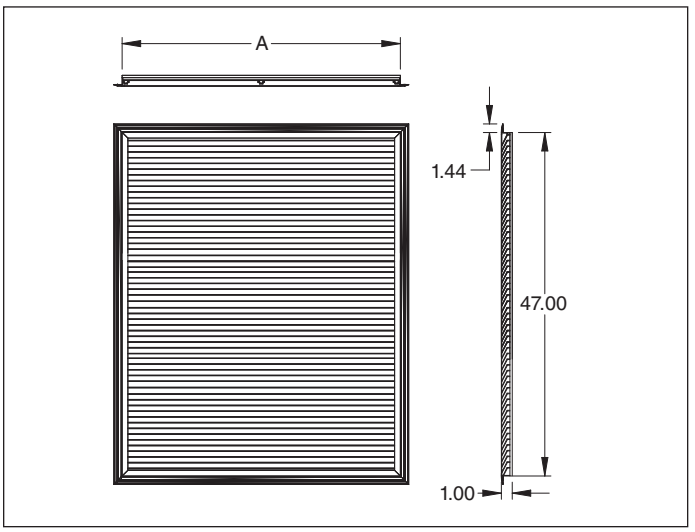


Table 28.1 - Standard Single Louver Dimensions

Model Size	Dimensions (inches)		
	A	B	C
24/36	39.00	39.75	40.00
48/60	45.00	45.75	46.00

Figure 28.3 - Standard Single Wall Sleeve

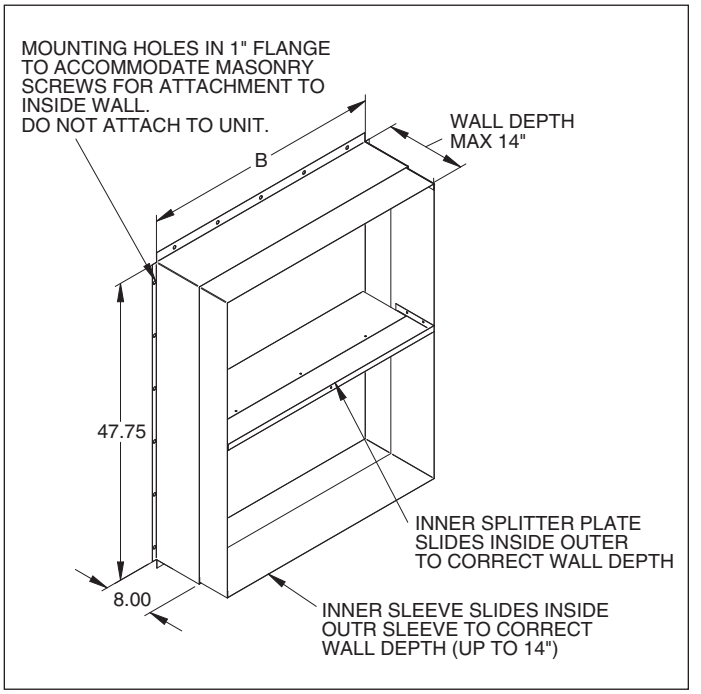
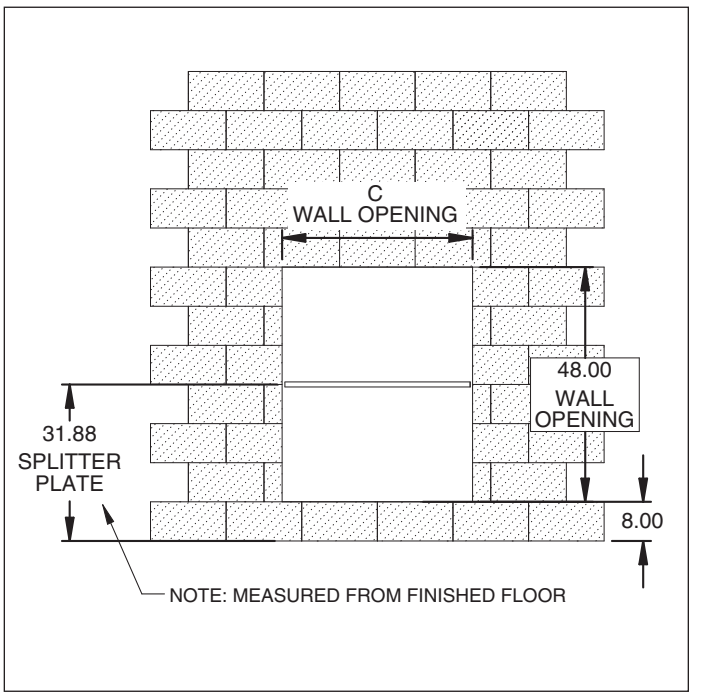


Figure 28.4 - Standard Single Wall Opening



Split No Exhaust Wall Sleeve and Louver Dimensions and Mounting - CMS

Figure 29.1 - Standard Arrangement

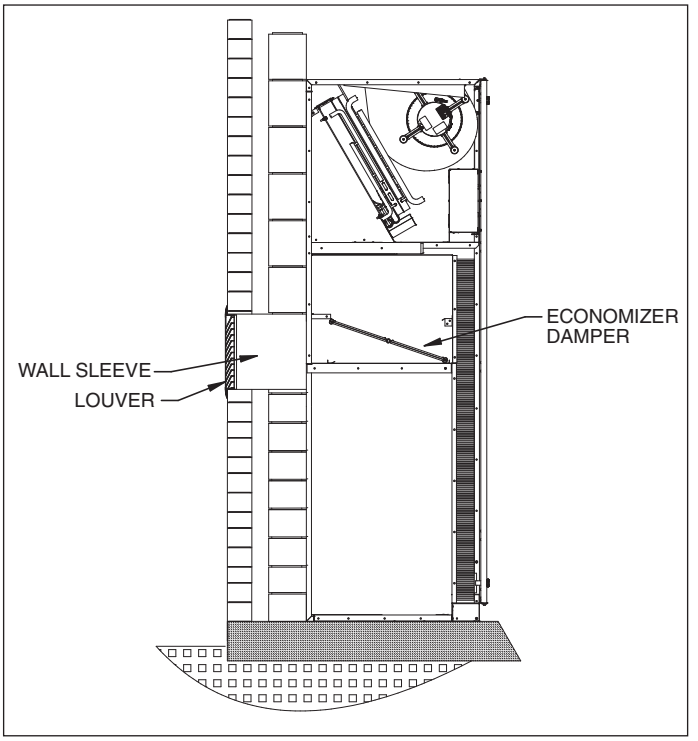


Figure 29.2 - Standard Louver

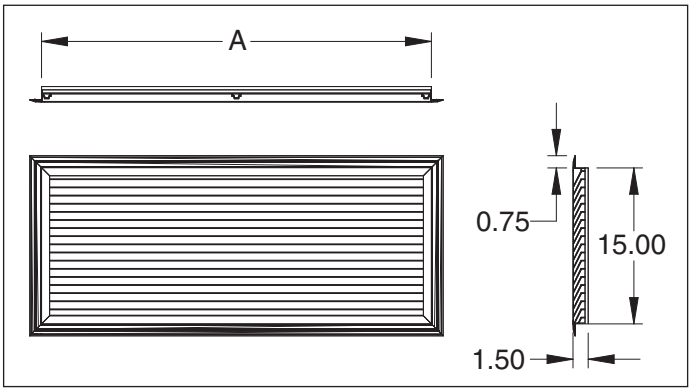


Table 29.1 - Standard Louver Dimensions

Model Size	Dimensions (inches)		
	A	B	C
24/36	39.00	39.75	40.00
48/60	45.00	45.75	46.00

Figure 29.3 - Standard Wall Sleeve

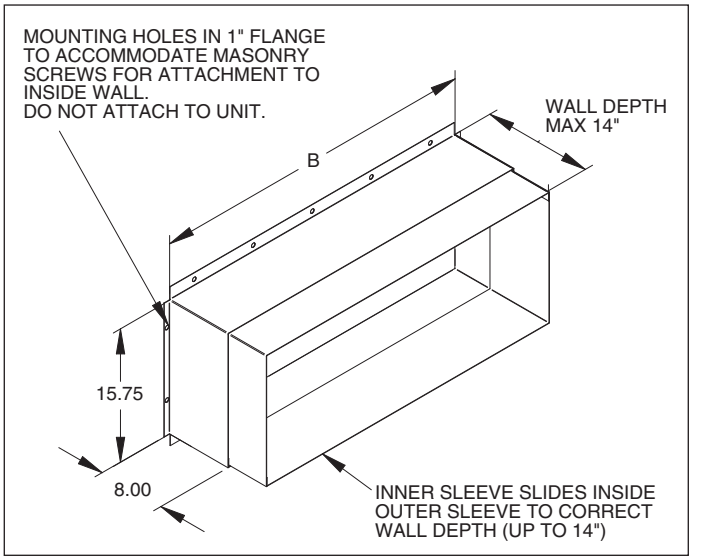
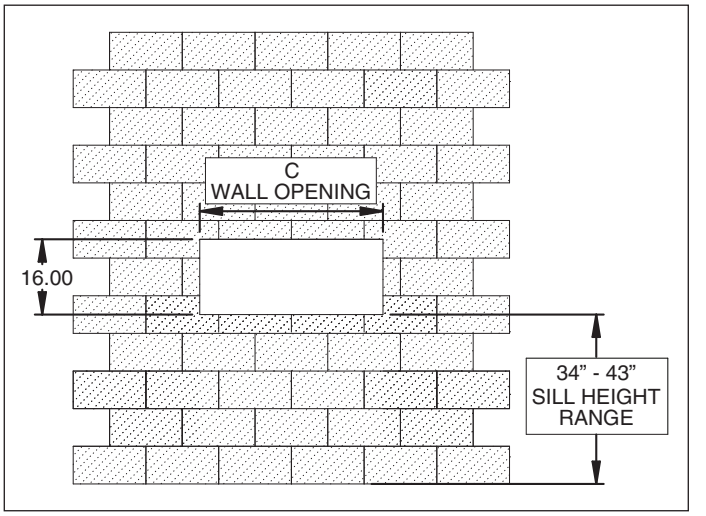


Figure 29.4 - Standard Wall Opening



6" Deep, Fixed Rear Extension / Wall Sleeve / Louver Dimensions and Mounting

Figure 30.1 - 6" Rear Extension Arrangement

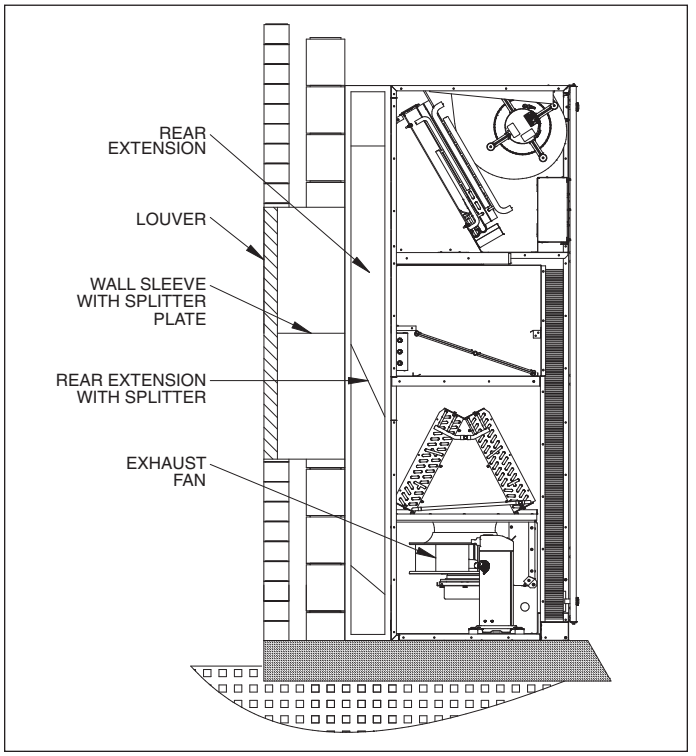


Figure 30.2 - 6" Rear Extension Louver

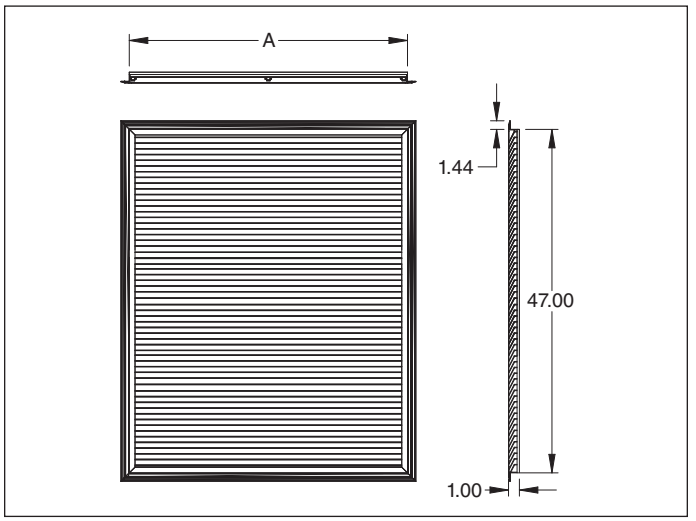


Table 30.1 - 6" Rear Extension Dimensions

Model Size	Sill Height	Dimensions (inches)				
		A	B	C	D	E
24/36	22-28"	39.00	39.75	40.00	42.00	42.00
	28-34"					50.00
	35-38"					60.50
48/60	22-28"	45.00	45.75	46.00	48.00	42.00
	28-34"					50.00
	35-38"					60.50

Figure 30.3 - 6" Rear Extension Wall Sleeve

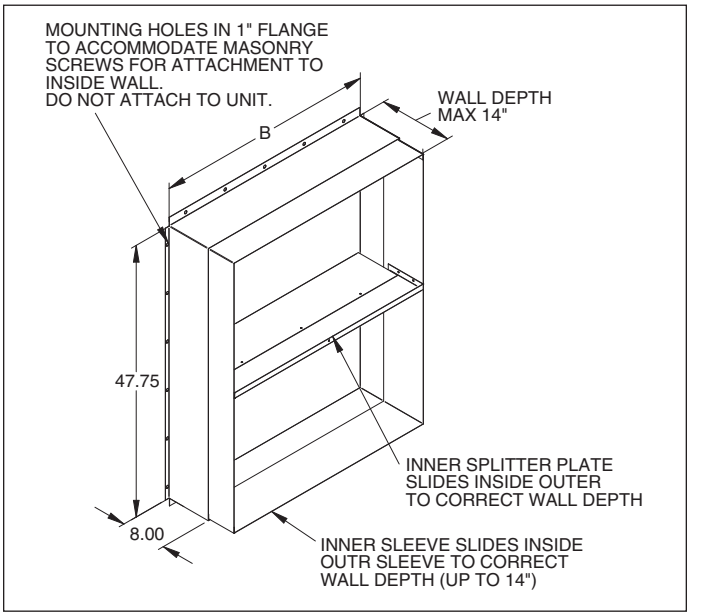


Figure 30.4 - 6" Rear Extension Wall Opening

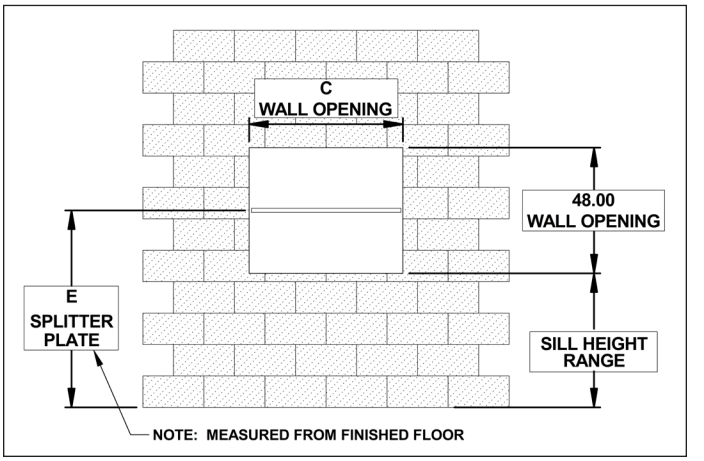
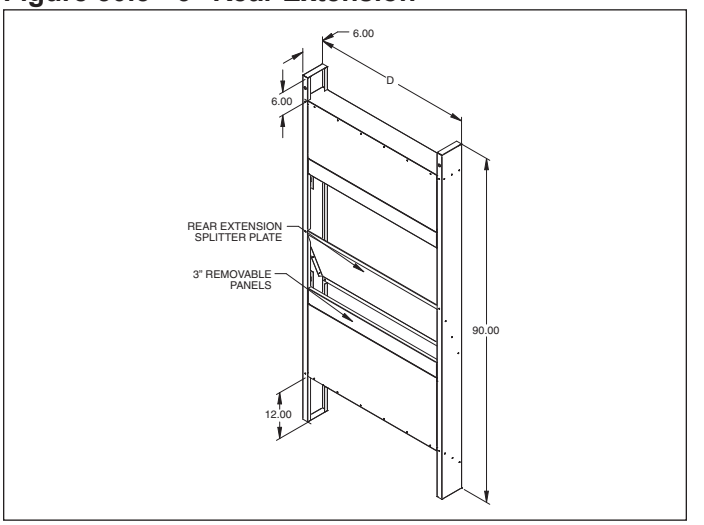


Figure 30.5 - 6" Rear Extension



15" Deep, Fixed Rear Extension / Wall Sleeve / Louver Dimensions and Mounting

Figure 31.1 - 15" Rear Extension Arrangement

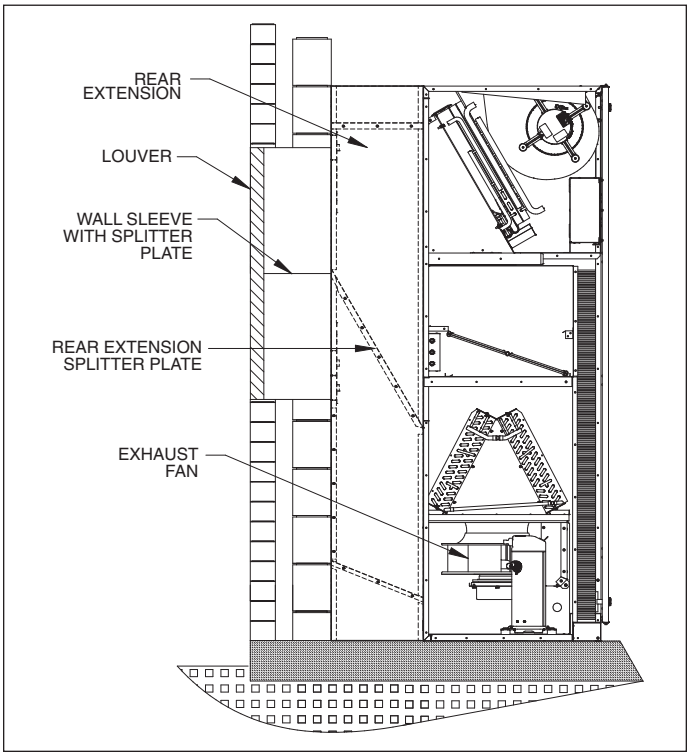


Figure 31.2 - 15" Rear Extension Louver

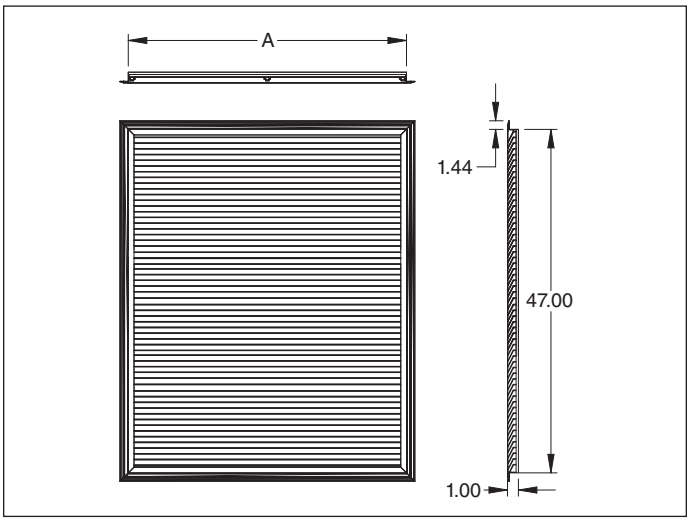


Table 31.1 - 15" Rear Extension Dimensions

Model Size	Sill Height	Dimensions (inches)				
		A	B	C	D	E
24/36	34-42"	39.00	39.75	40.00	42.00	60.00
48/60	34-42"	45.00	45.75	46.00	48.00	60.00

Figure 31.3 - 15" Rear Extension Wall Sleeve

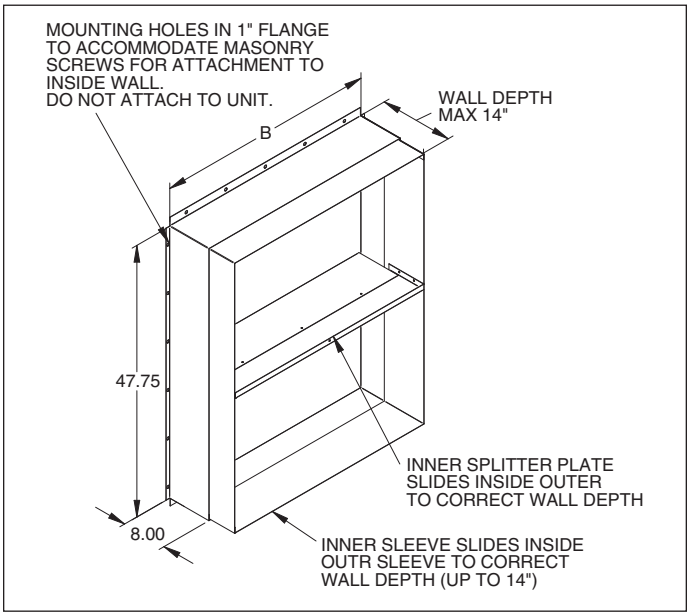


Figure 31.4 - 15" Rear Extension Wall Opening

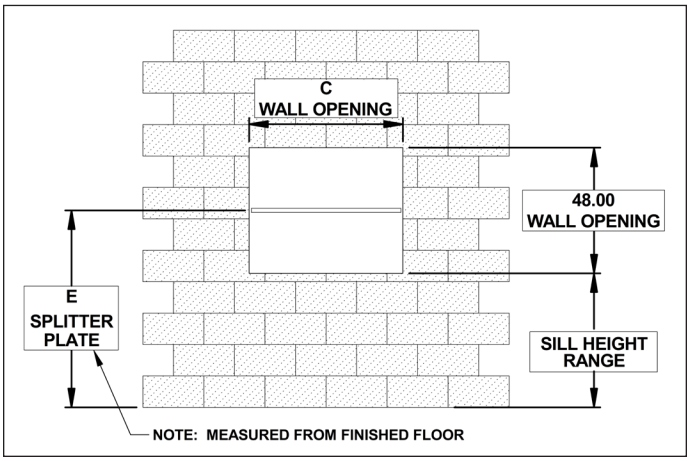
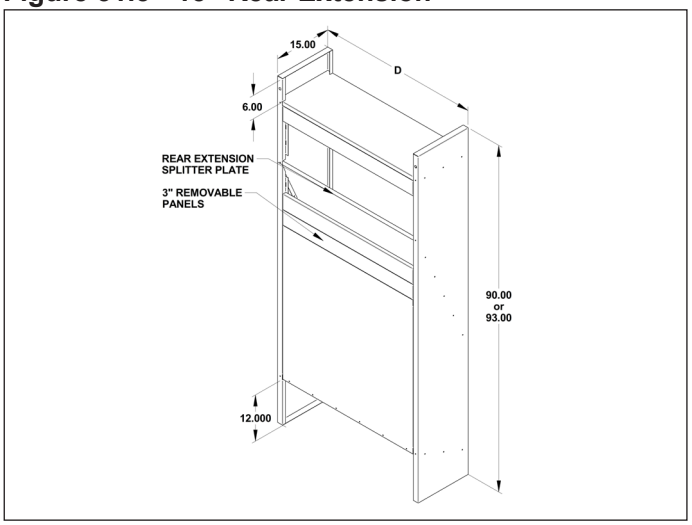


Figure 31.5 - 15" Rear Extension





Modine Manufacturing Company
1500 DeKoven Avenue
Racine, Wisconsin 53403-2552
Phone: 1.800.828.4328 (HEAT)
www.modinehvac.com

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www.linkedin.com/company/modinehvac/

WP2LED37N/PC

RAB Outdoor



Affordable 37W and 24W LED wallpacks with traditional look. 100,000 hour L70 lifespan. 5-year, no-compromise warranty.

Color: Bronze

Weight: 9.6 lbs

Project:	Type:
Prepared By:	Date:

Driver Info		LED Info	
Type	Constant Current	Watts	37W
120V	0.31A	Color Temp	4000K (Neutral)
208V	N/A	Color Accuracy	84 CRI
240V	N/A	L70 Lifespan	100,000
277V	N/A	Lumens	4,365
Input Watts	38.2W	Efficacy	114.3 LPW

Technical Specifications

Listings

UL Listing:

Suitable for wet locations. Wall mount only.

IESNA LM-79 & LM-80 Testing:

RAB LED luminaires and LED components have been tested by an independent laboratory in accordance with IESNA LM-79 and LM-80.

DLC Listed:

This product is on the Design Lights Consortium (DLC) Qualified Products List and is eligible for rebates from DLC Member Utilities.
DLC Product Code: PGP2GTJN

Optical

BUG Rating:

B1 U4 G3

Construction

Thermal Management:

Superior thermal management with die-cast aluminum heatsink

Maximum Ambient Temperature:

Suitable for use in 40°C (104°F)

Cold Weather Starting:

Minimum starting temperature is -40°C (-40°F)

Housing:

Precision die-cast aluminum housing

Mounting:

Die-cast backbox with four (4) conduit entry points and knockout pattern for junction box or direct wall mounting. Hinged door for easy re-assembly.

Lens:

Prismatic, heat-resistant borosilicate glass

Reflector:

High-gloss white aluminum

Gaskets:

High-temperature silicone gaskets

Finish:

Formulated for high durability and long-lasting color

Green Technology:

Mercury and UV free. RoHS-compliant components.

Electrical

Photocell:

120V Button Photocell Included. Photocell is only compatible with 120V.

Driver:

Constant Current, Class 2, 450mA, 50/60 Hz. 100 - 277V, 4kV surge protection

LED Characteristics

Color Stability:

LED color temperature is warrantied to shift no more than 200K in CCT over a 5-year period

Color Uniformity:

RAB's range of CCT (Correlated Color Temperature) follows the guidelines of the American National Standard for Specifications for the Chromaticity of Solid State Lighting (SSL) Products, ANSI C78.377-2017.

Other

Warranty:

RAB warrants that our LED products will be free from defects in materials and workmanship for a period of five (5) years from the date of delivery to the end user, including coverage of light output, color stability, driver performance and fixture finish. RAB's warranty is subject to all terms and conditions found at www.rablighting.com/legal#warranty

Technical Specifications (continued)

Other

Equivalency:

Equivalent to 175W Metal Halide

Buy American Act Compliance:

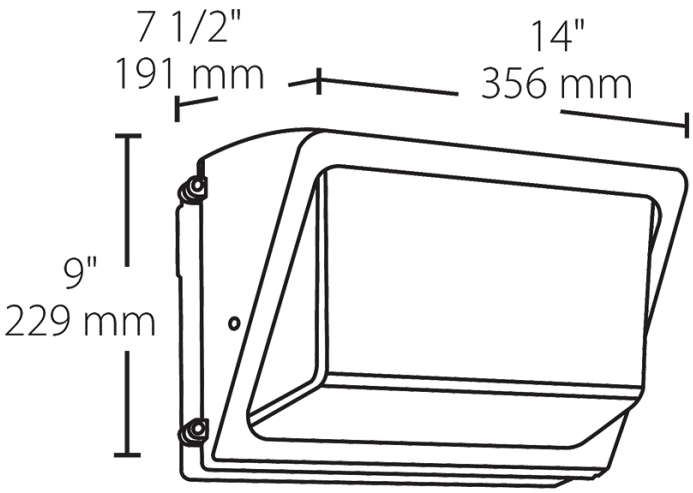
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WP2LED37N/PC

RAB Outdoor

Dimensions



Features

- Covers footprint of traditional HID wallpacks
- WP2LED replaces up to 175W MH
- 100,000-Hour LED lifespan

Ordering Matrix

Family	Wattage	Color Temp	Finish	Driver Options	Options
WP2LED	37	N			/PC
	24 = 24W **37 =** 37W	**Blank =** 5000K (Cool) **N =** 4000K (Neutral) **Y =** 3000K (Warm)	**Blank =** Bronze **W =** White	**Blank =** 120-277V **/480 =** 480V	**Blank =** No Option **/PC =** 120V Button **/PCS =** 120V Swivel **/PC2 =** 277V Button **/PCS2 =** 277V Swivel **/PCS4 =** 480V Swivel **/LC =** Lightcloud® Controller

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WP2LED237 NP/

RAB Outdoor



Affordable 37W and 24W LED wallpacks with traditional look. 100,000 hour L70 lifespan. 5-year, no-compromise warranty.

Color: Bronze

Weight: 9.6 lbs

PGroject:	: Tyjt
PGypGad Tt	Dpjt

DCBjCdlrr		LEDdlrr	
Type	Constant Current	Watts	24W
120V	0.2A	Color Temp	4000K (Neutral)
208V	N/A	Color Accuracy	85 CRI
240V	N/A	L70 Lifespan	100,000
277V	N/A	Lumens	2,983
Input Watts	24.5W	Efficacy	121.8 LPW

:jefl Eephdl yjeBBEepcB l S

LESdBssS

gLdLESdBst

Suitable for wet locations. Wall mount only.

vEl 7UdLAM-79&dLAM-80djSdBst

RAB LED luminaires and LED components have been tested by an independent laboratory in accordance with IESNA LM-79 and LM-80.

DL/ dLESqjat

This product is on the Design Lights Consortium (DLC) Qualified Products List and is eligible for rebates from DLC Member Utilities.
DLC Product Code: P32H6ACR

Oydeph

gGdRpdBst

B1 U3 G3

/rlScQuedBl

:fjCmphnAplpsjmjldt

Superior thermal management with die-cast aluminum heatsink

ApxBnumdUmbBjlcdjmyjCpcuGjt

Suitable for use in 40°C (104°F)

/rhadWjpdfjCdlcpCdBst

Minimum starting temperature is -40°C (-40°F)

HruSBst

Precision die-cast aluminum housing

Arul dBst

Die-cast backbox with four (4) conduit entry points and knockout pattern for junction box or direct wall mounting. Hinged door for easy re-assembly.

Ljlst

Prismatic, heat-resistant borosilicate glass

Rjrhjecr Ct

High-gloss white aluminum

GpSkjcSt

High-temperature silicone gaskets

FBlBEBft

Formulated for high durability and long-lasting color

GGjjldjeflrhrsTt

Mercury and UV free. RoHS-compliant components.

EhjecCBeph

Pfrcrejhtt

120V Button Photocell Included. Photocell is only compatible with 120V.

DCBjCt

Constant Current, Class 2, 450mA, 50/60 Hz. 100 - 277V, 4kV surge protection

LEDdlfpCpejCdSdBaS

/rhrCdlqpbBBETt

LED color temperature is warrantied to shift no more than 200K in CCT over a 5-year period

/rhrCdgjlBrCmBETt

RAB's range of CCT (Correlated Color Temperature) follows the guidelines of the American National Standard for Specifications for the Chromaticity of Solid State Lighting (SSL) Products, ANSI C78.377-2017.

OdfjC

WpCCplcTt

RAB warrants that our LED products will be free from defects in materials and workmanship for a period of five (5) years from the date of delivery to the end user, including coverage of light output, color stability, driver performance and fixture finish. RAB's warranty is subject to all terms and conditions found at www.rablighting.com/legal#warranty

:jefl Eephdl yjeBBEepcB l Sder ldBujaa)

OdfjC

EquBphjleTt

Equivalent to 70W Metal Halide

uTdUmjCkepldUecdlrmyHpplejt

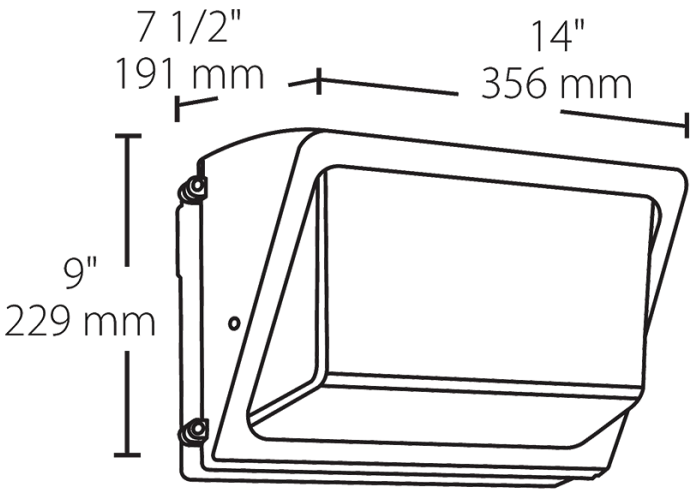
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WP2LED237 NP/

RAB Outdoor

DBenj I SBI S



Fj pou[S

- Covers footprint of traditional HID wallpacks
- WP2LED replaces up to 175W MH
- 100,000-Hour LED lifespan

OCaj GBsoA poGk

FpmBT	Wpoqpsj	/ rhrQdjmy	FBBSf	DGBjQDydBIS	OydBIS
WP2LED	24	N			/PC
	23dl 24W =-dlc87W	hpl kdldc5000K (Cool) 7 dl 4000K (Neutral) Ydlc3000K (Warm)	hpl kdldcBronze Wdld White	hpl kdldl20-277V N380dldl80V	hpl kdldcNo Option NP/ dl 120V Button NP/ I dldl20V Swivel NP/ 2dldc277V Button NP/ I 2dldc277V Swivel NP/ I 3dldl80V Swivel NL/ dldcLightcloud® Controller

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VANLED40NFR

RAB Outdoor



Low-profile vandal-resistant fixture covers the footprint of most traditional canopy lights. Available in flat or drop lens with frosted and unfrosted options.

Color: Bronze

Weight: 12.0 lbs

Project:	Type:
Prepared By:	Date:

Driver Info		LED Info	
Type	Constant Current	Watts	40W
120V	0.60A	Color Temp	4000K (Neutral)
208V	0.19A	Color Accuracy	78 CRI
240V	0.17A	L70 Lifespan	100,000
277V	0.14A	Lumens	4,607
Input Watts	39.2W	Efficacy	117.5 LPW

Technical Specifications

Listings

UL Listing:

Suitable for Wet Locations. Covered Ceiling Mount Only.

IESNA LM-79 & IESNA LM-80 Testing:

RAB LED luminaires and LED components have been tested by an independent laboratory in accordance with IESNA LM-79 and LM-80.

Construction

Maximum Ambient Temperature:

Suitable for use in 40°C (104°F)

Cold Weather Starting:

Minimum starting temperature is -40°C (-40°F)

Housing:

Die-cast aluminum housing and lens frame with (4) 1/2" NPS side conduit entries and weatherproof rear wire plug and access plate

Mounting:

Ceiling mount to recessed junction with knockout template or directy to ceiling surface, utilizing side conduit entry points

IP Rating:

Ingress Protection rating of IP66 for dust and water

Lens:

Vandal-resistant polycarbonate textured opaque for low glare drop lens

Reflector:

Semi-specular, vacuum-metalized polycarbonate

Gaskets:

High-temperature silicone gaskets

Finish:

Our environmentally friendly polyester powder coatings are formulated for high-durability and long-lasting color

Green Technology:

Mercury and UV free. RoHS-compliant components.

LED Characteristics

LEDs:

Discreet LEDs on PCB board

Color Stability:

RAB LEDs exceed industry standards for chromatic stability

Color Uniformity:

RAB's range of CCT (Correlated Color Temperature) follows the guidelines of the American National Standard for Specifications for the Chromaticity of Solid State Lighting (SSL) Products, ANSI C78.377-2017.

Other

Warranty:

RAB warrants that our LED products will be free from defects in materials and workmanship for a period of five (5) years from the date of delivery to the end user, including coverage of light output, color stability, driver performance and fixture finish. RAB's warranty is subject to all terms and conditions found at www.rablighting.com/legal#warranty

Buy American Act Compliance:

RAB values USA manufacturing! Upon request, RAB may be able to manufacture this product to be compliant with the Buy American Act (BAA). Please contact customer service to request a quote for the product to be made BAA compliant.

Electrical

Driver:

Class 2, Constant Current, 100-277V, 50-60Hz, 1050mA

THD:

12.8% at 120V, 14.7% at 277V

Technical Specifications (continued)

Electrical

Power Factor:

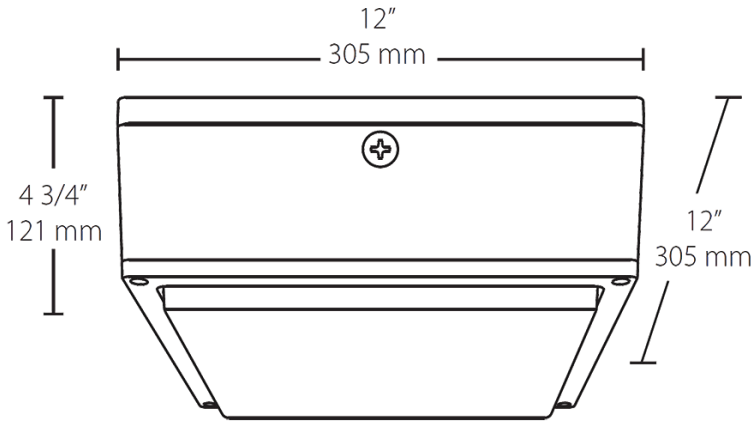
98.9% at 120V, 92.3% at 277V

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VANLED40NFR

RAB Outdoor

Dimensions



Features

- Fits the footprint of older canopy lights
- Vandal resistant and UV resistant lens
- Ultra-high efficiency
- Clean, contemporary, low-profile design
- Available with drop lens or flat lens
- IP66 rated, keeps dust, bugs and water out
- Photo and motion sensor options available

Ordering Matrix

Family	Wattage	Color Temp	Lens	Motion Sensor & Finish	Driver Options	Photocell Options	Other Options
VANLED	40	N	FR				
	10 = 10W **20 =** 20W **40 =** 40W **52 =** 52W **65 =** 65W **75 =** 75W	**Blank =** 5000K (Cool) **N =** 4000K (Neutral) **Y =** 3000K (Warm)	**Blank =** Drop lens **F =** Flat lens **FR =** Frosted Drop Lens **FFR =** Frosted Flat Lens	**Blank =** Bronze, no sensor **W =** White, no sensor **MS =** Bronze w/ SMS500 mini-sensor **MSW =** White w/ SMS500 mini-sensor	**Blank =** On/Off driver **/D10 =** 0-10V Dimming **/480 =** 480V **/480/D10 =** 480V w/ 0-10V dimming	**/PCS2 =** 277V Swivel **/PCS4 =** 480 Vac Swivel Photocell **Blank =** No Option **/PCS =** 120V Swivel	**USA =** BAA Compliant **Blank =** Standard

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PLL-17-840-BYP

RAB Lamps



Replace long-version, or TT5 compact fluorescent lamps.

Color: White | Weight: 0.6 lbs | Case Qty: 25

Project:	Type:
Prepared By:	Date:

Driver Info

Watts:	17W
Color Temp:	4000K (Cool White)
Lumens:	2,200
Efficacy:	129 LPW
Color Accuracy:	82 CRI
L70 Accuracy:	50,000

LED Info

Input Voltage:	120-277V
Power Factor:	0.9
Flicker:	N/A
THDi:	<20%

Technical Specifications

Listings

UL Recognized:
Yes

UL Classified:
Yes

NSF:
Complies with NSF

FCC:
Yes

Rohs:
Yes

CEC Status:
Lawful for sale in California

DLC Qualified:
Yes

DLC Listed:
This product is on the Design Lights Consortium (DLC) Qualified Products List and is eligible for rebates from DLC Member Utilities.
DLC Product Code: PJMAWKQ7

Description

Lamp Type:
PLL Compacts

Bulb Type:
PLL

Base Type:
2G11, 4 Pin

Dimmable:
No

Material:
Glass

LED Characteristics

Installation Type:
Type B

Lifespan:
50,000-hour LED lifespan based on IES LM-70 results

Construction

Operating Temperature:
-20 - 40°C

MOD:
0.06"

Other

Equivalent:
40W Fluorescent PLL

Warranty:
5 years

Shipping Information

Case Dimensions:
23.62 x 9.76 x 6.5

Pallet Quantity of Pieces:
1200

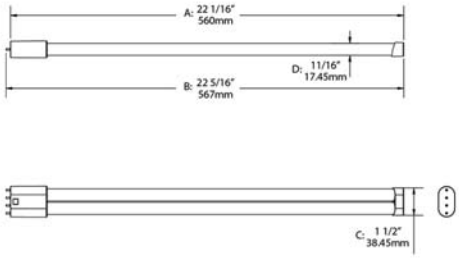
Pallet Dimensions:
47.24 x 39.37 x 40.16

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PLL-17-840-BYP

RAB Lamps

Dimensions



Features

- Replacement for Conventional Fluorescent Lamps
- Approximately 40% More Energy Efficient that Conventional Pin-Base CLF's with 2G11 base
- Instant on, no flicker or hum
- Internal Driver, Eliminates the need for External Driver or Ballast
- 111+ Lumens per watt
- Environmentally friendly: No Mercury Used

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HID-80-V-EX39-850-BYP-HB

RAB Lamps



Replace 200 - 400W MH lamps for high bays. 50,000-hour lifespan. Use 76% less energy than MH. 10% Uplight reduces cave effect.

Color: White

Weight: 2.5 lbs

Project:	Type:
Prepared By:	Date:

Driver Info		LED Info	
Watts	80W	Input Voltage	100-277V
Color Temp	5000K (Daylight)	Power Factor	0.9
Lumens	10,800	Flicker	<30%
Efficacy	135 LPW	THDi	<20%
Color Accuracy	80 CRI	R9	
L70 Accuracy	50,000		

Technical Specifications

Listings

UL Listed:

Yes

UL Classified:

Yes

FCC:

Yes

Rohs:

Yes

CEC Status:

Lawful for sale in California

DLC Qualified:

Yes

DLC Listed:

This product is on the Design Lights Consortium (DLC) Qualified Products List and is eligible for rebates from DLC Member Utilities.
DLC Product Code: PLMWE20R

Description

Lamp Type:

HID

Bulb Type:

High Bay

Base Type:

EX39, Mogul Base

Dimmable:

No

Construction

Operating Temperature:

-20 - 40°C

Bare Lamp Illuminated Length (inches):

2.32"

MOL (inches):

6.89"

MOD (inches):

7.87"

Minimum Compartment Size (inches):

Length: 9.84"
Width: 9.84"
Height: 8.26"

LED Characteristics

Lifespan:

50,000-hour LED lifespan based on IES LM-70 results

Optical

Beam Angle:

120°

Other

Warranty:

5-years

Technical Specifications (continued)

Other

Accessories:

Surge protector available. Click www.rablighting.com/product/SP10KV for surge protector accessory. Sold separately.

Shipping Information

Case Qty:

4

Case Dimensions:

17.72 x 17.72 x 9.06

Pallet Quantity of Pieces:

64

Pallet Dimensions:

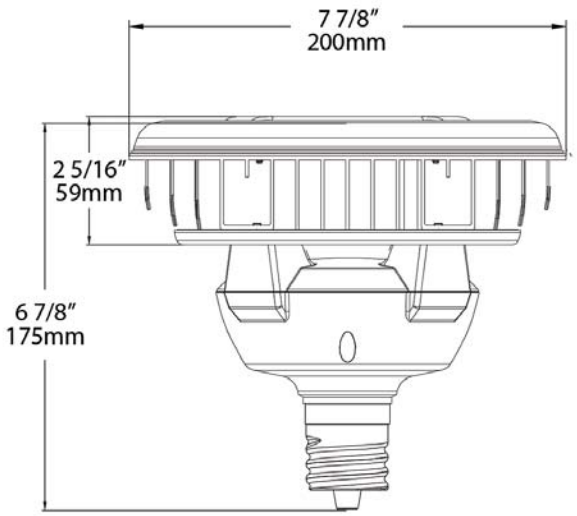
37.4 x 37.4 x 40.94

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HID-80-V-EX39-850-BYP-HB

RAB Lamps

Dimensions



Features

HID REPLACEMENT - Replacement for conventional HID lamps

BALLAST BYPASS - Internal driver eliminates the need for external driver or ballast

50,000-HOUR LIFESPAN - Lasts 25x the life of conventional HID lamps

ENERGY SAVINGS - Uses 76% less energy than traditional lamps

HEAT DISSIPATION - Thermal technology extends lifespan

WATER & DUST RESISTANT - Ideal for warehouse applications

ENCLOSED FIXTURE RATED - May be used in enclosed and open fixtures

UPLIGHTING - Ring of LEDs provides 10% uplighting to eliminate "cave effect"

MERCURY FREE - Environmentally friendly

SURGE PROTECTION - Includes 4kV surge protection

Ordering Matrix

Family	Lamp Power	Orientation	Base Type	CRI	Color Temp	Installation Type	Lamp Type
HID	80	V	EX39	8	50	BYP	HB
	60 = 200W **80 =** 320W **115 =** 400W	**V =** Vertical	**EX39 =** EX39	**8 =** 80 CRI	**30 =** 3000K **40 =** 4000K **50 =** 5000K	**BYP =** Bypass	**HB =** High Bay

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HAYBAY100N/D10

RAB | Indoor



Haybay's modular design creates a world of flexibility by keeping your base price low and letting you choose specific options like reflectors, motion sensors and emergency batteries separately.

Color: White

Weight: 14.7 lbs

Project:	**Type:**
Prepared By:	**Date:**

Driver Info		LED Info	
Type	Constant Current	Watts	100W
120V	0.87A	Color Temp	4000K (Neutral)
208V	0.52A	Color Accuracy	74 CRI
240V	0.45A	L70 Lifespan	100,000
277V	0.37A	Lumens	10,975
Input Watts	101.8W	Efficacy	107.8 LPW

Technical Specifications

Listings

UL Listing:

Suitable for damp locations

IESNA LM-79 & LM-80 Testing:

RAB LED luminaires and LED components have been tested by an independent laboratory in accordance with IESNA LM-79 and LM-80.

DLC Listed:

This product is on the Design Lights Consortium (DLC) Qualified Products List and is eligible for rebates from DLC Member Utilities.
DLC Product Code: PUT7SF9Z

Construction

Vibration Rating:

Industry-leading 5G vibration rating per ANSI C136.31

Cold Weather Starting:

Minimum starting temperature is -40°C (-40°F)

Maximum Ambient Temperature:

Suitable for use 12 hours a day, 5 days a week in up to 50°C and for 24/7 use in up to 40°C

Housing:

Precision die-cast aluminum with sheet metal driver bracket/mounting

Mounting:

Heavy-duty 3/4" NPS hook and 6 ft. cord; is also 3/4" pendant mount capable (pendant by others).

Finish:

Our environmentally friendly polyester powder coatings are formulated for high-durability and long-lasting color

Green Technology:

Mercury and UV free. RoHS-compliant components.

LED Characteristics

LEDs:

Long-life, high-efficiency, surface mount LEDs

Lifespan:

100,000-hour LED lifespan based on IES LM-80 results and TM-21 calculations

Color Uniformity:

RAB's range of CCT (Correlated Color Temperature) follows the guidelines of the American National Standard for (SSL) Products, ANSI C78.377-2017.

Electrical

Dimming Driver:

Driver includes dimming control wiring for 0-10V dimming systems. Requires separate 0-10V DC dimming circuit. Dims as low as 10%.

Surge Protection:

4kV

Drivers:

Class 2, constant current, 50/60 Hz., 120-277V, 120V: 0.87A, 208V: 0.52A, 240V: 0.45A, 277V: 0.37A

THD:

2.3% at 120V, 7.5% at 277V

Power Factor:

99.9% at 120V, 98.8% at 277V

Other

Reflector Options:

Clear prismatic acrylic reflectors available in 11" or 8.5" height; frosted prismatic acrylic reflectors available in 11" or 8.5" height; white aluminum reflector available in 5" height. Click www.rablighting.com.//productLine.php?productLine=LED_HIGH_BAY_REFLECTORSto see all reflectors.

Technical Specifications (continued)

Other

5 Yr Limited Warranty:

The RAB 5-year, limited warranty covers light output, driver performance and paint finish. RAB's warranty is subject to all terms and conditions found at www.rablighting.com/legal#warranty

Equivalency:

Equivalent to 250W Metal Halide

Buy American Act Compliance:

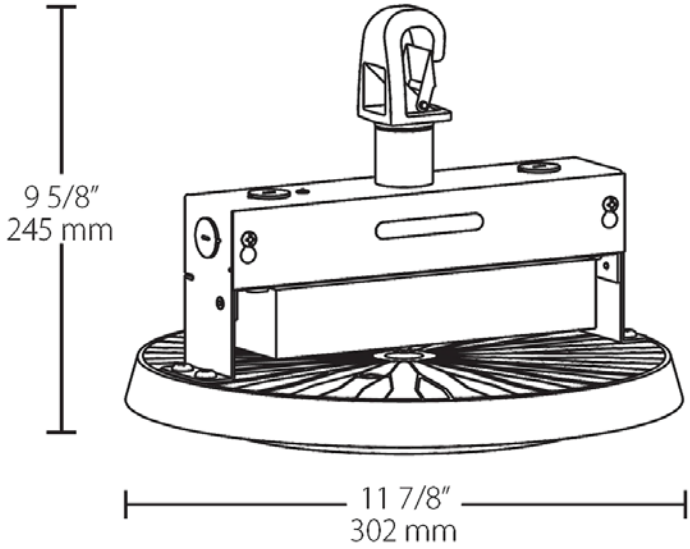
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HAYBAY100N/D10

RAB | Indoor

Dimensions



Features

Simple. Affordable, Modular design.

Open "airflow" design reduces operating temperatures and increases lifespan

Assortment of reflectors tailor the Haybay to specific applications

Available with a Lightcloud Controller, Lightcloud Sensor and other compatible RAB sensors

Ordering Matrix

Family	Wattage	Color Temp	Driver	Sensor Options	Options
HAYBAY	100	N	/D10		
	100 = 100W **130 =** 130W **150 =** 150W **180 =** 180W	**Blank =** 5000K **N =** 4000K	**/D10 =** 0-10V Dimming (standard)	**Blank =** No Sensor **/LOS =** LOSBAY 800 Sensor (base fixture only) **/LOSR =** LOSBAY 800 Sensor (required for reflector) **/LC =** Lightcloud® Controller **/LCS =** Lightcloud® Sensor (base fixture only) **/LCSR =** Lightcloud® Sensor (required for reflector)	**Blank =** No Emergency Battery Backup **/E2 =** Emergency Backup, 120-277V

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GLED26N

RAB



26 Watts of energy efficient LED garage lighting. 100,000 hour LED lifespan. 5 year warranty. High-performance output maximizes spacing criterion.

Color: Bronze Weight: 18.2 lbs

Project:	Type:
Prepared By:	Date:

Driver Info

Type:	Constant Current
120V:	0.30A
208V:	0.17A
240V:	0.15A
277V:	0.13A
Input Watts:	27W
Efficiency:	95%

LED Info

Watts:	26W
Color Temp:	4000K
Color Accuracy:	74 CRI
L70 Lifespan:	100000
Lumens:	3228
Efficacy:	118 LPW

Technical Specifications

Listings

UL Listing:

Suitable for Wet Locations. Covered Ceiling Mount Only.

DLC Listed:

This product is listed by Design Lights Consortium (DLC) as an ultra-efficient premium product that qualifies for the highest tier of rebates from DLC Member Utilities.
DLC Product Code: P000017AB

IESNA LM-79 & LM-80 Testing:

RAB LED luminaires have been tested by an independent laboratory in accordance with IESNA LM-79 and LM-80, and have received the Department of Energy "Lighting Facts" label

Construction

IP Rating:

Ingress Protection rating of IP66 for dust and water

Cold Weather Starting:

Minimum starting temperature is -40°C (-40°F)

Maximum Ambient Temperature:

Suitable for use in 40°C (104°F) ambient temperatures

Thermal Management:

Superior heat sinking with integrated air-flow fins

Housing:

Precision die-cast aluminum housing and door frame

Mounting:

Easy hanging plate with hooks for ceiling mount

Lens:

Prismatic polycarbonate lens

Reflector:

Semi-specular anodized aluminum with ultra-white, 97% reflective optics

Gaskets:

High-temperature silicone

Finish:

Formulated for high-durability and long lasting color

Green Technology:

Mercury and UV-free. RoHS compliant components. Polyester powder coat finish formulated without the use of VOCs or toxic heavy metals.

LED Characteristics

Lifespan:

100,000-hour LED lifespan based on IES LM-80 results and TM-21 calculations

LEDs:

High-output, long-life LEDs

Color Consistency:

3-step MacAdam Ellipse binning to achieve consistent fixture-to-fixture color

Color Stability:

LED color temperature is warrantied to shift no more than 200K in CCT over a 5 year period

Color Uniformity:

RAB's range of CCT (Correlated Color Temperature) follows the guidelines of the American National Standard for Specifications for the Chromaticity of Solid State Lighting (SSL) Products, ANSI C78.377-2017.

Electrical

THD:

7.7% at 120V, 17.4% at 277V

Power Factor:

99.1% at 120V, 89.9% at 277V

Drivers:

Constant Current, Class 2, 100V-277V, 50/60 Hz, 6kv Surge Protection, 720mA, 100-277VAC 0.4 Amps.

Other

Patents:

The design of GLED26 is protected by patents pending in US, Canada, China, Taiwan and Mexico

FTC Country of Origin:

This product was assembled in the USA by RAB using imported components

Buy American Act Compliance:

This product complies with the Buy American Act

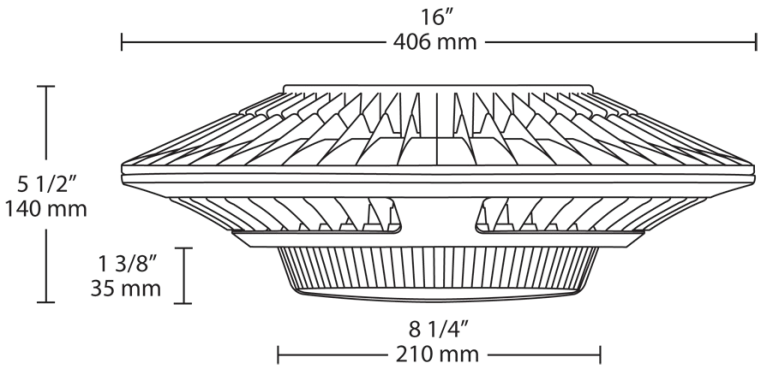
Optical

BUG Rating:

B2 U3 G1

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Dimensions



Features

- Low-profile design Ideal for Parking Garages
- 100,000-hour LED lifespan based on IES LM-80 results and TM-21 calculations
- Up to 25% Reduction in Fixture Count
- Lock screw provided for pendant mount

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FFLED80/D10/PCS



Rectangular shaped LED floodlight designed to replace 250W Metal Halide. Patent Pending airflow technology ensures long LED and driver lifespan. Use for building facade lighting, sign lighting, LED landscape lighting and instant-on security lighting.

Color: Bronze Weight: 12.6 lbs

Project:	Type:
Prepared By:	Date:

Driver Info		LED Info	
Type:	Constant Current	Watts:	80W
120V:	0.74A	Color Temp:	5000K
208V:	N/A	Color Accuracy:	72 CRI
240V:	N/A	L70 Lifespan:	100000
277V:	N/A	Lumens:	9,672
Input Watts:	89W	Efficacy:	109 LPW
Efficiency:	90%		

Technical Specifications

Listings

UL Listing:

Suitable for wet locations. Suitable for ground mounting.

IESNA LM-79 & LM-80 Testing:

RAB LED luminaires have been tested by an independent laboratory in accordance with IESNA LM-79 and LM-80, and have received the Department of Energy "Lighting Facts" label.

DLC Listed:

This product is on the Design Lights Consortium (DLC) Qualified Products List and is eligible for rebates from DLC Member Utilities.
DLC Product Code: P7WMZ8MN

LED Characteristics

LEDs:

Multi-chip, high-output, long-life LEDs

Lifespan:

100,000-hour LED lifespan based on IES LM-80 results and TM-21 calculations.

Color Consistency:

7-step MacAdam Ellipse binning to achieve consistent fixture-to-fixture color.

Color Stability:

LED color temperature is warrantied to shift no more than 200K in CCT over a 5 year period.

Color Uniformity:

RAB's range of CCT (Correlated Color Temperature) follows the guidelines of the American National Standard for (SSL) Products, ANSI C78.377-2015.

Electrical

Driver:

Constant Current, Class 2, 100-277V, 50/60 Hz, 6 kV surge protection, 120V: 0.74 A, 208V: 0.48 A, 240V: 0.41 A, 277V: 0.36 A

THD:

11.6% at 120V, 19.5% at 277V

Power Factor:

98.5% at 120V, 89.8% at 277V

Dimming Driver:

Driver includes dimming control wiring for 0-10V dimming systems. Dims as low as 10%.

Photocell:

120V Swivel Photocell Included. Photocell is only compatible with 120V.

Construction

IP Rating:

Ingress Protection rating of IP65 for dust and water.

Ambient Temperature:

Suitable for use in 40°C ambient temperatures.

Cold Weather Starting:

The minimum starting temperature is -40°C/-40°F

Thermal Management Housing:

Superior heat sinking with external Air-Flow fins.

Housing:

Die-cast aluminum housing, lens frame and mounting arm.

Threaded Size:

1/2" threaded arm.

Mounting:

Heavy-duty mounting arm with "O" ring seal & stainless steel screw.

Effective Projected Area:

EPA = 0.65

Reflector:

Specular polycarbonate

Gaskets:

High-temperature silicone gaskets.

Finish:

Our environmentally friendly polyester powder coatings are formulated for high-durability and long-lasting color, and contains no VOC or toxic heavy metals.

Green Technology:

Mercury and UV free. RoHS compliant components. Polyester powder coat finish formulated without the use of VOC or toxic heavy metals.

Optical

NEMA Type:

NEMA Beam Spread of 7H x 6V

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Technical Specifications (continued)

Other

Equivalency:

The FFLED80 is equivalent in delivered lumens to a 250W Metal Halide.

California Title 24:

FFLED80/D10 complies with 2013 California Title 24 building and electrical codes as commercial outdoor non-pole-mounted fixture > 30 Watts mounted up to 24 feet when used with the RC Stealth Dimmer. Use catalog code STLDIM10 to order a Stealth Dimmer module.

Warranty:

RAB warrants that our LED products will be free from defects in materials and workmanship for a period of five (5) years from the date of delivery to the end user, including coverage of light output, color stability, driver performance and fixture finish.

Patents:

The FFLED design is protected by U.S. Pat. D643,147, Canada Pat. 140798, China Pat. ZL201130171304.1, Mexico Pat. 36757 and pending patent in Taiwan.

Country of Origin:

Designed by RAB in New Jersey and assembled in the USA by RAB's IBEW Local 3 workers.

Buy American Act Compliant:

This product is a COTS item manufactured in the United States, and is compliant with the Buy American Act.

Recovery Act (ARRA) Compliant:

This product complies with the 52.225-21 "Required Use of American Iron, Steel, and Manufactured Goods-- Buy American Act-- Construction Materials (October 2010).

Trade Agreements Act Compliant:

This product is a COTS item manufactured in the United States, and is compliant with the Trade Agreements Act.

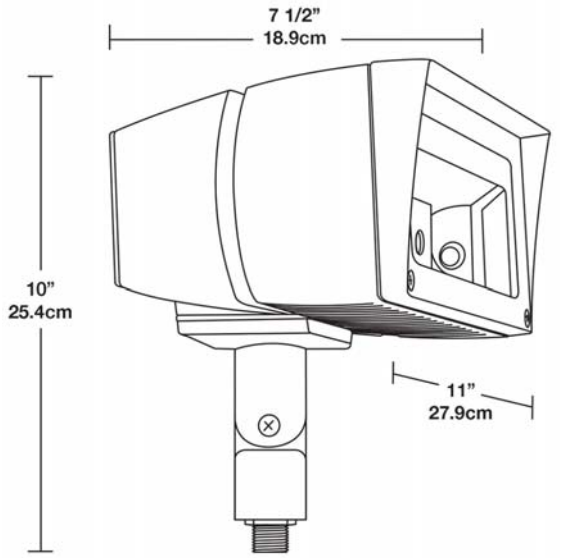
GSA Schedule:

Suitable in accordance with FAR Subpart 25.4.

American Bureau of Shipping (ABS) :

For use on Mobile Offshore Drilling Units (MODU) and shipping vessels.

Dimensions



Features

- Ultra efficient LED and optical design
- Replaces 250W MH floodlights
- 100,000 hour life based on LM-80 tests
- Air-flow technology heatsink
- 5-year warranty

Ordering Matrix

Family	Watts	Mount	Color Temp	Beam Spread	Finish	Dimming	Photocell
FFLED							
	80 = 80W	**Blank** = Arm **T** = Trunnion **SF** = Slipfitter	**Blank** = 5000K (Cool) **Y** = 3000K (Warm) **N** = 4000K (Neutral)	**Blank** = 7H x 6V **B44** = 4H x 4V **B55** = 5H x 5V	**Blank** = Bronze **W** = White	**Blank** = No Dimming **/D10** = Dimmable	**Blank** = No Photocell **/PC** = 120V Button **/PC2** = 277V Button **/PCS** = 120V Swivel **/PCS2** = 277V Swivel

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FFLED52N/PC

RAB Outdoor



Rectangular shaped LED floodlight designed to replace 175W Metal Halide. patent-pending "Air-Flow" technology ensures long LED and driver lifespan. Use for building façades lighting, sign lighting, LED landscape lighting and instant-on security lighting.

Color: Bronze

Weight: 12.5 lbs

Project:	**Type:**
Prepared By:	**Date:**

Driver Info		LED Info	
Type	Constant Current	Watts	52W
120V	0.45A	Color Temp	4000K (Neutral)
208V	0.27A	Color Accuracy	71 CRI
240V	0.24A	L70 Lifespan	100,000
277V	0.21A	Lumens	6,917
Input Watts	55.9W	Efficacy	123.7 LPW

Technical Specifications

Electrical

Photocell:

120V Button Photocell Included. Photocell is only compatible with 120V.

Driver:

Constant Current, Class 2, 100-277V, 50/60 Hz, 4 kV surge protection, 120V: 0.45A, 208V: 0.27A, 240V: 0.24A, 277V: 0.21A

Listings

UL Listing:

Suitable for wet locations. Suitable for mounting within 1.2m (4ft) of the ground.

IESNA LM-79 & LM-80 Testing:

RAB LED luminaires and LED components have been tested by an independent laboratory in accordance with IESNA LM-79 and LM-80.

DLC Listed:

This product is listed by Design Lights Consortium (DLC) as an ultra-efficient premium product that qualifies for the highest tier of rebates from DLC Member Utilities.
DLC Product Code: PWZ2ZZY6X

LED Characteristics

Lifespan:

100,000-hour LED lifespan based on IES LM-80 results and TM-21 calculations

Note:

All values are typical (tolerance +/- 10%)

LEDs:

Two multi-chip, 26Watt high performance LEDs

Color Consistency:

3-step MacAdam Ellipse binning to achieve consistent fixture-to-fixture color

Color Stability:

LED color temperature is warrantied to shift no more than 200K in CCT over a 5-year period

Color Uniformity:

RAB's range of CCT (Correlated Color Temperature) follows the guidelines of the American National Standard for (SSL) Products, ANSI C78.377-2017.

Construction

IP Rating:

Ingress Protection rating of IP66 for dust and water

Ambient Temperature:

Suitable For use in 40°C (104°F)

Cold Weather Starting:

Minimum starting temperature is -40°C (-40°F)

Thermal Management Housing:

Superior heat sinking with external Air-Flow fins

Housing:

Die-cast aluminum housing, lens frame and mounting arm

Threaded Size:

1/2" threaded arm

Mounting:

Heavy-duty mounting arm with "O" ring seal & stainless steel screw

Effective Projected Area:

EPA = 0.65

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Technical Specifications (continued)

Construction

Reflector:

Specular polycarbonate

Gaskets:

High-temperature silicone gaskets

Finish:

Formulated for high durability and long-lasting color

Green Technology:

Mercury and UV free. RoHS-compliant components.

Optical

NEMA Type:

NEMA Beam Spread of 7H x 6V

Other

Warranty:

RAB warrants that our LED products will be free from defects in materials and workmanship for a period of five (5) years from the date of delivery to the end user, including coverage of light output, color stability, driver performance and fixture finish. RAB's warranty is subject to all terms and conditions found at www.rablighting.com/legal#warranty

Patents:

The FFLED design is protected by U.S. Pat. D643,147, Canada Pat. 140798, China Pat. ZL201130171304.1, Mexico Pat. 36757 and pending patent in Taiwan.

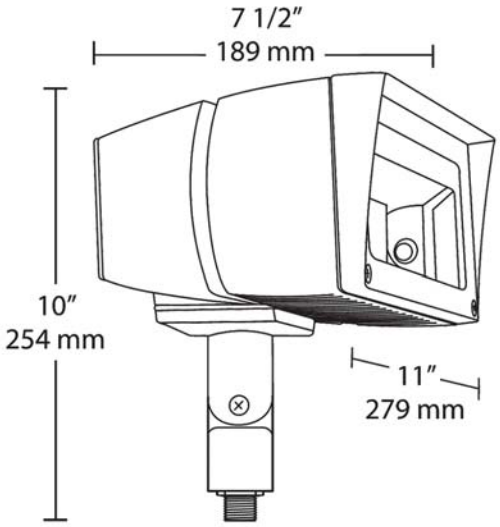
Equivalency:

Equivalent to 250W Metal Halide

Buy American Act Compliance:

RAB values USA manufacturing! Upon request, RAB may be able to manufacture this product to be compliant with the Buy American Act (BAA). Please contact customer service to request a quote for the product to be made BAA compliant.

Dimensions



Features

- Ultra-efficient LED and optical design
- Replaces 175W MH floodlights
- 100,000-hour life based on LM-80 results and TM-21 calculations
- "Air-Flow" technology heatsink
- 5-Year, No-Compromise Warranty

Ordering Matrix

Family	Wattage	Mounting	Color Temp	NEMA Type	Finish	Driver	Options	Other Options
FFLED	52		N				/PC	
	18 = 18W **26 =** 26W **39 =** 39W **52 =** 52W **80 =** 80W	**Blank =** Swivel Arm **SF =** Slipfitter **T =** Trunnion	**Blank =** 5000K (Cool) **N =** 4000K (Neutral) **Y =** 3000K (Warm)	**Blank =** 7H x 6V **B55 =** 5H x 5V **B44 =** 4H x 4V	**Blank =** Bronze **W =** White	**Blank =** On/Off **/D10 =** 0-10V Dimming **/480 =** 480V On/Off	**Blank =** No Option **/PC =** 120V Photocell **/PC2 =** 277V Photocell **/PCS =** 120V Swivel Photocell **/PCS2 =** 277V Swivel Photocell **/PCS4 =** 480V Swivel Photocell	**USA =** BAA Compliant **Blank =** Standard

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FFLED18N/D10/PC



Rectangular shaped LED floodlight designed to replace 70W Metal Halide. Patent Pending airflow technology ensures long LED and driver lifespan. Use for building facade lighting, sign lighting, LED landscape lighting and instant-on security lighting.

Color: Bronze Weight: 4.8 lbs

Project:	Type:
Prepared By:	Date:

Driver Info		LED Info	
Type:	Constant Current	Watts:	18W
120V:	0.2A	Color Temp:	4000K
208V:	N/A	Color Accuracy:	82 CRI
240V:	N/A	L70 Lifespan:	100000
277V:	N/A	Lumens:	2119
Input Watts:	23W	Efficacy:	92 LPW
Efficiency:	78%		

Technical Specifications

Electrical

Photocell:

120V Button Photocell Included. Photocell is only compatible with 120V.

Driver:

Constant Current, Class 2, 100 - 277V, 50 - 60 Hz, 100 - 277VAC 0.4 Amps.

Dimming Driver:

Driver includes dimming control wiring for 0-10V dimming systems. Requires separate 0-10V DC dimming circuit. Dims as low as 10%.

Surge Protection:

6kV

Listings

DLC Listed:

This product is on the Design Lights Consortium (DLC) Qualified Products List and is eligible for rebates from DLC Member Utilities.
DLC Product Code: PZQ74BHM

UL Listing:

Suitable For Wet Locations. Suitable for ground mounting.

IESNA LM-79 & LM-80 Testing:

RAB LED luminaires have been tested by an independent laboratory in accordance with IESNA LM-79 and LM-80, and have received the Department of Energy "Lighting Facts" label.

LED Characteristics

Lifespan:

100,000-hour LED lifespan based on IES LM-80 results and TM-21 calculations.

LEDs:

Multi-chip, high-output, long-life LEDs

Color Consistency:

3-step MacAdam Ellipse binning to achieve consistent fixture-to-fixture color.

Color Stability:

LED color temperature is warrantied to shift no more than 200K in CCT over a 5 year period.

Color Uniformity:

RAB's range of CCT (Correlated Color Temperature) follows the guidelines of the American National Standard for (SSL) Products, ANSI C78.377-2015.

Construction

IP Rating:

Ingress Protection rating of IP66 for dust and water

Airflow:

Airflow technology heat sink for superior cooling.

Ambient Temperature:

SuitableFor use in 40°C (104°F) ambient temperatures.

Cold Weather Starting:

Minimum starting temperature is -40°C (-40°F)

Thermal Management Housing:

Die-cast aluminum housing, lens frame and mounting arm.

Mounting:

Heavy-duty mounting arm with "O" ring seal & stainless steel screw.

Reflector:

Semi-specular anodized aluminum.

Gaskets:

High-temperature silicone gaskets

Finish:

Formulated for high-durability and long lasting color.

Green Technology:

Mercury and UV free. RoHS compliant components. Polyester powder coat finish formulated without the use of VOC or toxic heavy metals.

Optical

NEMA Type:

NEMA Beam Spread of 7H x 6V

Other

California Title 24:

FFLED18/PC complies with 2013 California Title 24 building and electrical codes as a commercial outdoor non-pole-mounted fixture < 30 Watts.

Warranty:

RAB warrants that our LED products will be free from defects in materials and workmanship for a period of five (5) years from the date of delivery to the end user, including coverage of light output, color stability, driver performance and fixture finish.

Patents:

The FFLED design is protected by U.S. Pat. D643,147, Canada Pat. 140798, China Pat. ZL201130171304.1, Mexico Pat. 36757 and pending patent in Taiwan.

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Technical Specifications (continued)

Other

American Bureau of Shipping (ABS) :

For use on Mobile Offshore Drilling Units (MODU) and shipping vessels.

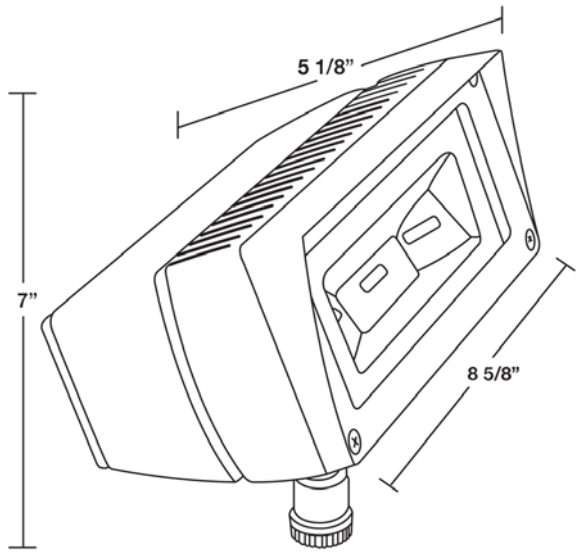
Equivalency:

Equivalent to 70W Metal Halide.

Buy American Act Compliance:

RAB values USA manufacturing! Upon request, RAB may be able to manufacture this product to be compliant with the Buy American Act (BAA). Please contact customer service to request a quote for the product to be made BAA compliant.

Dimensions



Features

- Ultra efficient LED and optical design
- Replaces 70W MH floodlights
- 100,000 hour life based on LM-80 tests
- NEMA type - 7H x 6V
- Air-flow technology heatsink
- 5-year warranty

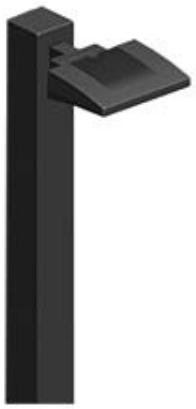
Ordering Matrix

Family	Wattage	Mounting	Color Temp	NEMA Type	Finish	Photocell Options
FFLED						
	18 = 18W	**Blank** = Swivel Arm	**Blank** = 5000K (Cool) **N** = 4000K (Neutral) **Y** = 3000K (Warm)	**Blank** = 7H x 6V	**Blank** = Bronze **W** = White	**Blank** = No Option **/PC** = 120V Photocell **/PC2** = 277V Photocell **/PCS** = 120V Swivel Photocell **/PCS2** = 277V Swivel Photocell

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ALED18N

RAB Outdoor



Color: Bronze

Weight: 6.5 lbs

Project:	Type:
Prepared By:	Date:

Driver Info		LED Info	
Type	Constant Current	Watts	18W
120V	0.17A	Color Temp	4000K (Neutral)
208V	0.11A	Color Accuracy	71 CRI
240V	0.09A	L70 Lifespan	100,000
277V	0.08A	Lumens	2,657
Input Watts	20.5W	Efficacy	129.6 LPW

Technical Specifications

Listings

UL Listing:

Suitable for wet locations

IESNA LM-79 & IESNA LM-80 Testing:

RAB LED luminaires and LED components have been tested by an independent laboratory in accordance with IESNA LM-79 and LM-80.

Dark Sky Conformance:

Conforms to (allows for conformance to) the IDA's fully shielding requirement, emitting no light above 90 degrees (with the exclusion of incidental light reflecting from fixture housing, mounts, and pole).

DLC Listed:

This product is listed by Design Lights Consortium (DLC) as an ultra-efficient premium product that qualifies for the highest tier of rebates from DLC Member Utilities.
DLC Product Code: P0000175K

LED Characteristics

Lifespan:

100,000-hour LED lifespan based on IES LM-80 results and TM-21 calculations

LED:

Multi-chip, high-output, long-life LED

Color Consistency:

3-step MacAdam Ellipse binning to achieve consistent fixture-to-fixture color

Color Stability:

LED color temperature is warrantied to shift no more than 200K in CCT over a 5-year period

Color Uniformity:

RAB's range of CCT (Correlated Color Temperature) follows the guidelines of the American National Standard for Specifications for the Chromaticity of Solid State Lighting (SSL) Products, ANSI C78.377-2017.

Construction

IES Classification:

The Type III distribution is ideal for roadway, general parking, and other area lighting applications where a larger pool of lighting is required. It is intended to be located near the side of the area, allowing the light to project outward and fill the area.

Effective Projected Area:

EPA = 0.27

Maximum Ambient Temperature:

Suitable for use in 40°C (104°F)

Cold Weather Starting:

Minimum starting temperature is -40°C (-40°F)

Thermal Management:

Superior thermal management with external "Air-Flow" fins

Finish:

Our environmentally friendly polyester powder coatings are formulated for high-durability and long-lasting color

Reflector:

Semi-specular, vacuum-metalized polycarbonate

Gaskets:

High-temperature silicone gaskets

Housing:

Die-cast aluminum housing, lens frame and mounting arm

Mounting:

Heavy-duty mounting arm with "O" ring seal & stainless steel screws

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Technical Specifications (continued)

Construction

Green Technology:

Mercury and UV free. RoHS-compliant components.

Other

Warranty:

RAB warrants that our LED products will be free from defects in materials and workmanship for a period of five (5) years from the date of delivery to the end user, including coverage of light output, color stability, driver performance and fixture finish. RAB's warranty is subject to all terms and conditions found at www.rablighting.com/legal#warranty

Equivalency:

Equivalent to 100W Pulse Start Metal Halide

Buy American Act Compliance:

RAB values USA manufacturing! Upon request, RAB may be able to manufacture this product to be compliant with the Buy American Act (BAA). Please contact customer service to request a quote for the product to be made BAA compliant.

Optical

BUG Rating:

B1 U0 G0

Electrical

Driver:

Constant Current, Class 2, 100-277V, 50/60 Hz., 4KV surge protection, 120V: 0.19A, 208V: 0.11A, 240V: 0.10A, 277V: 0.08A

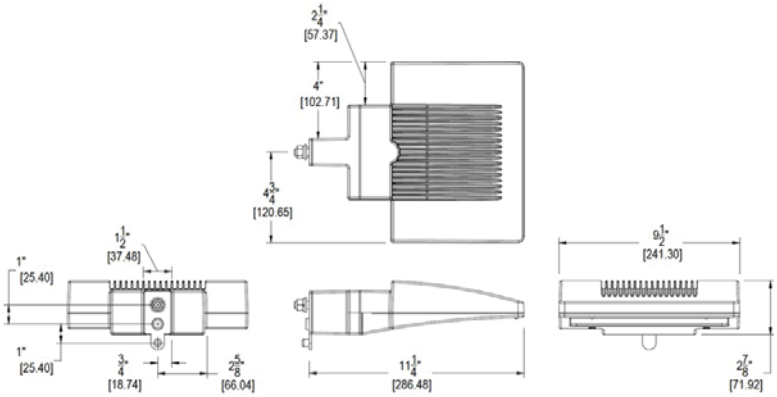
THD:

9.77% at 120V, 18.41% at 277V

Power Factor:

99.2% at 120V, 91.5% at 277V

Dimensions



Features

- High output LED light engine
- Maintains 70% of initial lumens at 100,000-hours
- Weatherproof high temperature silicone gaskets
- Superior heat sinking with die cast aluminum housing and external fins

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ALED4T125N

RAB Outdoor



Color: Bronze

Weight: 32.4 lbs

Project:	Type:
Prepared By:	Date:

Driver Info

Type	Constant Current
120V	1.12A
208V	0.70A
240V	0.61A
277V	0.52A
Input Watts	133.2W

LED Info

Watts	125W
Color Temp	4000K (Neutral)
Color Accuracy	71 CRI
L70 Lifespan	100,000
Lumens	15,760
Efficacy	118.3 LPW

Technical Specifications

Listings

UL Listing:

Suitable for wet locations

IESNA LM-79 & IESNA LM-80 Testing:

RAB LED luminaires and LED components have been tested by an independent laboratory in accordance with IESNA LM-79 and LM-80.

Dark Sky Conformance:

Conforms to (allows for conformance to) the IDA's fully shielding requirement, emitting no light above 90 degrees (with the exclusion of incidental light reflecting from fixture housing, mounts, and pole).

DLC Listed:

This product is on the Design Lights Consortium (DLC) Qualified Products List and is eligible for rebates from DLC Member Utilities.
DLC Product Code: P0000177O

LED Characteristics

Lifespan:

100,000-hour LED lifespan based on IES LM-80 results and TM-21 calculations

LEDs:

Multi-chip, high-output, long-life LEDs

Color Stability:

LED color temperature is warrantied to shift no more than 200K in CCT over a 5-year period

Color Uniformity:

RAB's range of CCT (Correlated Color Temperature) follows the guidelines of the American National Standard for Specifications for the Chromaticity of Solid State Lighting (SSL) Products, ANSI C78.377-2017.

Construction

IES Classification:

The Type IV distribution (also known as a Forward Throw) is especially suited for mounting on the sides of buildings and walls, and for illuminating the perimeter of parking areas. It produces a semiCircular distribution with essentially the same candlepower at lateral angles from 90° to 270°.

Effective Projected Area:

EPA = 0.75

Maximum Ambient Temperature:

Suitable for use in 40°C (104°F)

Cold Weather Starting:

Minimum starting temperature is -40°C (-40°F)

Thermal Management:

Superior thermal management with external "Air-Flow" fins

Lens:

Tempered glass lens included

Housing:

Die-cast aluminum housing, lens frame and mounting arm

Mounting:

Universal mounting arm compatible for hole spacing patterns from 1" to 5 1/2" center to center. Round Pole Adaptor plate included as a standard. Easy slide and lock to mount fixture with ease. Round pole diameter must be >4" to mount fixtures at 90° orientation.

Reflector:

Specular vacuum-metallized polycarbonate

Gaskets:

High-temperature silicone gaskets

IP Rating:

Ingress Protection rating of IP66 for dust and water

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Technical Specifications (continued)

Construction

Finish:

Formulated for high durability and long-lasting color

Green Technology:

Mercury and UV free. RoHS-compliant components.

Electrical

Surge Protection:

4kV

Driver:

One Driver, Constant Current, Class 2, 1800mA 100-277V, 50-60Hz, Power Factor 99%

THD:

5.4% at 120V, 15.5% at 277V

Power Factor:

99.4% at 120V, 92.1% at 277V

Optical

BUG Rating:

B1 U0 G2

Other

BAA Compliance:

Click www.rablighting.com/product/ALED4T125N USA for BAA compliance.

Warranty:

RAB warrants that our LED products will be free from defects in materials and workmanship for a period of five (5) years from the date of delivery to the end user, including coverage of light output, color stability, driver performance and fixture finish. RAB's warranty is subject to all terms and conditions found at www.rablighting.com/legal#warranty

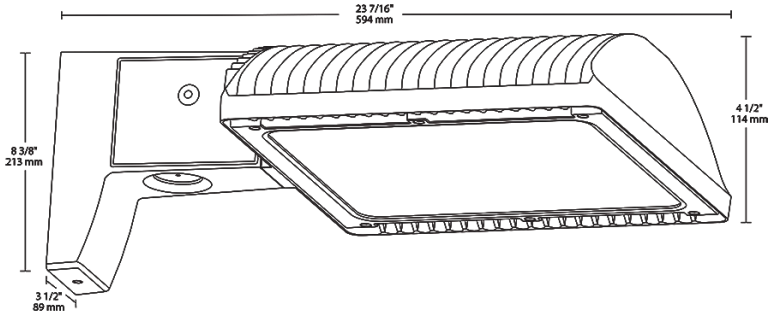
Equivalency:

Equivalent to 575W Pulse Start Metal Halide

Buy American Act Compliance:

RAB values USA manufacturing! Upon request, RAB may be able to manufacture this product to be compliant with the Buy American Act (BAA). Please contact customer service to request a quote for the product to be made BAA compliant.

Dimensions



Features

- 66% energy cost savings vs. HID
- 100,000-hour LED lifespan
- 5-Year, No-Compromise Warranty

Ordering Matrix

Family	Optics	Wattage	Mounting	Color Temp	Finish	Driver Options	Options	Other Options
ALED	4T	125		N				
	4T = Type IV **3T =** Type III **2T =** Type II	**50 =** 50W **78 =** 78W **105 =** 105W **125 =** 125W **150 =** 150W	**Blank =** Pole mount **SF =** Slipfitter	**Blank =** 5000K (Cool) **N =** 4000K (Neutral) **Y =** 3000K (Warm)	**Blank =** Bronze **RG =** Roadway Gray **W =** White **K =** Black	**Blank =** 120-277V **/480 =** 480V **/BL =** Bi-Level **/D10 =** 0-10V Dimming	**Blank =** No Option **/LC =** Lightcloud® Controller **/PCS =** 120V Swivel Photocell **/PCS2 =** 277V Swivel Photocell **/PCT =** 120-277V Twistlock Photocell **/PCS4 =** 480V Swivel Photocell **/PCT4 =** 480V Twistlock Photocell **/WS2 =** Multi-Level Motion Sensor 20 ft. **/WS4 =** Multi-Level Motion Sensor 40 ft.	**Blank =** Standard **USA =** BAA Compliant

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LED ENCLOSED RATED OMNIDIRECTIONAL A-LAMP
A19 GEN 6 SERIES



6W, 9W & 11W



15W



GU24 Base

PRODUCT DESCRIPTION:

MaxLite's LED enclosed rated Omnidirectional A-Line lamp replicate true A19 incandescents. They are suited to a wide variety of residential and commercial applications, including pendants, wall sconces and table and floor lamps.

FEATURES:

- 6W, 480lm, 40W Inc. replacement
- 9W, 800lm, 60W Inc. replacement
- 11W, 1100lm, 75W Inc. replacement
- 15W, 1600lm, 100W Inc. replacement
- Dimmable down to 10%
- Power factor: ≥ 0.70
- 25,000 hour life (L70 standards)
- CRI: ≥ 80
- Volts: 120V
- ENERGY STAR certified
- Available in E26 and GU24 base
- Suitable for dry and damp locations
- Suitable for use in fully enclosed luminaires
- Five year limited warranty

APPLICATIONS

- Pendants
- Table and floor lamps
- Sconces

ORDERING:

MODEL SELECTION (Full list of order codes on pg. 2) | Typical order example: E9A19DLED27/G6

		DLED		/G6
FAMILY	**BASE**	**DIMMABILITY**	**CCT**	**GENERATION**
E6A19 = 6 watts, A19 **E9A19 =** 9 watts, A19 **E11A19 =** 11 watts, A19 **E15A19 =** 15 watts, A19	**(OMIT) =** E26 **GU =** GU24	**DLED =** Dimmable	**27 =** 2700K **30 =** 3000K **40 =** 4000K **50 =** 5000K*	**/G6 =** Generation 6

NOTES:

1. E6A19DLED27/G6 is available in bulk pack (50pcs)
2. E9A19DLED27/G6 is available in 4-Packs and bulk pack (50pcs)

* 5000K CCT is only available as E9A19GUDLED50/G6

SPECIFICATIONS:

ITEM	SPECIFICATION	DETAILS			
		E6A19DLEDxx/G6	E9A19DLEDxx/G6	E11A19DLEDxx/G6	E15A19DLEDxx/G6
GENERAL PERFORMANCE	Power Consumption	6W	9W	11W	15W
	Lumens Delivered	480	800	1100	1600
	Efficacy (lm/w)	80	88	100	106
	CRI	≥80			
	Color Temperature (CCT)	2700K, 3000K, 4000K, 5000K*			
	Lumen Maintenance (L70)	25,000 Hours			
ELECTRICAL	Power Factor	≥0.70			
	Input Voltage	120V			
PHYSICAL	Base Type	E26			
	Operating Temperature	-4°F - 104°F			
CERTIFICATION	Certification	ENERGY STAR, UL Listed, FCC, RoHS Compliant			
	Environment	Dry, Damp			
	Warranty	5 Year Limited			

Lighting layouts and spacing criteria available upon request

* 5000K CCT is only available as E9A19GUDLED50/G6

ORDERING:

ORDER CODE	MODEL	ENERGY STAR	WATTS	EQUIVALENCY	DELIVER LUMENS	EFFICACY (lm/W)	CRI	CCT	DIMENSIONS (W" x MOL")
E26 Base									
14099390	E6A19DLED27/G6	★	6	40W Inc.	480	80	80	2700K	2.36" x 4.25"
14099391	E6A19DLED27/G6/BP	★	6	40W Inc.	480	80	80	2700K	
14099392	E6A19DLED30/G6	★	6	40W Inc.	480	80	80	3000K	
14099393	E6A19DLED40/G6	★	6	40W Inc.	480	80	80	4000K	
14099394	E9A19DLED27/G6	★	9	60W Inc.	800	88	80	2700K	
14099395	E9A19DLED27/G6/4P	★	9	60W Inc.	800	88	80	2700K	
14099396	E9A19DLED27/G6/BP	★	9	60W Inc.	800	88	80	2700K	
14099397	E9A19DLED30/G6	★	9	60W Inc.	800	88	80	3000K	
14099398	E9A19DLED40/G6	★	9	60W Inc.	800	88	80	4000K	
14099399	E11A19DLED27/G6	★	11	75W Inc.	1100	100	80	2700K	
14099400	E11A19DLED30/G6	★	11	75W Inc.	1100	100	80	3000K	
14099401	E11A19DLED40/G6	★	11	75W Inc.	1100	100	80	4000K	
14099402	E15A19DLED27/G6	★	15	100W Inc.	1600	106	80	2700K	2.36" x 4.61"
14099403	E15A19DLED30/G6	★	15	100W Inc.	1600	106	80	3000K	
14099404	E15A19DLED40/G6	★	15	100W Inc.	1600	106	80	4000K	

★ **ENERGY STAR certified**

ORDER CODE	MODEL	ENERGY STAR	WATTS	EQUIVALENCY	DELIVER LUMENS	EFFICACY (lm/W)	CRI	CCT	DIMENSIONS (W" x MOL")
GU24 Base									
14099405	E6A19GUDLED27/G6	★	6	40W Inc.	480	80	80	2700K	2.36" x 4.21"
14099406	E6A19GUDLED30/G6	★	6	40W Inc.	480	80	80	3000K	
14099407	E6A19GUDLED40/G6	★	6	40W Inc.	480	80	80	4000K	
14099408	E9A19GUDLED27/G6	★	9	60W Inc.	800	89	80	2700K	
14099409	E9A19GUDLED30/G6	★	9	60W Inc.	800	89	80	3000K	
14099410	E9A19GUDLED40/G6	★	9	60W Inc.	800	89	80	4000K	
100759	E9A19GUDLED50/G6	★	9	60W Inc.	800	89	80	5000K	
14099411	E11A19GUDLED27/G6	★	11	75W Inc.	1100	100	80	2700K	
14099412	E11A19GUDLED30/G6	★	11	75W Inc.	1100	100	80	3000K	
14099413	E11A19GUDLED40/G6	★	11	75W Inc.	1100	100	80	4000K	
14099414	E15A19GUDLED27/G6	★	15	100W Inc.	1600	106	83	2700K	2.36" x 4.61"
14099415	E15A19GUDLED30/G6	★	15	100W Inc.	1600	106	83	3000K	
14099416	E15A19GUDLED40/G6	★	15	100W Inc.	1600	106	83	4000K	

★ **ENERGY STAR certified**

COMPATIBLE DIMMERS FOR E6A19DLEDXX/G6 & E6A19GUDLEDXX/G6:

BRAND	MODEL	COMPATIBLE
ADRONE	ADPD453LW2	NO
	ADTP703TUW4	YES
	ADWR703HW4	YES
AH	SDM/600	YES
	SDM3/1000	NO
CONFORTO COMODIDADE	DLE-01	NO
COOPER	AAL06-C1	NO
	DAL06P-C2-K	NO
	SAL06P-W-K	NO
	TAL06P-C2-K	NO
CTL	DM600-12-3	YES
EATON	AAL06-C1	NO
	SAL06P-LA-K	NO
	TAL06P1-C5	NO
GE	18024	NO
HALO	SAL06P-W-HALOGF2	NO
LEGRAND	HCL453PTC	YES
	RHCL453PW	YES
LEVITON	6681	YES
	6684	YES
	603-6631-A	YES
	6631-A	YES
	6631-LA	YES
	6631-LA	NO
	6683	NO
	6683-10Z	YES
	6683-IW	NO
	IPE04-1LZ 400VA	NO
	IPI06	NO
	IPI06-1LZ	YES
	IPI10-1LZ	NO
	NO.6631	YES
	NO.6672	YES
	NO.6674	NO
	NO.6681	NO
	NO.6681	NO
	NO.IPL06	YES
	S-600P-WH	NO
LUS	DM600-15L	NO
LUTRON	AY-600PH-WH	NO
	AYCL-153P-WH	YES
	AYCL-153PH	YES
	CT-103P-WH	YES
	CT-600PR-WH	NO
	CTCL-153P-WH	NO

BRAND	MODEL	COMPATIBLE
LUTRON	CTCL-153PDH-WH	YES
	D-600PH-3CK	NO
	D-600PH-DK	YES
	D-600R-IV	YES
	D-600R-WH	YES
	D-600RH-DK	YES
	DV-600P-WH	NO
	DV-600PH-WH	YES
	DV-603P	NO
	DV-603PH-WH	YES
	DV-603PH-WH	YES
	DV-603PR	NO
	DVCL-153P-WH	YES
	DVCL-153P-WH	NO
	DVCL-153P-WH-3	YES
	DVCL-153PH	NO
	DVCL-153PR-WH	YES
	DVCL-253PH	YES
	DVELV-300P-WH	NO
	DVELV-303P-WH	YES
	DVW-600PH-WH	NO
	DVWCL-153PH-WH	NO
	DVWCL-153PH-WHC	NO
	LECL-153PH-WH	YES
	LGCL-153CL	NO
	MACL-153M-WH	YES
	MACL-153MH-WH	YES
	MACL-153MLH-WH	YES
	MACL-153MLRHW-WH	YES
	MACL-153MR-WH	YES
	MAELV-600-WH	YES
	MAW-600	NO
	MAW-600H-AL	NO
	MAW-600H-WH	NO
	MIR-600THW-WH	NO
	MRF2-6CL-WH	NO
	MSCL-OP153MH-WH	YES
	PD-6WCL-WH-P	NO
	S-10PH	YES
	S-600	YES
	S-600-AL	YES
	S-600-IV	YES
	S-600H-WH	YES
	S-600P-WH	NO
	S-600PR-WH	NO

BRAND	MODEL	COMPATIBLE
LUTRON	S-603PGH-WH	NO
	S-603PH-WH	NO
	SCL-153P-WH	NO
	SCL-153PH-WH	NO
	SCL-153PH-WH	YES
	TG-600PH-IV	YES
	TG-600PH-WH	NO
	TG-600PNLH-WH	NO
	TG-603PGH-WH	NO
	TGCL-153PH-WH	YES
	TGCL-153PH-WH	NO
	TGCL-153PLH-WH	NO
LUX	DM600-12	YES
MAXXIMA	MEW-DM600	YES
RHINE	UC7067RYE	NO
TAANCIL	Dim-L13B	NO

COMPATIBLE DIMMERS FOR E9A19DLEDXX/G6 & E9A19GUDLEDXX/G6:

BRAND	MODEL	COMPATIBLE
ADRONE	ADPD453LW2	YES
	ADTP703TUW4	NO
	ADWR703HW4	YES
AH	SDM/600	YES
	SDM3/1000	NO
CONFORTO COMODIDADE	DLE-01	NO
COOPER	AAL06-C1	NO
	DAL06P-C2-K	NO
	SAL06P-W-K	NO
	TAL06P-C2-K	NO
CTL	DM600-12-3	YES
EATON	AAL06-C1	NO
	SAL06P-LA-K	NO
	TAL06P1-C5	NO
GE	18024	NO
HALO	SAL06P-W-HALOGF2	NO
LEGRAND	HCL453PTC	YES
	RHCL453PW	YES
LEVITON	6681	YES
	6684	YES
	603-6631-A	YES
	6631-A	YES
	6631-LA	YES
	6631-LA	NO
	6683	NO
	6683-10Z	YES
	6683-IW	NO
	IPE04-1LZ 400VA	NO
	IPI06	NO
	IPI06-1LZ	YES
	IPI10-1LZ	NO
	NO.6631	YES
	NO.6672	YES
	NO.6674	NO
	NO.6681	NO
	NO.6681	NO
	NO.IPL06	YES
	S-600P-WH	NO
LUS	DM600-15L	NO
LUTRON	AY-600PH-WH	NO
	AYCL-153P-WH	YES
	AYCL-153PH	YES
	CT-103P-WH	YES
	CT-600PR-WH	NO
	CTCL-153P-WH	NO

BRAND	MODEL	COMPATIBLE
LUTRON	CTCL-153PDH-WH	YES
	D-600PH-3CK	NO
	D-600PH-DK	YES
	D-600R-IV	YES
	D-600R-WH	YES
	D-600RH-DK	YES
	DV-600P-WH	NO
	DV-600PH-WH	YES
	DV-603P	NO
	DV-603PH-WH	YES
	DV-603PH-WH	YES
	DV-603PR	NO
	DVCL-153P-WH	YES
	DVCL-153P-WH	NO
	DVCL-153P-WH-3	YES
	DVCL-153PH	NO
	DVCL-153PR-WH	YES
	DVCL-253PH	YES
	DVELV-300P-WH	NO
	DVELV-303P-WH	YES
	DVW-600PH-WH	NO
	DVWCL-153PH-WH	NO
	DVWCL-153PH-WHC	NO
	LECL-153PH-WH	YES
	LGCL-153CL	NO
	MACL-153M-WH	YES
	MACL-153MH-WH	YES
	MACL-153MLH-WH	YES
	MACL-153MLRHW-WH	YES
	MACL-153MR-WH	YES
	MAELV-600-WH	YES
	MAW-600	NO
	MAW-600H-AL	NO
	MAW-600H-WH	NO
	MIR-600THW-WH	NO
	MRF2-6CL-WH	NO
	MSCL-OP153MH-WH	YES
	PD-6WCL-WH-P	NO
	S-10PH	YES
	S-600	YES
	S-600-AL	YES
	S-600-IV	YES
	S-600H-WH	YES
	S-600P-WH	NO
	S-600PR-WH	NO

BRAND	MODEL	COMPATIBLE
LUTRON	S-603PGH-WH	NO
	S-603PH-WH	NO
	SCL-153P-WH	NO
	SCL-153PH-WH	NO
	SCL-153PH-WH	YES
	TG-600PH-IV	YES
	TG-600PH-WH	NO
	TG-600PNLH-WH	NO
	TG-603PGH-WH	NO
	TGCL-153PH-WH	YES
	TGCL-153PH-WH	NO
	TGCL-153PLH-WH	NO
LUX	DM600-12	YES
MAXXIMA	MEW-DM600	YES
RHINE	UC7067RYE	NO
TAANCIL	Dim-L13B	NO

Specifications are subject to change without notice.

COMPATIBLE DIMMERS FOR E11A19DLEDXX/G6 & E11A19GUDLEDXX/G6:

BRAND	MODEL	COMPATIBLE
ADRONE	ADPD453LW2	NO
	ADTP703TUW4	NO
	ADWR703HW4	NO
AH	SDM/600	NO
	SDM3/1000	NO
CONFORTO COMODIDADE	DLE-01	YES
COOPER	AAL06-C1	NO
	DAL06P-C2-K	NO
	SAL06P-W-K	NO
	TAL06P-C2-K	NO
CTL	DM600-12-3	YES
EATON	AAL06-C1	NO
	SAL06P-LA-K	NO
	TAL06P1-C5	NO
GE	18024	NO
HALO	SAL06P-W-HALOGF2	NO
LEGRAND	HCL453PTC	YES
LEVITON	RHCL453PW	YES
	6681	NO
	6684	NO
	603-6631-A	NO
	6631-A	NO
	6631-LA	YES
	6631-LA	NO
	6683	NO
	6683-10Z	NO
	6683-IW	NO
	IPE04-1LZ 400VA	NO
	IPI06	YES
	IPI06-1LZ	YES
	IPI10-1LZ	NO
	NO.6631	YES
	NO.6672	YES
	NO.6674	YES
	NO.6681	NO
	NO.6681	YES
	NO.IPL06	YES
LUS	S-600P-WH	NO
LUTRON	DM600-15L	NO
	AY-600PH-WH	YES
	AYCL-153P-WH	YES
	AYCL-153PH	YES
	CT-103P-WH	YES
	CT-600PR-WH	YES
	CTCL-153P-WH	NO

BRAND	MODEL	COMPATIBLE
LUTRON	CTCL-153PDH-WH	YES
	D-600PH-3CK	NO
	D-600PH-DK	YES
	D-600R-IV	NO
	D-600R-WH	NO
	D-600RH-DK	YES
	DV-600P-WH	YES
	DV-600PH-WH	YES
	DV-603P	YES
	DV-603PH-WH	YES
	DV-603PH-WH	NO
	DV-603PR	NO
	DVCL-153P-WH	YES
	DVCL-153P-WH	YES
	DVCL-153P-WH-3	YES
	DVCL-153PH	YES
	DVCL-153PR-WH	YES
	DVCL-253PH	YES
	DVELV-300P-WH	NO
	DVELV-303P-WH	YES
	DVW-600PH-WH	NO
	DVWCL-153PH-WH	YES
	DVWCL-153PH-WHC	YES
	LECL-153PH-WH	YES
	LGCL-153CL	NO
	MACL-153M-WH	YES
	MACL-153MH-WH	YES
	MACL-153MLH-WH	YES
	MACL-153MLRHW-WH	YES
	MACL-153MR-WH	YES
	MAELV-600-WH	YES
	MAW-600	NO
	MAW-600H-AL	YES
	MAW-600H-WH	NO
	MIR-600THW-WH	NO
	MRF2-6CL-WH	NO
	MSCL-OP153MH-WH	YES
	PD-6WCL-WH-P	NO
	S-10PH	YES
	S-600	YES
	S-600-AL	NO
	S-600-IV	YES
	S-600H-WH	YES
	S-600P-WH	NO
	S-600PR-WH	NO

BRAND	MODEL	COMPATIBLE
LUTRON	S-603PGH-WH	NO
	S-603PH-WH	NO
	SCL-153P-WH	YES
	SCL-153PH-WH	NO
	SCL-153PH-WH	YES
	TG-600PH-IV	NO
	TG-600PH-WH	YES
	TG-600PNLH-WH	NO
	TG-603PGH-WH	NO
	TGCL-153PH-WH	NO
	TGCL-153PH-WH	YES
	TGCL-153PLH-WH	NO
LUX	DM600-12	NO
MAXXIMA	MEW-DM600	YES
OLEGRAND	UC7067RYE	YES
RHINE	Dim-L13B	YES
TAANCIL	Dim-L13B	YES

COMPATIBLE DIMMERS FOR E15A19DLEDXX/G6 & E15A19GUDLEDXX/G6:

BRAND	MODEL	COMPATIBLE
ADRONE	ADPD453LW2	NO
	ADTP703TUW4	NO
	ADWR703HW4	NO
AH	SDM/600	NO
	SDM3/1000	NO
CONFORTO COMODIDADE	DLE-01	YES
COOPER	AAL06-C1	NO
	DAL06P-C2-K	NO
	SAL06P-W-K	NO
	TAL06P-C2-K	NO
CTL	DM600-12-3	YES
EATON	AAL06-C1	NO
	SAL06P-LA-K	NO
	TAL06P1-C5	NO
GE	18024	NO
HALO	SAL06P-W-HALOGF2	NO
LEGRAND	HCL453PTC	YES
	RHCL453PW	YES
LEVITON	6681	NO
	6684	NO
	603-6631-A	NO
	6631-A	NO
	6631-LA	YES
	6631-LA	NO
	6683	NO
	6683-10Z	NO
	6683-IW	NO
	IPE04-1LZ 400VA	NO
	IPI06	YES
	IPI06-1LZ	YES
	IPI10-1LZ	NO
	NO.6631	YES
	NO.6672	YES
	NO.6674	YES
	NO.6681	NO
	NO.6681	YES
	NO.IPL06	YES
	S-600P-WH	NO
LUS	DM600-15L	NO
LUTRON	AY-600PH-WH	YES
	AYCL-153P-WH	YES
	AYCL-153PH	YES
	CT-103P-WH	YES
	CT-600PR-WH	YES
	CTCL-153P-WH	NO

BRAND	MODEL	COMPATIBLE
LUTRON	CTCL-153PDH-WH	YES
	D-600PH-3CK	NO
	D-600PH-DK	YES
	D-600R-IV	NO
	D-600R-WH	NO
	D-600RH-DK	YES
	DV-600P-WH	YES
	DV-600PH-WH	YES
	DV-603P	YES
	DV-603PH-WH	YES
	DV-603PH-WH	NO
	DV-603PR	NO
	DVCL-153P-WH	YES
	DVCL-153P-WH	YES
	DVCL-153P-WH-3	YES
	DVCL-153PH	YES
	DVCL-153PR-WH	YES
	DVCL-253PH	YES
	DVELV-300P-WH	NO
	DVELV-303P-WH	YES
	DVW-600PH-WH	NO
	DVWCL-153PH-WH	YES
	DVWCL-153PH-WHC	YES
	LECL-153PH-WH	YES
	LGCL-153CL	NO
	MACL-153M-WH	YES
	MACL-153MH-WH	YES
	MACL-153MLH-WH	YES
	MACL-153MLRHW-WH	YES
	MACL-153MR-WH	YES
	MAELV-600-WH	YES
	MAW-600	NO
	MAW-600H-AL	YES
	MAW-600H-WH	NO
	MIR-600THW-WH	NO
	MRF2-6CL-WH	NO
	MSCL-OP153MH-WH	YES
	PD-6WCL-WH-P	NO
	S-10PH	YES
	S-600	YES
	S-600-AL	NO
	S-600-IV	YES
	S-600H-WH	YES
	S-600P-WH	NO
	S-600PR-WH	NO

BRAND	MODEL	COMPATIBLE
LUTRON	S-603PGH-WH	NO
	S-603PH-WH	NO
	SCL-153P-WH	YES
	SCL-153PH-WH	NO
	SCL-153PH-WH	YES
	TG-600PH-IV	NO
	TG-600PH-WH	YES
	TG-600PNLH-WH	NO
	TG-603PGH-WH	NO
	TGCL-153PH-WH	NO
	TGCL-153PH-WH	YES
	TGCL-153PLH-WH	NO
LUX	DM600-12	NO
MAXXIMA	MEW-DM600	YES
RHINE	UC7067RYE	YES
TAANCIL	Dim-L13B	YES

MaxLiTe
A NEW WAVE OF LIGHT

PROJECT NAME:_____ CATALOG NUMBER:_____

NOTES:_____FIXTURE SCHEDULE:_____

LED FLAT PANEL EDGE LIT

MLFP SERIES G2



1x4



2x2



2x4

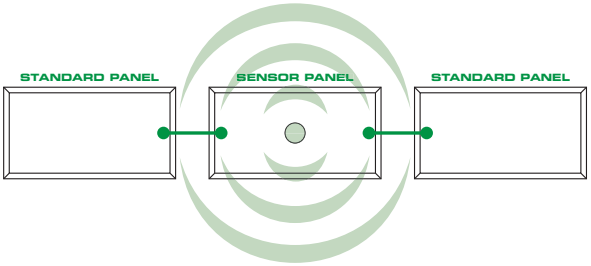
PRODUCT DESCRIPTION:

Typically used to replace 1'x4', 2'x2' and 2'x4' fluorescent fixtures, the FlatMax Edge Lit LED Flat Panel Series is designed to lay in drop ceilings in offices, schools, and healthcare applications. Utilizing 0-10v dimming protocols, the flat panels are fully dimmable, and are compatible with building controls, motion sensors, timers, and daylight harvesting systems.

The design of the panels produces an even, consistent shadowless light. The LEDs enable long life, high lumen maintenance, and are low maintenance and constructed without hazardous materials

FEATURES:

- Standard dimming: 0-10V dimming
- CRI: ≥80
- Fits standard T-bar and narrow grid drop ceilings
- Available in 1'x4', 2'x2' and 2'x4' sizes
- Standard white finish
- IC Rated for direct insulation contact
- Bi-Level motion sensor available behind lens for sleek appearance
- Multiple fixtures can be controlled by single sensor



APPLICATIONS:

FlatMax Edge Lit LED Flat Panels are the ideal energy-efficient replacements for fluorescent fixtures in offices, schools, hospitality, healthcare, and other commercials and industrial applications that require slim installation depth.

MODEL SELECTION (Full list of order codes on pg. 3-5) | Typical order example: MLFP22EP3550

MLFP					
FAMILY	**SIZE**	**WATTAGE (NOMINAL)**	**CCT**	**BATTERY BACKUP**	**MOTION SENSOR**
MLFP= Flat Panel Edge Lit	**14EP=** 1'x4'	**20=** 20W **30=** 30W **35=** 35W	**35=** 3500K **40/41=** 4000K/4100K **50=** 5000K	**(OMIT)=** None **EM=** Battery Backup Unit	**(OMIT) =** None **MS=** Motion Sensor
	22EP= 2'x2'	**20=** 20W **30=** 30W **35=** 35W			
	24EP= 2'x4'	**30=** 30W **40=** 40W **48=** 48W			

NOTES:

1. In the event of a power failure, the battery backup unit switches to emergency mode and operates the fixture for at 800 lumens for a minimum of 90 minutes.
2. 1x4 35W, 2x2 35W, and 2x4 48W MS models not DLC qualified.
3. 1x4 20W, 2x2 20W, and 2x4 30W EM models not DLC qualified.
4. 1x4 30W, 2x2 30W, and 2x4 40W not available with MS option.

SPECIFICATIONS:

ITEM	SPECIFICATION	MLFP 14EP2040	MLFP 14EP3041	MLFP 14EP3541	MLFP 22EP2040	MLFP 22EP3041	MLFP 22EP3541	MLFP 24EP3040	MLFP 24EP4041	MLFP 24EP4841
		DETAILS								
GENERAL PERFORMANCE	Wattage	18.9W	27.8W	35.1W	18.8W	28.6W	35.8W	27.6W	36.8W	44.6W
	Lumens Delivered (lm)	2,420 lm	3,300 lm	4,760 lm	2,415 lm	3,380 lm	4,550 lm	3,535 lm	4,290 lm	5,810 lm
	Efficacy (lm/W)	128 lm/W	120 lm/W	136 lm/W	129 lm/W	118 lm/W	127 lm/W	128 lm/W	117 lm/W	130 lm/W
	DLC	Premium	Standard	Premium	Premium	Standard	Premium	Premium	Standard	Premium
	CRI	≥80								
	Color Temperature (K)	3500, 4000/4100, 5000								
	L70 Lifetime (hours)	50,000								
	Color Consistency	Proprietary binning for uniform color								
ELECTRICAL	Power Factor	≥0.99								
	Input Voltage	120-277V								
	Compatible Dimmers	Designed to be compatible with most 0-10V dimmers								
PHYSICAL	Weight	9 lbs			10.6 lbs			15 lbs		
	Mounting	Mounts into standard T-Bar/Grid drop ceiling								
	Operating Temperature	-4°F to 104°F								
	Humidity	20-85% RH, non-condensing								
QUALIFICATION	Certifications	cULus, FCC, DLC 4.1 Premium, DLC Standard								
	Material Usage	RoHS compliant; no mercury								
	Environment	Indoor Damp / IC rated								
	Warranty	5 year standard, 10 year eligibility								

Lighting layouts and spacing criteria available upon request

OPTIONAL ACCESSORIES:

ORDER CODE	MODEL NUMBER	DESCRIPTION
99968	MLFPFK1X4-215	1x4 Flat Panel Flange Kit
99969	MLFPFK2X2-215	2x2 Flat Panel Flange Kit
99970	MLFPFK2X4-215	2x4 Flat Panel Flange Kit
100995	MLSMKFP14E-215	1x4 Edge Lit Surface Mount Kit
100996	MLSMKFP22E-215	2x2 Edge Lit Surface Mount Kit
100997	MLSMKFP24E-215	2x4 Edge Lit Surface Mount Kit
102258	MLCHK2X2-215	Cable Hanging Kit for 2x2 Edge Lit Flat Panel (4 Wires)
102259	MLCHK2X4-215	Cable Hanging Kit for 1x4 or 2x4 Edge Lit Flat Panel (6 Wires)
108133	RMHYTHRC-05	Remote Control for Motion Sensor Units

SENSOR OPTION	TECHNOLOGY	DIMMING	DAYLIGHT HARVESTING	REMOTE CONTROL	QR CODE
MS	High Frequency	Bi-Level	Set Point*	Yes	

For motion sensor settings and information, please visit www.maxlite.com/controls
***Daylight Harvesting feature not functional on flat panels**

1X4 ORDERING:

WATTAGE	CCT	MODEL NUMBER	ORDER CODE
20W	3500K	MLFP14EP2035	14099563
		MLFP14EP2035EM	14099731
		MLFP14EP2035MS	14099732
	4000K	MLFP14EP2040	14099564
		MLFP14EP2040EM	14099733
		MLFP14EP2040MS	14099734
	5000K	MLFP14EP2050	14099565
		MLFP14EP2050EM	14099735
		MLFP14EP2050MS	14099736
30W	3500K	MLFP14EP3035	105914
		MLFP14EP3035EM	108005
	4100K	MLFP14EP3041	105915
		MLFP14EP3041EM	108006
	5000K	MLFP14EP3050	108015
		MLFP14EP3050EM	105916
35W	3500K	MLFP14EP3535	108007
		MLFP14EP3535EM	107777
		MLFP14EP3535MS	108008
	4100K	MLFP14EP3541	101366
		MLFP14EP3541EM	107778
		MLFP14EP3541MS	108009
	5000K	MLFP14EP3550	101367
		MLFP14EP3550EM	107779
		MLFP14EP3550MS	101370

2X2 ORDERING:

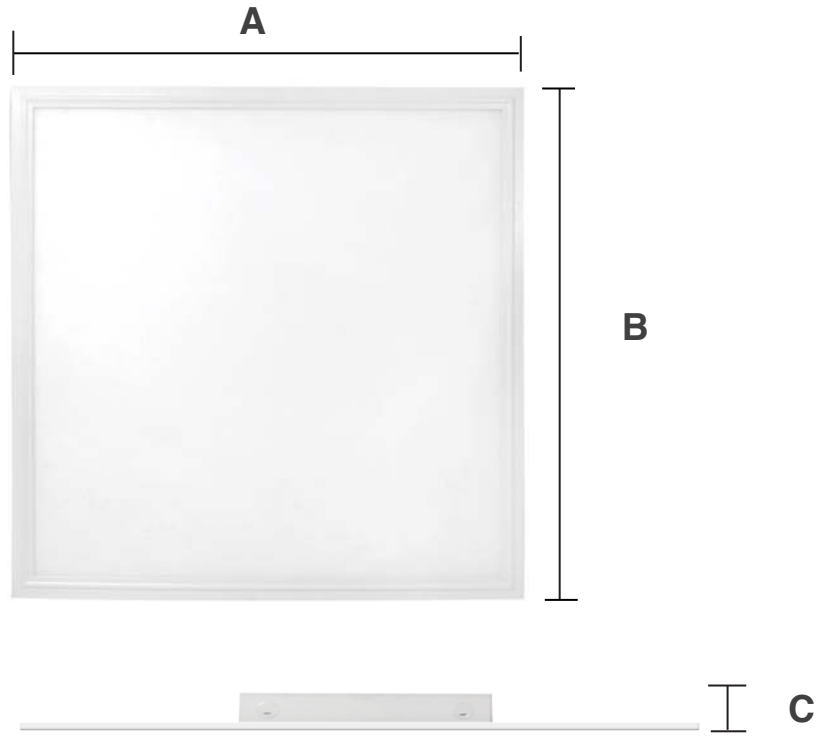
WATTAGE	CCT	MODEL NUMBER	ORDER CODE
20W	3500K	MLFP22EP2035	14099016
		MLFP22EP2035EM	14099737
		MLFP22EP2035MS	14099738
	4000K	MLFP22EP2040	14099254
		MLFP22EP2040EM	14099739
		MLFP22EP2040MS	14099740
	5000K	MLFP22EP2050	14099018
		MLFP22EP2050EM	14099741
		MLFP22EP2050MS	14099742
30W	3500K	MLFP22EP3035	105920
		MLFP22EP3035EM	108011
	4100K	MLFP22EP3041	105921
		MLFP22EP3041EM	108012
	5000K	MLFP22EP3050	105922
		MLFP22EP3050EM	108013
35W	3500K	MLFP22EP3535	107699
		MLFP22EP3535EM	108014
		MLFP22EP3535MS	14099786
	4100K	MLFP22EP3541	107700
		MLFP22EP3541EM	108015
		MLFP22EP3541MS	14099788
	5000K	MLFP22EP3550	107701
		MLFP22EP3550EM	108016
		MLFP22EP3550MS	14099790

2X4 ORDERING:

WATTAGE	CCT	MODEL NUMBER	ORDER CODE
30W	3500K	MLFP24EP3035	14099019
		MLFP24EP3035EM	14099743
		MLFP24EP3035MS	14099744
	4000K	MLFP24EP3040	14099255
		MLFP24EP3040EM	14099745
		MLFP24EP3040MS	14099746
	5000K	MLFP24EP3050	14099021
		MLFP24EP3050EM	14099747
		MLFP24EP3050MS	14099748
40W	3500K	MLFP24EP4035	105926
		MLFP24EP4035EM	108017
	4100K	MLFP24EP4041	105927
		MLFP24EP4041EM	108018
	5000K	MLFP24EP4050	105928
		MLFP24EP4050EM	108019
48W	3500K	MLFP24EP4835	107702
		MLFP24EP4835EM	108020
		MLFP24EP4835MS	14099792
	4100K	MLFP24EP4841	107703
		MLFP24EP4841EM	108021
		MLFP24EP4841MS	14099794
	5000K	MLFP24EP4850	107704
		MLFP24EP4850EM	108022
		MLFP24EP4850MS	14099796

DIMENSIONS:





PRODUCT	A	B	C
1x4	47.7”	11.9”	2.2”
2x2	23.8”	23.8”	2.2”
2x4	47.7”	23.8”	2.2”

MaxLiTe®
A NEW WAVE OF LIGHT

PROJECT NAME:_____ CATALOG NUMBER:_____

NOTES:_____FIXTURE SCHEDULE:_____

LED T8 - LINEAR REPLACEMENT LAMP

DOUBLE-ENDED POWER GLASS SERIES
UL TYPE-B



FEATURES:

- Wattages:
  -14W, 4FT, 1700-1800 lumens, replaces 32W fluorescent T8
  -17W, 4FT, 2100-2200 lumens, replaces 32W fluorescent T8
- Universal Voltage: 120V-277V applications
- Color Rendering Index (CRI): 82
- Beam angle: 330˚, uniform light distribution
- THD <20%
- Power factor: ≥ 0.90
- Easy retrofit into most common linear fluorescent fixtures
- Simple ballast bypass, double-ended wiring schematic
- **Compatible with shunted and non-shunted lamp holders**
- Instant on
- Mercury free and virtually no UV or IR light
- Non dimmable
- Suitable for enclosed fixture
- Suitable for dry and damp locations
- NSF certified
- 5 year limited warranty
- Rated Lifetime @ L_{70}: 50,000 Hours
- DLC qualifed

APPLICATIONS:

- Offices
- Commercial Buildings
- Hospitals
- Hotelsw
- Schools
- Recreation Centers

MODEL SELECTION (Full list of order codes on pg. 2) | Typical order example: L14T8DE435-G

L		T8	DE	4	
FAMILY	**WATTAGE**	**LAMP TYPE**	**OPERATION**	**LENGTH**	**COLOR TEMPERATURE**
L= LED Linear	**14=** 14W **17=** 17W	**T8=** T8 tube	**DE=** Double-Ended Power	**4=** 4FT	**35-G=** 3500K, Glass Lens **40-G=** 4000K, Glass Lens **50-G=** 5000K, Glass Lens

SPECIFICATIONS:

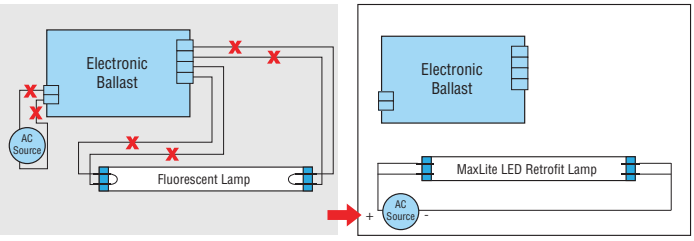
		L14T8DE4xx-G	L17T8DE4xx-G
ITEM	**SPECIFICATION**	**4FT - DETAILS**	**4FT - DETAILS**
GENERAL PERFORMANCE	Power Consumption (W)	14W	17W
	Lumens Delivered (lm)	1700-1800	2100-2200
	Efficacy	≥121 lm/w	≥123 lm/w
	CRI	82	
	Beam Angle	330°	
	Color Temperature (CCT)	3500K, 4000K, 5000K	
	Lumen Maintenance (L70)	50,000 Hours	
ELECTRICAL	Power Factor	≥ 0.90	
	Input Voltage	120V-277V, 50/60 Hz	
PHYSICAL	Operating Temperature	-4°F to 113°F	
	Dimension (MOL" x W")	47.72" x 1.02"	
	Lens	Glass	
CERTIFICATION	Certification	DLC 4.2, cULus Classified, NSF	
	Material Usage	RoHS compliant; no mercury	
	Environment	Dry & Damp, Enclosed Fixtures	
	Warranty	5 Years	

Lighting layouts and spacing criteria available upon request

ORDERING:

ORDER CODE	MODELS	WATTAGE	LUMENS (lm)	EFFICACY (lm/W)	COLOR TEMPERATURE (CCT)	CASE QTY
14099168	L14T8DE435-G	14W	1700	121	3500K	25 pcs
14099169	L14T8DE440-G		1800	128	4000K	
14099170	L14T8DE450-G		1800	128	5000K	
14099171	L17T8DE435-G	17W	2100	123	3500K	25 pcs
14099172	L17T8DE440-G		2200	129	4000K	
14099173	L17T8DE450-G		2200	129	5000K	

RELAMPING EXAMPLE:



MaxLiTe
A NEW WAVE OF LIGHT

PROJECT NAME:_____ CATALOG NUMBER:_____

NOTES:_____FIXTURE SCHEDULE:_____

LED T8 - LINEAR REPLACEMENT LAMP

DUAL-MODE/HYBRID SERIES UL TYPE A+B



PRODUCT DESCRIPTION:

MaxLite offers a safer, more reliable alternative to the dual-mode lamps on the market with the new Hybrid Series UL Type A/B LED T8 Lamp. Designed as a universal solution, the Hybrid Series lamp can be used with a compatible fluorescent ballast (UL-A) or ballast bypass (UL-B). Unlike competitors' lamps, the MaxLite product features improved integrated circuit (IC) technology that detects the lamp connection and corresponding operating mode. Each pin at the lamp base is engineered with a thermal fuse that detects overheating and responds by automatically shutting the lamp off. In addition, the lamp is packaged with a re-lamping label that provides a clear wiring description to help maintenance staff easily identify fixture modifications in the field. The MaxLite T8 also offers more robust ballast compatibility than competitors, including instant start, programmed start, emergency and dimming ballast compatibilities.

FEATURES:

- Wattage:
  - 9W, 2FT, ≥1350 lumens, replaces 17W fluorescent T8
  - 11W, 3FT, ≥1,600 lumens, replaces 25W fluorescent T8
  - 12W, 4FT, ≥1,800 lumens, replaces 32W fluorescent T8
- Voltage (UL TYPE-B): 120V-277V applications
- Color Rendering Index (CRI): ≥83
- Beam angle: 330˚
- THD <20%
- Power factor: ≥ 0.90
- Dual Mode: Can be used with compatible fluorescent ballast (UL-A) and ballast bypass (UL-B)
- Ballast bypass (UL-B): Can be wired for single-ended power or double-ended power.
- Compatible with shunted and non-shunted lamp holders
- Instant on
- Mercury free and virtually no UV or IR light
- Dimmable when used with compatible dimming ballast (UL-A)
- Suitable for enclosed fixture
- Suitable for dry and damp locations
- ETL Sanitation listed (tested under NSF standard)
- All glass construction with PET coating
- 5 year limited warranty
- Rated Lifetime @ L70: 50,000 Hours

MODEL SELECTION (Full list of order codes on pg. 2) — Typical order example: L9T8AB235-CG

L	9	T8	AB	2	
FAMILY	**WATTAGE**	**LAMP TYPE**	**OPERATION**	**LENGTH**	**COLOR TEMPERATURE**
L= LED Linear	**9=** 9W	**T8=** T8 tube	**AB=** Dual Mode A+B	**2=** 2FT	**35-CG=** 3500K, Coated Glass **40-CG=** 4000K, Coated Glass **50-CG=** 5000K, Coated Glass

L	11	T8	AB	3	
FAMILY	**WATTAGE**	**LAMP TYPE**	**OPERATION**	**LENGTH**	**COLOR TEMPERATURE**
L= LED Linear	**11=** 11W	**T8=** T8 tube	**AB=** Dual Mode A+B	**3=** 3FT	**35-CG=** 3500K, Coated Glass **40-CG=** 4000K, Coated Glass **50-CG=** 5000K, Coated Glass

L	12	T8	AB	4	
FAMILY	**WATTAGE**	**LAMP TYPE**	**OPERATION**	**LENGTH**	**COLOR TEMPERATURE**
L= LED Linear	**12=** 12W	**T8=** T8 tube	**AB=** Dual Mode A+B	**4=** 4FT	**35-CG=** 3500K, Coated Glass **40-CG=** 4000K, Coated Glass **50-CG=** 5000K, Coated Glass

SPECIFICATIONS:

ITEM	SPECIFICATION	L9T8AB2XX-CG 2FT - DETAILS	L11T8AB3XX-CG 3FT - DETAILS	L12T8AB4XX-CG 4FT - DETAILS
GENERAL PERFORMANCE	Bare Lamp Power (W)	8.5W	11.5W	12W
	System (UL-A) Power (W)	12W	14W	15.5W
	Bypass (UL-B) Power (W)	9W	12W	13W
	Lumens Delivered (lm)	1350-1420	1600-1650	1800-1900
	Efficacy (UL-A)	113-118 lm/w	114-118 lm/w	116-123 lm/w
	CRI	≥83		
	Beam Angle	330°		
	Color Temperature (CCT)	3500K, 4000K, 5000K		
	Lumen Maintenance (L70)	50,000 Hours		
ELECTRICAL	Power Factor	≥ 0.90		
	Input Voltage	120V-277V, 50/60 Hz		
PHYSICAL	Operating Temperature	-4°F to 113°F		
	Lens	Opal (Frosted) - Coated Glass		
CERTIFICATION	Certification	UL, CULus Classified, ETL Sanitation		
	Material Usage	RoHS compliant; no mercury		
	Environment	Dry & Damp, Enclosed Fixtures		
	Warranty	5 Years		

ORDERING:

Lighting layouts and spacing criteria available upon request

MODELS	DLC PRODUCT ID	BARE LAMP POWER (W)	SYSTEM (UL-A) POWER (W)	BYPASS (UL-B) POWER (W)	LUMENS (lm)	EFFICACY (lm/W)	CCT
9W 2FT T8 MODELS							
L9T8AB235-CG	PLSRNHV1JP1G	8.5W	12W	9W	1350	112 lm/W	3500K
L9T8AB240-CG	PL965FLVCC6A				1380	115 lm/W	4000K
L9T8AB250-CG	PLGDCFYKD348				1420	118 lm/W	5000K
11W 3FT T8 MODELS							
L11T8AB335-CG	PLGK52GQNL1N	11.5W	14W	12W	1600	114 lm/W	3500K
L11T8AB340-CG	PLKRU0NGV9SD				1625	116 lm/W	4000K
L11T8AB350-CG	PLLQF8KE9PIZ				1650	118 lm/W	5000K
12W 4FT T8 MODELS							
L12T8AB435-CG	PLF6U1JY4KRM	12W	15.5W	13W	1800	116 lm/W	3500K
L12T8AB440-CG	PL0NWYTS0ZZR				1900	123 lm/W	4000K
L12T8AB450-CG	PLVXLG8KIZUW				1900	123 lm/W	5000K

BALLAST COMPATIBILITY LIST:

BALLAST DESCRIPTION				1 LAMP LOAD		2 LAMPS LOAD		3 LAMPS LOAD		4 LAMPS LOAD		REMARK	
BRAND	MODEL	START METHOD	# OF LAMPS	INPUT VOLTAGE		INPUT VOLTAGE		INPUT VOLTAGE		INPUT VOLTAGE		DIMMING	BALLAST VERSION
				120 V	277V	120 V	277V	120 V	277V	120 V	277V		
Arcata	ACT2P32ISUNV	IS	2	✓	✓	✓	✓	-	-	-	-	/	/
	ACT4P32ISUNV	IS	4	-	-	-	-	✓	✓	✓	✓	/	/
Advance	ICN-2P32-N	IS	2	✗	✗	✓	✓	-	-	-	-	/	REV C/E
	ICN-3P32-N	IS	3	-	-	✓	✓	✓	✓	-	-	/	REV D
	ICN-2P32-SC	IS	2	✓	✓	✓	✓	-	-	-	-	/	/
	IOPA-1P32-N	IS	1	✓	✓	-	-	-	-	-	-	/	REV B
	IOPA-2P32-N	IS	2	✗	✗	✓	✓	-	-	-	-	/	REV A
	IOPA-3P32-N	IS	3	-	-	✓	✓	✓	✓	-	-	/	REV B
	IOPA-1P32-LW-N	IS	1	✗	✗	-	-	-	-	-	-	/	REV A
	IOPA-2P32-LW-N	IS	2	✗	✗	✓	✓	-	-	-	-	/	REV B
	IOPA-4P32-LW-N	IS	4	-	-	-	-	✓	✓	✓	✓	/	REV A
	REL-2P32-SC	IS	2	✓	-	✓	-	-	-	-	-	/	/
	ICN-4P32-SC	IS	4	-	-	-	-	✓	✓	✓	✓	/	REV D
ESPEN	VE232MVHIPHE	IS	2	✗	✗	✓	✓	-	-	-	-	/	/
	VE232MVHIPLE	IS	2	✓	✓	✓	✓	-	-	-	-	/	/
	VE432MVHIP	IS	4	-	-	-	-	✓	✓	✓	✓	/	/
	VE432MVHIPE	IS	4	-	-	-	-	✓	✓	✓	✓	/	/
Fulham	NPY-120-232-LT8	**PS**	**2**	✗	-	✗	-	-	-	-	-	/	/
	NPY-120-432-T8B	IS	4	-	-	-	-	✓	-	✓	-	/	/
	NPY-120-432-T8-IS	IS	4	-	-	-	-	✓	-	✓	-	/	/
	WHCG3-120-T8-IS	IS	3	-	-	✓	-	✓	-	-	-	/	/
	WH2-120-L	IS	1	✓	-	-	-	-	-	-	-	/	/
	WH5-120-L	IS	4	-	-	-	-	✓	-	✓	-	/	/
Fusion	FB232MVE	IS	2	✓	✓	✓	✓	-	-	-	-	/	/
	FB232MVE-N	IS	2	✓	✓	✓	✓	-	-	-	-	/	/
	FB232MVE-HE	IS	2	✓	✓	✓	✓	-	-	-	-	/	/
	FB232MVE-LHE	IS	2	✓	-	✓	-	-	-	-	-	/	/
	FB232MVE-PPS-HE	PS	2	✓	✓	✓	✓	-	-	-	-	/	/
	FB332MVE	IS	3	-	-	✓	✓	✓	✓	-	-	/	/
	FB432MVE	IS	4	-	-	-	-	✓	✓	✓	✓	/	/
	FB432MVE-HE	IS	4	-	-	-	-	✓	✓	✓	✓	/	/
	FB432MVE-N	IS	4	-	-	-	-	✓	✓	✓	✓	/	/
	FB432MVE-PPS-HE	PS	4	-	-	-	-	✓	✓	✓	✓	/	/
GE	GE 232-120-PS-N	PS	2	✓	-	✓	-	-	-	-	-	/	/
	GE232MAXP-N/ULTRA	IS	2	✓	✓	✓	✓	-	-	-	-	/	/
	GE232MAXP-H/ULTRA	IS	2	✗	✗	✓	✓	-	-	-	-	/	/
	GE232-MVPS-L	PS	2	✓	✓	✓	✓	-	-	-	-	/	/
	GE232-MVPS-H	PS	2	✗	✗	✓	✓	-	-	-	-	/	/

BALLAST COMPATIBILITY LIST:

BALLAST DESCRIPTION				1 LAMP LOAD		2 LAMPS LOAD		3 LAMPS LOAD		4 LAMPS LOAD		REMARK	
BRAND	MODEL	START METHOD	# OF LAMPS	INPUT VOLTAGE		INPUT VOLTAGE		INPUT VOLTAGE		INPUT VOLTAGE		DIMMING	BALLAST VERSION
				120 V	277V	120 V	277V	120 V	277V	120 V	277V		
GE	GE332MAX-L/ULTRA	IS	3	-	-	✓	✓	✓	✓			/	/
	GE332MAX90-V60	IS	3	-	-	✗	✗	✓	✓	-	-	Dimming	/
	GE332MV-N-DIY	IS	3	-	-	✓	✓	✓	✓	-	-	/	/
	GE432-120-N	IS	4	-	-	-	-	✓	-	✓	-	/	/
	GE432MAX-G-N	IS	4	-	-	-	-	✓	✓	✓	✓	/	/
	GE432MAX-H-42T	IS	4	-	-	-	-	✓	✓	✓	✓	/	/
	GE432MV-N-DIY	IS	4	-	-	-	-	✓	✓	✓	✓	/	/
Greenhill	GH4P32ISUNV	IS	4	-	-	-	-	✓	✓	✓	✓	/	/
Halco	EP332IS/MV/MC	IS	3	-	-	✓	✓	✓	✓	-	-	/	/
	EP432IS/L/MV/HE	IS	4	-	-	-	-	✓	✓	✓	✓	/	/
	EP432IS/MV/MC	IS	4	-	-	-	-	✓	✓	✓	✓	/	/
HOWARD	EP4/32IS/MV/MC/HE	IS	4	-	-	-	-	✓	✓	✓	✓	/	/
Huafeng	ENI-T8-32-P2SC-N	IS	2	✓	✓	✓	✓	-	-	-	-	/	/
	ENI-T8-32-P4MC-N	IS	4	-	-	-	-	✗	✓	✗	✓	/	/
KEYSTONE	KTEB-232-UV-IS-N-P	IS	2	✓	✓	✓	✓	-	-	-	-	/	Version D1
	KTEB-232-UV-PS-VDIM	PS	2	-	-	✓	✓	-	-	-	-	Dimming	/
	KTEB-332-UV-IS-N-P	IS	3	-	-	✓	✓	✓	✓	-	-	/	Version B
	KTEB-432-UV-IS-N-P	IS	4	-	-	-	-	✓	✓	✓	✓	/	Version A1
Osram	QHE 2x32T8/UNV DIM-TC	PS	2	-	-	✓	✓	-	-	-	-	Dimming	/
	QTP 4x32T8/UNV ISN-SC	IS	4	-	-	-	-	✓	✓	✓	✓	/	/
Pacific	EB-332IS-U	IS	3	-	-	✓	✓	✓	✓	-	-	/	/
	EB-432IS-U	IS	4	-	-	-	-	✓	✓	✓	✓	/	/
PQL	70201	IS	2	✓	✓	✓	✓	-	-	-	-	/	/
	70204	IS	4	-	-	-	-	✓	✓	✓	✓	/	/
Premium	BB-T8/UVH-2x32	IS	2	✓	✓	✓	✓	-	-	-	-	/	/
	BB-T8/UVH-3x32	IS	3	-	-	-	-	✓	✓	-	-	/	/
Robertson	RSW240T12120	PS	2	✓	-	✓	-	-	-	-	-	/	/
Standard	E232PI120L	IS	2	✓	-	✓	-	-	-	-	-	/	/
	E432T8IS120/H	IS	4	-	-	-	-	✗	-	✓	-	/	/
	E432T8IS120/N/AS/BULK	IS	4	-	-	-	-	✓	-	✓	-	/	/
Sunpark	SL15T	PS	2	✗	-	✓	-	-	-	-	-	/	/
Universal	B232PUSV3PLA	PS	2	✗	✗	✗	✗	-	-	-	-	Dimming	REV A
	B232SR120S30	PS	2	-	-	✗	-	-	-	-	-	Dimming	REV E
	B432IUNVHP-A	IS	4	-	-	-	-	✓	✓	✓	✓	/	REV B

MaxLite®
A NEW WAVE OF LIGHT

PROJECT NAME:_____ CATALOG NUMBER:_____

NOTES:_____FIXTURE SCHEDULE:_____

LED T8 - LINEAR REPLACEMENT LAMP

DOUBLE-ENDED POWER COATED GLASS SERIES
UL TYPE-B



PRODUCT DESCRIPTION:

MaxLite LED T8 Linear Replacement Lamps are the ideal energy saving choices when upgrading traditional linear T8 or T12 fluorescent lamps in fixtures containing standard G13 (medium bi-pin) sockets. The LED T8 lamps are designed to provide appropriate light levels while utilizing a dedicated internal driver. Tested to NSF Standards, these lamps carry the **ETL Sanitation Mark** and are suitable for use in an environment where food intended for human consumption is produced.

FEATURES:

- Wattage:
  - 9W, 2FT, ≥1125 lumens, replaces 17W fluorescent T8
  - 12W, 3FT, ≥1,225 lumens, replaces 25W fluorescent T8
  - 11.5W, 4FT, ≥1,650 lumens, replaces 32W fluorescent T8
- Universal Voltage: 120V-277V applications
- Color Rendering Index (CRI): ≥80
- Beam angle: 330˚
- THD <20%
- Power factor: ≥ 0.90
- Easy retrofit into most common linear fluorescent fixtures
- Simple ballast bypass, double-ended power
- **Compatible with shunted and non-shunted lamp holders**
- Instant on
- Mercury free and virtually no UV or IR light
- Non dimmable
- Suitable for enclosed fixture
- Suitable for dry and damp locations
- ETL Sanitation listed (tested under NSF standard)
- All glass construction with PET coating
- 7 year limited warranty
- Rated Lifetime @ L70: 62,000 Hours
- Products L9T8DE235-CG4, L9T8DE240-CG4, L9T8DE250-CG4, L11.5T8DE435-CG4, L11.5T8DE440-CG4 & L11.5T8DE450-CG4 are listed on the DLC QPL

MODEL SELECTION (Full list of order codes on pg. 2) Typical order example: L9T8DE240-CG4

L	9	T8	DE	2	
FAMILY	**WATTAGE**	**LAMP TYPE**	**OPERATION**	**LENGTH**	**COLOR TEMPERATURE**
L= LED Linear	**9=** 9W	**T8=** T8 tube	**DE=** Double-Ended Power	**2=** 2FT	**35-CG4=** 3500K, Coated Glass **40-CG4=** 4000K, Coated Glass **50-CG4=** 5000K, Coated Glass

L	12	T8	DE	3	
FAMILY	**WATTAGE**	**LAMP TYPE**	**OPERATION**	**LENGTH**	**COLOR TEMPERATURE**
L= LED Linear	**12=** 12W	**T8=** T8 tube	**DE=** Double-Ended Power	**3=** 3FT	**35-CG4=** 3500K, Coated Glass **40-CG4=** 4000K, Coated Glass **50-CG4=** 5000K, Coated Glass

L	11.5	T8	DE	4	
FAMILY	**WATTAGE**	**LAMP TYPE**	**OPERATION**	**LENGTH**	**COLOR TEMPERATURE**
L= LED Linear	**11.5=** 11.5W	**T8=** T8 tube	**DE=** Double-Ended Power	**4=** 4FT	**35-CG4=** 3500K, Coated Glass **40-CG4=** 4000K, Coated Glass **50-CG4=** 5000K, Coated Glass

BALLAST COMPATIBILITY LIST:

BALLAST DESCRIPTION				1 LAMP LOAD		2 LAMPS LOAD		3 LAMPS LOAD		4 LAMPS LOAD		REMARK	
BRAND	MODEL	START METHOD	# OF LAMPS	INPUT VOLTAGE		INPUT VOLTAGE		INPUT VOLTAGE		INPUT VOLTAGE		DIMMING	BALLAST VERSION
				347V	480V	347V	480V	347V	480V	347V	480V		
Arcata	ACT2P32IS347	IS	2	✓	✓	✓	✓	-	-	-	-	/	/
	ACT4P32IS347	IS	4	-	-	-	-	✓	✓	✓	✓	/	/
Advance	GOPA-2P32-LW-SC	IS	2	✓	-	✓	-	-	-	-	-	/	REV D
	GOPA-4P32-LW-SC	IS	4	-	-	-	-	✓	-	✓	-	/	REV D
	GOPA-2P32-SC	IS	2	✓	-	✓	-	-	-	-	-	/	REV C
	GOPA-4P32-SC	IS	4	-	-	-	-	✓	-	✓	-	/	REV D
Fusion	FB232347E-HE	IS	2	✓	-	✓	-	-	-	-	-	/	/
	FB232347E-L	IS	2	✓	-	✓	-	-	-	-	-	/	/
	FB232347E-N	IS	2	✓	-	✓	-	-	-	-	-	/	/
	FB232347E-PPS-HE	PS	2	✓	-	✓	-	-	-	-	-	/	/
	FB432347E-HE	IS	4	-	-	-	-	✓	-	✓	-	/	/
	FB432347E-L	IS	4	-	-	-	-	✓	-	✓	-	/	/
	FB432347E-N	IS	4	-	-	-	-	✓	-	✓	-	/	/
	FB432347E-PPS-HE	PS	4	-	-	-	-	✓	-	✓	-	/	/
GE	GE232MAX347-H	IS	2	✗	-	✓	-	-	-	-	-	/	/
	GE232PS347-N	PS	2	✓	-	✓	-	-	-	-	-	/	/
	GE332MAX347-H	IS	3	-	-	✗	-	✓	-	-	-	/	/
	GE432MAX347-H	**IS**	**4**	-	-	-	-	✗	-	✓	-	/	/
	GE432PS347-N	PS	4	-	-	-	-	✓	-	✓	-	/	/
OSRAM	QHE 2x32 T8/347 ISL-SC	IS	2	✓	-	✓	-	-	-	-	-	/	/
	QHE 2x32 T8/347 ISN-SC	IS	2	✓	-	✓	-	-	-	-	-	/	/
Standard	E232T8IS347/H/90C	IS	2	✗	-	✗	-	-	-	-	-	/	/
	E232T8IS347/L/BULK	IS	2	✓	-	✓	-	-	-	-	-	/	/
	E232T8IS347/N/BULK	IS	2	✓	-	✓	-	-	-	-	-	/	/
	E432PI347G01	IS	4	-	-	-	-	✓	-	✓	-	/	/
	E432T8IS347/L/BULK	IS	4	-	-	-	-	✓	-	✓	-	/	/
	E432T8IS347/N	IS	4	-	-	-	-	✓	-	✓	-	/	/
	E432T8IS347/N/BULK	IS	4	-	-	-	-	✓	-	✓	-	/	/
	E432T8IS347/H/90C	IS	4	-	-	-	-	✓	-	✗	-	/	/
Universal	B232I347HE-A	IS	2	✓	-	✓	-	-	-	-	-	/	/
	B432I347HE-A	IS	4	-	-	-	-	✓	-	✓	-	/	/

EMERGENCY BALLAST		COMPATIBLE
BRAND	PART NUMBER	
Keystone	KT-EMRG-500	✓
	KT-EMRG-750-CFL4	✓
	KT-EMRG-1300-T5	✓
IOTA	ISL-54	✓

LED T8 - LINEAR REPLACEMENT LAMP

DOUBLE-ENDED POWER COATED GLASS SERIES
UL-TYPE B

SPECIFICATIONS:

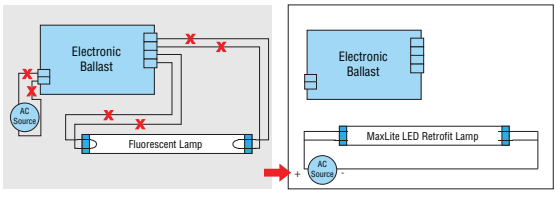
ITEM	SPECIFICATION	L9T8DE2xx-CG4	L12T8DE3xx-CG4	L11.5T8DE4xx-CG4
		2FT - DETAILS	3FT - DETAILS	4FT - DETAILS
GENERAL PERFORMANCE	Power Consumption (W)	9W	12W	11.5W
	Lumens Delivered (lm)	1125-1188	1225-1300	1650-1800
	Efficacy	≥125 lm/w	≥102 lm/w	≥143 lm/w
	CRI	≥80		
	Beam Angle	330°		
	Color Temperature (CCT)	3500K, 4000K, 5000K		
	Lumen Maintenance (L70)	62,000 Hours		
ELECTRICAL	Power Factor	≥ 0.90		
	Input Voltage	120V-277V, 50/60 Hz		
PHYSICAL	Operating Temperature	-4°F to 113°F		
	Lens	Opal (Frosted) - Coated Glass		
CERTIFICATION	Certification	DLC 4.2 Standard, CULus Classified, ETL Sanitation	cULus Classified, ETL Sanitation	DLC 4.2 Standard, CULus Classified, ETL Sanitation
	Material Usage	RoHS compliant; no mercury		
	Environment	Dry & Damp, Enclosed Fixtures		
	Warranty	7 Years		

Lighting layouts and spacing criteria available upon request

ORDERING:

MODELS	WATTS	LUMENS (lm)	EFFICACY (lm/W)	CCT	CASE QTY
9W 2FT T8 MODELS					
L9T8DE235-CG4	9W	1125	125 lm/W	3500K	25 pcs
L9T8DE240-CG4		1200	133 lm/W	4000K	
L9T8DE250-CG4		1250	139 lm/W	5000K	
12W 3FT T8 MODELS					
L12T8DE335-CG4	12W	1225	102 lm/W	3500K	25 pcs
L12T8DE340-CG4		1250	104 lm/W	4000K	
L12T8DE350-CG4		1300	108 lm/W	5000K	
11.5W 4FT T8 MODELS					
L11.5T8DE435-CG4	11.5W	1650	143 lm/W	3500K	25 pcs
L11.5T8DE440-CG4		1750	152 lm/W	4000K	
L11.5T8DE450-CG4		1800	156 lm/W	5000K	

RELAMPING EXAMPLE:



MaxLiTe®
A NEW WAVE OF LIGHT

PROJECT NAME:_____ CATALOG NUMBER:_____

NOTES:_____FIXTURE SCHEDULE:_____

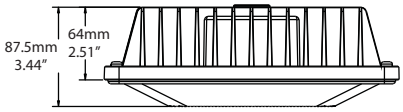
LED LOW-PROFILE CANOPY

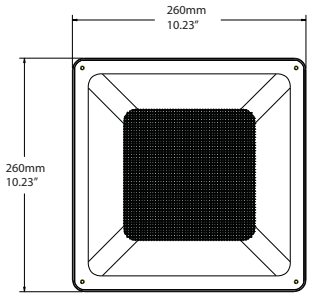
CPL SERIES





DIMENSIONS:





PRODUCT DESCRIPTION:

Quick to install, the LED Low-Profile Canopy is the ideal retrofit solution for 100-250W HID garage and canopy luminaires. Offered in 20, 30, 40, and 53-watt versions, with different reflector options for parking garage and canopy distributions, the CPL can address a variety of application needs.

The series offers 0-10V dimming drivers standard with an optional integral microwave motion sensor to negate interference on light output. Consuming 75 percent less energy than incumbent fixtures, the CPL series provides immediate payback and long-term energy and maintenance cost savings

PHOTOMETRICS:

All .IES files available online. Please see page 3 for Iso-footcandle layouts.

FEATURES:

- 20W replaces up to 100 watt metal halide
- 30W replaces up to 150 watt metal halide
- 40W replaces up to 175 watt metal halide
- 53W replaces up to 250 watt metal halide
- Easy one-person installation, light weight with latch allowing both hands for wire connections hanging
- Universal 120- 277V operation
- 0-10V Dimming driver standard
- Dusk-to-dawn and occupancy sensor compatible
- Two Distribution patterns, Canopy & Parking Garage
- 5-Year Limited Warranty

CONTROLS:

Motion/Daylight Sensor with Remote Control Compatibility: 0-10V microwave-based motion sensor with integral photocontrol, allowing for three output states: 100%; 10/20/30/50% output; or 0% output. Detection area, hold time, daylight threshold, and dimming level are configurable via DIP switches. At its maximum mounting height of 32 feet, the sensor can detect motion up to 30 feet away. Sensor mounted internally, behind lens which reduces vandalism and provides a cleaner look.

A compatible remote control is available with the sensor, which allows for easy sensor configuration, reprogramming, and troubleshooting when necessary. Users should review supplementary motion sensor datasheets and the product instruction manual for detailed remote control programming and operation. In the event of loss of power, remote control programmed settings return to DIP switch programmed settings.

120-277VAC Photocontrol: Universal voltage photocontrols turn fixture on and off based on footcandle levels to help conserve energy during daylight hours. The operating temperature of the photocontrol is -30°F-120°F. Photocell mounted external.

MOUNTING:

- Latch design to hold fixture and allows both hands for wiring
- Standard ¾" NPT for pendant mounting (pendants by others)
- Standard adapter plate included for junction box mounting (junction boxes by others)
- Three side-mounted ½" NPT knockouts
- Cannot be mounted directly to combustible surfaces
- Beauty Plate accessory available to cover up to 14" x 14" opening

MODEL SELECTION (Full list of order codes on pg. 2) — Typical order example: CPL40AUP50BMS

CPL		A	U				
FAMILY	**NOMINAL WATTAGE, EQUIVALENCY**	**GENERATION**	**VOLTAGE**	**DISTRIBUTION**	**CCT**	**FINISH**	**OPTIONS**
CPL= Low Profile Canopy	**20=** 20W, replaces up to 100W MH **30=** 30W, replaces up to 150W MH **40=** 40W, replaces up to 175W MH **58=** 53W, replaces up to 250W MH	**A=** Generation A	**U=** 120-277V, std	**P=** Parking Garage Distribution **C=** Canopy Distribtion	**40=** 4000K **50=** 5000K	**B=** Bronze, std **W=** White *Contact Maxlite for additional finishes.*	**(BLANK)=** None **PC=** 120-277V Photocell **MS=** Motion/ Daylight Sensor

ACCESSORIES			
ORDER CODE	**MODEL NUMBER**	**DESCRIPTION**	**ACCESSORIES IMAGE**
108133	RMHYTHRC-05	REMOTE CTRL PROGRAMMING HC403VRC/ HC419VRC	
1409168	CPL-15SQ-PLATE	CPL SERIES ALUMINUM BEAUTY PLATE FOR 15" X 15" SQUARE HOLES, BRONZE*	

***See page 7 for CPL Cover Plate dimensions**

SPECIFICATIONS:

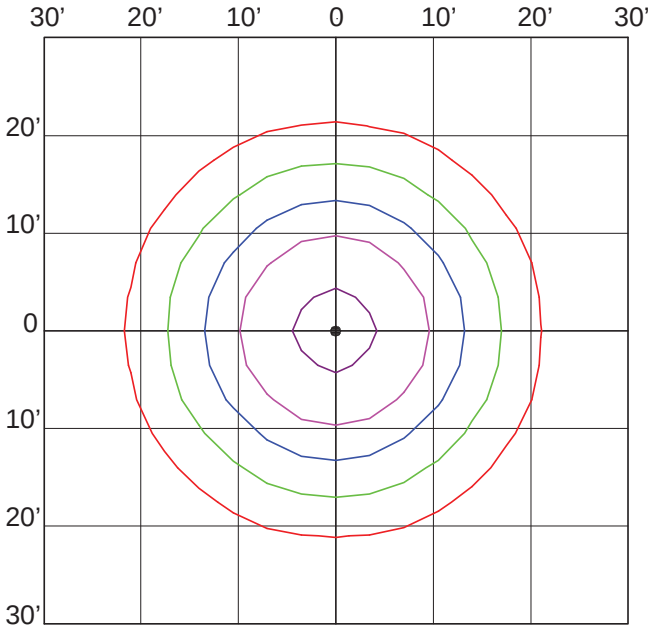
ITEM	SPECIFICATION	CPL20AUX50XXXX	CPL30AUX50XXXX	CPL40AUX50XXXX	CPL58AUX50XXXX
GENERAL PERFORMANCE	Distribution	Parking Garage, Canopy distributions available			
	Input Power (W)	20	30	40	53
	Lumens Delivered Parking Distribution (lm)	2278	3329	4713	6347
	Lumens Delivered Canopy Distribution (lm)	2374	3431	4935	6539
	Efficacy (lm/W)	120 - 125	115 - 118	119 - 124	123 - 127
	Color Temperature	5000K, 4000K available			
	CRI	≥70			
	Lumen Maintenance (L70, TM-21 @ 25° C)	≥100,000			
ELECTRICAL	Input Voltage	120-277V			
	Power Factor	≥0.90			
PHYSICAL	Operating Temperature	-40°F - 104°F / -40°C - 40°C			
	Housing	Die-cast Aluminium			
	Lens	Polycarbonate Lens			
QUALIFICATION	Qualifications	DLC 4.2 Premium, cULus (30W, 40W, 58W), ETL (20W), Supports Title 24 Compliance			
	Environment	Outdoor, wet location			
	Warranty	5 Years			

ORDERING*:

MODEL	ORDER CODE	NOMINAL WATTAGE	EQUIVALENCY	DISTRIBUTION	FINISH	INPUT VOLTAGE	COLOR TEMPERATURE (CCT)
CPL20AUC50B	1408347	20W	100W MH	Canopy	Bronze	120-277V	5000K
CPL20AUP50B	1408349	20W	100W MH	Parking Garage			
CPL30AUC50B	102005	30W	150W MH	Canopy			
CPL30AUP50B	102001	30W	150W MH	Parking Garage			
CPL40AUC50B	102010	40W	175W MH	Canopy			
CPL40AUP50B	101024	40W	175W MH	Parking Garage			
CPL58AUC50B	102339	53W	250W MH	Canopy			
CPL58AUP50B	102335	53W	250W MH	Parking Garage			
CPL40AUP50W	101436	40W	175W MH	Parking Garage	White		

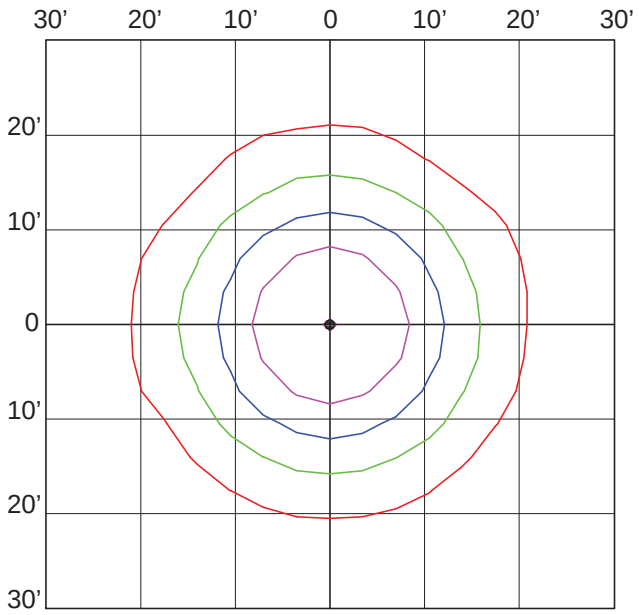
Lighting layouts and spacing criteria available upon request.
***Please contact your MaxLite representative to order products that don't have order codes listed here.**

CPL20:



20W, Canopy
2,415 Lumens
10’ Mounting Height
Foot-candle Correction Factor:

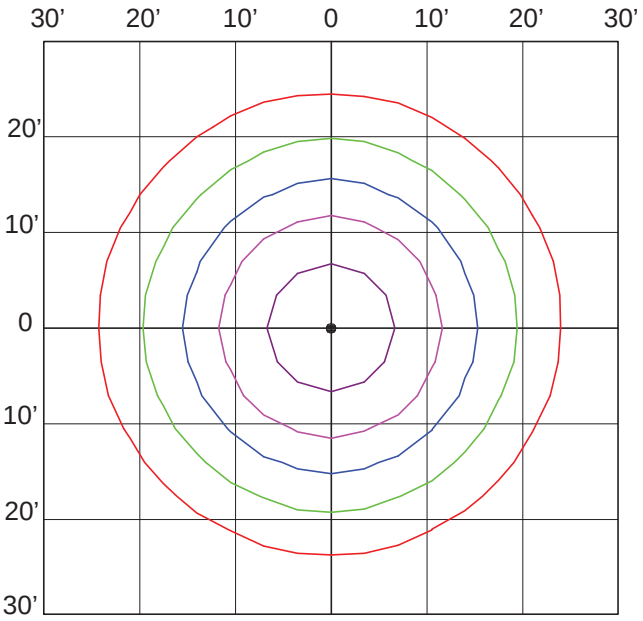
New Height:	8’	10’	15’	20’
Multiply by:	1.56	1	0.44	0.25



20W, Parking
2,200 Lumens
10’ Mounting Height
Foot-candle Correction Factor:

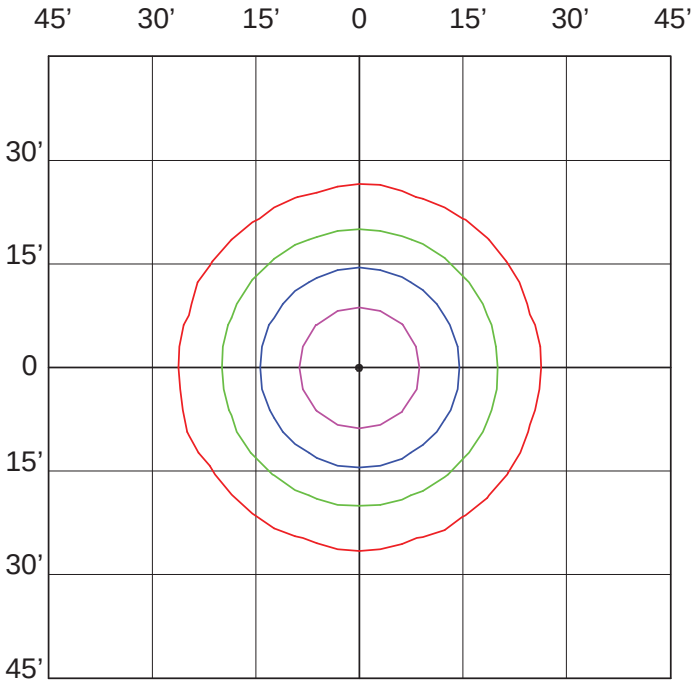
New Height:	8’	10’	15’	20’
Multiply by:	1.56	1	0.44	0.25

CPL30:



30W, Canopy
3,525 Lumens
15’ Mounting Height
Foot-candle Correction Factor:

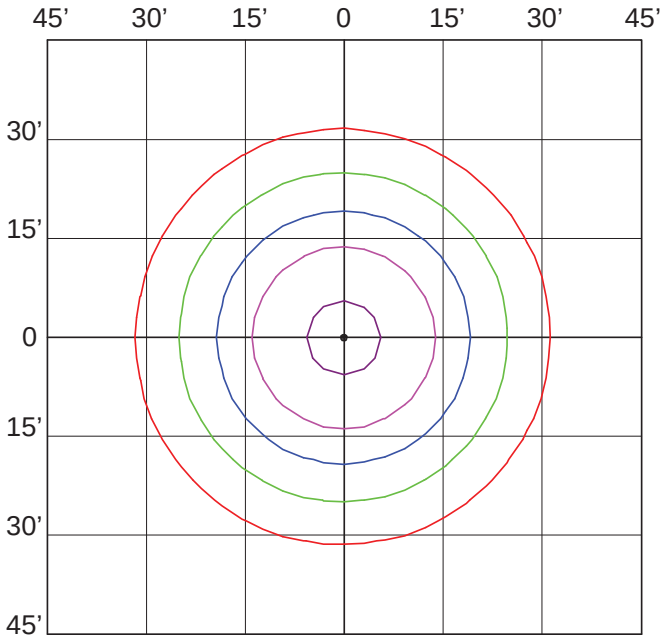
New Height:	10’	15’	20’	25’
Multiply by:	2.25	1	0.56	0.36



30W, Parking
3,320 Lumens
15’ Mounting Height
Foot-candle Correction Factor:

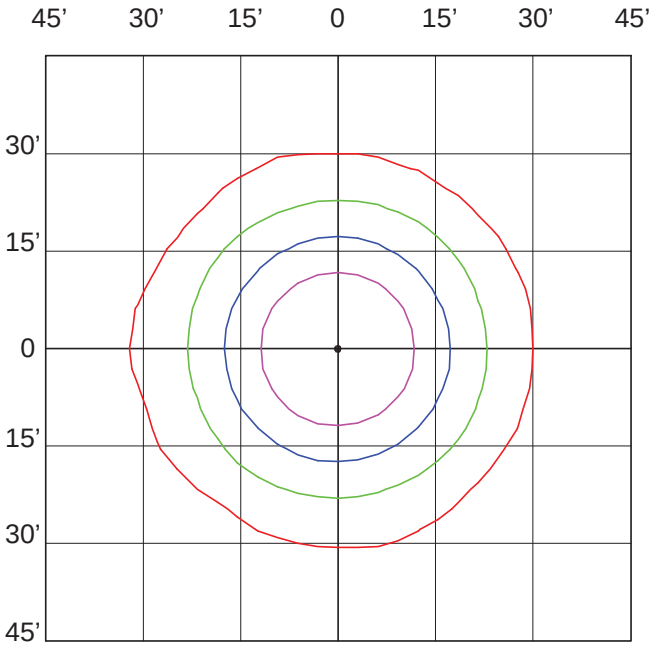
New Height:	10’	15’	20’	25’
Multiply by:	2.25	1	0.56	0.36

CPL40:



40W, Canopy
5,150 Lumens
15’ Mounting Height
Foot-candle Correction Factor:

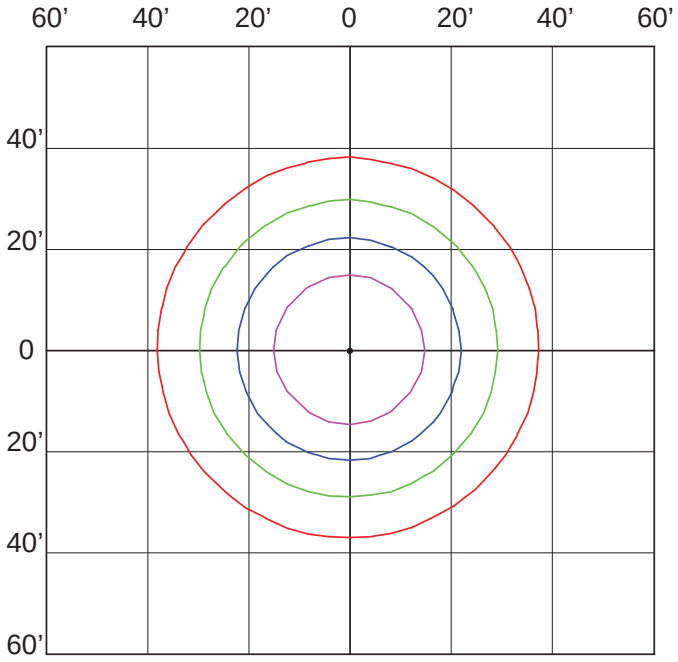
New Height:	10’	15’	20’	25’
Multiply by:	2.25	1	0.56	0.36



40W, Parking
4,645 Lumens
15’ Mounting Height
Foot-candle Correction Factor:

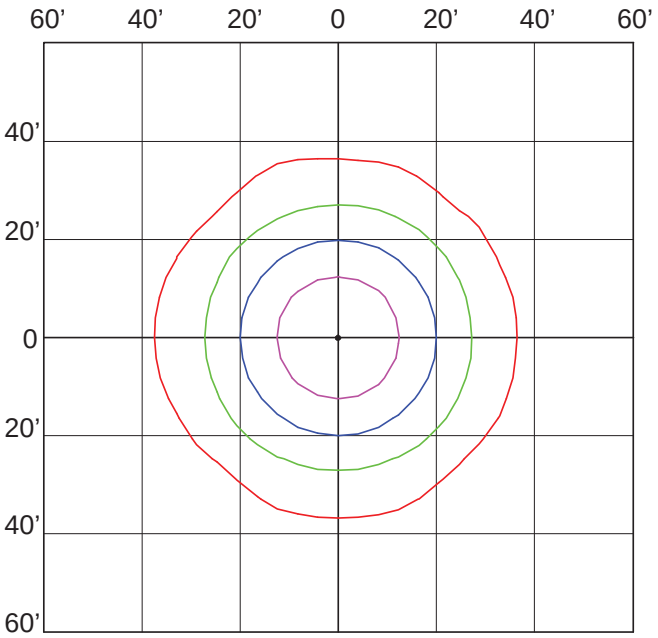
New Height:	10’	15’	20’	25’
Multiply by:	2.25	1	0.56	0.36

CPL58:



58W, Canopy
6,510 Lumens
20’ Mounting Height
Foot-candle Correction Factor:

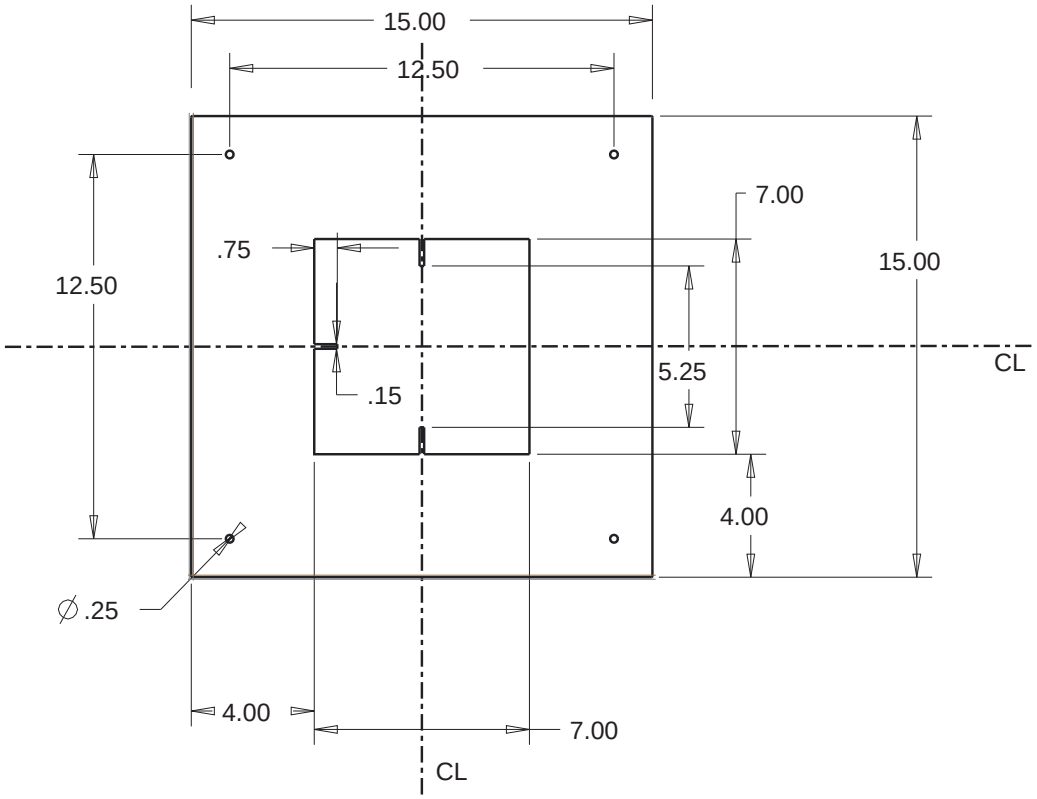
New Height:	10’	15’	20’	25’
Multiply by:	4	1.78	1	0.64



58W, Parking
6,095 Lumens
20’ Mounting Height
Foot-candle Correction Factor:

New Height:	10’	15’	20’	25’
Multiply by:	4	1.78	1	0.64

CPL BEAUTY PLATE DIMENSIONS:



LED CORN LAMP

HID REPLACEMENT SERIES



36W

54W



120W

FEATURES:

- Wattages:
  -36W, replaces 150W HID,
  4,500 lumens (bare lamp), 3,500 lumens in fixture

  -54W, replaces 250W HID
  6,700 lumens (bare lamp), 5,200 lumens in fixture

  -120W, replaces 400W HID
  14,000 lumens (bare lamp), 12,300 lumens in fixture
- Universal voltage: 120V-277V, Ballast bypass
- Beam Degree: 360°
- Color Temperature: 4000K, 5000K
- Frequency: 50/60Hz
- Base: EX39 base
- CRI: ≥ 82
- Power factor: ≥ 0.90
- Instant on
- IP64
- Non-Dimmable
- Emits no UV light & mercury free
- Operating temperature of -40°F - 113°F
- Suitable for dry and damp locations
- Suitable for use in open and enclosed luminaires
- Vertical mounting operation only
- 5 year limited warranty
- 50,000 hour life
- 2.5kV surge protection for 36W & 54W, 4kV for 120W

APPLICATIONS:

- Post Top Lighting
- Tear drop Lighting

MODEL SELECTION Typical order example: 120PT50

FAMILY	COLOR TEMPERATURE
36PT= 36W, LED Corn Lamp, EX39 base **54PT=** 54W, LED Corn Lamp, EX39 base **120PT=** 120W, LED Corn Lamp, EX39 base	**40=** 4000K **50=** 5000K

NOTES:

1. Tether Kit included for 120PT50
2. The lamps are suitable for enclosed fixtures, however ensure that there is adequate space around the device for heat dissipation. Min. compartment dimensions (54W & 120W): 16.14" L x 16.14" W x 15.35" H

CAUTIONS:

1. Suitable for use in dry or damp locations only. DO NOT use where directly exposed to liquid, vapor, rain.
2. The lamps requires all ballasts, capacitors, and starters to be bypassed or removed.
3. The lamps are not intended for use with emergency exits.
4. The lamps are not intended for use with dimmers or remote controls.
5. The lamps can be installed base-up or base-down operation only.

SPECIFICATIONS:

ITEM	SPECIFICATION	36PTxx	54PTxx	120PTxx
		DETAILS		
GENERAL PERFORMANCE	Input Power (W)	36	54	120
	Initial Lumens - **Bare Lamp**	4,500lm	6,700lm	14,000lm
	Efficacy (lm/W) - **Bare Lamp**	125	124	116
	Lumens Delivered - **In Fixture**	3400-3500lm	5000-5,200lm	12,000-12,300lm
	Efficacy (lm/W) - **In Fixture**	≥ 94.4	≥ 92.6	≥ 100
	Color Temperature	4000k - 5000K		
	Lumen Maintenance (L70)	50,000 Hours		
	Color Rendering Index (CRI)	≥ 82		
ELECTRICAL	Input Voltage (V)	120-277V		
	Power Factor	≥ 0.90		
	Surge Protection	2.5kV	2.5kV	4kV
PHYSICAL	Base Type	EX39 mogul		
	Operating Temperature	-40°F - 113°F		
QUALIFICATION	Qualification	DLC 4.2, cULus, LM80		
	Environment	Dry, damp, enclosed rated		
	Material Usage	RoHS compliant; no mercury		
	Warranty	5 years		

ORDERING:

ORDER CODE	MODEL	NOMINAL POWER (W)	HID REPLACEMENT	CCT	DIMENSION (MOL. x DIA.)	MASTER CASE QTY
14099702	36PT40	36	150W HID	4000K	9.35” x 3.58”	12pcs
14099578	36PT50			5000K		
14099703	54PT40	54	250W HID	4000K	10.5” x 3.58”	12pcs
14099579	54PT50			5000K		
14099704	120PT40	120	400W HID	4000K	12.14” x 5.89”	4pcs
14099580	120PT50			5000K		

LED PAR Lamps

PAR20, PAR30, PAR38 SERIES



7W PAR20



11W PAR30 Short Neck



11W PAR30 Long Neck



13W & 15W PAR38

PRODUCT DESCRIPTION:

MaxLite's energy-efficient PAR lamps offer 7-, 11-, 13- and 15-watt LED replacements for 50-, 75-, 100- and 120- incandescent lamps to significantly reduce your carbon footprint while maintaining a very high quality of light. Available in the PAR20, PAR30 (Short and Long Neck), and PAR38 sizes, Maxlite's lineup has industry leading light output, making it ideal for architectural and wall wash lighting in track, recessed and decorative lighting fixtures in retail, high-end residential and office environments. The LED Lamps produce a strong center beam candle power that provides bright and crisp lighting to showcase artwork and products.

FEATURES:

- 7W PAR20, 500 lumens, replaces 50W Inc.
- 11W PAR30, 850 lumens, replaces 75W Inc.
- 13W PAR38, 1050 lumens, replaces 100W Inc.
- 15W PAR38, 1250 lumens, replaces 120W Inc.
- Beam angles: 30° and 40° available
- Available in 2700K, 3000K, 4000K & 5000K
- Votlage: 120V
- Frequency: 60Hz
- CRI: ≥80
- Instant on (no warm up time)
- Base: E26 (medium)
- UV and IR free
- Dimmable down to 10%
- 10W PAR30 Short neck are models are damp rated, while others are wet locations rated
- ENERGY STAR certified
- Operating temperature range: - 4° to 104°F
- Power Factor: 0.70 -0.80
- Ideal for use in both indoor and outdoor
- Not for use in enclosed luminaires
- Five year warranty
- 25,000 hour life at L70 standards

APPLICATIONS:

- Retail
- Hospitality
- Residential
- Restaurant
- Outdoor architectural/spot lighting

NOTES:

1. All lamps are wet location rated besides 11W PAR30 Short neck models.
2. See page 5 for compatible dimmer list

SPECIFICATIONS:

		PAR20	PAR30 Short Neck	PAR30 Long Neck	PAR38	PAR38
ITEM	**SPECIFICATION**	**7 WATTS**	**11 WATTS**	**11 WATTS**	**13 WATTS**	**15 WATTS**
GENERAL PERFORMANCE	Color Temperature	2700K, 3000K, 4000K	2700K, 3000K, 4000K, 5000K	2700K, 3000K, 4000K, 5000K	2700K, 3000K, 4000K, 5000K	2700K, 3000K, 4000K
	Lumens Delivered (lm)	500	850	850	1050	1250
	Efficacy (lm/w)	71	77	77	80	83
	Equivalency	50W	75W	75W	100W	120W
	CRI	≥80				
	Lumen Maintenance (L70)	25,000 hours				
ELECTRICAL	Power Factor	≥0.90				
	Input Voltage	120V				
PHYSICAL	Operating Temperature	-4° F to 104° F				
APPLICATION	Environment	Dry, Damp, Wet	Dry, Damp	Dry, Damp, Wet	Dry, Damp, Wet	Dry, Damp, Wet
	Certification	UL Listed, ENERGY STAR, FCC, LM80				
	Warranty	5 Year				

ORDERING (FLOOD MODELS):

ORDER CODE	MODEL	ENERGY STAR	WATTAGE	DELIVERED LUMENS	EFFI-CACY (lm/W)	INCANDESCENT EQUIVALENCY	BEAM ANGLE	CBCP (cd)	CRI	CCT (K)	DIMENSION (MOL" X W")	CARTON QTY
PAR20 - WET LOCATION RATED												
14099200	7P20WD27FL	★	7W	500	71	50W Inc.	40˚	1135	83	2700K	3.19" x 2.48"	24pcs
14099201	7P20WD30FL	★						969	84	3000K		
14099202	7P20WD40FL	★						1169	84	4000K		
PAR30 SHORT NECK - DAMP LOCATION RATED												
14099226	11P30D27FL	★	11W	850	77	75W Inc.	40˚	1649	84	2700K	3.62" x 3.74"	24pcs
14099227	11P30D30FL	★						1536	84	3000K		
14099228	11P30D40FL	★						1586	83	4000K		
14099229	11P30D50FL	★						1668	84	5000K		
PAR30 LONG NECK - WET LOCATION RATED												
14099203	11P30WLND27FL	★	11W	850	77	75W Inc.	40˚	1917	83	2700K	4.57" x 3.74"	24pcs
14099204	11P30WLND30FL	★						1564	84	3000K		
14099205	11P30WLND40FL	★						1605	83	4000K		
103237	11P30WLND50FL	☆						1605	83	5000K		
PAR38 - WET LOCATION RATED												
14099206	13P38WD27FL	★	13W	1050	80	100W Inc.	40˚	2578	83	2700K	5.16" x 4.72"	24pcs
14099207	13P38WD30FL	★						1886	84	3000K		
14099208	13P38WD40FL	★						2424	83	4000K		
14099209	13P38WD50FL	★						2163	84	5000K		
14099210	15P38WD27FL	★	15W	1250	83	120W Inc.	40˚	2411	83	2700K		
14099211	15P38WD30FL	★						2527	83	3000K		
14099212	15P38WD40FL	★						2870	84	5000K		

★ **ENERGY STAR certified**
☆ **ENERGY STAR Pending**

ORDERING (NARROW FLOOD MODELS):

ORDER CODE	MODEL	ENERGY STAR	WATTAGE	DELIVERED LUMENS	EFFI-CACY (lm/W)	INCANDESCENT EQUIVALENCY	BEAM ANGLE	CBCP (cd)	CRI	CCT (K)	DIMENSION (MOL" X W")	CARTON QTY
PAR20 - WET LOCATION RATED												
14099213	7P20WD27NF	★	7W	500	71	50W Inc.	30˚	1366	83	2700K	3.19" x 2.48"	24pcs
14099214	7P20WD30NF	★						1533	84	3000K		
14099215	7P20WD40NF	★						1639	84	4000K		
PAR30 SHORT NECK - DAMP LOCATION RATED												
14099230	11P30D27NF	★	11W	850	77	75W Inc.	30˚	2460	84	2700K	3.62" x 3.74"	24pcs
14099231	11P30D30NF	★						2415	80	3000K		
14099232	11P30D40NF	★						2297	83	4000K		
14099233	11P30D50NF	★						2569	84	5000K		
PAR30 LONG NECK - WET LOCATION RATED												
14099216	11P30WLND27NF	★	11W	850	77	75W Inc.	30˚	2460	83	2700K	4.57" x 3.74"	24pcs
14099217	11P30WLND30NF	★					25˚	3043	84	3000K		
14099218	11P30WLND40NF	★						2548	83	4000K		
PAR38 - WET LOCATION RATED												
14099219	13P38WD27NF	★	13W	1050	80	100W Inc.	30˚	3261	83	2700K	5.16" x 4.72"	24pcs
14099220	13P38WD30NF	★						3452	84	3000K		
14099221	13P38WD40NF	★						3460	80	4000K		
14099222	13P38WD50NF	★						3678	84	5000K		
14099223	15P38WD27NF	★	15W	1250	83			3333	80	2700K		
14099224	15P38WD30NF	★						3483	82	3000K		
14099225	15P38WD40NF	★						3942	83	5000K		

★ **ENERGY STAR certified**

COMPATIBLE DIMMERS FOR 7P20WDXXFL & 7P20WDXXNF:

BRAND	MODEL	COMPATIBLE
ADRONE	ADPD453LW2	YES
	ADWR703HW4	YES
AH	SDM/600/WHTTE	YES
ALMOND	LUXDM600-12	YES
COOPER	DAL06P-C2-K	NO
	SAL06P-W-K	NO
	TAL06P-C2-K	NO
CTL	DM600-12-3	YES
EATON	AAL06-C1	NO
	TAL06P1-C5	NO
	SAL06P-LA-K	NO
GE	18024	NO
HALO	SAL06P-W-HALOGF2	NO
LEGRAND	HCL453PTC	YES
	RHCL453PW	YES
LEVITON	603-6631-A	YES
	6631-A	YES
	6631-LA	YES
	6672	YES
	6683-10Z	YES
	6684	YES
	IPI06	NO
	IPI06-1LZ	YES
	IPI10-1LZ	NO
	NO. 6681	YES
	NO.6631	YES
	NO.6674	NO
	NO.6681	NO
	NO.IPL06	YES
	S-600P-WH	NO
LUTRON	AY-600PH-WH	NO
	AYCL-153P-WH	YES
	AYCL-153PH	YES
	CT-103P-WH	YES
	CT-600PR-WH	NO
	CTCL-153P-WH	NO
	CTCL-153PDH-WH	YES
	D-600PH-DK	YES
	D-600R-IV	YES
	D-600R-WH	YES
	D-600RH-DK	YES
	DV-600P-WH	NO
	DV-600PH-WH	YES
	DV-603P	NO
	DV-603PH-WH	YES

BRAND	MODEL	COMPATIBLE
LUTRON	DV-603PH-WH	YES
	DV-603PR	NO
	DVCL-153P-WH	YES
	DVCL-153P-WH	NO
	DVCL-153P-WH-3	YES
	DVCL-153PH	NO
	DVCL-153PR-WH	YES
	DVCL-253PH	YES
	DVELV-303P-WH	YES
	DVW-600PH-WH	NO
	DVWCL-153PH-WH	NO
	DVWCL-153PH-WHC	NO
	LECL-153PH-WH	YES
	LGCL-153CL	NO
	MACL-153M-WH	YES
	MACL-153MH-WH	YES
	MACL-153MLH-WH	YES
	MACL-153MLRHW-WH	YES
	MACL-153MR-WH	YES
	MAELV-600-WH	YES
	MSCL-OP153MH-WH	YES
	PD-6WCL-WH-P	NO
	S-10PH	YES
	S-600	YES
	S-600-AL	YES
	S-600-IV	YES
	S-600H-WH	YES
	S-600P-WH	NO
	S-600PR-WH	NO
	S-603PGH-WH	NO
	S-603PH-WH	NO
	SCL-153P-WH	NO
	SCL-153PH-WH	YES
	TG-600PH-IV	YES
	TG-600PH-WH	NO
	TG-600PNLH-WH	NO
	TG-603PGH-WH	NO
	TGCL-153PH-WH	YES
	TGCL-153PH-WH	NO
MAXXIMA	MEW-DM600	YES

COMPATIBLE DIMMERS FOR 11P30DXXFL, 11P30DXXNF, 11P30WLNDXXFL & 11P30WLNDXXNF:

BRAND	MODEL	COMPATIBLE
ADRONE	ADPD453LW2	YES
	ADWR703HW4	YES
AH	SDM/600/WHTTE	YES
ALMOND	LUXDM600-12	YES
COOPER	DAL06P-C2-K	NO
	TAL06P-C2-K	NO
	SAL06P-W-K	NO
CTL	DM600-12-3	YES
EATON	AAL06-C1	NO
	SAL06P-LA-K	NO
	TAL06P1-C5	NO
GE	18024	NO
HALO	SAL06P-W-HALOGF2	NO
LEGRAND	HCL453PTC	YES
	RHCL453PW	YES
LEVITON	6684	YES
	6681	YES
	603-6631-A	YES
	6631-A	YES
	6631-LA	YES
	6683-10Z	YES
	IPI06	NO
	IPI06-1LZ	YES
	IPI10-1LZ	NO
	NO.6631	YES
	NO.6672	YES
	NO.6674	NO
	NO.6681	NO
	NO.IPL06	YES
	S-600P-WH	NO
LUTRON	AY-600PH-WH	NO
	AYCL-153P-WH	YES
	AYCL-153PH	YES
	CT-103P-WH	YES
	CT-600PR-WH	NO
	CTCL-153P-WH	NO
	CTCL-153PDH-WH	YES
	D-600PH-DK	YES
	D-600R-IV	YES
	D-600R-WH	YES
	D-600RH-DK	YES
	DV-600P-WH	NO
	DV-600PH-WH	YES
	DV-603P	NO
	DV-603PH-WH	YES

BRAND	MODEL	COMPATIBLE
LUTRON	DV-603PH-WH	YES
	DV-603PR	NO
	DVCL-153P-WH	NO
	DVCL-153P-WH	YES
	DVCL-153P-WH-3	YES
	DVCL-153PH	NO
	DVCL-153PR-WH	YES
	DVCL-253PH	YES
	DVELV-303P-WH	YES
	DVW-600PH-WH	NO
	DVWCL-153PH-WH	NO
	DVWCL-153PH-WHC	NO
	LECL-153PH-WH	YES
	LGCL-153CL	NO
	MACL-153M-WH	YES
	MACL-153MH-WH	YES
	MACL-153MLH-WH	YES
	MACL-153MLRHW-WH	YES
	MACL-153MR-WH	YES
	MAELV-600-WH	YES
	MSCL-OP153MH-WH	YES
	PD-6WCL-WH-P	NO
	S-10PH	YES
	S-600	YES
	S-600-AL	YES
	S-600-IV	YES
	S-600H-WH	YES
	S-600P-WH	NO
	S-600PR-WH	NO
	S-603PGH-WH	NO
	S-603PH-WH	NO
	SCL-153P-WH	NO
	SCL-153PH-WH	YES
	TG-600PH-IV	YES
	TG-600PH-WH	NO
	TG-600PNLH-WH	NO
	TG-603PGH-WH	NO
	TGCL-153PH-WH	NO
	TGCL-153PH-WH	YES
MAXXIMA	MEW-DM600	YES

COMPATIBLE DIMMERS FOR 13P38WDXXFL & 13P38WDXXNF:

BRAND	MODEL	COMPATIBLE
ADRONE	ADPD453LW2	YES
	ADWR703HW4	YES
AH	SDM/600/WHTTE	YES
ALMOND	LUXDM600-12	YES
COOPER	DAL06P-C2-K	NO
	SAL06P-W-K	NO
	TAL06P-C2-K	NO
CTL	DM600-12-3	YES
EATON	AAL06-C1	NO
	SAL06P-LA-K	NO
	TAL06P1-C5	NO
GE	18024	NO
HALO	SAL06P-W-HALOGF2	NO
LEGRAND	HCL453PTC	YES
	RHCL453PW	YES
LEVITON	6684	YES
	6681	YES
	603-6631-A	YES
	6631-A	YES
	6631-LA	YES
	6683-10Z	YES
	IPI06	NO
	IPI06-1LZ	YES
	IPI10-1LZ	NO
	NO.6631	YES
	NO.6672	YES
	NO.6674	NO
	NO.6681	NO
	NO.IPL06	YES
	S-600P-WH	NO
LUTRON	AY-600PH-WH	NO
	AYCL-153P-WH	YES
	AYCL-153PH	YES
	CT-103P-WH	YES
	CT-600PR-WH	NO
	CTCL-153P-WH	NO
	CTCL-153PDH-WH	YES
	D-600PH-DK	YES
	D-600R-IV	YES
	D-600R-WH	YES
	D-600RH-DK	YES
	DV-600P-WH	NO
	DV-600PH-WH	YES
	DV-603P	NO
	DV-603PH-WH	YES

BRAND	MODEL	COMPATIBLE
LUTRON	DV-603PH-WH	YES
	DV-603PR	NO
	DVCL-153P-WH	YES
	DVCL-153P-WH	NO
	DVCL-153P-WH-3	YES
	DVCL-153PH	NO
	DVCL-153PR-WH	YES
	DVCL-253PH	YES
	DVELV-303P-WH	YES
	DVW-600PH-WH	NO
	DVWCL-153PH-WH	NO
	DVWCL-153PH-WHC	NO
	LECL-153PH-WH	YES
	LGCL-153CL	NO
	MACL-153M-WH	YES
	MACL-153MH-WH	YES
	MACL-153MLH-WH	YES
	MACL-153MLRHW-WH	YES
	MACL-153MR-WH	YES
	MAELV-600-WH	YES
	MSCL-OP153MH-WH	YES
	PD-6WCL-WH-P	NO
	S-10PH	YES
	S-600	YES
	S-600-AL	YES
	S-600-IV	YES
	S-600H-WH	YES
	S-600P-WH	NO
	S-600PR-WH	NO
	S-603PGH-WH	NO
	S-603PH-WH	NO
	SCL-153P-WH	NO
	SCL-153PH-WH	YES
	TG-600PH-IV	YES
	TG-600PH-WH	NO
	TG-600PNLH-WH	NO
	TG-603PGH-WH	NO
	TGCL-153PH-WH	YES
	TGCL-153PH-WH	NO
MAXXIMA	MEW-DM600	YES

COMPATIBLE DIMMERS FOR 15P38WDXXNF & 15P38WDXXNF:

BRAND	MODEL	COMPATIBLE
ADRONE	ADPD453LW2	YES
	ADWR703HW4	YES
AH	SDM/600/WHTTE	YES
ALMOND	LUXDM600-12	YES
COOPER	DAL06P-C2-K	NO
	SAL06P-W-K	NO
	TAL06P-C2-K	NO
CTL	DM600-12-3	YES
EATON	AAL06-C1	NO
	SAL06P-LA-K	NO
	TAL06P1-C5	NO
GE	18024	NO
HALO	SAL06P-W-HALOGF2	NO
LEGRAND	HCL453PTC	YES
	RHCL453PW	YES
LEVITON	6681	YES
	603-6631-A	YES
	6631-A	YES
	6631-LA	YES
	6683-10Z	YES
	6684	YES
	IPI06	NO
	IPI06-1LZ	YES
	IPI10-1LZ	NO
	NO.6631	YES
	NO.6672	YES
	NO.6674	NO
	NO.6681	NO
	NO.IPL06	YES
	S-600P-WH	NO
LUTRON	AY-600PH-WH	NO
	AYCL-153P-WH	YES
	AYCL-153PH	YES
	CT-103P-WH	YES
	CT-600PR-WH	NO
	CTCL-153P-WH	NO
	CTCL-153PDH-WH	YES
	D-600PH-DK	YES
	D-600R-IV	YES
	D-600R-WH	YES
	D-600RH-DK	YES
	DV-600P-WH	NO
	DV-600PH-WH	YES
	DV-603P	NO
	DV-603PH-WH	YES

BRAND	MODEL	COMPATIBLE
LUTRON	DV-603PH-WH	YES
	DV-603PR	NO
	DVCL-153P-WH	YES
	DVCL-153P-WH	NO
	DVCL-153P-WH-3	YES
	DVCL-153PH	NO
	DVCL-153PR-WH	YES
	DVCL-253PH	YES
	DVELV-303P-WH	YES
	DVW-600PH-WH	NO
	DVWCL-153PH-WH	NO
	DVWCL-153PH-WHC	NO
	LECL-153PH-WH	YES
	LGCL-153CL	NO
	MACL-153M-WH	YES
	MACL-153MH-WH	YES
	MACL-153MLH-WH	YES
	MACL-153MLRHW-WH	YES
	MACL-153MR-WH	YES
	MAELV-600-WH	YES
	MSCL-OP153MH-WH	YES
	PD-6WCL-WH-P	NO
	S-10PH	YES
	S-600	YES
	S-600-AL	YES
	S-600-IV	YES
	S-600H-WH	YES
	S-600P-WH	NO
	S-600PR-WH	NO
	S-603PGH-WH	NO
	S-603PH-WH	NO
	SCL-153P-WH	NO
	SCL-153PH-WH	YES
	TG-600PH-IV	YES
	TG-600PH-WH	NO
	TG-600PNLH-WH	NO
	TG-603PGH-WH	NO
	TGCL-153PH-WH	YES
	TGCL-153PH-WH	NO
MAXXIMA	MEW-DM600	YES

LED BR LAMPS G3

BR20, BR30, BR40 SERIES



7W BR20



8W BR30
11W BR30



12W BR40
17W BR40

PRODUCT DESCRIPTION:

With a full array of BR lamps, MaxLite products offer an immediate payback with 7-, 8-, 11-, 12-, 14-, 17-watt LED replacements for 50-, 65-, 75-, and 100-watt incandescent lamps. Available in a standard medium base, the LED BR lamp is an ideal lighting solution for track lights, display lights and recessed lights. They provide efficient, general lighting suited for architectural, residential, retail, office space and hospitality applications.

FEATURES:

- 120V, 60Hz
- 25,000 hour life (at L70 standards)
- CRI: >80
- ENERGY STAR Certified
- BR lens conceals LEDs from sight and evenly distributes the light
- Smooth aluminum housing with ANSI standard form factor
- Dimmable down to ten percent
- Operating temperature: -4°F to 104°F
- Suitable for use in damp locations
- Not for use in enclosed luminaires
- Five year warranty

MODEL SELECTION (Full list of order codes on pg. 2) | Typical order example: 17BR40DLED27/G3

	DLED	
FAMILY	**DIMMABILITY**	**COLOR TEMPERATURE (CCT)**
7BR20 = 7 watts, BR20 **8BR30 =** 8 watts, BR30 **11BR30 =** 11 watts, BR30 **12BR40 =** 12 watts, BR40 **17BR40 =** 17 watts, BR40	**DLED =** Dimmable	**27/G3 =** 2700K **30/G3 =** 3000K **40/G3 =** 4000K **50/G3 =** 5000K*

NOTES:
1. Bulk pack and 4 pack are available. See Ordering Table on Page 2.
* 5000K model only available for 8BR30DLED50/G3

COMPATIBLE DIMMERS:

MAKE	DIMMER MODEL
Lutron	CTCL-153P
Lutron	DVCL-153P
Lutron	LGCL-153P
Lutron	S-600

MAKE	DIMMER MODEL
Leviton	IPL06
Leviton	IPI10
Leviton	6631-LW
Leviton	6683-IW

SPECIFICATIONS:

		BR20	BR30		BR40	
ITEM	**SPECIFICATION**	**7 WATTS**	**8 WATTS**	**11 WATTS**	**12 WATTS**	**17 WATTS**
GENERAL PERFORMANCE	Color Temperature	2700K, 3000K, 4000K	2700K, 3000K, 4000K, 5000K	2700K, 3000K, 4000K	2700K, 3000K, 4000K	2700K, 3000K, 4000K
	Lumens Delivered (lm)	550	650	850	1050	1400
	Efficacy (lm/W)	79	81	77	88	82
	Equivalency	50W	65W	65W	75W	100W
	Lumen Maintenance (L70)	25,000 hours				
ELECTRICAL	Power Factor	≥.70				
	Input Voltage	120V				
PHYSICAL	Operating Temperature	-4°F to 104°F				
APPLICATION	Environment	Dry, Damp				
	Warranty	5 Year				

ORDERING:

ORDER CODE	MODEL	ENERGY STAR	WATTAGE	INCANDESCENT EQUIVALENCY	CRI	OUTPUT (LUMENS)	DIMENSIONS H" X W"	CCT
BR20								
14099046	7BR20DLED27/G3	★	7W	50W	82	550	3.8" x 2.5"	2700K
14099047	7BR20DLED30/G3	★	7W	50W	82	550	3.8" x 2.5"	3000K
14099048	7BR20DLED40/G3	★	7W	50W	84	550	3.8" x 2.5"	4000K
BR30								
14099149	8BR30DLED27/G3	★	8W	65W	82	650	5.10" x 3.75"	2700K
14099158	8BR30DLED27/G3/4P (4-Pack)	★	8W	65W	82	650	5.10" x 3.75"	2700K
14099159	8BR30DLED27/G3/BP (Bulk Pack)	★	8W	65W	82	650	5.10" x 3.75"	2700K
14099050	8BR30DLED30/G3	★	8W	65W	82	650	5.10" x 3.75"	3000K
14099051	8BR30DLED40/G3	★	8W	65W	84	650	5.10" x 3.75"	4000K
14099657	8BR30DLED50/G3	★	8W	65W	84	650	5.10" x 3.75"	5000K
14099421	11BR30DLED27/G3	★	11W	65W	82	850	5.10" x 3.75"	2700K
14099422	11BR30DLED27/G3/BP	★	11W	65W	82	850	5.10" x 3.75"	2700K
14099423	11BR30DLED30/G3	★	11W	65W	82	850	5.10" x 3.75"	3000K
14099424	11BR30DLED40/G3	★	11W	65W	84	850	5.10" x 3.75"	4000K
BR40								
14099052	12BR40DLED27/G3	★	12W	75W	82	1050	6.25" x 4.75"	2700K
14099417	12BR40DLED27/G3/BP	★	12W	75W	82	1050	6.25" x 4.75"	2700K
14099053	12BR40DLED30/G3	★	12W	75W	84	1050	6.25" x 4.75"	3000K
14099054	12BR40DLED40/G3	★	12W	75W	84	1050	6.25" x 4.75"	4000K
14099418	17BR40DLED27/G3	★	17W	100W	82	1400	6.25" x 4.75"	2700K
14099419	17BR40DLED30/G3	★	17W	100W	82	1400	6.25" x 4.75"	3000K
14099420	17BR40DLED40/G3	★	17W	100W	84	1400	6.25" x 4.75"	4000K

★ **ENERGY STAR Certified**

LED BR LAMPS G3

BR20, BR30, BR40 SERIES



7W BR20



8W BR30
11W BR30



12W BR40
17W BR40

PRODUCT DESCRIPTION:

With a full array of BR lamps, MaxLite products offer an immediate payback with 7-, 8-, 11-, 12-, 14-, 17-watt LED replacements for 50-, 65-, 75-, and 100-watt incandescent lamps. Available in a standard medium base, the LED BR lamp is an ideal lighting solution for track lights, display lights and recessed lights. They provide efficient, general lighting suited for architectural, residential, retail, office space and hospitality applications.

FEATURES:

- 120V, 60Hz
- 25,000 hour life (at L70 standards)
- CRI: >80
- ENERGY STAR Certified
- BR lens conceals LEDs from sight and evenly distributes the light
- Smooth aluminum housing with ANSI standard form factor
- Dimmable down to ten percent
- Operating temperature: -4°F to 104°F
- Suitable for use in damp locations
- Not for use in enclosed luminaires
- Five year warranty

MODEL SELECTION (Full list of order codes on pg. 2) | Typical order example: 17BR40DLED27/G3

	DLED	
FAMILY	**DIMMABILITY**	**COLOR TEMPERATURE (CCT)**
7BR20 = 7 watts, BR20 **8BR30 =** 8 watts, BR30 **11BR30 =** 11 watts, BR30 **12BR40 =** 12 watts, BR40 **17BR40 =** 17 watts, BR40	**DLED =** Dimmable	**27/G3 =** 2700K **30/G3 =** 3000K **40/G3 =** 4000K **50/G3 =** 5000K*

NOTES:
1. Bulk pack and 4 pack are available. See Ordering Table on Page 2.
* 5000K model only available for 8BR30DLED50/G3

COMPATIBLE DIMMERS:

MAKE	DIMMER MODEL
Lutron	CTCL-153P
Lutron	DVCL-153P
Lutron	LGCL-153P
Lutron	S-600

MAKE	DIMMER MODEL
Leviton	IPL06
Leviton	IPI10
Leviton	6631-LW
Leviton	6683-IW

SPECIFICATIONS:

		BR20	BR30		BR40	
ITEM	**SPECIFICATION**	**7 WATTS**	**8 WATTS**	**11 WATTS**	**12 WATTS**	**17 WATTS**
GENERAL PERFORMANCE	Color Temperature	2700K, 3000K, 4000K	2700K, 3000K, 4000K, 5000K	2700K, 3000K, 4000K	2700K, 3000K, 4000K	2700K, 3000K, 4000K
	Lumens Delivered (lm)	550	650	850	1050	1400
	Efficacy (lm/W)	79	81	77	88	82
	Equivalency	50W	65W	65W	75W	100W
	Lumen Maintenance (L70)	25,000 hours				
ELECTRICAL	Power Factor	≥.70				
	Input Voltage	120V				
PHYSICAL	Operating Temperature	-4°F to 104°F				
APPLICATION	Environment	Dry, Damp				
	Warranty	5 Year				

ORDERING:

ORDER CODE	MODEL	ENERGY STAR	WATTAGE	INCANDESCENT EQUIVALENCY	CRI	OUTPUT (LUMENS)	DIMENSIONS H" X W"	CCT
BR20								
14099046	7BR20DLED27/G3	★	7W	50W	82	550	3.8" x 2.5"	2700K
14099047	7BR20DLED30/G3	★	7W	50W	82	550	3.8" x 2.5"	3000K
14099048	7BR20DLED40/G3	★	7W	50W	84	550	3.8" x 2.5"	4000K
BR30								
14099149	8BR30DLED27/G3	★	8W	65W	82	650	5.10" x 3.75"	2700K
14099158	8BR30DLED27/G3/4P (4-Pack)	★	8W	65W	82	650	5.10" x 3.75"	2700K
14099159	8BR30DLED27/G3/BP (Bulk Pack)	★	8W	65W	82	650	5.10" x 3.75"	2700K
14099050	8BR30DLED30/G3	★	8W	65W	82	650	5.10" x 3.75"	3000K
14099051	8BR30DLED40/G3	★	8W	65W	84	650	5.10" x 3.75"	4000K
14099657	8BR30DLED50/G3	★	8W	65W	84	650	5.10" x 3.75"	5000K
14099421	11BR30DLED27/G3	★	11W	65W	82	850	5.10" x 3.75"	2700K
14099422	11BR30DLED27/G3/BP	★	11W	65W	82	850	5.10" x 3.75"	2700K
14099423	11BR30DLED30/G3	★	11W	65W	82	850	5.10" x 3.75"	3000K
14099424	11BR30DLED40/G3	★	11W	65W	84	850	5.10" x 3.75"	4000K
BR40								
14099052	12BR40DLED27/G3	★	12W	75W	82	1050	6.25" x 4.75"	2700K
14099417	12BR40DLED27/G3/BP	★	12W	75W	82	1050	6.25" x 4.75"	2700K
14099053	12BR40DLED30/G3	★	12W	75W	84	1050	6.25" x 4.75"	3000K
14099054	12BR40DLED40/G3	★	12W	75W	84	1050	6.25" x 4.75"	4000K
14099418	17BR40DLED27/G3	★	17W	100W	82	1400	6.25" x 4.75"	2700K
14099419	17BR40DLED30/G3	★	17W	100W	82	1400	6.25" x 4.75"	3000K
14099420	17BR40DLED40/G3	★	17W	100W	84	1400	6.25" x 4.75"	4000K

★ **ENERGY STAR Certified**

KT-EMRG-LED-5-500-K1

CONSTANT WATTAGE LED EMERGENCY BACK-UP

DESCRIPTION

LED Emergency Back-Up Driver Kit | 5W Output | 120–277V Input

- **DRIVER TYPE:** Constant Wattage LED Emergency
- **MAX. OUTPUT POWER:** 5W
- **INPUT VOLTAGE:** 120–277Vac ±10%
- **OUTPUT VOLTAGE:** 12~41Vdc
- **OUTPUT CURRENT:** 400–100mA
- **WARRANTY:** 5 Years



PRODUCT FEATURES

- Drives dedicated LED load (included) at 5W for a minimum of 90 minutes
- Meets FCC Part 15 (Class B) consumer limits
- Short circuit overload and open load protection
- Suitable for dry and damp locations
- Evaluated to UL 924 standards
- Operating temperature: 0ºC/32ºF to 50ºC/122ºF
- Input frequency: 50/60 Hz
- Test switch/Charging indicator light
- Battery pack with quick connect: NiCd
- Battery capacity: 1200mAh

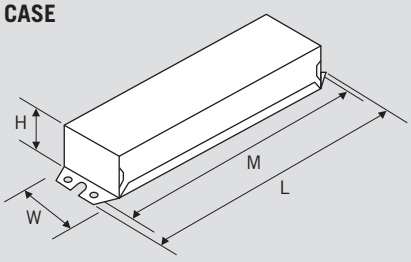
ELECTRICAL SPECIFICATIONS

	INPUT CHARACTERISTICS			OUTPUT CHARACTERISTICS		
Family	**Input Voltage**	**Power Factor**	**Max. Current**	**Max. Output Power**	**Rated Output Current**	**Output Voltage**
5W	120–277Vac	≥0.5	0.03A @ 120V	5W	400mA–100mA	12~41Vdc

Emergency pack designed to deliver 5W to a constant current LED load. Approximate output is 500 lumens, assuming a nominal minimum efficacy of 100 lm/W.

MECHANICAL SPECIFICATIONS

CASE

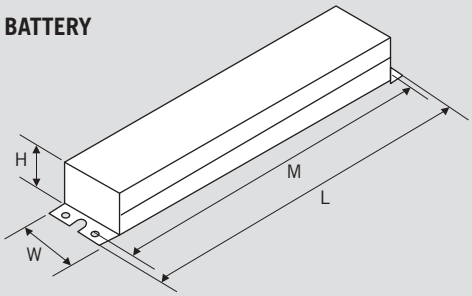


CASE DIMENSIONS

L (Length)	6.46"
W (Width)	1.37"
H (Height)	1.00"
M (Mounting)	6.00"

Case Style: L7
Case Material: Metal

BATTERY



BATTERY DIMENSIONS

L (Length)	8.10"
W (Width)	1.97"
H (Height)	0.98"
M (Mounting)	7.57"

MODULE SPECIFICATIONS

Catalog Number: KTLM-120-L9-850-12A

Length	5.00"
Width	0.70"
Number of LEDs	12
Color Temperature	5000K

KT-EMRG-LED-5-500-K1

CONSTANT WATTAGE LED EMERGENCY BACK-UP

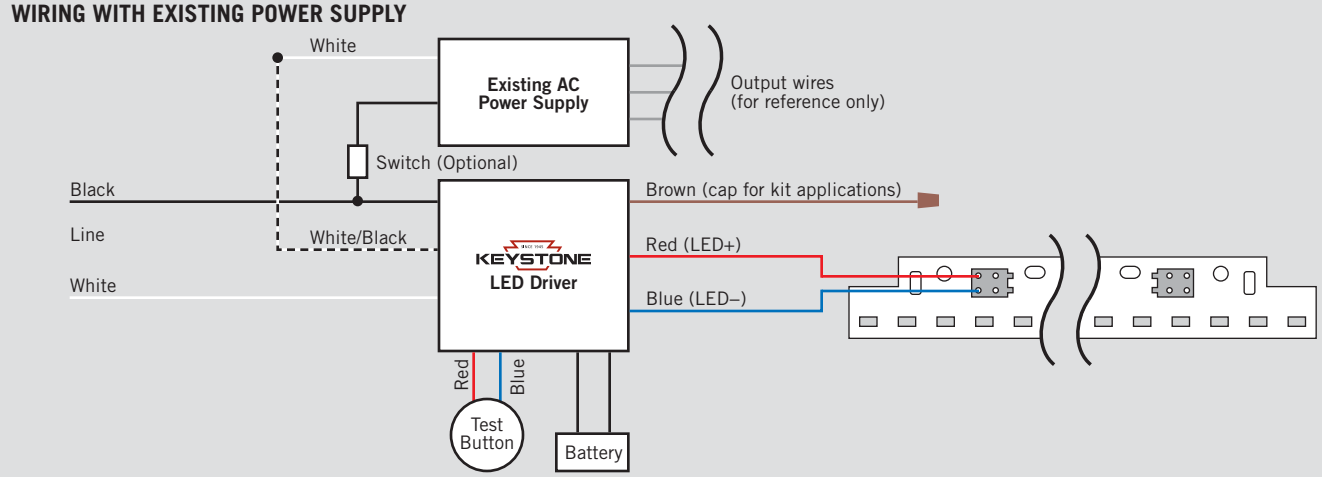
KIT WIRING SPECIFICATIONS

STANDARD LEAD LENGTHS*

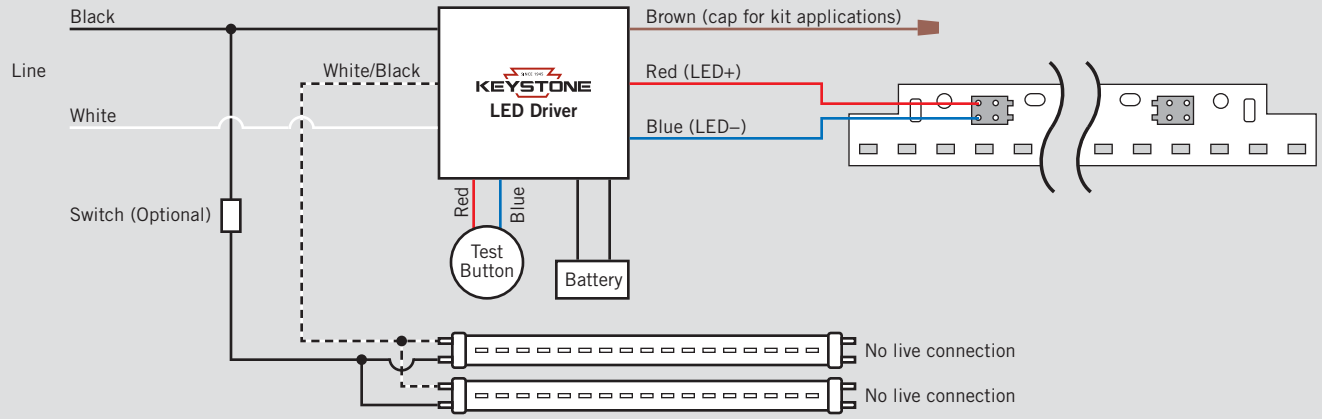
Input	Black, White, White/Black: 12" #18AWG
Output	Red, Blue: 24" #18AWG
	Brown: 24" #20AWG
Test Button	Red, Blue: 24" #22AWG

** Consult Keystone for special lead length requirements.*

WIRING WITH EXISTING POWER SUPPLY



WIRING WITH DIRECT DRIVE LED TUBE FIXTURE



KT-EMRG-LED-5-500-K1
CONSTANT WATTAGE LED EMERGENCY BACK-UP

ORDERING INFORMATION

ORDER CODE	DESCRIPTION	PACKAGING STYLE	PACK QUANTITY	ITEM STATUS
KT-EMRG-LED-5-500-K1-IP	LED Emergency Driver with Battery and 0.7" × 6" 500 lumen LED Module	Individually Packaged	1	Active

CATALOG NUMBER BREAKDOWN

KT-EMRG-LED-5-500-K1-IP

1 2 3 4 5 6 7

1 **Keystone Technologies**
2 **Emergency Back-up Driver**
3 **LED Driver**
4 **Wattage Family**
5 **Nominal Lumen Output**
6 **Kit**
7 **Packaging Style**

KT-EMRG-LED-5-500-AC/DF

CONSTANT WATTAGE LED EMERGENCY BACK-UP DRIVER

c UL us LISTED | RoHS Compliant | 5 YEAR WARRANTY

DESCRIPTION

LED Emergency Back-Up Driver | Dual-Flex Conduit | 5W Output | 120–277V Input

DRIVER TYPE: Constant Wattage LED Emergency
MAX. OUTPUT POWER: 5W
INPUT VOLTAGE: 120–277Vac ±10%
OUTPUT VOLTAGE: 40–300Vdc
OUTPUT CURRENT: Load Dependant
WARRANTY: 5 Years



PRODUCT FEATURES

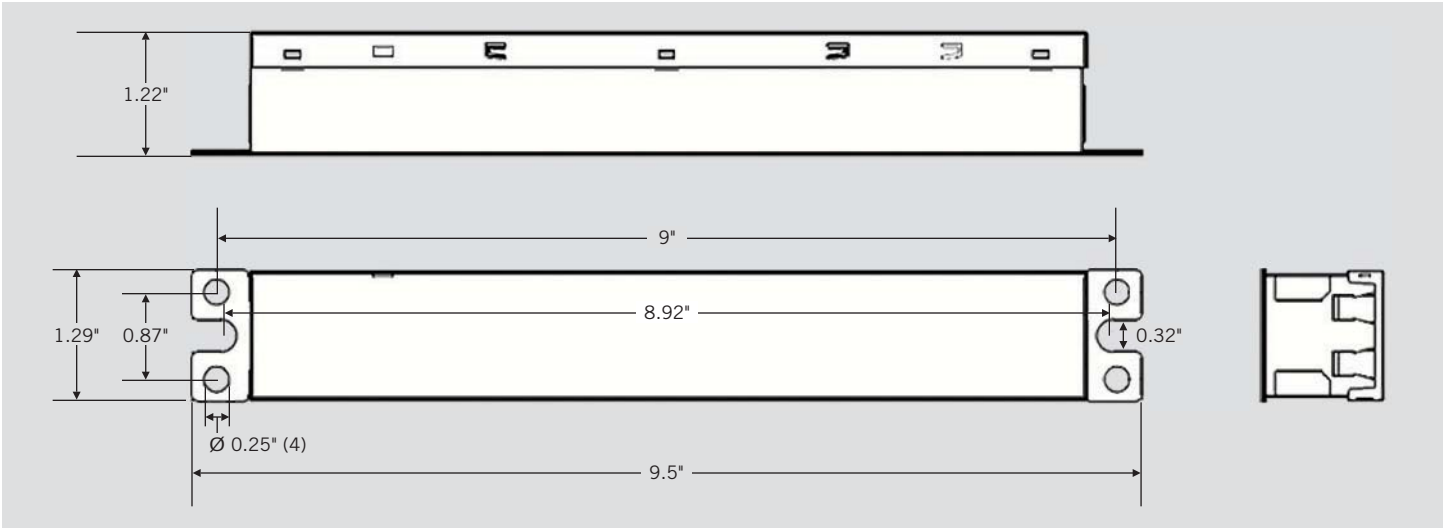
- Optimized for recessed LED downlight fixtures and retrofit kits, and Keystone DirectDrive compact lamps. Contact Keystone for details on functioning with other LED products
- Illuminates entire LED load at reduced output under emergency mode
- One-piece design with metal housing
- 2-in-1 LED test switch and indicator light included
- Dual-flex conduit fits into ½" knockouts
- Evaluated to UL 924 requirements
- 90-minute operation in emergency mode
- UL listed
- Operating temperature: 0ºC/32ºF to 50ºC/122ºF
- Input frequency: 50/60 Hz
- Maximum load: 50W
- Li(NiCoMn)O_2 battery

ELECTRICAL SPECIFICATIONS

	INPUT CHARACTERISTICS			OUTPUT CHARACTERISTICS			
Family	**Input Voltage**	**Power Factor**	**Max. Current**	**Max. Output Power**	**Rated Output Current**	**Output Voltage**	**LED Module Included**
5W	120–277Vac	≥0.35	100mA @120V	5W	Load Dependent	40~300Vdc	No

EMERGENCY PACK DESIGNED TO DELIVER 5W TO A CONSTANT CURRENT LED LOAD. APPROXIMATE OUTPUT IS 500 LUMENS, ASSUMING A NOMINAL MINIMUM EFFICACY OF 100LM/W.

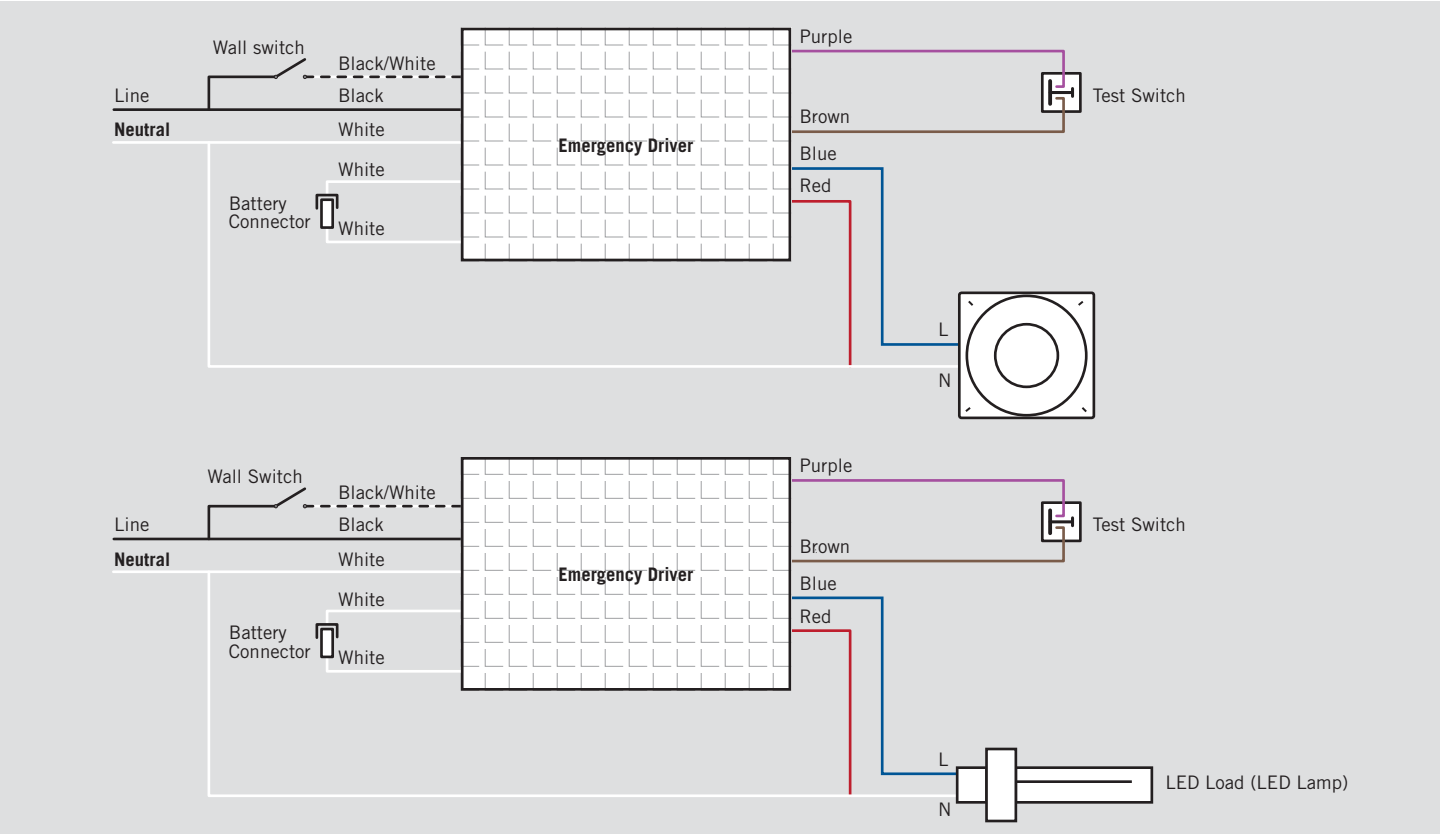
PHYSICAL SPECIFICATIONS



KT-EMRG-LED-5-500-AC/DF

CONSTANT WATTAGE LED EMERGENCY BACK-UP DRIVER

WIRING DIAGRAM



ORDERING INFORMATION

ORDER CODE	DESCRIPTION	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KT-EMRG-LED-5-500-AC/DF	1-Piece LED Emergency Back Up with Duel-Flex Conduit	Individually Packaged	1	Active

CATALOG NUMBER BREAKDOWN

KT-EMRG-LED-5-500-AC/DF

1 2 3 4 5 6 7

1 **Keystone Technologies**
2 **Emergency Back-Up Driver**
3 **LED Driver**
4 **Wattage Family**
5 **Nominal Lumen Output**
6 **Alternating Current**
7 **Dual-Flex**

PLS 6W HYB GX23 TITANIUM LED SERIES

GREENCREATIVE

PL EDGE SERIES

PRO



6W REPLACES



13W CFL

60% Energy Savings

- HYBrid installation - DIRect or BYPass
- Compatible with magnetic ballasts - DIRect installation
- Built-in universal voltage driver - BYPass installation
- Exceptional efficacy 92 LPW
- Lasts 5 times longer than CFL
- 310° rotatable base

50,000 H

MAGNETIC BALLAST COMPATIBLE

120-277V UNIVERSAL

5 YR WARRANTY

80 CRI (Ra)

NON ENCL.*

CLASSIFIED c UL us

FC

lighting facts LED Product Partner

LM 79

LM 80

TM 21

IES

COMPACT FORM FACTOR AND ROTATABLE BASE SUITABLE FOR ALL APPLICATIONS

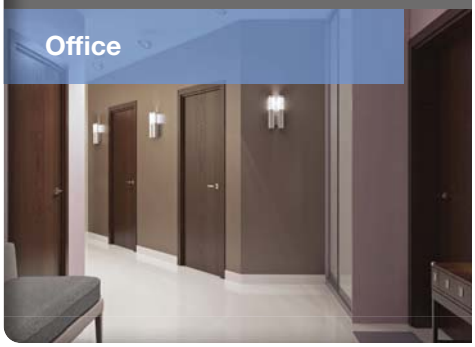


PLS 6W HYB GX23 TITANIUM LED SERIES

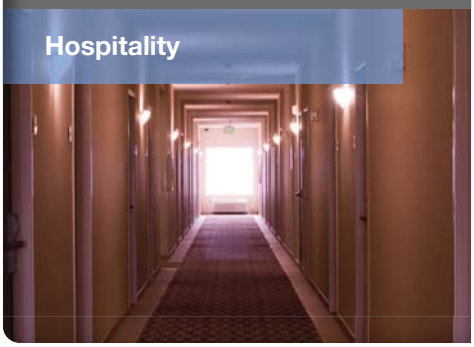
GREENCREATIVE

APPLICATIONS

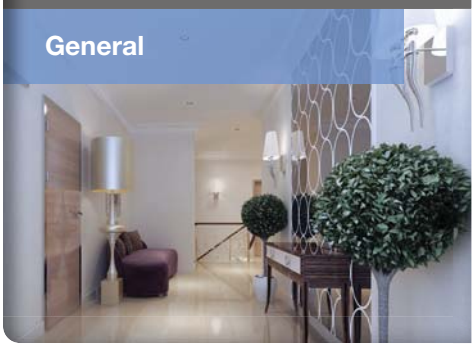
Office



Hospitality



General



Ref.#:DS162-PLS-6W-HYB-GX23

Base:	GX23 (2-pin CFL)
Voltage:	Magnetic ballast compatible 120-277V
Dimmable:	No
PF:	0.9
Lifetime:	50,000 hrs
Weight:	0.15lb / 68g



Note: Product designed to replace 13W Double Twin Tube CFL. For Single Twin Tube CFL replacement, please use PLS 5.5W HYB GX23.

SPECIFICATIONS

Model	Product	Power (W)	CCT	CRI (typ.)	Lumens	LPW	Beam Angle
6PLS/827/HYB/GX23	57962	6	Soft White 2700K	80	520	87	120°
6PLS/830/HYB/GX23	57963	6	Warm White 3000K	80	550	92	120°
6PLS/835/HYB/GX23	57964	6	Neutral White 3500K	80	550	92	120°
6PLS/840/HYB/GX23	57965	6	Cool White 4000K	80	560	93	120°

* Not intended for use in totally enclosed fixtures
** Suitable for damp locations. Not for use where directly exposed to weather or water
*** Full installation guide and more details available on website

PL H 9.5W BYP TITANIUM LED SERIES

GREENCREATIVE

PL EDGE SERIES

PRO



9.5W REPLACES



26W CFL

60% Energy Savings

- **HYBrid installation - DIRect or BYPass**
- **Compatible with magnetic ballasts - DIRect installation**
- **Built-in universal voltage driver - Bypass installation**
- **Compatible with G24d, GX24d, G24q & GX24q bases**
- **Exceptional efficacy 100 LPW**
- **Lasts 4 times longer than CFL**

50,000 H

MAGNETIC BALLAST COMPATIBLE

120-277V UNIVERSAL

5 YR WARRANTY

82 CRI (Ra)

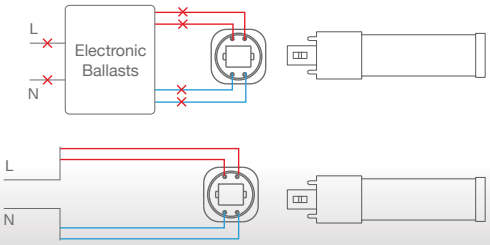
SEMI DIRECTIONAL

CLASSIFIED cULus FC lighting facts LED Product Partner LM 79 LM 80 TM 21 IES

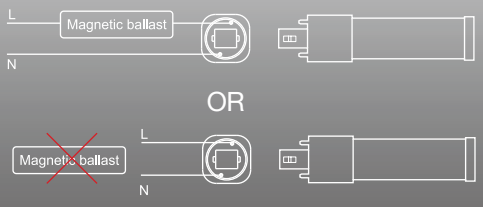
PL PRODUCT FEATURES

BYPass Installation - Electronic Ballasts

This PL H lamp is not compatible with electronic ballasts and requires bypassing the ballast during installation. The lamp runs directly off line voltage to eliminate compatibility problems, incidental power loss, lifetime issues, and maintenance costs associated with ballasts.



HYBrid Installation - DIRect or BYPass - Magnetic Ballasts



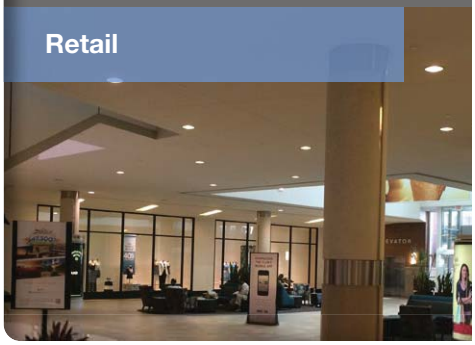
When used with a magnetic ballast, the PL H can function as a plug & play lamp and operate with the existing ballast. If the ballast is not compatible, it can be bypassed and the lamp can run directly off line voltage.

PL H 9.5W BYP TITANIUM LED SERIES

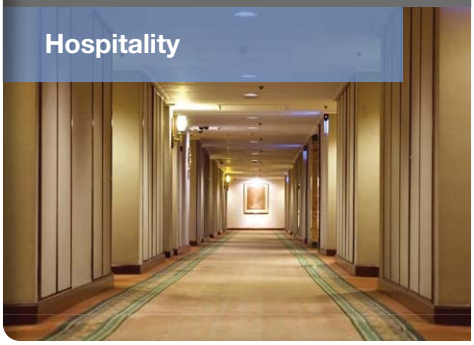
GREENCREATIVE

APPLICATIONS

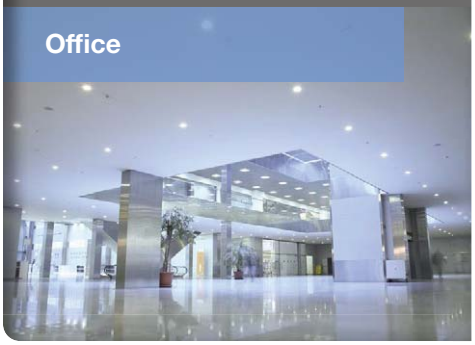
Retail



Hospitality



Office



Ref.#: DS182-PLH-9.5W-BYP-291216

Base:	G24d, GX24d, G24q & GX24q (2/4-pin CFL)
Voltage:	Magnetic ballast compatible 120-277V
Dimmable:	No
PF:	0.9
Lifetime (L70):	50,000 hrs
Weight:	0.18lb / 82g



SPECIFICATIONS

Model	Product	Power (W)	CCT	CRI (typ.)	Lumens	LPW	Beam Angle
9.5PLH/827/BYP	28354	9.5	Soft White 2700K	82	870	92	110°
9.5PLH/830/BYP	28355	9.5	Warm White 3000K	82	920	97	110°
9.5PLH/835/BYP	28356	9.5	Neutral White 3500K	82	920	97	110°
9.5PLH/840/BYP	28357	9.5	Cool White 4000K	82	950	100	110°

* Suitable for damp locations. Not for use where directly exposed to weather or water
** Not intended for use in enclosed fixtures
*** Full installation guide and more details available on website

PROJECT NAME:_____ CATALOG NUMBER:_____

NOTES:_____FIXTURE SCHEDULE:_____

LED T8 - LINEAR REPLACEMENT LAMP

Single-Ended/ Double-Ended Power Coated Glass Series

UL TYPE-B



FEATURES:

- Wattage:
  - 9W, 2FT, ≥1125 lumens, replaces 17W fluorescent T8
  - 12W, 3FT, ≥1,225 lumens, replaces 25W fluorescent T8
  - 11.5W, 4FT, ≥1,650 lumens, replaces 32W fluorescent T8
- Universal Voltage: 120V-277V applications
- Color Rendering Index (CRI): ≥80
- Beam angle: 330˚
- THD <20%
- Power factor: ≥ 0.90
- Easy retrofit into most common linear fluorescent fixtures
- Simple ballast bypass, single-ended/ double-ended power
- **Compatible with shunted and non-shunted lamp holders**
- Instant on
- Mercury free and virtually no UV or IR light
- Non dimmable
- Suitable for enclosed fixture
- Suitable for dry and damp locations
- ETL Sanitation listed (tested under NSF standard)
- All glass construction with PET coating
- Rated Lifetime @ L70: 62,000 Hours
- Products L9T8DE235-CG4, L9T8DE240-CG4, L9T8DE250-CG4, L11.5T8DE435-CG4, L11.5T8DE440-CG4 & L11.5T8DE450-CG4 are listed on the DLC QPL

PRODUCT DESCRIPTION:

Offering the versatility of single or double ended wiring options in one product SKU, this LED UL Type-B T8 lamp is an easy retrofit into most common linear fluorescent fixtures with shunted or non-shunted lamp holders (see re-lamping examples provided). In addition to flexible installation features that save installers time and money, the Single-Ended/Double-Ended LED T8 lamp consumes up to 50% less energy than standard fluorescent tubes, providing facilities with long-term operational savings.

WARRANTY:

5-year standard warranty
(further details available at www.maxlite.com/warranties)
Product may be eligible for a warranty extension to 10 years, for an additional fee. Contact MaxLite for details.

MODEL SELECTION (Full list of order codes on pg. 2) — Typical order example: L9T8DE240-CG4

L	9	T8	DE	2	
FAMILY	**WATTAGE**	**LAMP TYPE**	**OPERATION**	**LENGTH**	**COLOR TEMPERATURE**
L= LED Linear	**9=** 9W	**T8=** T8 tube	**DE=** Double-Ended Power	**2=** 2FT	**35-CG4=** 3500K, Coated Glass **40-CG4=** 4000K, Coated Glass **50-CG4=** 5000K, Coated Glass

L	12	T8	DE	3	
FAMILY	**WATTAGE**	**LAMP TYPE**	**OPERATION**	**LENGTH**	**COLOR TEMPERATURE**
L= LED Linear	**12=** 12W	**T8=** T8 tube	**DE=** Double-Ended Power	**3=** 3FT	**35-CG4=** 3500K, Coated Glass **40-CG4=** 4000K, Coated Glass **50-CG4=** 5000K, Coated Glass

L	11.5	T8	DE	4	
FAMILY	**WATTAGE**	**LAMP TYPE**	**OPERATION**	**LENGTH**	**COLOR TEMPERATURE**
L= LED Linear	**11.5=** 11.5W	**T8=** T8 tube	**DE=** Double-Ended Power	**4=** 4FT	**35-CG4=** 3500K, Coated Glass **40-CG4=** 4000K, Coated Glass **50-CG4=** 5000K, Coated Glass

LED T8 - LINEAR REPLACEMENT LAMP

Single-Ended/ Double-Ended Power Coated Glass Series
UL TYPE-B

SPECIFICATIONS:

		L9T8DE2xx-CG4	L12T8DE3xx-CG4	L11.5T8DE4xx-CG4
ITEM	**SPECIFICATION**	**2FT - DETAILS**	**3FT - DETAILS**	**4FT - DETAILS**
GENERAL PERFORMANCE	Power Consumption (W)	9W	12W	11.5W
	Lumens Delivered (lm)	1125-1188	1225-1300	1650-1800
	Efficacy	≥125 lm/w	≥102 lm/w	≥143 lm/w
	CRI	≥80		
	Beam Angle	330°		
	Color Temperature (CCT)	3500K, 4000K, 5000K		
	Lumen Maintenance (L70)	62,000 Hours		
ELECTRICAL	Power Factor	≥ 0.90		
	Input Voltage	120V-277V, 50/60 Hz		
PHYSICAL	Operating Temperature	-4°F to 113°F		
	Lens	Opal (Frosted) - Coated Glass		
CERTIFICATION	Certification	CULus Classified, ETL Sanitation	cULus Classified, ETL Sanitation	CULus Classified, ETL Sanitation
	Material Usage	RoHS compliant; no mercury		
	Environment	Dry & Damp, Enclosed Fixtures		
	Warranty	5-year standard warranty		
QUALIFICATION	DesignLight Consortium	DLC 4.2 Standard	N/A	DLC 4.2 Standard

Lighting layouts and spacing criteria available upon request

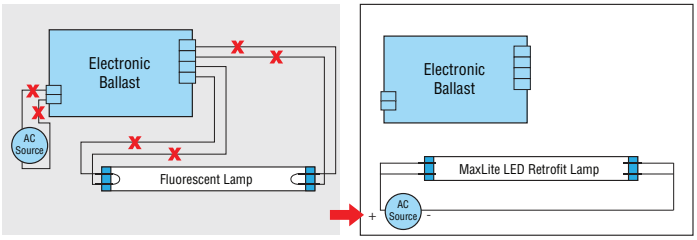
ORDERING:

ORDER CODE	MODELS	WATTS	LUMENS (lm)	EFFICACY (lm/W)	CCT	CASE QTY
9W 2FT T8 MODELS						
1409555	L9T8DE235-CG4	9W	1125	125 lm/W	3500K	25 pcs
1409556	L9T8DE240-CG4		1200	133 lm/W	4000K	
1409557	L9T8DE250-CG4		1250	139 lm/W	5000K	
12W 3FT T8 MODELS						
1409555	L12T8DE335-CG4	12W	1225	102 lm/W	3500K	25 pcs
1409556	L12T8DE340-CG4		1250	104 lm/W	4000K	
1409557	L12T8DE350-CG4		1300	108 lm/W	5000K	
11.5W 4FT T8 MODELS						
1409558	L11.5T8DE435-CG4	11.5W	1650	143 lm/W	3500K	25 pcs
1409559	L11.5T8DE440-CG4		1750	152 lm/W	4000K	
1409560	L11.5T8DE450-CG4		1800	156 lm/W	5000K	

LED T8 - LINEAR REPLACEMENT LAMP

Single-Ended/ Double-Ended Power Coated Glass Series
UL TYPE-B

RELAMPING EXAMPLE:



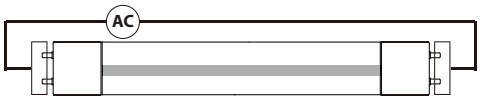


Figure 1. - Double-Ended connection

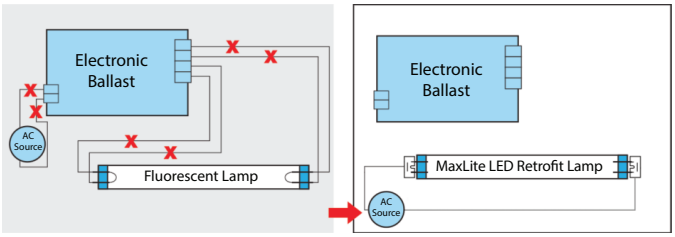


Figure 2. - Retrofit with One Lamp

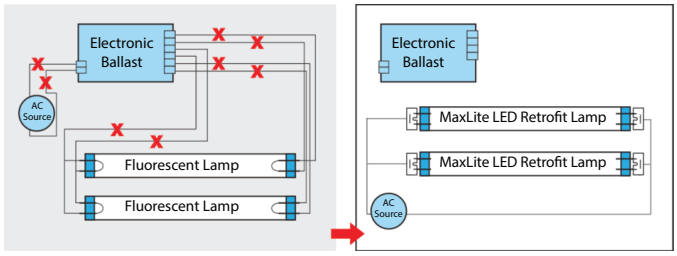


Figure 3. - Retrofit with Two Lamps

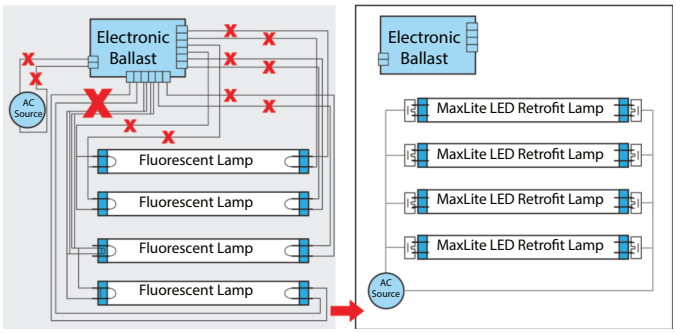


Figure 4. - Retrofit with Three/Four Lamps

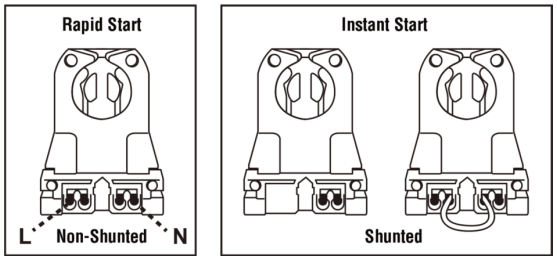


Figure 1. - Non-shunted & Shunted Lamp Holder



Figure 2. - Single sided connection

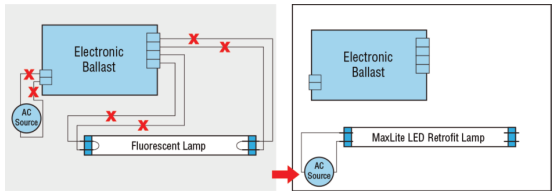


Figure 3. - Retrofit with One Lamp

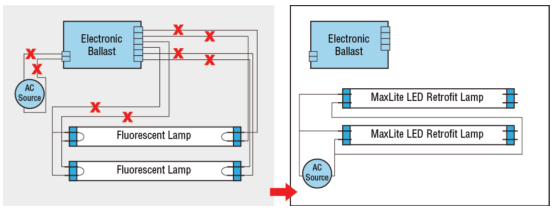


Figure 4. - Retrofit with Two Lamps

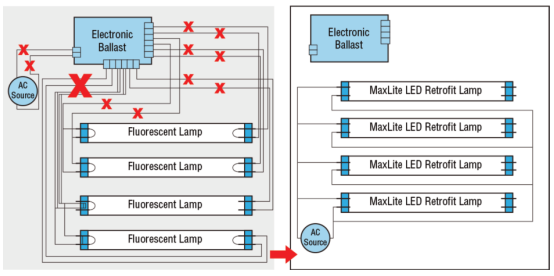


Figure 5. - Retrofit with Three/Four Lamps

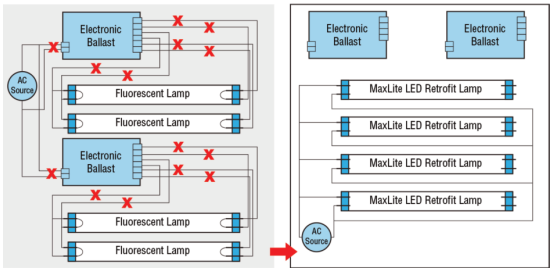


Figure 6. - Retrofit with Three/Four Lamps & Two Ballasts

MaxLite
A NEW WAVE OF LIGHT

PROJECT NAME:_____ CATALOG NUMBER:_____

NOTES:_____FIXTURE SCHEDULE:_____

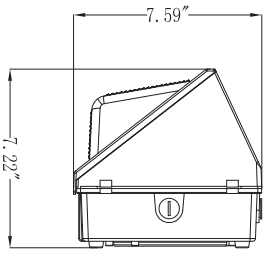
WALLMAX™ OPEN FACE

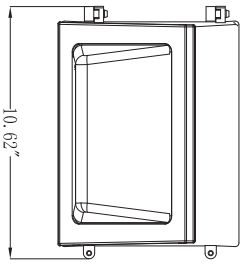
WP-OP Series



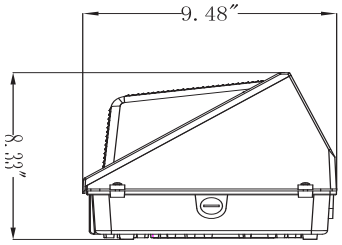
DIMENSIONS:

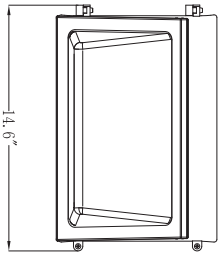
SIZE 1 - 28W & 40W





SIZE 2 - 28W, 40W, 50W, 80W & 120W





MaxLite Makes It!

Don't see what you need? Additional wattages and specifications available upon request - contact your MaxLite rep!

PRODUCT DESCRIPTION:

WallMax™ Open Face Wall Packs are ideal for brightly-lit outdoor environments in parking garages, entrances, public areas, schools, hospitals, hotels and outdoor walkways nationwide. The 28-, 40-, 50-, 80-, and 120-watt LED fixtures are energy-efficient replacements for up to 750-watt metal halide fixtures. The fixtures are rebatable, save energy, generate lower maintenance costs, and prevent light pollution.

FEATURES:

- Trade Agreements Act (TAA) compliant product available - Contact MaxLite for details
- Heavy-duty cast aluminum housing is polyester powder coated to be rust and corrosion proof
- Shatter-resistant borosilicate glass
- 0-10V dimming driver standard
- 6kV integral surge suppression standard
- Six ½ NPS knockouts available
- Photo/Motion Sensor, 347-480V, Battery Back-Up options, Visors and Wire Guards available.

CONTROLS:

120-277VAC Photocontrol:

- Power the fixture when light levels reach 20 lux or below
- Turn off the fixture at 30 lux or higher

PIR Outdoor Daylight/Motion Sensor:

- Sensor provides multi-level control based on motion and/or
- daylight contribution for 0-10V DC Drivers
- All control parameters are adjustable remotely
- At least one FSIR-100 remote control must be ordered per
- project to be able to adjust factory settings for daylight / motion sensor
- For more information, please see supplementary datasheet for sensor model **MSWSFSP221B>>>**

WARRANTY:

10-year standard warranty with labor allowance*
(further details available at www.maxlite.com/warranties)
*Warranty Limitations: Product must be rated for the application per the Product Data Sheet (PDS); operated ≤16 hrs/day; in ambient of -29°F to 104°F.
*Up to $25/unit; labor allowances of up to $500/unit available for purchase – contact MaxLite representative for details.

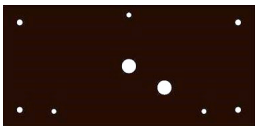
MODEL SELECTION — Typical order example: WP-OP28U-50B

WP-OP			-		B	
FAMILY	**WATTAGE**	**VOLTAGE**	-	**LED MODULE**	**FINISH**	**OPTION**
WP-OP= Open Face Wall Pack	**28=** 28W, 150W MH replacement **40=** 40W, 175W MH replacement **50=** 50W, 250W MH replacement **80=** 80W, 400W MH replacement **120=** 120W, 750W MH replacement	**U=** 120-277V **H[1]=** 347-480V	-	**40=** 4000K, CRI 80+ **50=** 5000K, CRI 80+	**B=** Bronze Contact MaxLite for additional finishes	**(BLANK)=** None **PC=** 120-277V Photocontrol **MS[2]=** PIR Daylight/Motion Sensor **L[3]=** Size 2 housing **EM2[4]=** Size 2 housing, Battery Backup, -20° C **EM0[4]=** Size 2 housing, Battery Backup, 0° C

1. Not DLC listed. Not available with LEM2 or LEM0 options.
2. Motion Sensor performs at 20' up to 48' diameter. External model MSWSFSP221B-D will be provided on models with 120W; 347-480V; or -20 C Battery back up.
3. Use with 28W and 40W fixtures only.
4. Option L must be used with options EM0 and EM2 for all wattages.

Phone: 1-800-555-5629 | **Fax:** 973-244-7333 | **Web**: www.maxlite.com | **E-mail:** info@maxlite.com

MaxLite

ACCESSORIES			
ORDER CODE	**MODEL NUMBER**	**DESCRIPTION**	**ACCESSORIES IMAGE**
100679	WP-OP-S1PLATE-B	Beauty Plate, 14.50" X 9.50" X 0.08", Size 1, Bronze, 28W and 40W Models	
100461	WP-OP-S2PLATE-B	Beauty Plate, 18.1" * 8.7" * 0.08", Size 2, Bronze, 50W, 80W, and 120W Models	
102184	FSIR-100	Remote Control for daylight / motion sensor	
100821	WP-OP-S1VISOR-B	Cutoff Visor, Size 1, Bronze, 28W and 40W models	
100822	WP-OP-S2VISOR-B	Cutoff Visor, Size 2, Bronze, 50W, 80W and 120W models	
14099860	WP-OPSWG	Wire Guard, Size 1, Bronze, 28W and 40W models	
101499	WP-OPLWG	Wire Guard, Size 2, Bronze, 50W, 80W and 120W models	

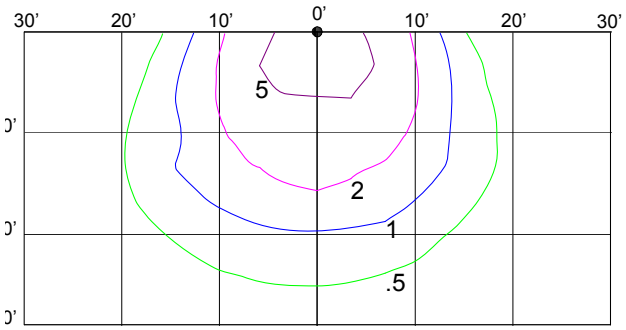
SPECIFICATIONS:

		28W	40W	50W	80W	120W
ITEM	**SPECIFICATION**	**DETAILS**				
GENERAL PERFORMANCE	Input Power (W)	28	40	50	80	120
	Lumens Delivered (up to)	3,770	5,645	7,065	11,375	16,945
	Efficacy (up to)	136	138	138	140	140
	CRI	≥80				
	Lumen Maintenance (L85, TM-21 @ 25°C)	>100,000 hours				
	Color Temperature	4000K, 5000K				
	Spacing Criteria	Available upon request				
ELECTRICAL	Input Voltage	120-277V standard; 347-480V available				
	Power Factor	>90%				
	THD	<15%				
PHYSICAL	Housing	Die-Cast Polyester Aluminum				
	Lens	Shatter-resistant borosilicate glass				
CERTIFICATION	Certifications	ETL, IP65				
	Environment	Outdoor, wet location				
	Warranty	10-year standard warranty*				
	Operating Temperature	-40°F ~104°F (-40°C ~ 40°C)				
	Humidity	10%-90% RH, non-condensing				
QUALIFICATION	DesignLight Consortium	DLC Premium				

Lighting layouts and spacing criteria available upon request.

LAYOUTS:

WP-OP 28W:

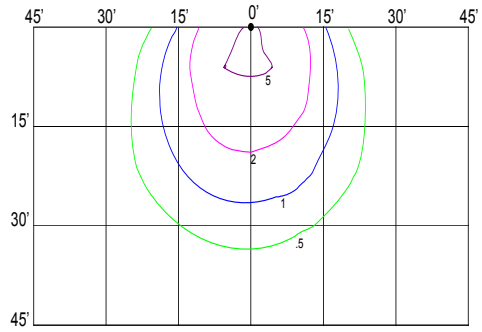


28W
3,640 LUMENS (SIZE 1 HOUSING)
10' MOUNTING HEIGHT

FOOT-CANDLE CORRECTION FACTOR:

NEW HEIGHT:	10'	15'	20'	25'
MULTIPLY BY:	1	0.67	0.50	0.40

WP-OP 40W:

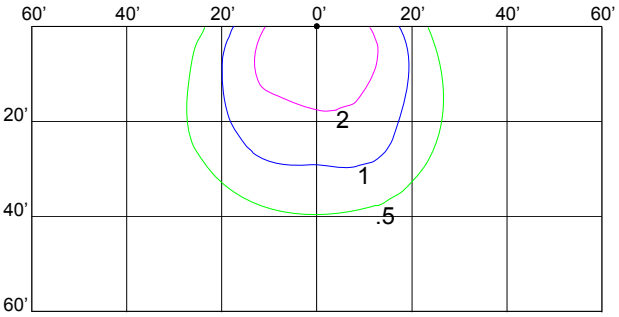


40W
5,540 LUMENS (SIZE 1 HOUSING)
15' MOUNTING HEIGHT

FOOT-CANDLE CORRECTION FACTOR:

NEW HEIGHT:	10'	15'	20'	25'
MULTIPLY BY:	1.50	1	0.75	0.60

WP-OP 50W:

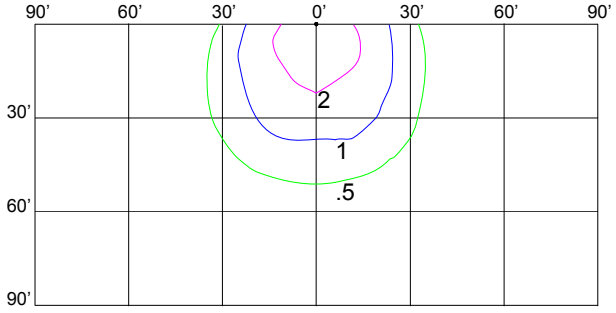


50W
7,065 LUMENS
20' MOUNTING HEIGHT

FOOT-CANDLE CORRECTION FACTOR:

NEW HEIGHT:	10'	15'	20'	25'
MULTIPLY BY:	2	1.33	1	0.80

WP-OP 80W:

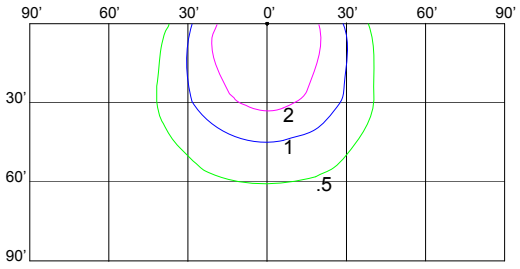


80W
11,375 LUMENS
30' MOUNTING HEIGHT

FOOT-CANDLE CORRECTION FACTOR:

NEW HEIGHT:	10'	15'	20'	25'	30'
MULTIPLY BY:	3	2	1.50	1.2	1

WP-OP 120W:



120W
16,945 LUMENS
30' MOUNTING HEIGHT

FOOT-CANDLE CORRECTION FACTOR:

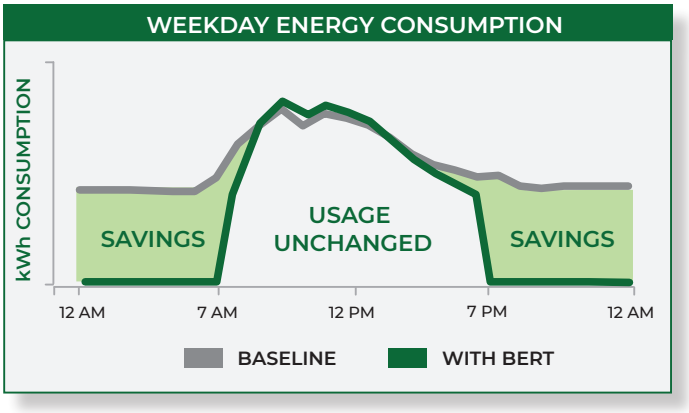
NEW HEIGHT:	10'	15'	20'	25'	30'
MULTIPLY BY:	3	2	1.50	1.2	1

BERT® CONTROL

STANDARD SOFTWARE
SOPHISTICATED MASS REMOTE CONTROL

TURN SMALL LOADS OFF AND SAVE BIG

Plug load devices consume energy whether they are being used or sitting idle overnight. Energy consumed when devices are not being used is known as standby load or overnight load. Bert eliminates standby load by automatically turning plug load and other small miscellaneous loads off nights, weekends, and extended holidays when buildings are unoccupied.



EASY SCHEDULE CREATION

To create a schedule, select whether devices should turn on or off, enter the day of the week, and the scheduled on or off time. Schedule hours can be set for Every Day, Week Days, Weekends, or Individual day (Saturday). Devices can be turned on and off up to 50 times per week.

Unique schedules can be created for specific buildings, groups of buildings, areas with a building or device types. Multiple versions of each schedule, such as school year and summer vacation, are created and saved on the server.

Once the schedules are created, they are applied to each group. When new schedules are needed, the appropriate stored schedules are selected and applied to the groups.

SCHEDULE STORED ON BERT

Because the current schedule is also stored locally in each Bert, Berts continue to run their schedule even when the wireless network is down. When communications are restored, the Bert immediately checks the server for schedule updates.

MANUAL OVERRIDE BUTTON

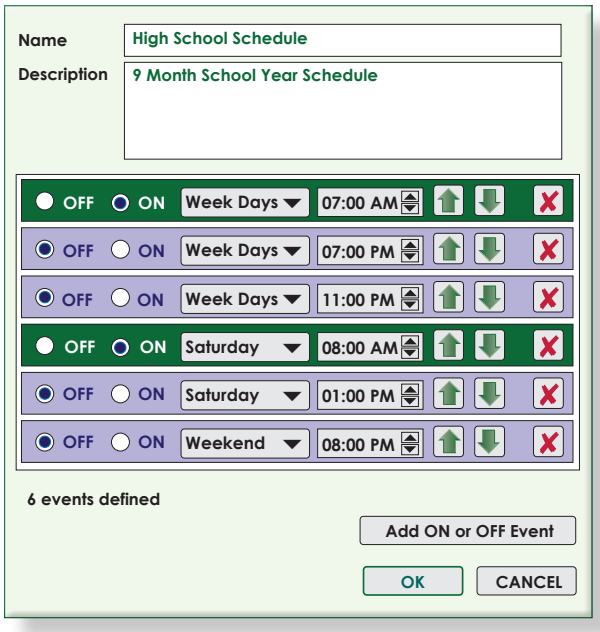
Every Bert has a manual override button that lets users turn devices on during off hours.

INSTANT LOAD SHEDDING

In addition to regular operating schedules, load shedding schedules can be created, instantly turning selected devices off for demand curtailment events. Devices can be turned off for a set duration or powered on with the click of a button if the load shedding event ends early.

LOAD SHIFTING SCHEDULES

Certain loads can be shifted to lower rate time periods. With Bert, laptop carts can be recharged overnight when rates are lower and water heaters can be scheduled to reheat water during non-peak hours.



BUILDING SYSTEM INTEGRATION

Control and manage devices from the BAS UI with Bert's BACnet gateway, BERT CONNECT.

Meet BERT Your energy control freak.

Bert Your energy control freak

All Plug and Hardwired Loads

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BERT® Smart Plug Series Data Sheet

Plug-in measurement and control for individual 110V/15A devices

	BERT 110 M	BERT 110 X
BERT		
Dimensions	3.5" W x 3.5" H x 2" D	3.5" W x 3.5" H x 2" D
Weight	4.2 Ounces	4.4 Ounces
Voltage	120 Volts	120 Volts
Amperage	Up to 15 Amps	Up to 15 Amps
Operating Environment	Indoor Use Only	Indoor Use Only
Manual Override Button	Yes	Yes
BAS Integration	BACnet/IP	BACnet/IP
Standard Software	Measurement, Analysis and Control	Measurement, Analysis and Control
Intelligent Control Options	Threshold and Temperature	Threshold and Temperature
Measurement Accuracy	+/-5%	+/-5%
Measurement Update Frequency	Configurable: 1 to 999 seconds	Configurable: 1 to 999 seconds
Stored Measurement Data - Server	Unlimited	Unlimited
Stored Measurement Data - Bert	14-Day Rolling Log	14-Day Rolling Log
M & V Reporting	Daily, Weekly, Monthly, Yearly or User Defined	Daily, Weekly, Monthly, Yearly or User Defined
Wireless Specifications	2.4 GHz, 802-11 b/g	2.4/5 GHz, 802.11 a/b/g/n
Communication Protocol	UDP	UDP
Network Security	WPA/WPA2-PSK	WPA/WPA2-PSK, WPA/WPA2-Enterprise
Certifications	UL 916 and 60950-1, FCC	UL 916 and 60950-1, FCC

RECOMMENDED DEVICES FOR USE WITH BERT SMART PLUGS

Printers, Copiers, Projectors, Charging Carts, Vending Machines,
Large Coffeemakers, Hot/Cold Beverage Dispensers, Window AC units

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Appendix F
Formulae

Lighting Upgrades

Algorithms

$$\Delta kW = (\#\ of\ replaced\ fixtures) * (baseline\ fixture\ wattage\ from\ table) - (\#\ of\ fixtures\ installed) * (wattage\ of\ new\ fixture)$$

$$\text{Energy Savings}\left(\frac{\text{kWh}}{\text{yr}}\right) = (\Delta\text{kW}) * (Hrs) * (1 + HVAC_e)$$

$$\text{Peak Demand Savings (kW)} = (\Delta\text{kW}) * (CF) * (1 + HVAC_d)$$

$$\text{Fuel Savings}\left(\frac{\text{MMBtu}}{\text{yr}}\right) = (\Delta\text{kW}) * (\text{Hrs}) * (\text{HVAC}_g)$$

Definition of Variables

ΔkW	= Change in connected load from baseline to efficient lighting level.
CF	= Coincidence factor
Hrs	= Annual hours of operation
$HVAC_d$	= HVAC interactive factor for peak demand savings
$HVAC_e$	= HVAC interactive factor for annual energy savings
$HVAC_g$	= HVAC interactive factor for annual fuel savings

Boilers and Furnaces

Fuel Savings (MMBtu/yr) = Cap_{in} * $EFLH_h$ * ((Eff_q/Eff_b)-1) / 1000 kBtu/MMBtu

Definition of Variables

Cap_{in}	= Input capacity of qualifying unit in kBtu/hr
$EFLH_h$	= The Equivalent Full Load Hours of operation for the average unit during the heating season in hours
Eff_b	= Boiler Baseline Efficiency
Eff_q	= Boiler Proposed Efficiency
1000	= Conversion from kBtu to MMBtu

HVAC Equipment Replacement

Air Conditioning Algorithms:

Energy Savings (kWh/yr) = N * Tons * 12 kBtuh/Ton * $(1/EER_b - 1/EER_q) * EFLH_c$

Peak Demand Savings (kW) = N * Tons * 12 kBtuh/Ton * $(1/EER_b - 1/EER_q) * CF$

Heat Pump Algorithms:

Cooling Energy Savings (kWh/yr) = N * Tons * 12 kBtuh/Ton * $(1/EER_b - 1/EER_q) * EFLH_c$

Heating Energy Savings (Btu/yr) = N * Tons * 12 kBtuh/Ton * $((1/(COP_b * 3.412)) - (1/(COP_q * 3.412)) * EFLH_h$

Where $_c$ is for cooling and $_h$ is for heating.

Definition of Variables

N = Number of units

Tons = Rated cooling capacity of unit.This value comes from ARI/AHRI or AHAM rating or manufacturer data.

EER_b = Energy Efficiency Ratio of the baseline unit. This data is found in the HVAC and Heat Pumps table below. For units < 65,000 BtuH (5.4 tons), SEER should be used in place of EER.

COP_b = Coefficient of Performance of the baseline unit. This data is found in the HVAC and Heat Pumps table below. For units < 65,000 BtuH (5.4 tons), SEER and HSPF/3.412 should be used in place of COP * 3.412 for cooling and heating savings, respectively.

EER_q = Energy Efficiency Ratio of the high efficiency unit. This value comes from the ARI/AHRI or AHAM directories or manufacturer data. For units < 65,000 (5.4 tons) BtuH, SEER should be used in place of EER.

COP_q = Coefficient of Performance of the high efficiency unit. This value comes from the ARI/AHRI or AHAM directories or manufacturer data. For units < 65,000 BtuH

Motor Replacement

From application form calculate ΔkW where:

$$\Delta kW = 0.746 * HP * IF_{VFD} * (1/\eta_{base} - 1/\eta_{prem})$$

Demand Savings = (ΔkW) * CF

Energy Savings = (ΔkW)*HRS * LF

Definition of Variables

ΔkW = kW Savings at full load

HP = Rated horsepower of qualifying motor, from nameplate/manufacturer specs.

LF = Load Factor, percent of full load at typical operating condition

IF_{VFD} = VFD Interaction Factor, 1.0 without VFD, 0.9 with VFD

η_{base} = Efficiency of the baseline motor

η_{prem} = Efficiency of the energy-efficient motor

HRS = Annual operating hours

CF = Coincidence Factor

Component	Type	Value	Source
HP	Variable	Nameplate/Manufacturer Spec. Sheet	Application
LF	Fixed	0.75	1
hp_{base}	Fixed	ASHRAE 90.1-2013 Baseline Efficiency Table	ASHRAE
hp_{prem}	Variable	Nameplate/Manufacturer Spec. Sheet	Application
IF_{VFD}	Fixed	1.0 or 0.9	3
Efficiency - η_{ee}	Variable	Nameplate/Manufacturer Spec. Sheet	Application
CF	Fixed	0.74	1
HRS	Fixed	Annual Operating Hours Table	1

Chillers

Algorithms

For IPLV:

Energy Savings (kWh/yr) = N * Tons * EFLH * ($IPLV_b$ – $IPLV_q$)

Peak Demand Savings (kW) = N * Tons * PDC * ($IPLV_b$ – $IPLV_q$)

For FLV:

Energy Savings (kWh/yr) = N * Tons * EFLH * (FLV_b – FLV_q)

Peak Demand Savings (kW) = N * Tons * PDC * (FLV_b – FLV_q)

Definition of Variables

N = Number of units

Tons = Rated capacity of coolling equipment.

EFLH = Equivalent Full Load Hours – This represents a measure of energy use by season during the on-peak and off peak periods.

PDC = Peak Duty Cycle: fraction of time the compressor runs during peak hours

$IPLV_b$ = Integrated Part Load Value of baseline equipment, kW/Ton. The efficiency of the chiller under partial-load conditions.

$IPLV_q$ = Integrated Part Load Value of qualifying equipment, kW/Ton. The efficiency of the chiller under partial-load conditions.

FLV_b = Full Load Value of baseline equipment, kW/Ton. The efficiency of the chiller under full-load conditions.

FLV_q = Full Load Value of qualifying equipment, kW/Ton. The efficiency of the chiller under full-load conditions.

Summary of Inputs

Electric Chiller Assumptions

Electric Chillers Component	Type	Situation	Value	Source
Tons	Rated Capacity, Tons	All	Varies	From Application
$IPLV_b$ (kW/ton)	Variable	See table below	Varies	1
$IPLV_q$ (kW/ton)	Variable	All	Varies	From Application (per

Appendix G
ASHRAE 90.1 Minimum Performance Requirement and Baseline HVAC System Types

TABLE G3.1.1-3 Baseline HVAC System Types

Building Type	Climate Zones 3b, 3c, and 4–8	Climate Zones 1–3a
Residential	System 1—PTAC	System 2—PTHP
Public assembly <120,000 ft^2	System 3—PSZ-AC	System 4—PSZ-HP
Public assembly ≥120,000 ft^2	System 12—SZ-CV-HW	System 13—SZ-CV-ER
Nonresidential and 3 floors or fewer and <25,000 ft^2	System 3—PSZ-AC	System 4—PSZ-HP
Nonresidential and 4 or 5 Floors and <25,000 ft^2 or 5 floors or fewer and 25,000 ft^2 to 150,000 ft^2	System 5—Packaged VAV with reheat	System 6—Packaged VAV with PFP boxes
Nonresidential and more than 5 floors or >150,000 ft^2	System 7—VAV with reheat	System 8—VAV with PFP boxes
Heated-only storage	System 9—Heating and ventilation	System 10—Heating and ventilation
Retail and 2 floors or fewer	System 3—PSZ-AC	System 4—PSZ-HP

Notes:
1. Residential building types include dormitory, hotel, motel, and multifamily. Residential space types include guest rooms, living quarters, private living space, and sleeping quarters. Other building and space types are considered nonresidential.
2. Where attributes make a building eligible for more than one baseline system type, use the predominant condition to determine the system type for the entire building except as noted in Exception (1) to Section G3.1.1.
3. For laboratory spaces in a building having a total laboratory exhaust rate greater than 5000 cfm, use a single system of type 5 or 7 serving only those spaces.
4. For hospitals, depending on building type, use System 5 or 7 in all climate zones.
5. Public assembly building types include houses of worship, auditoriums, movie theaters, performance theaters, concert halls, arenas, enclosed stadiums, ice rinks, gymnasiums, convention centers, exhibition centers, and natatoriums.

G3.1.1-4 Baseline System Descriptions

System No.	System Type	Fan Control	Cooling Type	Heating Type
1. PTAC	Packaged terminal air conditioner	Constant volume	Direct expansion	Hot-water fossil fuel boiler
2. PTHP	Packaged terminal heat pump	Constant volume	Direct expansion	Electric heat pump
3. PSZ-AC	Packaged rooftop air conditioner	Constant volume	Direct expansion	Fossil fuel furnace
4. PSZ-HP	Packaged rooftop heat pump	Constant volume	Direct expansion	Electric heat pump
5. Packaged VAV with Reheat	Packaged rooftop VAV with reheat	VAV	Direct expansion	Hot-water fossil fuel boiler
6. Packaged VAV with PFP Boxes	Packaged rooftop VAV with parallel fan power boxes and reheat	VAV	Direct expansion	Electric resistance
7. VAV with Reheat	VAV with reheat	VAV	Chilled water	Hot-water fossil fuel boiler
8. VAV with PFP Boxes	VAV with parallel fan-powered boxes and reheat	VAV	Chilled water	Electric resistance
9. Heating and Ventilation	Warm air furnace, gas fired	Constant volume	None	Fossil fuel furnace
10. Heating and Ventilation	Warm air furnace, electric	Constant volume	None	Electric resistance
11. SZ–VAV	Single-zone VAV	VAV	Chilled water	See note.
12. SZ-CV-HW	Single zone	Constant volume	Chilled water	Hot-water fossil fuel boiler
13. SZ-CV-ER	Single zone	Constant volume	Chilled water	Electric resistance

Notes:
1. For purchased chilled water and purchased heat, see G3.1.1.3.
2. Where the proposed design heating source is electric or other, the heating type shall be electric resistance. Where the proposed design heating source is fossil fuel, fossil/electric hybrid, or purchased heat, the heating type shall be hot-water fossil fuel boiler.

TABLE 6.8.1-1 Electrically Operated Unitary Air Conditioners and Condensing Units—Minimum Efficiency Requirements

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure[a]
Air conditioners, air cooled	<65,000 Btu/h[b]	All	Split system	13.0 SEER	AHRI 210/240
			Single package	13.0 SEER (before 1/20/15) 14 SEER (as of 1/1/2015)	
Through the wall, air cooled	≤30,000 Btu/h[b]	All	Split system	12.0 SEER	
			Single package	12.0 SEER	
Small duct high velocity, air cooled	<65,000 Btu/h[b]	All	Split System	11.0 SEER	
Air conditioners, air cooled	≥65,000 Btu/h and <135,000 Btu/h	Electric resistance (or none)	Split system and single package	11.2 EER 11.4 IEER (before 1/1/2016) 12.9 IEER (as of 1/1/2016)	AHRI 340/360
		All other	Split system and single package	11.0 EER 11.2 IEER (before 1/1/2016) 12.7 IEER (as of 1/1/2016)	
	≥135,000 Btu/h and <240,000 Btu/h	Electric resistance (or none)	Split system and single package	11.0 EER 11.2 IEER (before 1/1/2016) 12.4 IEER (as of 1/1/2016)	
		All other	Split system and single package	10.8 EER 11.0 IEER (before 1/1/2016) 12.2 IEER (as of 1/1/2016)	
	≥240,000 Btu/h and <760,000 Btu/h	Electric resistance (or none)	Split system and single package	10.0 EER 10.1 IEER (before 1/1/2016) 11.6 IEER (as of 1/1/2016)	
		All other	Split system and single package	9.8 EER 9.9 IEER (before 1/1/2016) 11.4 IEER (as of 1/1/2016)	
	≥760,000 Btu/h	Electric resistance (or none)	Split system and single package	9.7 EER 9.8 IEER (before 1/1/2016) 11.2 IEER (as of 1/1/2016)	
		All other	Split system and single package	9.5 EER 9.6 IEER (before 1/1/2016) 11.0 IEER (as of 1/1/2016)	

a. Section 12 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
b. Single-phase, air-cooled air conditioners <65,000 Btu/h are regulated by NAECA. SEER values are those set by NAECA.

TABLE 6.8.1-1 Electrically Operated Unitary Air Conditioners and Condensing Units—Minimum Efficiency Requirements *(Continued)*

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure[a]
Air conditioners, water cooled	<65,000 Btu/h	All	Split system and single package	12.1 EER 12.3 IEER	AHRI 210/240
	≥65,000 Btu/h and <135,000 Btu/h	Electric resistance (or none)	Split system and single package	12.1 EER 12.3 IEER (before 1/1/2016) 13.9 IEER (as of 1/1/2016)	AHRI 340/360
		All other	Split system and single package	11.9 EER 12.1 IEER (before 1/1/2016) 13.7 IEER (as of 1/1/2016)	
	≥135,000 Btu/h and <240,000 Btu/h	Electric resistance (or none)	Split system and single package	12.5 EER 12.5 IEER (before 1/1/2016) 13.9 IEER (as of 1/1/2016)	
		All other	Split system and single package	12.3 EER 12.5 IEER (before 1/1/2016) 13.7 IEER (as of 1/1/2016)	
	≥240,000 Btu/h and <760,000 Btu/h	Electric resistance (or none)	Split system and single package	12.4 EER 12.6 IEER (before 1/1/2016) 13.6 IEER (as of 1/1/2016)	AHRI 340/360
		All other	Split system and single package	12.2 EER 12.4 IEER (before 1/1/2016) 13.4 IEER (as of 1/1/2016)	
	≥760,000 Btu/h	Electric resistance (or none)	Split system and single package	12.2 EER 12.4 IEER (before 1/1/2016) 13.5 IEER (as of 1/1/2016)	AHRI 340/360
		All other	Split system and single package	12.0 EER 12.2 IEER (before 1/1/2016) 13.3 IEER (as of 1/1/2016)	

a. Section 12 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
b. Single-phase, air-cooled air conditioners <65,000 Btu/h are regulated by NAECA. SEER values are those set by NAECA.

TABLE 6.8.1-1 Electrically Operated Unitary Air Conditioners and Condensing Units—Minimum Efficiency Requirements *(Continued)*

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure[a]
Air conditioners, evaporatively cooled	<65,000 Btu/h[b]	All	Split system and single package	12.1 EER 12.3 IEER	AHRI 210/240
	≥65,000 Btu/h and <135,000 Btu/h	Electric resistance (or none)	Split system and single package	12.1 EER 12.3 IEER	AHRI 340/360
		All other	Split system and single package	11.9 EER 12.1 IEER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric resistance (or none)	Split system and single package	12.0 EER 12.2 IERR	
		All other	Split system and single package	11.8 EER 12.0 IEER	
	≥240,000 Btu/h and <760,000 Btu/h	Electric resistance (or none)	Split system and single package	11.9 EER 12.1 IEER	
		All other	Split system and single package	11.7 EER 11.9 IEER	
	≥760,000 Btu/h	Electric resistance (or none)	Split system and single package	11.7 EER 11.9 IEER	
		All other	Split system and single package	11.5 EER 11.7 IEER	
Condensing units, air cooled	≥135,000 Btu/h			10.5 EER 11.8 IEER	AHRI 365
Condensing units, water cooled	≥135,000 Btu/h			13.5 EER 14.0 IEER	
Condensing units, evaporatively cooled	≥135,000 Btu/h			13.5 EER 14.0 IEER	

a. Section 12 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
b. Single-phase, air-cooled air conditioners <65,000 Btu/h are regulated by NAECA. SEER values are those set by NAECA.

TABLE 6.8.1-2 Electrically Operated Unitary and Applied Heat Pumps—Minimum Efficiency Requirements

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure[a]
Air cooled (cooling mode)	<65,000 Btu/h[b]	All	Split system	13.0 SEER (before 1/1/2015) 14 SEER (as of 1/1/2015)	AHRI 210/240
			Single package	13.0 SEER (before 1/1/2015) 14 SEER (as of 1/1/2015)	
Through the wall, air cooled (cooling mode)	≤30,000 Btu/h[b]	All	Split system	12.0 SEER	
			Single package	12.0 SEER	
Small duct high velocity, air cooled	<65,000 Btu/h[b]	All	Split System	11.0 SEER	
Air cooled (cooling mode)	≥65,000 Btu/h and <135,000 Btu/h	Electric resistance (or none)	Split system and single package	11.0 EER 11.2 IEER (before 1/1/2016) 12.2 IEER (as of 1/1/2016)	AHRI 340/360
		All other	Split system and single package	10.8 EER 11.0 IEER (before 1/1/2016) 12.0 IEER (as of 1/1/2016)	
	≥135,000 Btu/h and <240,000 Btu/h	Electric resistance (or none)	Split system and single package	10.6 EER 10.7 IEER (before 1/1/2016) 11.6 IEER (as of 1/1/2016)	
		All other	Split system and single package	10.4 EER 10.5 IEER (before 1/1/2016) 11.4 IEER (as of 1/1/2016)	
	≥240,000 Btu/h	Electric resistance (or none)	Split system and single package	9.5 EER 9.6 IEER (before 1/1/2016) 10.6 IEER (as of 1/1/2016)	
		All other	Split system and single package	9.3 EER 9.4 IEER (before 1/1/2016) 0.4 IEER (as of 1/1/2016)	

a. Section 12 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
b. Single-phase, air-cooled air conditioners <65,000 Btu/h are regulated by NAECA. SEER values are those set by NAECA.

TABLE 6.8.1-2 Electrically Operated Unitary and Applied Heat Pumps—Minimum Efficiency Requirements *(Continued)*

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency	Test Procedure[a]
Water to air, water loop (cooling mode)	<17,000 Btu/h	All	86°F entering water	12.2 EER	ISO 13256-1
	≥17,000 Btu/h and <65,000 Btu/h	All	86°F entering water	13.0 EER	
	≥65,000 Btu/h and <135,000 Btu/h	All	86°F entering water	13.0 EER	
Water to air, groundwater (cooling mode)	<135,000 Btu/h	All	59°F entering water	18.0 EER	
Brine to air, ground loop (cooling mode)	<135,000 Btu/h	All	77°F entering water	14.1 EER	
Water to water, water loop (cooling mode)	<135,000 Btu/h	All	86°F entering water	10.6 EER	ISO 13256-2
Water to water, groundwater (cooling mode)	<135,000 Btu/h	All	59°F entering water	16.3 EER	
Brine to water, ground loop (cooling mode)	<135,000 Btu/h	All	77°F entering water	12.1 EER	
Air cooled (heating mode)	<65,000 Btu/h[b] (cooling capacity)	—	Split system	7.7 HSPF (before 1/1/2015) 8.2 HSPF (as of1/1/2015)	AHRI 210/240
			Single package	7.7 HSPF (before 1/1/2015) 8.0 HSPF (as of1/1/2015)	
Through the wall, air cooled (heating mode)	≤30,000 Btu/h[b] (cooling capacity)	—	Split system	7.4 HSPF	
			Single package	7.4 HSPF	
Small duct high velocity, air cooled (heating mode)	<65,000 Btu/h[b]	—	Split System	6.8 HSPF	
Air cooled (heating mode)	≥65,000 Btu/h[c] and <135,000 Btu/h (cooling capacity)	—	47°F db/43°F wb outdoor air	3.3 COP_H	AHRI 340/360
			17°F db/15°F wb outdoor air	2.25 COP_H	
	≥135,000 Btu/h[c] (cooling capacity)	—	47°F db/43°F wb outdoor air	3.2 COP_H	
			17°F db/15°F wb outdoor air	2.05 COP_H	

a. Section 12 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
b. Single-phase, air-cooled air conditioners <65,000 Btu/h are regulated by NAECA. SEER values are those set by NAECA.