UNION BEACH BOARD OF EDUCATION

District-Wide Energy Savings Plan

An ESCO Energy Savings Improvement Program

WILLDAN

Contacts

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04/05/2022 – Draft for 3rd Party Review
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06/21/2022 – 3rd Party Review REV2
07/19/2022 – 3rd Party Review REV3

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Section 1. Executive Summary

Willdan Energy Solutions was selected by Union Beach Board of Education in June 2021 for engineering services related to the development of an Energy Savings Plan (ESP) to be used in an Energy Savings Improvement Program (ESIP). The scope of work is to develop an ESP for Union Beach district's three (3) buildings. 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 Union Beach BOE, as described initially, are as follows:

- Lighting
- Unit Ventilators
- Boilers
- Solar
- Rooftop Units and Air Handling Units
- BMS
- Hot Water System

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. 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: Union Beach Memorial School Energy Savings

Savings		
Annual Electric Energy	248,470	kWh
Annual Electric Demand	116	kW
Annual Natural Gas	16,655	therms
Annual Utility Cost Savings	$41,591	

Table 2: Union Beach Adult School Energy Savings

Savings		
Annual Electric Energy	19,581	kWh
Annual Electric Demand		kW
Annual Natural Gas		therms
Annual Utility Cost Savings	$2,289	

Table 3: Union Beach Board Office Energy Savings

Savings		
Annual Electric Energy	7,686	kWh
Annual Electric Demand		kW
Annual Natural Gas		therms
Annual Utility Cost Savings	$899	

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 275,736 kWh of electricity and 16,655 therms of natural gas. The project will also reduce energy cost by $829,505 over the life of the project. This project is estimated to receive a maximum financial incentive of $1,381,821 from NJOCE programs and PJM's Demand Response (DR) Program. This project shall also reduce Operational and Maintenance cost by $245,000. Additionally, these energy savings will result in a net reduction of greenhouse gases and will reduce the school district's carbon footprint by 508,361 lbs of CO2 annually.

Table 4: Energy Conservation Measures for Union Beach Schools for 15-year plan

ECM Description	Union Beach Memorial School	Union Beach Board Office	Adult School
ECM#1 – LED Lighting	X	X	X
ECM#2 – High Efficiency Boilers	X		
ECM#3 – Direct Install covered Roof top Units	X		
ECM#4 – Additional Rooftop Units	X		
ECM#5 – Building Management System (BMS)	X		
ECM#6 – Unit Ventilators	X		

Table 5: Energy Savings for Union Beach Schools for 15-year plan

ECMs	Measure	Annual Estimated Savings 15-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	213,242	54	-	$24,932	$102,201	4.1
ECM - 2	High Efficiency Boilers	-	-	15,763	$11,869	$467,807	39.4
ECM - 3	Direct Install covered Rooftop Units	1,862	2	-	$218	$55,874	256.7
ECM - 4	Additional Rooftop Units	3,179	3	-	$372	$282,150	759.1
ECM - 5	Building Management System (BMS)	13,214	-	892	$2,217	$52,112	23.5
ECM - 6	Unit Ventilators	44,239	56	-	$5,172	$1,526,400	295.1
	Total	**275,736**	**116**	**16,655**	**$44,779**	**$2,449,807**	**54.7**

In accordance with the NJ ESIP process, the next step in the project development phase is for Willdan to work with Union Beach BOE, to select the desired ECMs based on the Union Beach 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 Union Beach 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 15-year term as outlined in legislation.

Overall, it is evident that Union Beach 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 Union Beach BOE to improve the comfort and efficiency of your facilities through the successful implementation of this Energy Savings Plan.

Willdan is supporting Union Beach 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 6: Union Beach BOE Form I 15-year plan

Form I	
ESCO'S PRELIMINARY ENERGY SAVINGS PLAN (ESP)	
GENERAL INFORMATION: CONTRACTOR	
UNIONBEACH BOE	
ENERGY SAVINGS IMPROVEMENT PROGRAM	
1. Name of Firm	Willdan Energy Solutions
2. Address	3910 Park Ave, Suite 5, Edison NJ 08820
3. Contact Person	Matthew Velozo
4. E-mail	mvelozo@willdan.com
Lead Personnel for this project (persons who will have supervisory or other responsibility for the work to be performed	
Name	Title
Matthew Velozo	Program Manager
Rahul Sheth CEM EIT	IGA Team Lead
Nick Hesser PE	QA/QC
Robert Braun PE	Principal in charge

Table 7: Union Beach BOE Form II 15-year plan

FORM II

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):

ENERGY CONSERVATION MEASUREs (ECMs) SUMMARY FORM

Union Beach BOE

ENERGY SAVING IMPROVEMENT PROGRAM

ESCO Name: Willdan Energy Solutions

Proposed Preliminary Energy Savings Plan: Base Project 15 years @ 2.5%

Energy Conservation Measures	Estimated Installed Hard Costs (1) ($)	Estimated Annual Savings ($)	Estimated Simple Payback (Yrs)
ECM#1 - LED Lighting	$102,201	$24,932	4.1
ECM#2 - High Efficiency Boilers	$467,801	$11,869	39.4
ECM#3 - Direct Install RTU	$55,874	$218	256.7
ECM#4 - Additional High Efficiency Rooftop Units	$282,150	$372	759.1
ECM#5 - Building Management System (BMS)	$52,112	$2,217	23.5
ECM#6 – Unit Ventilators	$1,526,400	$5,172	295.1
Project Summary:	**$2,449,807**	**$44,779**	**54.7**

(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 8: Union Beach BOE Form III 15-year plan

FORM III

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):

PROJECTED ANNUAL ENERGY SAVINGS DATA FORM

Union Beach BOE

ENERGY SAVING IMPROVEMENT PROGRAM

ESCO Name: Willdan Energy Solutions

Proposed Preliminary Energy Savings Plan: Base Project 15 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)	216		116	$5,955
Electric Energy (kWh)	217,787	$125,120	275,736	$32,456
Natural Gas (ccf)	34,948	$36,241	16,061	$12,541
Water (Gallons)	679,875	$12,918	3,229	$61
AVOIDED EMISSIONS (1)	Provide in Pounds (Lbs)			
NOX	925	Lbs.		
SO_2	1,792	Lbs.		
CO_2	613,984	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 9: Union Beach BOE Form IV 15-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

Union Beach BOE

ENERGY SAVING IMPROVEMENT PROGRAM

ESCO Name: Willdan Energy Solutions

Proposed Preliminary Energy Savings Plan: Base Project 15 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)	74,309	94,081	
Natural Gas (MMBTUs)	4,813	1,606	

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 10: Union Beach BOE Form V 15-year plan

FORM V

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):

ESCOs PROPOSED FINAL PROJECT COST FORM FOR 15-year

.

Union Beach BOE

ENERGY SAVING IMPROVEMENT PROGRAM

ESCO Name: Willdan Energy Solutions

Proposed Preliminary Energy Savings Plan: Base Project 15 years @ 2.5%

PROPOSED CONSTRUCTION FEES

Fee Category	Fees (1) Dollar ($) Value
Estimated Value of Hard Costs (2):	$2,449,807
Project Service Fees	
Investment Grade Energy Audit	$97,992
Design Engineering Fees	$146,988
Construction Management & Project Administration	$122,490
System Commissioning	$24,498
Equipment Initial Training Fees	$9,799
ESCO Overhead	$134,739
ESCO Profit	$61,245
Project Service Fees Sub Total	$597,753
Other costs	$-
TOTAL FINANCED PROJECT COSTS:	$3,047,560

PROPOSED ANNUAL SERVICE FEES

Fee Category	Fees (1) Dollar ($) Value
SAVINGS GUARANTEE (*OPTION*)	
ENERGY STAR™ Services (*optiona*l)	$30,623
Post Construction Services *(If applicable)*	Included Above
Performance Monitoring	Included Above
On-going Training Services	Included Above
Verification Reports	Included Above
TOTAL FIRST YEAR ANNUAL SERVICES	$30,623

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.

Table 11: Union Beach BOE Form VI 15-year plan

FORM VI 15-Year Plan

ESCO's PRELIMINARY ENERGY SAVINGS PLAN (ESP):

ESCO's PRELIMINARY ANNUAL CASH FLOW ANALYSIS FORM

Union Beach BOE

ENERGY SAVINGS IMPROVEMENT PROGRAM

ESCO Name: Willdan Energy Solutions

Proposed Preliminary Energy Savings Plan: Base Project 15 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: 15 years	(180 Months)
2. Construction Period [2] (months):	12
3. Cash Flow Analysis Format:	
4. ESP Fee	$597,753
7. Bond Fee	$20,000
8. Legal Fee	$20,000
9. Third Party Fee	$2,200
10. Project Hard Costs	$2,449,807
11. District Contribution	$1,088,000
Project Cost [1]:	$1,999,560
Interest Rate to Be Used for Proposal Purposes:	2.75%

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
Installation	$36,801	$-			$36,801		$36,801	$36,801
1	$44,997	$85,000	$1,381,821	$0	$1,511,818	$162,833	$1,193	$37,993
2	$46,012	$85,000	$1,354	$0	$132,366	$162,833	$1,193	$39,186
3	$47,050	$25,000	$1,354	$0	$73,404	$162,833	$1,193	$40,378
4	$48,111	$25,000	$1,354	$0	$74,465	$162,833	$1,193	$41,571
5	$49,196	$25,000		$0	$74,196	$162,833	$1,193	$42,763
6	$50,306			$0	$50,306	$162,833	$1,193	$43,956
7	$51,441			$0	$51,441	$162,833	$1,193	$45,149
8	$52,602			$0	$52,602	$162,833	$1,193	$46,341
9	$53,789			$0	$53,789	$162,833	$1,193	$47,534
10	$55,002			$0	$55,002	$162,833	$1,193	$48,726
11	$56,243			$0	$56,243	$162,833	$1,193	$49,919
12	$57,513			$0	$57,513	$162,833	$1,193	$51,112
13	$58,810			$0	$58,810	$162,833	$1,193	$52,304
14	$60,138			$0	$60,138	$162,833	$1,193	$53,497
15	$61,495			$0	$61,495	$162,833	$1,193	$54,689
Totals	**$829,505**	**$245,000**	**$1,385,884**	**$0**	**$2,460,389**	**$2,442,500**	**$54,689**	

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.
(5) As of July 1, 2021, all of former NJ Clean Energy Program incentive programs transitioned over to the investor-owned gas and electric utility companies. Subsequently, the BPU is requiring that all ESIP projects consult with the DCA and follow all DCA guidance regarding the procurement of all subcontractors.

Section 2. Facility Information

Union Beach Memorial School

Figure 1: Union Beach Memorial School

Union Beach Memorial School (Memorial School), built in 1955, is a one-story, 104,223 square foot building. The school is comprised of various space types such as classrooms, offices, media center, 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 6:00 pm, Monday to Friday. The school has an occupancy of 640 students accompanied with 61.7 staff members.

Building Condition

Envelop
Building walls are concrete block over structural steel with a brick façade. The roof is flat and covered with white rubber membrane and is in good condition. Most of the windows are double glazed and have aluminum frames. The glass-to-frame seals are in fair condition. The operable part of many windows does not hold position when lifted. Also, window film is flaking off from a significant number of windows. The metal panels below some windows are in poor condition; several metal panels on classroom exterior walls are rusted and in poor condition. Exterior doors have aluminum frames and are in good condition with functional door seals.

Figure 2: Union Beach Memorial School Exterior conditions

Lighting

The primary interior lighting system uses 32-Watt linear fluorescent T8 lamps. There are also several 40watt T12 linear fluorescent tube lamps and compact fluorescent lamps (CFL). In addition, there are some 4-foot LED tubes, a few LED fixtures and a few 32-Watt U-shaped T8 fluorescent lamps. The multi-purpose room/cafeteria has 250-Watt metal halide lamps. Fixture types include 1-lamp, 2-lamp, 3-lamp, and 4-lamp, 4-foot-long troffer, recessed and surface mounted fixtures. Most fixtures are in good condition. All exit signs are LED type. Interior lighting levels in 34 classrooms with 3-lamp and 4-lamp T8 and T12 fixtures were found to be higher than the recommended lighting level of 30-foot to 50 foot-candles and were judged over lit. Besides being visually uncomfortable, over lit spaces lead to excess energy consumption. When the school upgrades additional lighting to LED, it is recommended that the school facility staff work with the contactor to ensure that lighting levels are not excessive. Lighting fixtures in five classrooms, three restrooms, an electrical closet and janitor closet were noted to be controlled by wall-mounted occupancy sensors. All the remaining interior lighting are manually controlled by wall switched. Exterior fixtures include several wall mounted fixtures containing metal halide lamps, some LED wall mounted fixtures, a few wall mounted fixtures with compact fluorescent lamps and several linear fluorescent tube lamps mounted under the solar PV canopy. All exterior fixtures are timer controlled. Very few of the exterior lighting lamps are functional. Most of the metal halide lamps, compact fluorescent lamps and linear fluorescent tubes under the solar PV canopy have burned out. Existing line-by-line fixture table is attached as an appendix.

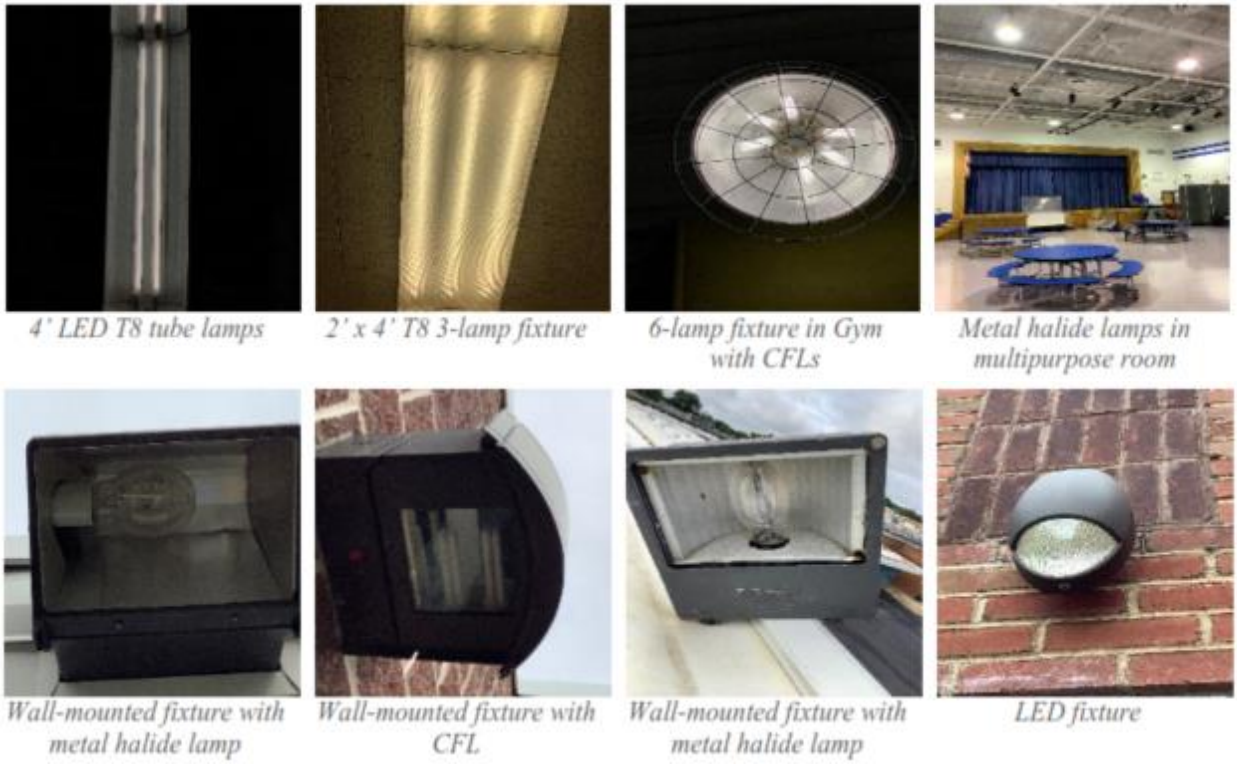


Figure 3: Union Beach Memorial School Existing Lighting

Mechanical

The heating load for the school is served with two boiler plants. First boiler plant consists of two (2) gas-fired non-condensing boilers, one (1) hot water supply pump, five (5) hot water return pumps. The supply and return pumps are in series with no redundancy. Each boiler is equipped with its own factory mounted controller. From discussion with plant operator, it appears that boiler operation is configured manually at their respective local control panels. The boilers are beyond its service life. Willdan recommends replacing existing boiler with condensing boilers. Substantial Insulation was found missing in the hot water pipes and boiler vent breeching duct portions.

Figure 3: Union Beach Memorial School Boiler Plant 1

The second boiler plant consists of three (3) RBI Water Heaters condensing boilers, two (2) duty-standby set of two (2) hot water supply pumps, and a set of hot water return pumps, duty-standby. Each boiler is equipped with its own factory mounted controller. Boilers are controlled by a pneumatic system. The boilers are 15 years old and in fair operating condition based on visual inspection.

Figure 4: Union Beach Memorial School Boiler Plant 2

Two boiler plants serve different section of the school. There are two separate hydronic loops, both operating as hot water serving unit ventilators at different sections of the building. There is no VFD control on the distribution pumps. The pumps are manually controlled by the facility personnel.

Several spaces in the school are served by gas-fired Make-up Air Units (MAU), including the kitchen, locker room, and gym hallway bring in fresh air to the school and surrounding areas, manually controlled by facility personnel.

Figure 5: Union Beach Memorial School HVAC Systems (1)

Unit ventilators are the majority heating system present in the schools that condition fifty (50) classrooms, the child study team office, and the facility manager's office, a total of 53 UVs. They are equipped with ¼ HP motors with pneumatically controlled OA dampers, zone valves. There are eight (8) UVs which were installed about 10 years ago. The rest of the UVs were original to the building. Each classroom is equipped with one (1) window AC unit installed for cooling only purposes.

Figure 6: Union Beach Memorial School HVAC Systems (2)

The school has several packaged Rooftop Units (RTUs) as shown in figure 13. They serve spaces like the few classrooms, media center, cafeteria, all purpose room, and common area.

Table 12: Union Beach Memorial School mechanical schedule

Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (mbh)
Roof	Locker Room	1	Furnace	-	150,000
Roof	Locker Room	1	Furnace	-	150,000
Roof	Gym hallway	1	Furnace	-	100,000
Roof	1-6 classroom and hallway	1	RTU	26	-
Roof	Media Center & Common Area	1	RTU	20	-
Roof	Media Center & Common Area	1	RTU	16	-
Roof	Cafeteria & all purpose room	1	RTU	20	-
Roof	Cafeteria & all purpose room	1	RTU	20	-
Roof	Cafeteria	1	Furnace	-	100,000
Roof	Gym	1	RTU	15	320,000
Roof	Gym	1	RTU	15	320,000
Classroom	Classroom	50	Unit Ventilator	-	unknown
Classroom	Classroom	50	Window AC	1 to 2	-

Table 13: Union Beach Memorial School pump/motor schedule

Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP	Full Load Efficiency
Boiler Room	Hydronic Heating	1	Hot Water Supply	3	86.5%
Boiler Room	Hydronic Heating	1	Hot Water Supply	3	89.5%
Boiler Room	Hydronic Heating	1	Hot Water Supply	3	89.5%
Boiler Room	Hydronic Heating	1	Hot Water Supply	3	89.5%
Boiler Room	Hydronic Heating	1	Hot Water Return	7.5	91.0%
Boiler Room	Hydronic Heating	1	Hot Water Return	7.5	89.5%
Boiler Room 2	Hydronic Heating	1	Hot Water Supply	1.5	86.5%
Boiler Room 2	Hydronic Heating	1	Hot Water Return	0.5	85.5%
Boiler Room 2	Hydronic Heating	1	Hot Water Return	0.5	85.5%
Boiler Room 2	Hydronic Heating	1	Hot Water Return	0.5	85.5%
Boiler Room 2	Hydronic Heating	1	Hot Water Return	0.75	85.5%
Boiler Room 2	Hydronic Heating	1	Hot Water Return	0.75	85.5%
Boiler Room 2	DHW Circulator	1	DHW Pump	0.04	86.5%

Building Management System (BMS)

Building management system (BMS) controls the RTUs, eight (8) newer unit ventilators. The system allows equipment scheduling space temperatures, unit ventilation operation, and heating hot water loop temperature monitoring and control.

Domestic Water Heater (DWH)

There are two (2) 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 7: Union Beach Memorial School Domestic hot water

Kitchen Equipment

The kitchen has a mix of gas and electric equipment that is used to prepare and store meals for students. Most of the cooking is done using the electric convection ovens and a gas steamer. Also, there are two electric insulated food holding cabinets. The kitchen has one walk-in cooler and one walk-in medium temperature freezer. In addition, there is one stand-up, glass door refrigerator chest, and freezer chest. All equipment is in good condition.

Plumbing Fixtures

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

On-site Generation

UnionBeach has an existing PPA contract that provides on-site renewable energy to the school. Additionally, the PV system has reduced the school's peak demand under 200kW. The entire system provided offsets 65% of the electrical usage currently. The current PPA contract ends in the year 2026.

Union Beach Adult School

Figure 8: Union Beach Adult School

Union Beach Adult School (Union Beach AS) is a one-story, 9,000 square foot building that was built in 1852. The building is 100% heated and only 10% cooled. The building is currently unoccupied and serves as a storage space.

Building Condition

Envelope

Building walls are concrete block over structural steel with a brick facade. The roof is pitched and covered with clay tiles. Most of the windows are double glazed and have aluminum frames. The glass-to-frame seals are in fair condition. The operable window weather seals are in fair condition. Exterior doors have metal frame and are in good condition with door seals in good condition.

Figure 9: Union Beach Adult School exterior conditions

Lighting

The primary interior lighting system uses 32-Watt linear fluorescent T8 lamps. There are also several 40-Watt T12 fixtures. Additionally, there are some U-shaped fluorescent lamps. Typically, T8 fluorescent lamps use electronic ballasts and T12 fluorescent lamps use magnetic ballasts. Fixture types include 2-lamp or 4-lamp, 2-foot, 4-foot, and 8-foot-long troffer and surface mounted fixtures. All exit signs are LED. Interior lighting levels were found to be sufficient.

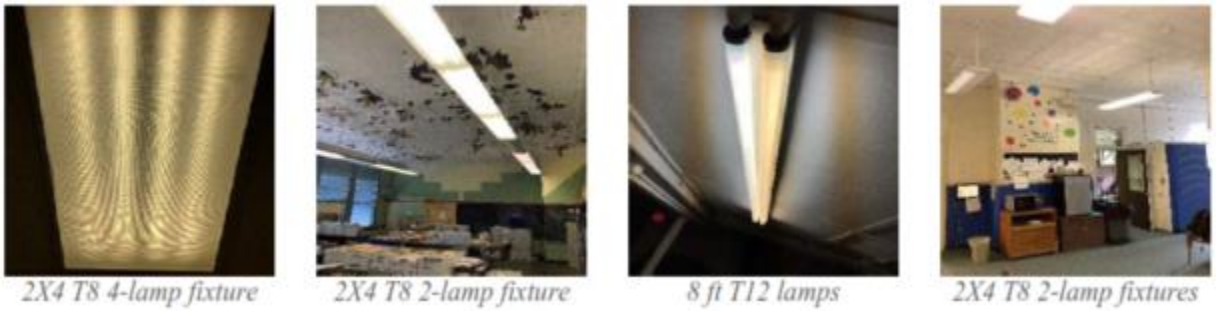


Figure 10: Union Beach Adult School exterior conditions

Mechanical

One Aerco 707 MBh output hot water boiler serves the building space heating load. The boiler is the condensing type with a nominal efficiency of 91.0%. The boiler was installed in 2013 and is in good condition. Heating hot water is supplied throughout the building by six small, fractional hp circulation pumps. The boilers and pumps provide hot water to hot water radiator units in the office spaces. There is a boiler digital control module installed in the boiler room that allows users to enter a hot water supply set point. During the audit it was noticed that despite no need for space heating during the month of September, the boiler hot water supply set point was 123F. Since running the boilers in summer is not needed in this building, shutting down the boiler during the summer would lead to natural gas cost savings.

Figure 11: Union Beach Adult School Heating system

Table 14: Union Beach Adult 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)**
Boiler Room	Entire Building	1	Condensing Hot Water Boiler	-	700
Various Rooms	Classrooms	6	Window AC	1.50	-
Corridor	Corridor	3	Resistance Heat	-	5kW
Various Rooms	Classrooms	3	Unit Ventilator	0.50HP	-

Table 15: Union Beach Adult School pump/motor schedule

	Existing Conditions				
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency
Boiler Room	Entire Building	4	Hot water distribution	0.1	60%
Boiler Room	Entire Building	1	Hot water distribution	0.3	60%
Boiler Room	Entire Building	1	Hot water distribution	0.4	60%

Domestic Hot Water (DHW)

Hot water is produced with an 80-gallon, 9 kW electric storage water heater. The heater is in fair condition and beyond its useful life. We recommend installing a new, heat pump-type electric water heater. See Section 4.0 (Energy Conservation Measures) for further details. The domestic hot water pipes are insulated, and the insulation is in fair condition.

Electric domestic hot water heater

Figure 12: Union Beach Adult School DWH system

Plug Loads

The location is doing a great job managing their electrical plug loads. This report makes additional suggestions for ECMs in this area as well as Energy Efficient Best Practices. There are 10 computer workstations throughout the facility. Plug loads throughout the building include general café and office equipment such as printers, water coolers, microwave oven, toaster oven, ceiling fans, paper shredder, and a refrigerator. There are no vending machines in this building.

Union Beach Board Office

UnionBeach Board Office is a 1 story 4,950 sqft building that is occupied the entire year, five days w week. Spaces include offices, basement with storage space. The office is 100% heated and 40% cooled.

Figure 13: Union Beach BOE Office

Building Condition

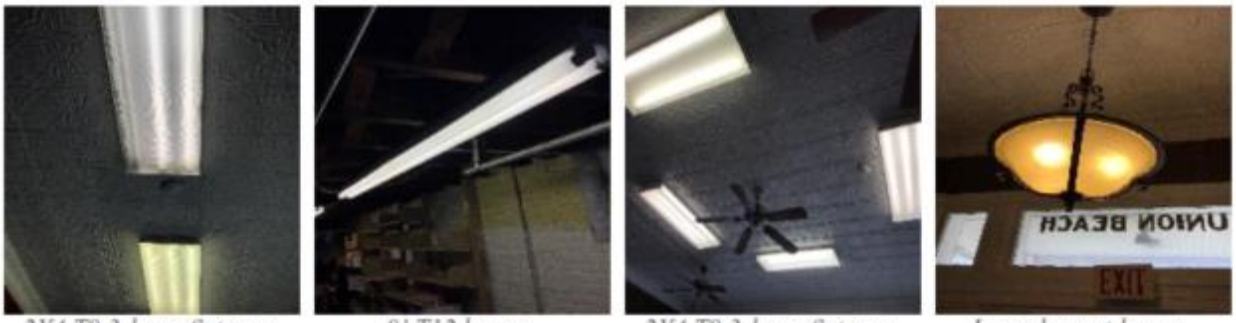
Envelop

Building walls are unreinforced masonry brick. The roof is pitched and covered with clay tiles. Most of the windows are double glazed and have aluminum frames. The glass-to-frame seals are in fair condition. The operable window weather seals are in fair condition. Exterior doors have metal frames and are in good condition with door seals in good condition.

Figure 14: Union Beach BOE Office exterior conditions

Lighting

he primary interior lighting system uses 32-Watt linear fluorescent T8 lamps. There are also a few 4-foot 40-Watt and 8-foot 110-Watt high output T12 fixtures. Additionally, there are also a few incandescent lamps. Typically, T8 fluorescent lamps use electronic ballasts and T12 fluorescent lamps use magnetic ballasts. Fixture types include 2-lamp or 3-lamp, 2-foot, 4-foot, and 8-foot long troffer and surface mounted fixtures. All exit signs are LED type. Interior lighting levels were found to be sufficient. All interior lighting fixtures are controlled by wall switches.

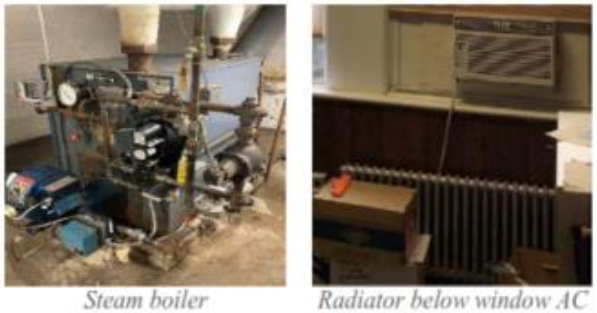


2X4 T8 3-lamp fixtures | 8' T12 lamps | 2X4 T8 3-lamp fixtures | Incandescent lamps

Figure 15: Union Beach BOE Office exterior conditions

Mechanical

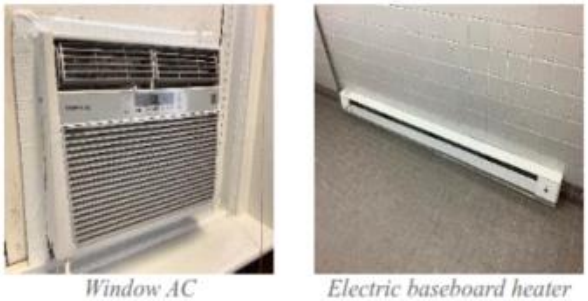
One Weil-McLain 416 MBh output natural draft steam boiler serves the building space heating load. The boiler has a nominal efficiency of 80%. It was installed in 1994 and is reaching the end of its life. The boiler is in fair condition. Steam is supplied to radiators located below the windows in offices and other spaces, and they transfer the heat in the steam to the air in the building. The boiler is shut down between May and September every year.



Steam boiler | Radiator below window AC

Figure 16: Union Beach BOE Office Cooling systems (1)

Space cooling for the offices is provided by seven window air conditioners (ACs). The nameplate for a few units was either not accessible or not legible and the capacity and SEER values for those window ACs had to be estimated. The unit capacities range from 0.5-tons to 1.0 ton with SEER values of approximately 10.0. For the units without inaccessible nameplates, we estimated the capacity to be 1-ton. At least one of the units is old and in poor condition. There is one electric baseboard heater installed in the restroom. It has a heating capacity of 1.5kW.



Window AC | Electric baseboard heater

Figure 17: Union Beach BOE Office Cooling systems (2)

Table 16: Union Beach BOE Office mechanical schedule

	Existing Conditions				
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)
Boiler Room	Entire Building	1	Natural Draft Steam boiler		420
Various Rooms	Offices	7	Window AC	1	

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 with a 20-gallon, 2 kW electric storage water heater. The heater was installed in 2013 and is in good condition. We recommend installing a heat pump-type electric water heater when this electric water heater reaches the end of its useful life. The domestic hot water pipes are not insulated.

Electric domestic water heater

Uninsulated hot water pipe

Figure 18: Union Beach BOE Office DHW systems

Plug load

The location is doing a great job managing their electrical plug loads. This report makes additional suggestions for ECMs in this area as well as Energy Efficient Best Practices. There are seven computer workstations throughout the facility. Plug loads throughout the building include general café and office equipment such as printers, water cooler, microwave oven, toaster oven, ceiling fans, and refrigerator.

Plumbing Fixtures

The restrooms are equipped with standard flowing plumbing fixtures. Union Beach School District does not pay for its water or sewer discharge.

Section 3. Utility Summary and Benchmarking

Union Beach BOE has included the following buildings under their scope of work:

Table 17: List of schools

Union Beach Board of Education	
Union Beach Memorial School	221 Morningside Ave, UnionBeach NJ 07735
Union Beach Board of Education Office	1207 Florence Ave, UnionBeach NJ 07735
Union Beach Adult School	1205 Florence Ave, UnionBeach NJ 07735

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 18: District-Wide Utility Baseline

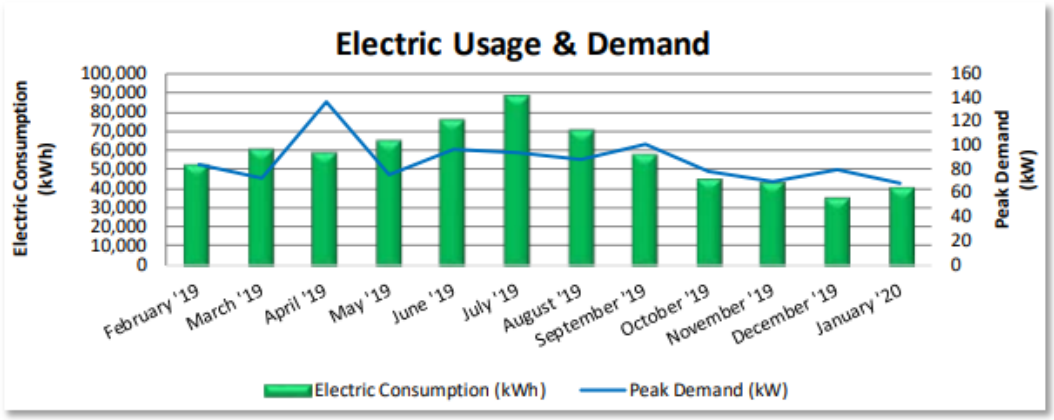
	Total	Memorial School	Adult School	Board Office
Area (sqft)	118,173	104,223	4,950	9,000
Annual utility $	$125,120.00	$105,017.00	$3,775.00	$16,328.00
Total kBtu	7,406,863	6,715,090	235,590	456,183
Total therms	48,131	44,607	1,717	1,807
$ therms	36,241.00	$33,502.00	$1,356.00	$1,383.00
kW	216	111.10	8.79	96.60
Total kWh utility	217,787	118,320	18,725	80,742
Total kWh produced	542,404	542,404	-	-
$ kWh	$88,879.00	$71,515.00	$2,419.00	$14,945.00
Total kWh	760,191	660,724	18,725	80,742
Number of stories		1	1	1
Yr Blt		1955	1852	1852
staff	105	90	10	5
students	630	630	-	-
Hours		12		
$/kWh	$0.1169	$0.1082	$0.1292	$0.1851
$/therm	$0.75	$0.75	$0.79	$0.77
$/kBtu	$0.02	$0.02	$0.02	$0.04
$/sf	$1.06	$1.01	$0.76	$1.81
$/p	$170.23	$145.86	$377.50	$3,265.60

Union Beach Memorial School

The following tables and figures breakdown the electric and natural gas usage at Union Beach Memorial High 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 high school, we are observing following irregularities as highlighted below.

Table 19: Union Beach Memorial School Electric Usage

Electric Billing Data					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
2/27/19	30	52,249	84	$527	$2,803
3/27/19	28	60,396	73	$456	$4,174
4/25/19	29	58,371	136	$415	$4,456
5/29/19	34	65,360	75	$469	$4,827
6/27/19	29	75,318	96	$638	$5,401
7/26/19	29	87,930	94	$625	$5,598
8/27/19	32	70,611	89	$587	$4,734
9/26/19	30	58,149	101	$670	$3,799
10/28/19	32	45,588	79	$485	$2,582
11/25/19	28	43,387	70	$429	$2,386
12/27/19	32	36,045	80	$491	$1,304
1/24/20	28	40,560	68	$421	$1,906
Totals	**361**	**693,964**	**136**	**$6,213**	**$43,971**
Annual	**365**	**701,653**	**136**	**$6,282**	**$44,458**



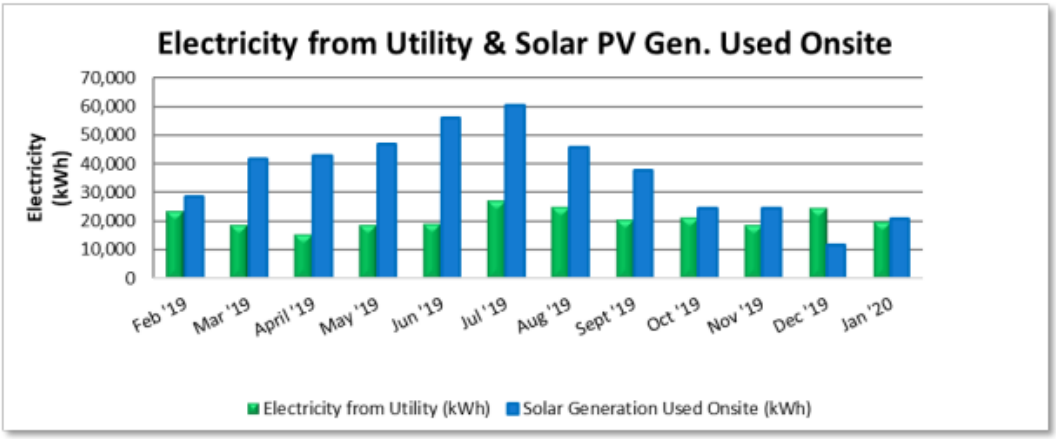


Figure 19: Union Beach Memorial School Electric Usage (kWh, kW)

Table 20: Union Beach Memorial School Natural Gas Usage

Gas Billing Data			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
2/14/19	28	10,647	$10,690
3/19/19	33	10,871	$10,657
4/17/19	29	5,857	$5,533
5/16/19	29	1,363	$2,014
6/19/19	34	186	$1,078
7/22/19	33	104	$1,008
8/19/19	28	76	$986
9/17/19	29	124	$1,023
10/17/19	30	224	$1,087
11/14/19	28	3,985	$4,245
12/17/19	33	10,092	$9,579
1/17/20	31	9,100	$8,811
Totals	**365**	**52,629**	**$56,711**
Annual	**365**	**52,629**	**$56,711**

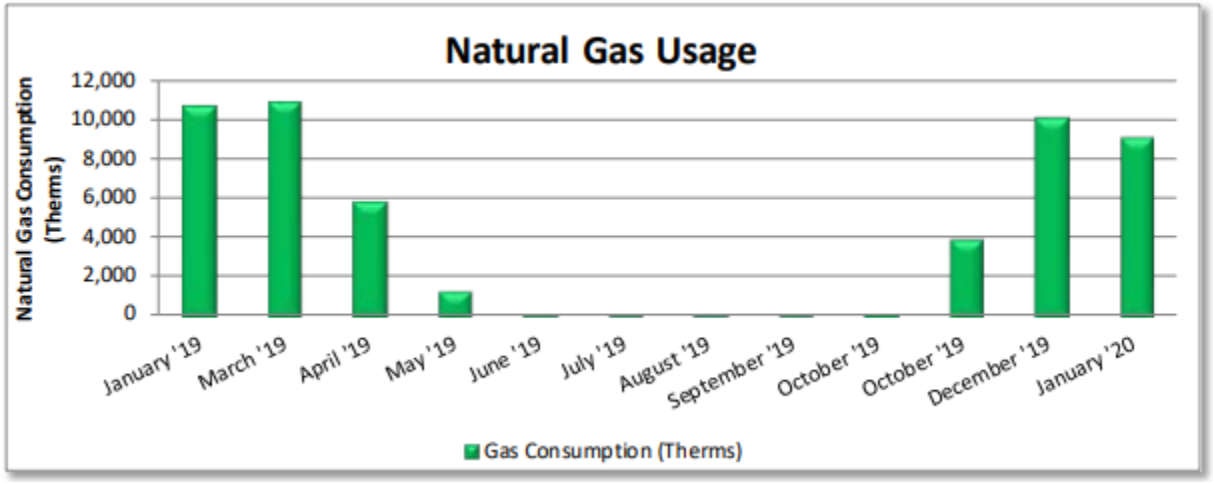


Figure 20: Union Beach Memorial School Natural Gas Usage (Therms)

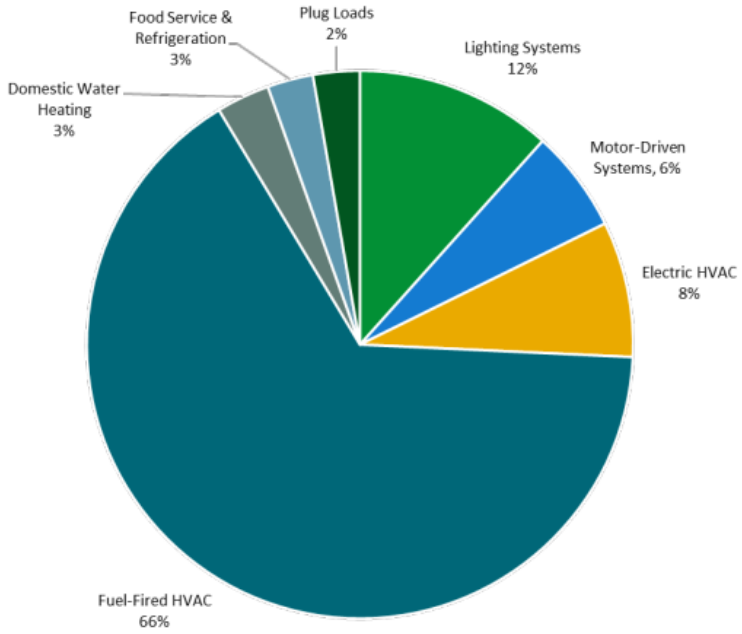


Figure 21: Union Beach Memorial School End use Breakdown

Union Beach Board Office

The following tables and figures breakdown the electric and natural gas usage at Union Beach Board Office. A typical office operation with 100% heating and 40% cooling of the building would see a bell curve on electric consumption for summer months.

Table 21: Union Beach BOE Office Electric Usage

Electric Billing Data					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
2/27/19	30	1,499	6	-	$192
3/27/19	28	1,671	7	-	$208
4/25/19	29	1,316	5	-	$177
5/29/19	34	1,588	7	-	$203
6/26/19	28	1,557	7	-	$203
7/26/19	30	2,248	8	-	$273
8/27/19	32	1,915	9	-	$241
9/24/19	28	1,499	9	-	$201
10/25/19	31	1,563	8	-	$203
11/25/19	31	1,409	5	-	$189
12/17/19	22	1,514	6	-	$195
1/27/20	41	1,488	7	-	$191
Totals	**364**	**19,267**	**9**	**$0**	**$2,475**
Annual	**365**	**19,320**	**9**	**$0**	**$2,481**

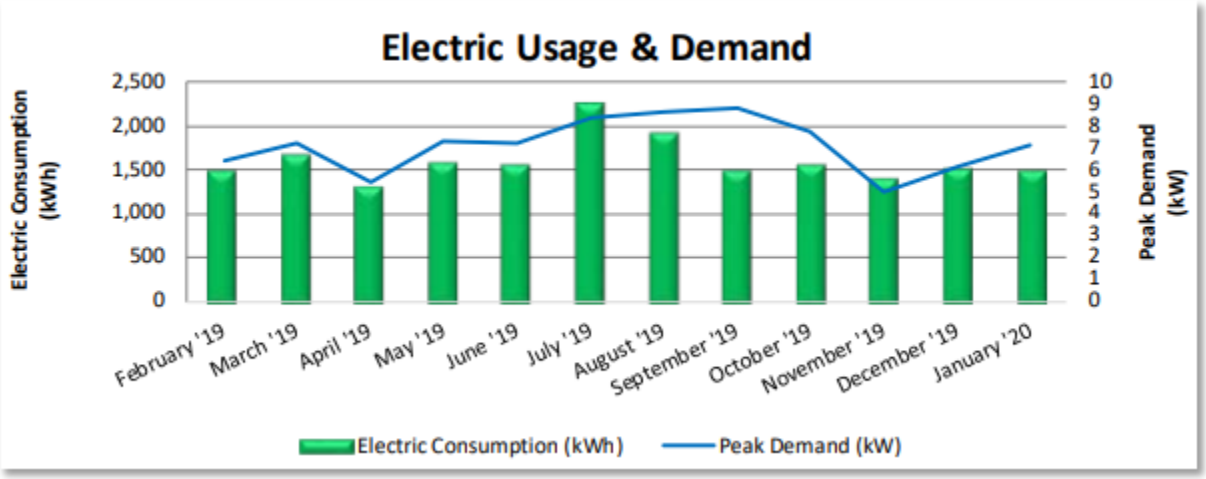


Figure 22: Union Beach BOE Office Electric Usage (kWh, kW)

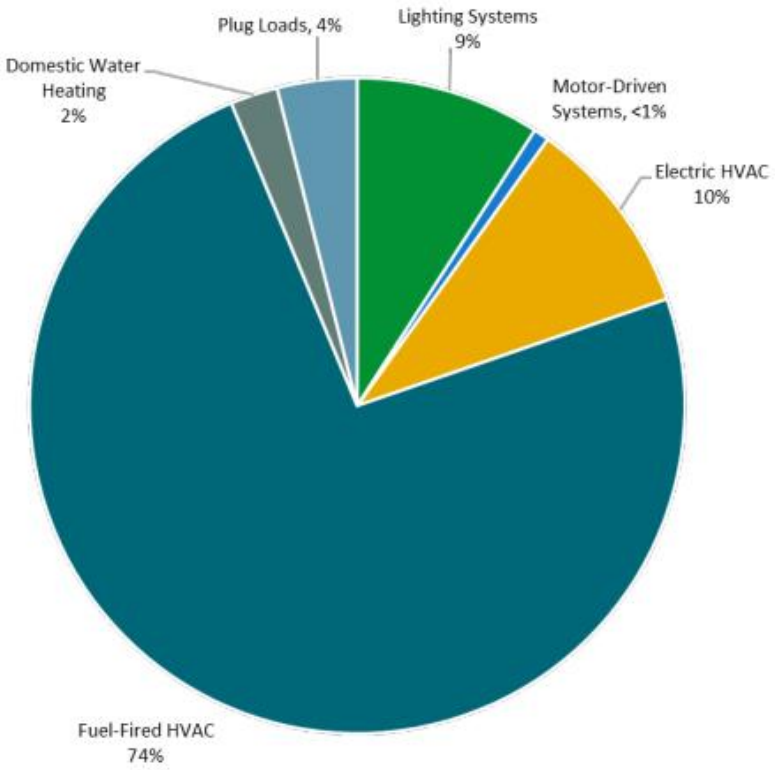


Figure 23: Union Beach BOE Office End use Breakdown

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Table 22: Union Beach BOE Office Natural Gas Usage

Gas Billing Data			
Period Ending	**Days in Period**	**Natural Gas Usage (Therms)**	**Natural Gas Cost**
2/14/19	28	423	$387
3/19/19	33	362	$348
4/17/19	29	183	$184
5/16/19	29	72	$87
6/19/19	34	0	$26
7/22/19	33	0	$26
8/19/19	28	0	$26
9/17/19	29	0	$26
10/17/19	30	21	$45
11/14/19	28	143	$157
12/17/19	33	337	$354
1/17/20	31	335	$354
Totals	**365**	**1,876**	**$2,022**
Annual	**365**	**1,876**	**$2,022**

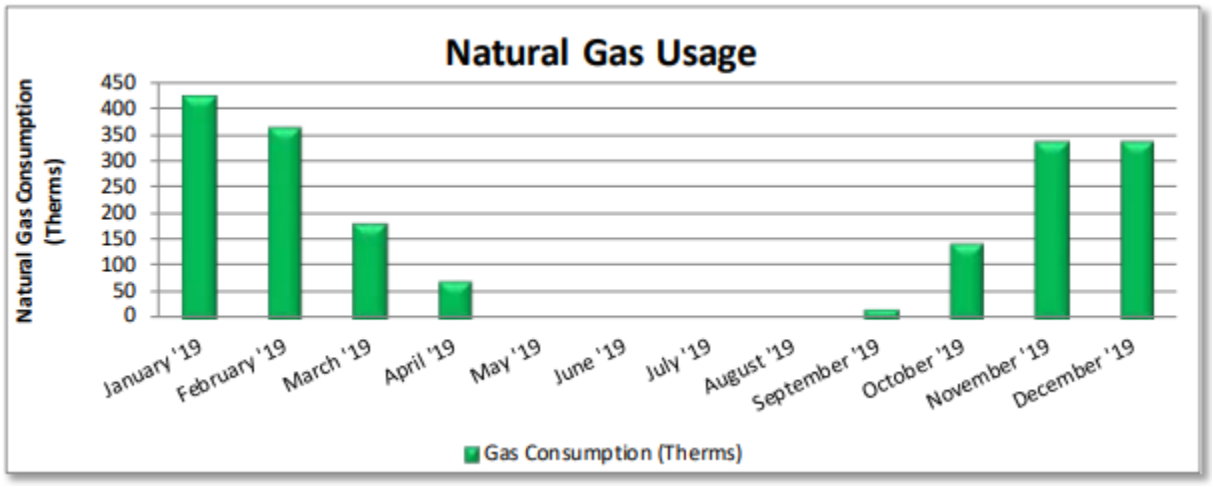


Figure 24: Union Beach BOE Office Natural Gas Usage (therms)

UnionBeach Adult School

The following tables and figures breakdown the electric and natural gas usage at Unionbeach Adult School. The school would see similar increase in gas consumption for winter months. From the chart provided below, it is evident that the school's demand charge is based on the ratchet clause where the demand charge for each month is based on the highest demand recorded for any month of that year. 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 23: Union Beach Adult School Electric Usage

Electric Billing Data					
Period Ending	Days in Period	Electric Usage (kWh)	Billed Demand (kW)	Demand Cost	Total Electric Cost
2/27/19	30	7,626	97	$542	$1,310
3/27/19	28	4,467	97	$542	$1,020
4/25/19	29	4,776	97	$542	$1,054
5/29/19	34	6,142	97	$542	$1,182
6/26/19	28	5,203	97	$542	$1,127
7/26/19	30	7,517	97	$542	$1,365
8/27/19	32	5,898	97	$542	$1,209
9/24/19	28	4,014	97	$542	$1,028
10/25/19	31	4,345	97	$542	$1,016
11/25/19	31	8,037	97	$542	$1,371
12/17/19	22	11,825	97	$542	$1,703
1/27/20	41	8,788	97	$542	$1,410
Totals	**364**	**78,638**	**97**	**$6,508**	**$14,796**
Annual	**365**	**78,854**	**97**	**$6,526**	**$14,837**

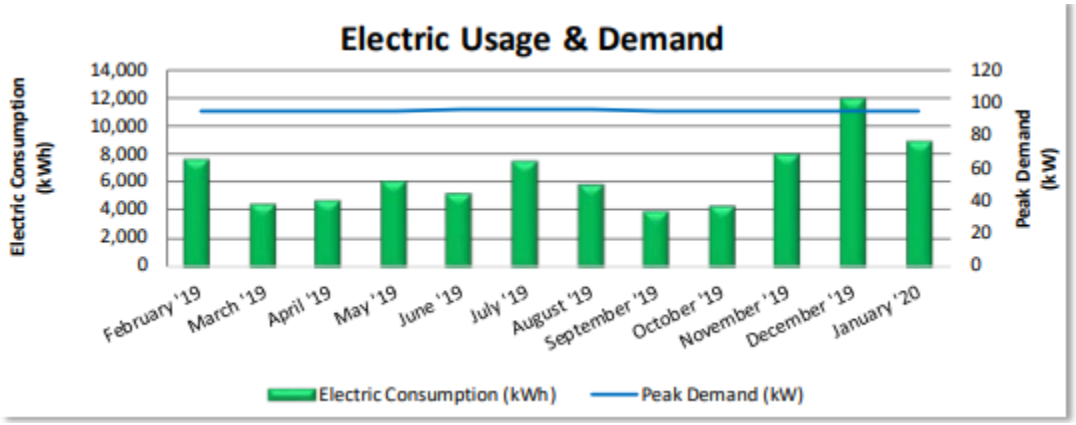


Figure 25: Union Beach Adult School Electric Usage (kWh, kW)

Table 24: Union Beach Adult School Natural Gas Usage

Gas Billing Data			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
2/14/19	28	343	$318
3/19/19	33	299	$293
4/17/19	29	151	$156
5/16/19	29	72	$87
6/19/19	34	69	$85
7/22/19	33	51	$68
8/19/19	28	41	$59
9/17/19	29	44	$62
10/17/19	30	49	$69
11/14/19	28	127	$142
12/17/19	33	302	$321
1/17/20	31	276	$298
Totals	**365**	**1,823**	**$1,958**
Annual	**365**	**1,823**	**$1,958**

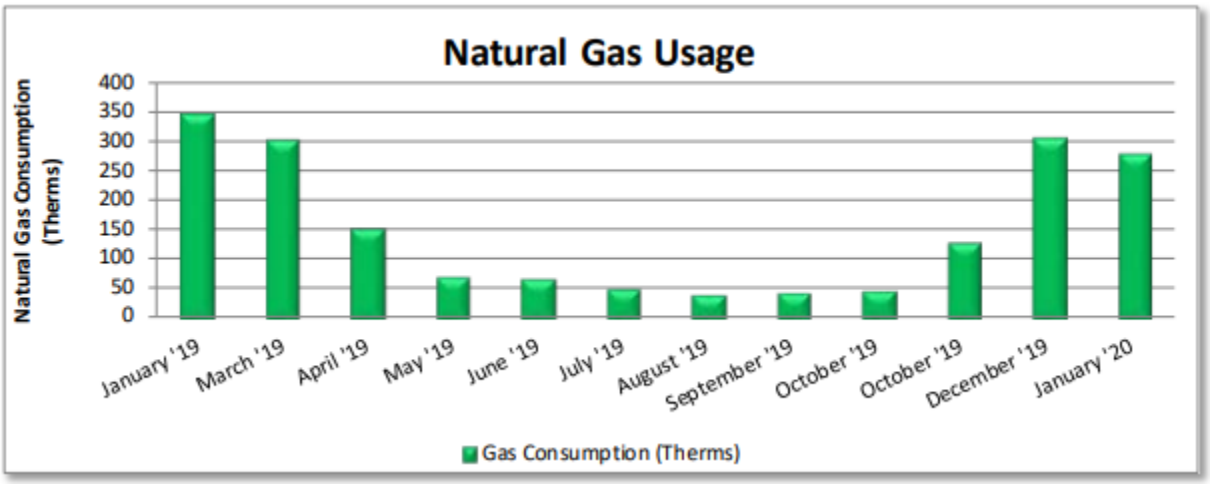


Figure 26: Union Beach Adult School Natural Gas Usage (therms)

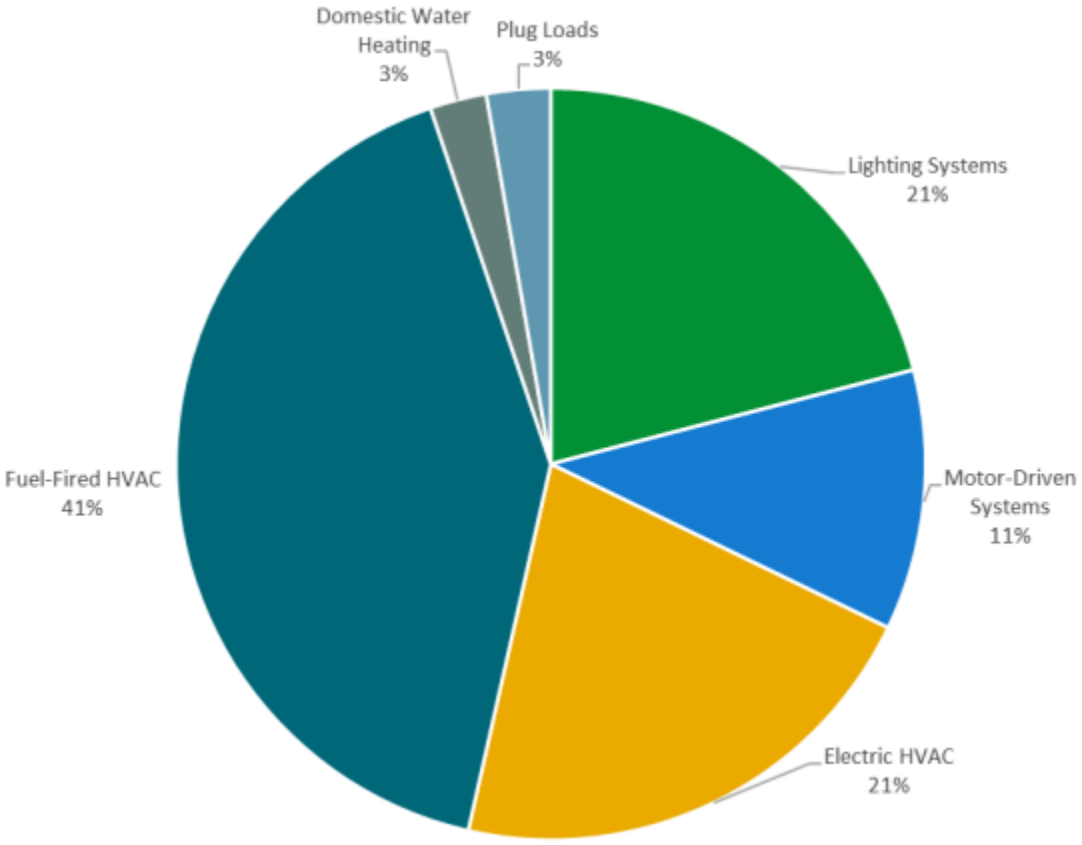


Figure 27: Union Beach Adult School Natural Gas Usage End use Breakdown

Section 4. Energy Conservation Measures (ECMs)

Union Beach Memorial High School

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

Table 25: Union Beach Memorial School ECMs

Measure	Annual Estimated Savings				Estimated Implementation Cost ($)	Estimated Simple Payback Period
	Electricity (kWh)	Annual Demand (kW)	Natural Gas (Therms)	Cost Savings ($)		
LED Lighting	185,975	54	-	$21,744	$93,074	4
High Efficiency Boilers	-	-	15,763	$11,869	$467,801	80
Direct Install RTU	1,862	2	-	$218	$55,874	86
Additional High Efficiency Rooftop Units	3,179	3	-	$372	$282,150	759
Building Management System (BMS)	13,214	-	892	$2,217	$52,112	24
Unit Ventilators	44,239	56	-	$5,172	$1,526,400	295.1

ECM 1: LED Lighting Upgrades

Existing Conditions

A thorough survey was conducted at Union Beach 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 JCP&Ls Direct Install program.

Measure Baseline and Proposed Upgrades

Baseline:

- Existing fluorescent

Proposed

- High-efficiency LED lighting lamps/fixtures

Calculation Methodology

Savings have been calculated using NJ Tech Manual FY20.

Maintenance Considerations

- None

ECM 2: High Efficiency Boilers

Existing Conditions

A thorough survey was conducted at Union Beach Elementary School. The school currently has 2 hydronic distribution system for heating. The older section of the building is heated using 2 HB Smith boilers that are operating beyond their useful life. Additionally, the boilers have been affected severely from flooding in the past based on its location. The newer section of the school is heated using 3 old condensing boilers that are also operating beyond their useful life.

ECM Description

Willdan recommends replacing two (2) 1500 MBH existing gas-fired hot water boilers with new 1500MBH condensing boilers. The other 3 boilers will be replaced 1 for 1 as well. 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 JCP&Ls Direct Install program.

Measure Baseline and Proposed Upgrades

Baseline:

- Two (2) 1500 MBH HB Smith boilers.
- Three (3) 2000 MBH RBI boilers.

Proposed

- Two (2) 1500 MBH RBI boilers.
- Three (3) 2000 MBH RBI 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 FY21.

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 3/4: Install High Efficiency Roof Top Units

Existing Conditions

A thorough survey was conducted at Union Beach Elementary School. There are existing roof top units that provide heating and cooling in several areas of the building.

ECM Description

Willdan recommends replacement of all roof top units 1 for 1.

Measure Baseline and Proposed Upgrades

Baseline:

- Two (2) 15 Ton RTUs
- One (1) 16 Ton RTU
- Three (3) 20 Ton RTUs
- One (1) 26 Ton RTU

Proposed

- Replace all RTUs 1 for 1 with gas heating on the 20-ton units.

Calculation Methodology

Savings have been calculated using NJ Tech Manual FY21.

Design Considerations

- Integrating controls with BMS.

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 Memorial Elementary School. The school has a BMS control system that only covers five (5) unit ventilators, VAV boxes, some RTUs and 3 boilers.

ECM Description

Willdan recommends using existing BMS system to control the newly installed units. 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:

- Limited BMS control.

Proposed

- Expand existing system to newly installed equipment.

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 6: Unit Ventilators

Existing Conditions

A thorough survey was conducted at Memorial Elementary School. The school has 53 heating only unit ventilators that are as old as the building itself and have been depreciated over the years due to flooding. Some of the fans in the ventilators are not operating hence, limiting the flow of air in the classroom.

ECM Description

With the approval of the incentives, in order to improve the air quality and energy performance, Willdan will replace all unit ventilators in the school. Not only will these UVs provide heating but will also provide cooling to the classrooms. This will remove the need for window ACs for cooling purposes while increasing the efficiency and reducing the energy cost.

Measure Baseline and Proposed Upgrades

Baseline:

- Heating only UVs with reduced airflow

Proposed

- Heating and cooling capable UVs with updated ventilation system
- Local controls with in-built energy management capability

Calculation Methodology

Savings have been calculated using NJ Tech Manual FY21 and in house calculation methods.

Design Considerations

- Existing electrical system sizing
- Ventilation requirements by the SSB-VEER program

Maintenance Considerations

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

Union Beach Adult School

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

Table 26: Union Beach Adult School ECMs

Measure	Annual Estimated Savings				Estimated Implementation Cost ($)
	Electricity (kWh)	Annual Demand (kW)	Natural Gas (Therms)	Cost Savings ($)	
LED Lighting	19,581	-	-	$2,289	$3,015

ECM 1: LED Lighting Upgrades

Existing Conditions

A thorough survey was conducted at Union Beach Adult 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 JCP&L's Direct Install 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

UnionBeach BOE Office

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

Table 27: Union Beach BOE Office ECMs

Measure	Annual Estimated Savings				Estimated Implementation Cost ($)
	Electricity (kWh)	Annual Demand (kW)	Natural Gas (Therms)	Cost Savings ($)	
LED Lighting	7,686	-	-	$899	$6,112

ECM 1: LED Lighting Upgrades

Existing Conditions

A thorough survey was conducted at the Board of Education's office. 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 JCP&L's Direct Install 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

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 28: Optional ECMs not considered

Optional ECM: Considered, but not included with base project at this time	Union Beach Memorial Elementary School	Union Beach Adult School	Union Beach BOE Office
Window Replacement/ Upgrade	X	X	X
VRF System	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 Union Beach 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 Union Beach 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 will work with Union Beach BOE to apply for and maximize all available rebates, utility incentives, PJM incentives or tax incentives. Willdan will also work with Union Beach 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 utility programs – Equipment Incentives
- PJM Interconnection Incentive Programs (Demand Response and Frequency Regulation)
- Federal Government Energy Policy Act (Renewable Energy Technologies Tax Credits and Funding Grants)

1. JCP&L Direct Install Program

Union Beach BOE has a potential of implementing ECMs worth $1.1 Million through this program with up to 80% of the above project cost, paid by the utility company.

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. Union Beach 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

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 29: District-Wide DI Incentives

School Name	Direct Install
Union Beach Memorial Elementary School	$489,846.44
Union Beach Adult School	$3,512.52
Union Beach BOE Office	$5,000.85

2. JCP&L 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 Union Beach BOE.

Table 30: District-Wide SmartStart Incentives

School Name	JCPL Prescriptive
Union Beach Memorial Elementary School	$11,542
Union Beach Adult School	N/A
Union Beach BOE Office	N/A

3. 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 31: District-Wide PJM Incentives

	PJM Savings
DY 2021/22	$1,354
DY 2022/23	$1,354
DY 2023/24	$1,354
DY 2024/25	$1,354
TOTAL	**$5,416**

4. SSB-VEER Program

On August 24, 2021, Governor Phil Murphy signed into law the School and Small Business Energy Efficiency Stimulus Program Fund as P.L. 2021, c. 200 ("Law"). This Law funds two distinct programs: 1) the School and Small Business Ventilation and Energy Efficiency Verification and Repair (SSB-VEEVR) Program; and 2) the School and Small Business Noncompliant Plumbing Fixture and Appliance (SSB-NPFA) Program.

These programs provide grants to improve air quality and energy performance in schools and small businesses through the repair, maintenance, upgrade, replacement, and installation of certain HVAC systems, and the installation of energy efficient and water-conserving appliances. These programs will improve the health and safety of schools and small businesses.

The programs pay for up to 75% of the cost to repair and/or replace equipment. 75% of program funds will be awarded to schools and small businesses located in underserved communities.

Table 32: District-Wide SSB-VEER Incentives

School Name	SSB-VEER Incentives
Union Beach Memorial Elementary School	$1,379,925
Union Beach Adult School	$0
Union Beach BOE Office	$0
TOTAL	**$1,379,925**

5. 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 Union Beach Board of Education spent an amount of $85,000 annually for regular operation and maintenance costs. Willdan is projecting an O&M savings of $245,000 for five years which will be used towards the ESIP.

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

Measurement and Verification

The M&V protocol developed collaboratively between Willdan and Union Beach 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 Union Beach 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 Union Beach 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 Union Beach 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 LGEA 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 323: District-Wide Utility Baseline

	Total	Memorial School	Adult School	Board Office
Area (sqft)	118,173	104,223	4,950	9,000
Annual utility $	$125,120.00	$105,017.00	$3,775.00	$16,328.00
Total kBtu	7,406,863	6,715,090	235,590	456,183
Total therms	48,131	44,607	1,717	1,807
$ therms	36,241.00	$33,502.00	$1,356.00	$1,383.00
kW	216	111.10	8.79	96.60
Total kWh utility	217,787	118,320	18,725	80,742
Total kWh produced	542,404	542,404	-	-
$ kWh	$88,879.00	$71,515.00	$2,419.00	$14,945.00
Total kWh	760,191	660,724	18,725	80,742
Number of stories		1	1	1
Yr Blt		1955	1852	1852
staff	105	90	10	5
students	630	630	-	-
Hours		12		
$/kWh	$0.1169	$0.1082	$0.1292	$0.1851
$/therm	$0.75	$0.75	$0.79	$0.77
$/kBtu	$0.02	$0.02	$0.02	$0.04
$/sf	$1.06	$1.01	$0.76	$1.81
$/p	$170.23	$145.86	$377.50	$3,265.60

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, Union Beach schools will be going through various M&V options. The following is the decision per school

Union Beach Memorial School

Willdan has recommended option C for Measurement and Verification at Union Beach Memorial School.

Union Beach Adult School

Willdan has recommended option C for Measurement and Verification at Union Beach Adult School. Since lighting is the only ECM, Willdan will be able to verify the savings from calculations using their overall electrical usage.

Union Beach BOE Office

Willdan has recommended option C for Measurement and Verification at Union Beach BOE Office. Since lighting is the only ECM, Willdan will be able to verify the savings from calculations using their overall electrical usage.

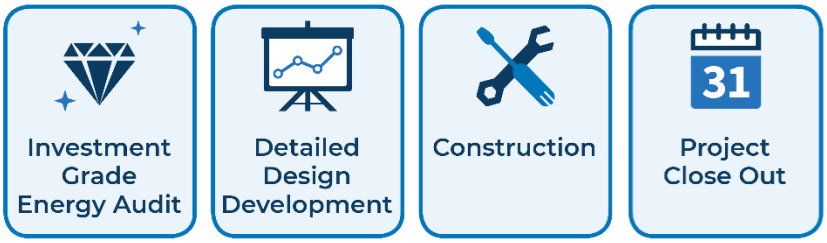
Section 7. Project Development and Management Overview

Project Development and Management Overview

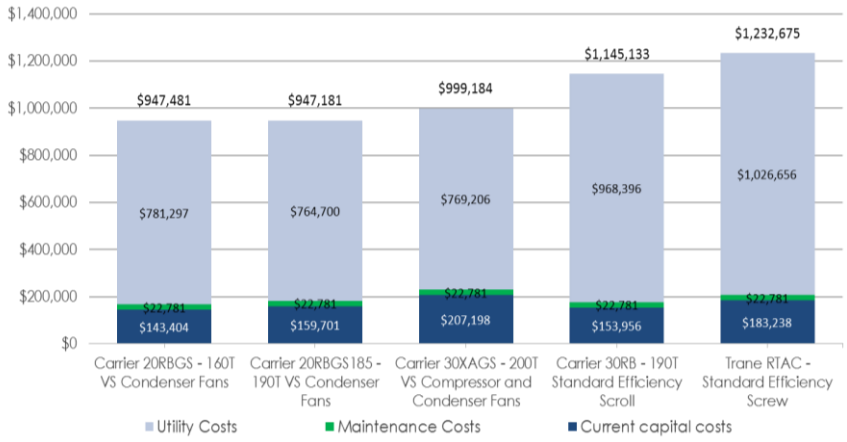
Energy Performance project development and management Approach

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 Union Beach 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 Union Beach 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 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 Union Beach 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 Union Beach 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 Union Beach 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 Union Beach 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).

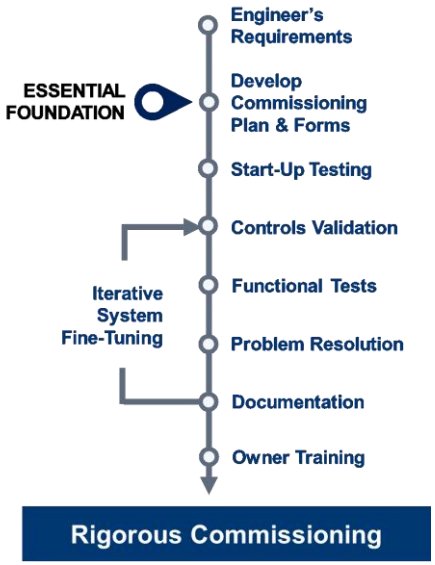
Project Closeout

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 Union Beach 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

Union Beach 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 Union Beach 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.

Union Beach 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 Union Beach Board of Education staff and operations personnel on all new equipment and dynamic systems. We will arrange and facilitate these trainings at Union Beach Board of Education, and we bring in equipment experts to provide advanced technical training and advocate that Union Beach 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 Union Beach 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 Union Beach 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 Union Beach. 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 Energy Performance (Energy Star Portfolio)
- Appendix B: Direct Install Proposal
- Appendix C: Proposed Equipment
- Appendix D: Formulae
- Appendix E: ASHRAE 90.1 Minimum Performance Requirement and Baseline HVAC System Types

Appendix A
Statement of Performance (Energy Star Portfolio)

EUI is presented in terms of *site energy* and *source energy*. Site energy is the amount of fuel and electricity consumed by a building as reflected in utility bills. Source energy includes fuel consumed to generate electricity consumed at the site, factoring in electric production and distribution losses for the region.

LEARN MORE AT energystar.gov

ENERGY STAR® Statement of Energy Performance

40

ENERGY STAR® Score[1]

Union Beach Public Works Office (Formerly Union Beach Adult School)

Primary Property Type: Office
Gross Floor Area (ft²): 9,000
Built: 1852

For Year Ending: December 31, 2019
Date Generated: September 16, 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
Union Beach Public Works Office (Formerly Union Beach Adult School) 1205 Florence Avenue Union Beach, New Jersey 07735	UnionBeachBOE 221 Morningside Ave Union Beach, NJ 07735 (732) 864-4992	Union Beach Public Schools Board of Education 221 Morningside Avenue Union Beach, NJ 07735 (732) 864-4992 jlauer@unionbeachschools.org

Property ID: 12420534

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
51.5 kBtu/ft²

Source EUI
108 kBtu/ft²

Annual Energy by Fuel	
Natural Gas (kBtu)	185,732 (40%)
Electric - Grid (kBtu)	277,643 (60%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	45.6
National Median Source EUI (kBtu/ft²)	95.7
% Diff from National Median Source EUI	13%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	36

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

____ _____
.
(___)___-_____
_____

Professional Engineer or Registered Architect Stamp (if applicable)

EUI is presented in terms of *site energy* and *source energy*. Site energy is the amount of fuel and electricity consumed by a building as reflected in utility bills. Source energy includes fuel consumed to generate electricity consumed at the site, factoring in electric production and distribution losses for the region.

LEARN MORE AT energystar.gov

ENERGY STAR® Statement of Energy Performance

73

ENERGY STAR® Score[1]

Union Beach School District - Board Office

Primary Property Type: Office
Gross Floor Area (ft²): 4,950
Built: 1852

For Year Ending: December 31, 2019
Date Generated: September 16, 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
Union Beach School District - Board Office 1207 Florence Avenue Union Beach, New Jersey 07735	UnionBeachBOE 221 Morningside Ave Union Beach, NJ 07735 (732) 864-4992	Union Beach Public Schools Board of Education 221 Morningside Avenue Union Beach, NJ 07735 (732) 864-4992 jlauer@unionbeachschools.org

Property ID: 12420636

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
51.6 kBtu/ft²

Source EUI
77.9 kBtu/ft²

Annual Energy by Fuel	
Electric - Grid (kBtu)	66,976 (26%)
Natural Gas (kBtu)	188,668 (74%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	72.6
National Median Source EUI (kBtu/ft²)	109.5
% Diff from National Median Source EUI	-29%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	16

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

___ _____
,
(___)___-_____
_____

Professional Engineer or Registered Architect Stamp (if applicable)

EUI is presented in terms of *site energy* and *source energy*. Site energy is the amount of fuel and electricity consumed by a building as reflected in utility bills. Source energy includes fuel consumed to generate electricity consumed at the site, factoring in electric production and distribution losses for the region.

LEARN MORE AT energystar.gov

ENERGY STAR® Statement of Energy Performance

77

ENERGY STAR® Score[1]

Union Beach Memorial School

Primary Property Type: K-12 School
Gross Floor Area (ft²): 104,223
Built: 1955

For Year Ending: December 31, 2019
Date Generated: September 16, 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
Union Beach Memorial School
221 Morningside Avenue
Union Beach, New Jersey 07735

Property Owner
UnionBeachBOE
221 Morningside Ave
Union Beach, NJ 07735
(732) 864-4992

Primary Contact
Union Beach Public Schools Board of Education
221 Morningside Avenue
Union Beach, NJ 07735
(732) 864-4992
jlauer@unionbeachschools.org

Property ID: 12420388

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
72.8 kBtu/ft²

Source EUI
90.7 kBtu/ft²

Annual Energy by Fuel	
Electric - Solar (kBtu)	1,498,216 (20%)
Electric - Grid (kBtu)	891,164 (12%)
Natural Gas (kBtu)	5,198,777 (68%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	99.7
National Median Source EUI (kBtu/ft²)	124.1
% Diff from National Median Source EUI	-27%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	505

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

___ _____
,
(___)___-_____
_____

Professional Engineer or Registered Architect Stamp (if applicable)

APPENDIX B
DIRECT INSTALL PROPOSAL

WILLDAN Direct Install

Customer Work Order (Page 1 of 5)

Tel: 1-877-831-5419 - Email: energysavenj@willdan.com

Jersey Central Power & Light
A FirstEnergy Company

Sales Representative Name	Energy Assessment Date
Chris Fornicola	7/21/21
Installation Contractor	
Tri-State Light & Energy	

UNION BEACH BORO BD OF ED
Union Beach BOE Memorial School
221 MORNINGSIDE AVE
UNION BEACH,NJ7735

WORK ORDER #	
6317522-A	
Customer Phone	**Tool Version**
7322643133	1.4
Contact Person	**Customer Email**
Jamison Lauer	jlauer@unionbeachschools.org

ENERGY SAVINGS UPGRADES

LOCATION	PRODUCT DESCRIPTION	EXISTING PROD/MODEL #	EXIST. QTY	PROD/MODEL #	REPLACE. QTY	ID	UNIT PRICE (Installed)	TOTAL COST	CUSTOMER COST	QTY INSTALLED (IF DIFFERENT)	CUSTOMER TO INITIALS CHANGES
1)Room 50 - 1 ()	LED T8 Tube Type B	4L4'32W T8 Electronic Ballast	6	4L 48" 13W LED T8 Tube with Line Driver - Normal	6		$106.27	$637.62			
2)33 Classrooms ()	LED T8 Tube Type B	3L4'32W T8 Electronic Ballast	478	3L 48" 13W LED T8 Tube with Line Driver - Normal	478		$86.93	$41,552.54			
3)Room 50 - 11 ()	LED T8 Tube Type B	4L4'32W T8 Electronic Ballast	12	4L 48" 13W LED T8 Tube with Line Driver - Normal	12		$106.27	$1,275.24			
4)Room 49 - 12 ()	LED T8 Tube Type B	4L4'32W T8 Electronic Ballast	6	4L 48" 13W LED T8 Tube with Line Driver - Normal	6		$106.27	$637.62			
5)Bathroom + Electrical - 15 ()	LED T8 Tube Type B	2L4'32W T8 Electronic Ballast	2	2L 48" 13W LED T8 Tube with Line Driver - Normal	2		$80.00	$160.00			
6)Bathroom + Electrical - 15 ()	LED T8 Tube Type B	4L4'32W T8 Electronic Ballast	2	4L 48" 13W LED T8 Tube with Line Driver - Normal	2		$106.27	$212.54			
7)Bathroom + Electrical - 15 ()	LED T8 Tube Type B	2L4'32W T8 Electronic Ballast	2	2L 48" 13W LED T8 Tube with Line Driver - Normal	2		$80.00	$160.00			
8)Office + Nurse - 16 ()	LED Fixture - Flat Panel	2L2' F40 Biax / Twin Tube Lamp / Electronic Ballast	48	New 30w 2x4 LED Flat Panel	48		$220.07	$10,563.36			
9)Office + Nurse - 16 ()	LED Fixture - Flat Panel	2L2' F40 Biax / Twin Tube Lamp / Electronic Ballast	8	New 20w 2x2 LED Flat Panel	8		$200.89	$1,607.12			
10)Office + Nurse - 16 ()	LED T8 Tube Type B	2L4'32W T8 Electronic Ballast	4	2L 48" 13W LED T8 Tube with Line Driver - Normal	4		$80.00	$320.00			
11)Office + Nurse - 16 ()	LED T8 Tube Type B	2L4'32W T8 Electronic Ballast	4	2L 48" 13W LED T8 Tube with Line Driver - Normal	4		$80.00	$320.00			
12)Restrooms - 21 ()	LED T8 Tube Type B	4L4'32W T8 Electronic Ballast	3	4L 48" 13W LED T8 Tube with Line Driver - Normal	3		$106.27	$318.81			
13)Restrooms - 21 ()	LED T8 Tube Type B	2L4'32W T8 Electronic Ballast	1	2L 48" 13W LED T8 Tube with Line Driver - Normal	1		$80.00	$80.00			
14)Storage + Boiler - 28 ()	LED T8 Tube Type B	2L4'32W T8 Electronic Ballast	1	2L 48" 13W LED T8 Tube with Line Driver - Normal	1		$80.00	$80.00			
15)Storage + Boiler - 28 ()	LED T8 Tube Type B	4L4'32W T8 Electronic Ballast	8	4L 48" 13W LED T8 Tube with Line Driver - Normal	8		$106.27	$850.16			

		Customer Initials
Cost of Installed Measures (Current Page):	$58,775.01	
Cost of Installed Measures (Other Pages):	$97,837.20	
Total Cost of Installed Measures:	$1,038,515.03	
Incentive:	$489,846.44	
Customer Payment Due upon Completion:	$548,668.59	

Terms and Condition

By signing the below I agree to the following:

1) I have reviewed the Energy Efficiency Assessment for the premises listed above. 2) I authorize energy efficiency related services work on the above listed premises. 3) I understand that all work identified on this Customer Work Order above in the section "JCP&L Program Incentive" is paid for by Willdan. I understand that I am responsible to pay Willdan or, if applicable the Installation Program Allies identified above, for that portion of the total cost identified above in the section "Customer Payment Due Upon Completion" at the time that the installation is completed. I further understand that I may pay Willdan, or if applicable the Installation Program Ally, by any of the following methods: credit card, money order, cashier's check, PayPal, or cash. 4) I understand that JCP&L does not endorse, guarantee or warrant any particular manufacturer or product, and that JCP&L provides no warranties, expressed or implied, for any products or services. Customer's reliance on warranties is limited to warranties provided by Willdan, or Installation Program Allies and that products installed under this DI Program are warranted for a limited time. After the lapse of this warranty period, I will be responsible for replacement of said products. The warranty periods are provided below. 5) I authorize access to the above listed address for the purpose of installing the energy-saving upgrades and inspecting them upon completion. 6) I agree to indemnify, defend, and hold Willdan, JCP&L, and Installation Program Allies, harmless from any claims, losses, expenses, liabilities, and costs for damage to or destruction of this property, or injuries to any person (including death) arising out of inappropriate/non-intended use of equipment installed as authorized by this agreement. 7) I agree that JCP&L may provide Customer information including Customer name, account number, electric consumption data and electric energy savings to its third-party evaluation contractor for DI Program evaluation purposes. The evaluation contractor has agreed to keep Customer information confidential. Customer information may also be provided to the New Jersey Board of Public Utilities (NJBPU) Commission. Any Customer information provided to the NJBPU Commission will be aggregated with information about other customers and not personally identifiable. 8) The scope of work and pricing presented in this document is valid for no more than six (6) months after the signature date. After six (6) months, the project scope and/or pricing may be updated. 9) I understand all energy savings values are calculated based upon the New Jersey Technical Resource Manual ("TRM") for estimating savings for energy efficiency programs. The annual energy savings estimate presented in the Summary Report is based upon pre-determined sector hours listed in the TRM. Actual savings may vary depending on actual operating hours at the site. JCP&L DOES NOT MAKE ANY REPRESENTATIONS OF ANY KIND REGARDING THE RESULTS TO BE ACHIEVED BY THE ENERGY-SAVING MEASURES OR THE ADEQUACY OR SAFETY OF SUCH MEASURES, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. 10) I understand that if existing lighting that is not in service when upgraded through the DI Program, actual energy savings will also vary from the Summary Report. 11) If non-compatible emergency ballasts are found, Customer can elect to leave existing fixtures as is or replace ballasts at an additional cost. 12) Willdan reserves the right to cancel any DI project for any reason. 13) I have read, understand and am in compliance with all rules and regulations concerning this DI Program. I certify that all information provided is correct to the best of my knowledge. 14) By participating in , I agree to assign ownership of any Energy Efficiency resource credits resulting from my project(s) to JCP&L for the purpose of offering these credits into the markets operated by PJM Interconnection, Inc. ("PJM").

Warranty Periods

The energy savings upgrades are warranted from the date of installation as follows:

Lighting Parts & Labor	1 Year	LED Tubes, Ballasts & Integrated Fixtures**	5 Years
LED Screw-In Lamps & Smart Thermostats**	3 Years	Evaporator & Door Heater Controls inc. parts & labor	2 Years
Exit Signs	1 Year	EC Motors inc. parts & labor	1 Year
HVAC & HVAC controls	1 Year	Food Service Equipment	1 Year
**Manufacturer's warranty			

Notes

I accept the terms & Conditions above (Must Sign Before Installation):

Contractor Signature	Date
Customer Signature G. Gahles	Date 5-6-22
Print Name G. Gahles	Title BA

Energy Saving Upgrades have been completed to my satisfaction (After Installation)

Contractor Signature	Date
Customer Signature G. Gahles	Date 5-6-22
Print Name G. Gahles	Title BA

Direct Install

Customer Work Order (Page 2 of 5)

Jersey Central Power & Light
A FirstEnergy Company

JCP&L Account # 0

UNION BEACH BORO BD OF ED

WORK ORDER # 6317522-A

LOCATION	PRODUCT DESCRIPTION	EXISTING PROD/MODEL #	EXIST. QTY	PROD/MODEL #	REPLACE. QTY	ID	UNIT PRICE (Installed)	TOTAL COST	CUSTOMER COST	QTY INSTALLED (IF DIFFERENT)	CUSTOMER TO INITIALS CHANGES
16)Storage + Boiler - 28 ()	LED T8 Tube Type B	4L4'32W T8 Electronic Ballast	1	4L 48" 13W LED T8 Tube with Line Driver - Normal	1		$106.27	$106.27			
17)Storage + Boiler - 28 ()	LED Screw-In	40W INC	3	LED 9W A-Lamp	3		$16.72	$50.16			
18)Multipupose - 29 ()	LED Fixture - High Bay	400W METAL HALIDE	15	New 90W LED High Bay	15		$520.36	$7,805.40			
19)Multipupose - 29 ()	LED T8 Tube Type B	3L4'32W T8 Electronic Ballast	1	3L 48" 13W LED T8 Tube with Line Driver - Normal	1		$86.93	$86.93			
20)Multipupose - 29 ()	LED T8 Tube Type B	3L4'32W T8 Electronic Ballast	1	3L 48" 13W LED T8 Tube with Line Driver - Normal	1		$86.93	$86.93			
21)Multipupose - 29 ()	LED Screw-In	100W INC	2	LED 12W A-Lamp	2		$18.40	$36.80			
22)Multipupose - 29 ()	LED T8 Tube Type B	4L4'32W T8 Electronic Ballast	4	4L 48" 13W LED T8 Tube with Line Driver - Normal	4		$106.27	$425.08			
23)Kitchen - 30 ()	LED T8 Tube Type B	2L4'32W T8 Electronic Ballast	18	2L 48" 13W LED T8 Tube with Line Driver - Normal	18		$80.00	$1,440.00			
24)Kitchen - 30 ()	LED Screw-In	60W INC	4	LED 9W A-Lamp	4		$16.72	$66.88			
25)Kitchen - 30 ()	LED Screw-In	18W COMPACT HARD WIRE FIXTURE	1	LED 9W A-Lamp	1		$16.72	$16.72			
26)3 Classrooms ()	LED T8 Tube Type B	2L4'32W T8 Electronic Ballast	9	2L 48" 13W LED T8 Tube with Line Driver - Normal	9		$80.00	$720.00			
27)3 Classrooms ()	LED T8 Tube Type B	2L4'32W T8 Electronic Ballast	5	3L 24" 8W LED T8 Tube with Line Driver - Normal	5		$127.95	$639.75			
28)Room 116 - 32 ()	LED T8 Tube Type B	4L4'32W T8 Electronic Ballast	5	4L 48" 13W LED T8 Tube with Line Driver - Normal	5		$106.27	$531.35			
29)Bathrooms + Elec - 35 ()	LED T8 Tube Type B	2L4'32W T8 Electronic Ballast	15	2L 48" 13W LED T8 Tube with Line Driver - Normal	15		$80.00	$1,200.00			
30)Bathrooms + Elec - 35 ()	LED T8 Tube Type B	4L4'32W T8 Electronic Ballast	2	4L 48" 13W LED T8 Tube with Line Driver - Normal	2		$106.27	$212.54			
31)Bathrooms + Elec - 35 ()	LED T8 Tube Type B	3L4'32W T8 Electronic Ballast	6	3L 48" 13W LED T8 Tube with Line Driver - Normal	6		$86.93	$521.58			
32)Room 26 - 43 & Room 23 - 45 ()	LED Fixture - Flush Mount	2/13W COMPACT HARD WIRE FIXTURE ELECTRONIC BALLAST	2	New 16w LED Flush Mount	2		$120.64	$241.28			
33)Room 26 - 43 & Room 23 - 45 ()	LED Fixture - Flush Mount	32W CIRCLINE HARD WIRE FIXTURE	2	New 16w LED Flush Mount	2		$120.64	$241.28			
34)8 Classrooms ()	LED T8 Tube Type B	3L4'32W T8 Electronic Ballast	104	3L 48" 13W LED T8 Tube with Line Driver - Normal	104		$86.93	$9,040.72			
35)Restroom + Roof + Mech - 49 ()	LED T8 Tube Type B	2L4'32W T8 Electronic Ballast	1	2L 24" 8W LED T8 Tube with Line Driver - Normal	1		$111.52	$111.52			
36)Restroom + Roof + Mech - 49 ()	LED T8 Tube Type B	2L4'32W T8 Electronic Ballast	1	2L 48" 13W LED T8 Tube with Line Driver - Normal	1		$80.00	$80.00			
37)Restroom + Roof + Mech - 49 ()	LED T8 Tube Type B	2L4'32W T8 Electronic Ballast	3	2L 48" 13W LED T8 Tube with Line Driver - Normal	3		$80.00	$240.00			
38)7 Classrooms ()	LED Fixture - Recessed Can	28W COMPACT HARD WIRE FIXTURE	16	New LED Downlight 12W	16		$128.76	$2,060.16			
39)4 Classrooms ()	LED Fixture - Flat Panel	2L2' F40 Biax / Twin Tube Lamp / Electronic Ballast	1	New 20w 2x2 LED Flat Panel	1		$200.89	$200.89			
40)Boys RR - 56 ()	LED T8 Tube Type B	2L4' 34W Standard Lamp / Standard Ballast	3	2L 48" 13W LED T8 Tube with Line Driver - Normal	3		$80.00	$240.00			
41)14 Classrooms ()	LED T8 Tube Type B	2L4'32W T8 Electronic Ballast	138	2L 48" 13W LED T8 Tube with Line Driver - Normal	138		$80.00	$11,040.00			
42)Fire Panel - 59 ()	LED T8 Tube Type B	3L4'32W T8 Electronic Ballast	2	3L 48" 13W LED T8 Tube with Line Driver - Normal	2		$86.93	$173.86			
43)Girls RR + Closet - 60 ()	LED T8 Tube Type B	2L4'32W T8 Electronic Ballast	2	2L 48" 13W LED T8 Tube with Line Driver - Normal	2		$80.00	$160.00			
44)Girls RR + Closet - 60 ()	LED T8 Tube Type B	4L4'32W T8 Electronic Ballast	1	4L 48" 13W LED T8 Tube with Line Driver - Normal	1		$106.27	$106.27			

Cost of Installed Measures (Page 2 only): $37,882.37

Direct Install

Customer Work Order (Page 3 of 5)

Jersey Central Power & Light
A FirstEnergy Company

JCP&L Account #												
0				UNION BEACH BORO BD OF ED							WORK ORDER # 6317522-A	
LOCATION	PRODUCT DESCRIPTION	EXISTING PROD/MODEL #	EXIST. QTY	PROD/MODEL #	REPLACE. QTY	ID	UNIT PRICE (Installed)	TOTAL COST	CUSTOMER COST	QTY INSTALLED (IF DIFFERENT)	CUSTOMER TO INITIALS CHANGES	
45)Girls RR + Closet - 60 ()	LED T8 Tube Type B	2L4' 34W Standard Lamp / Standard Ballast	2	2L 48" 13W LED T8 Tube with Line Driver - Normal	2		$80.00	$160.00				
46)Hallway - 61 ()	LED T8 Tube Type B	2L4'32W T8 Electronic Ballast	80	2L 48" 13W LED T8 Tube with Line Driver - Normal	80		$80.00	$6,400.00				
47)Hallway - 61 ()	LED T8 Tube Type B	2L4'32W T8 Electronic Ballast	25	2L 48" 13W LED T8 Tube with Line Driver - Normal	25		$300.98	$7,524.50				
48)Hallway - 61 ()	LED Fixture - Recessed Can	18W COMPACT HARD WIRE FIXTURE ELECTRONIC BALLAST	15	New LED Downlight 12W	15		$128.76	$1,931.40				
49)Hallway - 61 ()	LED T8 Tube Type B	3L4'32W T8 Electronic Ballast	1	3L 48" 13W LED T8 Tube with Line Driver - Normal	1		$86.93	$86.93				
50)Boiler - 62 ()	LED T8 Tube Type B	2L4'32W T8 Electronic Ballast	3	2L 48" 13W LED T8 Tube with Line Driver - Normal	3		$80.00	$240.00				
51)Boiler - 62 ()	LED T8 Tube Type B	2L4'32W T8 Electronic Ballast	1	2L 48" 13W LED T8 Tube with Line Driver - Normal	1		$80.00	$80.00				
52)Break Room - 63 ()	LED T8 Tube Type B	3L4' 34W Standard Lamp / Standard Ballast	4	4L 48" 13W LED T8 Tube with Line Driver - Normal	4		$106.27	$425.08				
53)Boys Locker - 64 ()	LED Fixture - Flat Panel	2L2' F40 Biax / Twin Tube Lamp / Electronic Ballast	10	New 20w 2x2 LED Flat Panel	10		$200.89	$2,008.90				
54)Rest Room + Elec - 65 ()	LED T8 Tube Type B	2L4' 34W Standard Lamp / Standard Ballast	4	2L 48" 13W LED T8 Tube with Line Driver - Normal	4		$80.00	$320.00				
55)Rest Room + Elec - 65 ()	LED T8 Tube Type B	2L4' 34W Standard Lamp / Standard Ballast	2	2L 48" 13W LED T8 Tube with Line Driver - Normal	2		$80.00	$160.00				
56)Gym - 66 ()	LED Fixture - High Bay	400W METAL HALIDE	24	New 90W LED High Bay	24		$520.36	$12,488.64				
57)Gym - 66 ()	LED T8 Tube Type B	2L4'32W T8 Electronic Ballast	6	2L 48" 13W LED T8 Tube with Line Driver - Normal	6		$80.00	$480.00				
58)Gym - 66 ()	LED Fixture - Flat Panel	2L2' F40 Biax / Twin Tube Lamp / Electronic Ballast	2	New 20w 2x2 LED Flat Panel	2		$200.89	$401.78				
59)Girls Locker Room - 67 ()	LED Fixture - Flat Panel	2L2' F40 Biax / Twin Tube Lamp / Electronic Ballast	13	New 20w 2x2 LED Flat Panel	13		$200.89	$2,611.57				
60)Boys RR - 68 ()	LED T8 Tube Type B	2L4' 34W Standard Lamp / Standard Ballast	5	2L 48" 13W LED T8 Tube with Line Driver - Normal	5		$80.00	$400.00				
61)Boys RR - 68 ()	LED T8 Tube Type B	2L4' 34W Standard Lamp / Standard Ballast	2	2L 48" 13W LED T8 Tube with Line Driver - Normal	2		$80.00	$160.00				
62)Room 12 - 69 ()	LED Fixture - Flat Panel	2L4'32W T8 Electronic Ballast	16	New 20w 2x2 LED Flat Panel	16		$200.89	$3,214.24				
63)5 Classrooms ()	LED T8 Tube Type B	3L4' 34W Standard Lamp / Standard Ballast	80	4L 48" 13W LED T8 Tube with Line Driver - Normal	80		$106.27	$8,501.60				
64)Storage - 76 ()	LED T8 Tube Type B	2L4'32W T8 Electronic Ballast	2	2L 48" 13W LED T8 Tube with Line Driver - Normal	2		$80.00	$160.00				
65)Elec Rm - 78 ()	LED T8 Tube Type B	2L4'32W T8 Electronic Ballast	2	2L 48" 13W LED T8 Tube with Line Driver - Normal	2		$80.00	$160.00				
66)Storage - 83 ()	LED T8 Tube Type B	2L4' 34W Standard Lamp / Standard Ballast	2	2L 48" 13W LED T8 Tube with Line Driver - Normal	2		$80.00	$160.00				
67)Library - 84 ()	LED T8 Tube Type B	2L4'32W T8 Electronic Ballast	26	2L 48" 13W LED T8 Tube with Line Driver - Normal	26		$80.00	$2,080.00				
68)Library - 84 ()	LED T8 Tube Type B	2L4'32W T8 Electronic Ballast	2	2L 48" 13W LED T8 Tube with Line Driver - Normal	2		$80.00	$160.00				
69)Library - 84 ()	LED Fixture - Flat Panel	2L2' F40 Biax / Twin Tube Lamp / Electronic Ballast	2	New 30w 2x4 LED Flat Panel	2		$220.07	$440.14				
70)Library - 84 ()	LED Fixture - Flat Panel	2L2' F40 Biax / Twin Tube Lamp / Electronic Ballast	9	New 20w 2x2 LED Flat Panel	9		$200.89	$1,808.01				
71)Nurse Extension - 85 ()	LED Fixture - Flat Panel	2L2' F40 Biax / Twin Tube Lamp / Electronic Ballast	6	New 20w 2x2 LED Flat Panel	6		$200.89	$1,205.34				
72)Bathrooms - 86 ()	LED T8 Tube Type B	2L4'32W T8 Electronic Ballast	2	2L 48" 13W LED T8 Tube with Line Driver - Normal	2		$80.00	$160.00				
73)Hallway + Vestibule - 87 ()	LED Fixture - Flat Panel	2L2' F40 Biax / Twin Tube Lamp / Electronic Ballast	30	New 20w 2x2 LED Flat Panel	30		$200.89	$6,026.70				

Cost of Installed Measures (Page 3 only): $59,954.83

Direct Install

Customer Work Order (Page 4 of 5)

Jersey Central Power & Light
A FirstEnergy Company

JCP&L Account #		WORK ORDER #
0	UNION BEACH BORO BD OF ED	6317522-A

LOCATION	PRODUCT DESCRIPTION	EXISTING PROD/MODEL #	EXIST. QTY	PROD/MODEL #	REPLACE. QTY	ID	UNIT PRICE (Installed)	TOTAL COST	CUSTOMER COST	QTY INSTALLED (IF DIFFERENT)	CUSTOMER TO INITIALS CHANGES
74)Hallway + Vestibule - 87 ()	- Recessed Can	28W COMPACT HARD WIRE FIXTURE	9	New LED Downlight 12W	9		$128.76	$1,158.84			
75)Hallway + Vestibule - 87 ()	T8 Tube Type B	2L4'32W T8 Electronic Ballast	14	2L 48" 13W LED T8 Tube with Line Driver - Normal	14		$80.00	$1,120.00			
76)Hallway + Vestibule - 87 ()	T8 Tube Type B	2L4'32W T8 Electronic Ballast	2	2L 48" 13W LED T8 Tube with Line Driver - Normal	2		$80.00	$160.00			
77)Hallway + Vestibule - 87 ()	T8 Tube Type B	3L4'32W T8 Electronic Ballast	14	3L 48" 13W LED T8 Tube with Line Driver - Normal	14		$86.93	$1,217.02			
78)Hallway + Vestibule - 87 ()	T8 Tube Type B	2L2' 17W T8 Electronic Ballast Energy	2	2L 24" 8W LED T8 Tube with Line Driver - Normal	2		$80.00	$160.00			
79)Ext A ()	cture - Wall Pack	100W METAL HALIDE	8	New 20w LED Wallpack	8		$179.80	$1,438.40			
80)Ext B ()	LED Screw-In	100W INC	2	LED 9W A-Lamp	2		$16.72	$33.44			
81)Ext C ()	cture - Wall Pack	2/42W COMPACT HARD WIRE FIXTURE ELECTRONIC BALLAST	2	New 20w LED Wallpack	2		$356.82	$713.64			
82)Ext D ()	Fixture - Canopy	100W METAL HALIDE	1	New 39w LED Canopy	1		$360.42	$360.42			
83)Ext F ()	No Upgrade	250W METAL HALIDE	10	No Upgrade	8						
84)Ext G ()	cture - Wall Pack	200W HPS	1	New 80w LED Wallpack	10		$302.14	$3,021.40			
85)Ext H ()	D Fixture - Flood	70W METAL HALIDE	1	New 45w LED Flood	1		$168.10	$168.10			
86)Ext I ()	cture - Wall Pack	100W INC	1	New 20w LED Wallpack	1		$179.80	$179.80			
87)Ext J ()	LED Screw-In	400W METAL HALIDE	4	LED 9W A-Lamp	1		$16.72	$16.72			
88)Ext K ()	cture - Wall Pack	100W METAL HALIDE	3	New 20w LED Wallpack	4		$356.82	$1,427.28			
89)Ext L ()	Fixture - Canopy	400W HPS	1	New 39w LED Canopy	3		$360.42	$1,081.26			
90)Ext M ()	cture - Wall Pack	400W METAL HALIDE	2	New 20w LED Wallpack	1		$356.82	$356.82			
91)System 3	lectric HVAC-AC	York/DJ180S32B4VZZ2		Electric HVAC-AC	1		$30,075.00	$30,075.00			
92)System 4	lectric HVAC-AC	York/DJ180S32B4VZZ2		Electric HVAC-AC	1		$30,075.00	$30,075.00			
93)System 1	ler Replacement	HB Smith - 28A-5		Gas Furnace/Boiler Replacement	1		$147,072.00	$147,072.00			
94)System 2	ler Replacement	HB Smith - 28A-5		Gas Furnace/Boiler Replacement	1		$147,072.00	$147,072.00			
95)BLR 3 - 5	ler Replacement	RBI		Gas Furnace/Boiler Replacement	1		$159,000.00	$159,000.00			
96)BLR 3 - 5	ler Replacement	RBI		Gas Furnace/Boiler Replacement	1		$159,000.00	$159,000.00			
97)BLR 3 - 5	ler Replacement	RBI		Gas Furnace/Boiler Replacement	1		$159,000.00	$159,000.00			
98)System 3	ler Replacement	York		Gas Furnace/Boiler Replacement	1		$6,250.00	$6,250.00			
99)System 4	ler Replacement	York		Gas Furnace/Boiler Replacement	1		$6,250.00	$6,250.00			
100)RTU - 1	alpy Economizer			Dual Enthalpy Economizer	1		$3,360.00	$3,360.00			
101)RTU - 2	alpy Economizer			Dual Enthalpy Economizer	1		$3,360.00	$3,360.00			
102)RR	tor, Spray Valve			Faucet, Aerator, Spray Valve	11		$55.00	$605.00			

Cost of Installed Measures (Page 4 only): $863,732.14

Direct Install

Customer Work Order (Page 5 of 5)

Jersey Central Power & Light
A FirstEnergy Company

JCP&L Account #		WORK ORDER #
0	UNION BEACH BORO BD OF ED	6317522-A

LOCATION	PRODUCT DESCRIPTION	EXISTING PROD/MODEL #	EXIST. QTY	PROD/MODEL #	REPLACE. QTY	ID	UNIT PRICE (Installed)	TOTAL COST	CUSTOMER COST	QTY INSTALLED (IF DIFFERENT)	CUSTOMER TO INITIALS CHANGES
103)Kitchen	ıtor, Spray Valve			Faucet, Aerator, Spray Valve	1		$55.00	$55.00			
104)Boiler Room	Pipe Insulation			Pipe Insulation	1		$2,400.00	$2,400.00			
105)Boiler Room	Pipe Insulation			Pipe Insulation	1		$2,400.00	$2,400.00			
106)Boiler Room	Pipe Insulation			Pipe Insulation	1		$1,800.00	$1,800.00			
107)RTU-1	ıart Thermostats	NA		Smart Thermostats	1		$525.00	$525.00			
108)RTU-2	ıart Thermostats	NA		Smart Thermostats	1		$525.00	$525.00			
109)RTU -1	Use Economizer			Fuel Use Economizer	1		$1,146.42	$1,146.42			
110)RTU - 2	Use Economizer			Fuel Use Economizer	1		$1,146.42	$1,146.42			
111)RTU-1	Use Economizer			Fuel Use Economizer	1		$786.42	$786.42			
112)RTU-2	Use Economizer			Fuel Use Economizer	1		$786.42	$786.42			
113)RTU-1	ng CO2 Sensors			Demand Control Ventilation Using CO2 Sensors	1		$3,300.00	$3,300.00			
114)RTU-2	ng CO2 Sensors			Demand Control Ventilation Using CO2 Sensors	1		$3,300.00	$3,300.00			
115)											
116)											
117)											
118)											
119)											
120)											
121)											
122)											
123)											
124)											
125)											
126)											
127)											
128)											
129)											
130)											
131)											

Cost of Installed Measures (Page 5 only): $18,170.68

Incentive Summary

UNION BEACH BORO BD OF ED

The Lighting Tier depends on the percentage of total MMBtu Energy Savings

You are in Lighting Tier 3

	kWh Savings	Therms Savings	Total MMBtu savings	% Of Total MMBtu	Cost	Electric Calculated Incentive (% of cost)	Electric Capped Incentive ($/kWh)	Gas Calculated Incentive	Gas Capped Incentive	Final Incentive (lesser of G or H, plus lessor of I or J)
Lighting	236,690.34		807.5875	29.77%	$169,225.35	$109,996.48	$94,676.14			$94,676.14
Electric HVAC	9,021.69		30.7820	1.13%	$70,103.35	$56,082.68	$20,298.81			$20,298.81
Electric Other	0.00		0.0000	0.00%	$0.00	$0.00	$0.00			$0.00
Gas		18,743.57	1,874.3575	69.09%	$799,186.33			$639,349.07	$374,871.49	$374,871.49
TOTAL	**245,712.04**	**18,743.5746**	**2,712.7269**		**$1,038,515.03**					**$489,846.44**
Final Incentive (% of Cost)										***47.17%***
Total Electric Incentive										*$114,974.95*
Total Gas Incentive										*$374,871.49*
$/kWh										*$0.47*
$/therm										*$20.00*

Energy Saving Lighting Upgrades	Est. Annual Cost Savings	Est. Annual Energy Savings (kWh)	Gas Savings (therms)	Total Installation Cost	Total Incentive	Your Contribution	Simple Payback Immediate
Lighting	$30,769.74			$169,225.35	$94,676.14	#VALUE!	#VALUE!
Lighting Controls	$0.00			$0.00	$0.00	$0.00	0.00
TOTALS	**$30,769.74**	**0.00**	**$0.00**	**$169,225.35**	**$94,676.14**	**#VALUE!**	**#VALUE!**

Electric HVAC Saving Upgrades	Est. Annual Cost Savings	Est. Annual Energy Savings (kWh)	Gas Savings (therms)	Total Installation Cost	Electric Incentive	Gas Incentive	Your Contribution	Simple Payback Immediate
Electric HVAC-AC	$195.92	1,507.1000	0.0000	$60,150.00	$3,390.98	$0.00	$56,759.02	3,476.46
Electric HVAC-Heat Pump	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
Dual Enthalpy Economizer	$52.65	405.0000	0.0000	$6,720.00	$911.25	$0.00	$5,808.75	1,323.93
Smart Thermostats	$128.12	985.5700	138.6000	$1,050.00	$2,217.54	$2,772.00	-$3,939.54	-368.99
Fuel Use Economizer (electric and Gas)	$0.00	0.0000	0.0000	$0.00	$2,763.04	$1.51	$0.00	0.00
Demand Control Ventilation Using CO2 Sensors	$636.48	4,896.0000	1,332.0000	$6,600.00	$1,800.00	$11,016.00	-$31,056.00	-585.52
Variable Frequency Drives	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
TOTALS	**$1,013.17**	**7,793.67**	**1,470.60**	**$74,520.00**	**$11,082.81**	**$13,789.51**	**$27,572.23**	**326.57**

HVAC Others Saving Upgrades	Est. Annual Cost Savings	Est. Annual Energy Savings (kWh)	Gas Savings (therms)	Total Installation Cost	Electric Incentive	Gas Incentive	Your Contribution	Simple Payback Immediate
Faucet, Aerator, Spray Valve	$0.00	0.0000	6.7300	$660.00	$0.00	$134.69	$525.31	0.00
Pipe Insulation	$0.00	0.0000	1,891.5700	$6,600.00	$0.00	$3,783.15	$2,816.85	0.00
Electronically Commutated Motors For Refrigeration	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
Door Heater Control	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
Door Closer	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
Gasket	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
Vending Machine	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
Strip Curtains	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
Night Covers	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
Walk-In Cooler/Freezer Evaporator Fan Control	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
Electronically Commutated Motors for Refrigeration	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
TOTALS	**$0.00**	**0.00**	**$1,898.30**	**$7,260.00**	**$0.00**	**$3,917.83**	**$3,342.16**	**0.00**

Gas Saving Upgrades	Est. Annual Cost Savings	Est. Annual Energy Savings (kWh)	Gas Savings (therms)	Total Installation Cost	Total Incentive	Your Contribution	Simple Payback Immediate
Gas Furnace/Boiler Replacement	$0.00	0.0000	15,373.9100	$783,644.00	$307,478.28	$476,165.72	0.00
Gas Furnace/Boiler Tune-up	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	0.00
Boiler Reset Controls	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	0.00
Faucet, Aerator, Spray Valve	$0.00	0.0000	6.7300	$660.00	$134.69	$525.31	0.00
Pipe Insulation	$0.00	0.0000	1,891.5700	$6,600.00	$3,783.15	$2,816.85	0.00
Smart Thermostats	$1,005.29	985.5700	138.6000	$1,050.00	$4,989.54	-$3,939.54	-47.03
Fuel Use Economizer (electric and Gas)	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	0.00
Demand Control Ventilation Using CO2 Sensors	$4,993.92	4,896.0000	1,332.0000	$6,600.00	$37,656.00	-$31,056.00	-74.63
TOTALS	**$5,999.21**	**5,881.57**	**$18,742.81**	**$798,554.00**	**$307,478.28**	**$444,512.34**	**889.14**

Jersey Central Power & Light
A FirstEnergy Company

Direct Install

Customer Installation Agreement
Tel: 1-877-831-5419 - http://sbdi.energysavenj.com

Representative Name	Energy Assessment Date
Chris Fornicola	7/21/21
Installation Contractor	
Tri-State Light & Energy	

UNION BEACH BORO BD OF ED
Union Beach BOE Memorial School
221 MORNINGSIDE AVE, Union Beach BOE Memorial School
UNION BEACH, NJ 7735

WORK ORDER #
6317522-A

Customer Phone	Tool Version
7322643133	1.4
Contact Person	**Customer Email**
Jamison Lauer	jlauer@unionbeachschools.org

Dear JCP&L Customer:
Thank you for your participation in the Direct Install ("DI") Program sponsored by JCP&L Company. This Customer Installation Agreement sets forth and confirms the understanding of the installation of Energy Efficiency measures as listed on the Customer Work Order (attached).

TERMS AND CONDITIONS:

1. Scope of Work. See attached Customer Work Order, the contents of which are hereinafter referred to as the "Scope of Work".
2. Electrical Violations. If electrical violations (as defined by the New Jersey County in which the install takes place) are found within Customer's establishment, Willdan must inform the owner, or the responsible Customer representative, of the life safety electrical hazard situation that exists before Willdan proceeds with the retrofit installation of the lighting fixtures. The existing violations must be corrected either by the owner, or by Willdan at an additional cost, which is not part of the DI Program. Willdan reserves the right to cancel any job for any reason.
3. Payment. Customer is responsible for paying that portion of the total cost identified above in the section "Customer Payment Due Upon Completion". All payments are due upon completion of the work. Upon receipt of full payment, title to the installed Energy Efficiency measures transfers to Customer.
4. Disposal. All DI Program related materials will be removed and disposed of in accordance with all federal, state and local regulations.
5. Schedule. Customer will allow reasonable access for purposes of installing Energy Efficiency measures per the Scope of Work during normal business hours.
6. Installation. Installation will commence within sixty (60) days of execution of this Customer Installation Agreement.
7. Taxes. Customer agrees that it is solely responsible for any taxes or fees that may be assessed as a result of installation of Energy Efficiency measures and shall indemnify Willdan and JCP&L for any tax related claims. In the event that Customer claims any exemption from any tax, it must provide appropriate documentation prior to installation of measures.
8. Willdan's entire liability and obligation under this agreement will not exceed the net customer cost. Under no circumstances will Willdan or JCP&L be liable for any special, incidental, indirect, punitive and/or consequential losses or damages of any kind or nature whatsoever (including, without limitation, for lost profits, time or revenue) for anything arising out of the performance or nonperformance of this agreement, whether claims for said losses or damages are premised on warranty, negligence, strict liability, contract or otherwise..
9. General Terms. This Customer Installation Agreement incorporates the Terms and Conditions agreed to on the Customer Work Order (attached).
10. The energy assessment and associated pricing is valid for a period of sixty (60) days from receipt of the proposal.
11. Governing Law, Jurisdiction & Venue. All matters of dispute between the parties shall be governed, construed, and enforced in accordance with the laws of the State of New Jersey for both substantive and procedural matters (without giving effect to conflict of laws principles) regardless of the theory upon which such matter is asserted. The parties expressly exclude the applicability of the United Nations Convention on Contracts for the International Sale of Goods. Any legal suit, action, or proceeding regarding, arising from or relating to the Customer Installation Agreement must be instituted in a State or Federal Court in the Sate of New Jersey. Customer waives any objection it may have now or hereafter regarding the jurisdiction or venue of any such suit, action or proceeding and hereby irrevocably submits to the jurisdiction of any such court in any such suit, action or proceeding.
12. Direct Install Do It Yourself Program. All measures listed as "DIY" or "No Cost" in the Customer Work Order are subject to the following conditions:
   a. The Total Cost is for material only; it does not include installation.
   b. The products provided are warranted by the manufacturer; refer to the manufacturer's warranty.
   c. The customer understands that there is a 15-day deadline from the Delivery Date for installing incentivized products. If the customer does not install the products within 15 days of delivery, the customer will be invoiced for the Program Incentive amount.
   d. If an existing ballast or fixture is found to be deficient by the Customer or Willdan, the deficiency must be rectified by the Customer, or by Willdan at an additional cost, which is not part of the Direct Install Program. Willdan reserves the right to cancel any job for any reason.

Payment Terms:

Total Cost of Installed Measures:	**$1,038,515.03**
Less: Program Incentive	$489,846.44
Plus: Code Violation Fixing Fee	
Customer Payment Due Upon Completion:	**$548,668.59**

Warranty Periods

The energy savings upgrades are warranted from the date of installation as follows:

Lighting Part & Labor	1 Year	LED Tubes Ballasts & Integrated Fixtures **	5 Years
LED Screw-In Lamps & Smart Thermostats**	3 Years	Evaporator & Door Heater Controls inc. parts & Labor	2 Years
Exit Signs	1 Year	EC Motors inc. parts & Labor	1 Year
HVAC & HVAC controls	1 Year	Food Service Equipment	1 Year

** Manufacturer's warranty

Authorization for Installation of Energy Saving Upgrades(Must Sign Before Installation)

Print Name G. Gahlos
Customer Signature [signature] Date 5-6-22

Installation Contractor(Must Sign Before Installation)

Print Name
Signature Date

JCP&L programs are funded by a charge on your energy bill. JCP&L programs can help you reduce your energy consumption and save you money. To learn more about JCP&L and how you can participate, go to www.energysaveNJ.com.

JCP&L has contracted with Willdan Energy Solutions and its subsidiary Willdan Lighting and Electric, Inc. ("Willdan") to administer the DI Program. DI offers a range of LED lighting, commercial refrigeration, HVAC replacement and HVAC controls upgrades. For more information please call 1-877-831-5419 or email energysavenj@willdan.com

1) I have reviewed the Energy Efficiency Assessment for the premises listed above. 2) I authorize energy efficiency related services work on the above listed premises. 3) I understand that all work identified on this Customer Work Order above in the section "JCP&L Program Incentive" is paid for by Willdan. I understand that I am responsible to pay Willdan or, if applicable the Installation Program Allies identified above, for that portion of the total cost identified above in the section "Customer Payment Due Upon Completion" at the time that the installation is completed. I further understand that I may pay Willdan, or if applicable the Installation Program Ally, by any of the following methods: credit card, money order, cashier's check, PayPal, or cash. 4) I understand that JCP&L does not endorse, guarantee or warrant any particular manufacturer or product, and that JCP&L provides no warranties, expressed or implied, for any products or services. Customer's reliance on warranties is limited to warranties provided by Willdan, or Installation Program Allies and that products installed under this DI Program are warranted for a limited time. After the lapse of this warranty period, I will be responsible for replacement of said products. The warranty periods are provided below. 5) I authorize access to the above listed address for the purpose of installing the energy-saving upgrades and inspecting them upon completion. 6) I agree to indemnify, defend, and hold Willdan, JCP&L, and Installation Program Allies, harmless from any claims, losses, expenses, liabilities, and costs for damage to or destruction of this property, or injuries to any person (including death) arising out of inappropriate/non-intended use of equipment installed as authorized by this agreement. 7) I agree that JCP&L may provide Customer information including Customer name, account number, electric consumption data and electric energy savings to its third-party evaluation contractor for DI Program evaluation purposes. The evaluation contractor has agreed to keep Customer information confidential. Customer information may also be provided to the New Jersey Board of Public Utilities (NJBPU) Commission. Any Customer information provided to the NJBPU Commission will be aggregated with information about other customers and not personally identifiable. 8) The scope of work and pricing presented in this document is valid for no more than six (6) months after the signature date. After six (6) months, the project scope and/or pricing may be updated. 9) I understand all energy savings values are calculated based upon the New Jersey Technical Resource Manual ("TRM") for estimating savings for energy efficiency programs. The annual energy savings estimate presented in the Summary Report is based upon pre-determined sector hours listed in the TRM. Actual savings may vary depending on actual operating hours at the site. JCP&L DOES NOT MAKE ANY REPRESENTATIONS OF ANY KIND REGARDING THE RESULTS TO BE ACHIEVED BY THE ENERGY-SAVING MEASURES OR THE ADEQUACY OR SAFETY OF SUCH MEASURES, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. 10) I understand that if existing lighting that is not in service when upgraded through the DI Program, actual energy savings will also vary from the Summary Report. 11) If non-compatible emergency ballasts are found, Customer can elect to leave existing fixtures as is or replace ballasts at an additional cost. 12) Willdan reserves the right to cancel any DI project for any reason. 13) I have read, understand and am in compliance with all rules and regulations concerning this DI Program. I certify that all information provided is correct to the best of my knowledge. 14) By participating in , I agree to assign ownership of any Energy Efficiency resource credits resulting from my project(s) to JCP&L for the purpose of offering these credits into the markets operated by PJM Interconnection, Inc. ("PJM").

Jersey Central Power & Light Company (JCP&L)
Direct Install Program for Government and K-12 Public Schools
Non-Profit Facilities and Small Businesses

Customer Audit Access Agreement

with Attachment A - Owner Consent to Conduct Audit

Government / Non-Profit / Small Business Information			
Facility Name:	Memorial School		
Contact Name:	Jamison Lauer		
Street:	Morningside Ave	Floor/Apt:	
Municipality:	Union Beach	Zip:	07735
Facility Phone:	732-	Cell Phone:	-
JCP&L Account Number:			
Type of Facility:	Municipal/State/Federal Non-Profit Small Business (K-12 Public Schools)		
Primary Building Use, NAICS description:	School		

*The North American Industry Classification System (NAICS) is the standard used by Federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy.

Building Information		
(Same as Installation Address) Owner Tenant (Owner Permission Required; see attached) Bill to:		
Name:		
Street:		Floor/Apt:
Municipality:		Zip:
Account Number:		

JCP&L is offering an energy conservation program (the "Program") to customers in its electric service territory that are government, K-12 Public Schools, qualified non-profit entities or small businesses with annual peak demands equal to or less than 200 kW. Customer is the Company's customer of record, i.e., the JCP&L electric account holder. Under the Program, Company is arranging the installation of certain energy conservation measures ("ECMs") at the facilities of eligible customers. Upon acceptance of the "Energy Efficiency Upgrade Proposal" by Customer, the work to be performed thereunder will be deemed the "Project."

This Customer Audit Access Agreement is entered into by Union Beach BOE (the "Customer") and JCP&L's Direct Install Program Representative Willdan Energy Solutions (designee) for the benefit of Jersey Central Power & Light Company (the "Company" or "JCP&L"), each individually referred to as a "Party" and collectively referred to as the "Parties" in accordance with the following:

A. Customer desires for Company to perform a "walk though" energy audit (the "Audit") at Customer's facility (the "Facility") to determine whether Customer may benefit from participating in the Program.

B. Customer shall authorize and permit Company or its designee to enter the Facility to conduct the Audit subject to the terms and conditions below:

1. Customer hereby grants Company or its designee reasonable access to the Facility to perform the Audit at such date and time as the Parties shall mutually agree. The Audit shall be performed at no cost to Customer. In the event that Customer is not the owner of the Facility, Customer will obtain the consent of the owner as set forth in Attachment A - Owner Consent to Conduct Audit.

2. The Audit results will identify whether the Facility may be suitable any energy saving upgrades to lighting, refrigeration and/or ventilation/air conditioning. Company does not promise that the Audit will identify any or all energy savings measures that may be suitable for the Facility. Company does not warrant that, if Customer agrees to implement the recommendations of the Audit, Customer will realize energy savings. The information provided in the "Energy Efficiency Upgrade Proposal" is for informational purposes only and Customer's actual energy savings may vary based on numerous determining factors including but not limited to weather, changes to Customer utility rates, or Facility use and operating hours.

3. Customer agrees to indemnify, defend, and hold harmless Company, its employees and designees (each an "Indemnified Person") from and against any claim, dispute, complaint, suit, demand, judgment, liability, loss, injury, accident, fine, expense, penalty, damage, action, fee, cost, or charge of any kind or nature (including reasonable attorney fees) that may be imposed on, incurred by, or asserted against such Indemnified Person in any way relating to, arising out of or resulting from this Agreement except to the extent of gross negligence or intentional misconduct by the Indemnified Person.

4. Customer agrees that (i) it possesses all requisite power and authority to enter into this Agreement and to carry out the transactions contemplated herein; (ii) the execution, delivery, and performance of this Agreement have been duly authorized by, or are in accordance with, its organizational documents; (iii) this Agreement has been duly executed and delivered; and (iv) this Agreement constitutes the legal, valid, binding, and enforceable agreement of Customer.

5. Customer has obtained, to the extent it has deemed necessary or prudent, legal counsel to advise it on this Agreement.

6. Customer agrees that this Agreement constitutes the full, complete, and only agreement between the Parties and supersedes any previous representations or agreements with respect to the subject matter hereof. This Agreement shall not be amended except in writing signed by duly authorized representatives of both Parties.

7. JCP&L shall consider all information furnished by Customer to be confidential and shall not disclose any such information to any other person, or use such information itself for any purpose other than in connection with the Program, without Customer's prior written consent. Customer shall consider all information furnished by JCP&L to be confidential and shall not disclose any such information to any other person, or use such information itself for any purpose other than in connection with the Program, without JCP&L's prior written consent; provided, however, either Party may disclose such information as may be required to be disclosed by law or court order from a court of competent jurisdiction, and provided further that, unless otherwise prohibited by law, the Party whose information is required to be disclosed is given reasonable time to take legal action to quash such action and seek other protection. Customer expressly understands and agrees that JCP&L is required to report to New Jersey regulators on a periodic basis all Program data, including customer-specific information ("Regulatory Reporting") as well as to prepare and submit to New Jersey regulators a Program evaluation report (the "Program Evaluation Report"). Customer expressly further understands and agrees that both the Regulatory Reporting and the Program Evaluation Report may, among other participant and Project information, identify the Program participants by name and

Project address, identify the ECMs implemented by each Program participant and the energy and cost savings estimates for each Project.

8. JCP&L may participate in the PJM Capacity Market* through the demand reductions achieved by the ECMs installed as part of this Program. Customer acknowledges and agrees that, for purposes of participating in the PJM Capacity Market, JCP&L shall own the rights to all such demand reductions without cost or obligation to Customer. JCP&L's ownership of the Project's demand reductions does not affect Customer's ownership of the ECMs nor the energy savings derived from the ECMs.

*PJM Capacity Market. PJM Interconnection is the regional transmission operator that coordinates the m ovement of wholesale electricity in all or parts of 13 states including New Jersey. PJM operates a competitive wholesale electricity market and manages the high-voltage electricity grid to ensure reliability for more than 61 million people. PJM holds regular capacity auctions to ensure there is sufficient generating capacity available to meet customer needs. Load reductions from ECMs are allowed to participate in these auctions as
'negative' generation.

As required by PJM, JCP&L reserves the right to perform measurement and verification ("M&V") at all participating facilities. JCP&L M&V activities at the Facility may, in JCP&L's sole discretion, include but not be limited to, meter installation, calibration and maintenance of M&V equipment, data gathering and screening, verification of M&V reports and the use of customer energy and cost savings, and billing information. JCP&L will notify Customer if an ECM installed at the Facility requires M&V, will inform Customer of the JCP&L M&V activities, and will work with Customer to minimize any adverse effects on Customer's normal operations. JCP&L, or its subcontractor, may audit the Facility to verify the operation of all installed ECMs for up to four (4) years following installation to ensure compliance with PJM Capacity Market rules and regulations. Customer shall cooperate with and support JCP&L's ownership of the demand reductions as set forth in this Paragraph 8.

9. Customer agrees (A) That the laws of the State of New Jersey shall govern this Agreement and any dispute arising hereunder shall be litigated in a Federal or State Court located in the State of New Jersey, (B) TO WAIVE TO THE FULLEST EXTENT PERMITTED BY LAW THE RIGHT TO A TRIAL BY JURY.

10. In the event any provision of this Agreement shall for any reason be held to be invalid, illegal or unenforceable in any respect, the remaining provisions of this Agreement shall remain in full force and effect to the maximum extent possible.

11. This Agreement is neither intended to create, nor shall it be construed as creating, a joint venture, partnership or other form of business association between the Parties, or an agreement to enter into any business relationship.

Authorized Signature of Customer:	
Customer Name: Union Beach BOE	Title:
Signatory Name (Please Print): George Gahler	
Signature: G Gahler	Date: 5-6-22

Return completed form by email or mail to:
JCP&L Direct Install Program c/o Willdan Energy Solutions 3910 Park Avenue, Suite 5
Edison, NJ 08820
Phone: 877-831-5419
Email: energysavenj@willdan.com

Attachment A - Owner Consent to Conduct Audit

The undersigned, a duly authorized representative of the owner of the Facility, does hereby:

1. Consent to Jersey Central Power & Light Company (or its designee) (the "Company") to enter the Facility to conduct a free energy audit ("Audit"),
2. Acknowledge that the purpose of the Audit is to identify potential measures that, if implemented, may result in energy savings to the owner or tenant occupying the Facility, and in consideration thereof, does further
3. Agree to indemnify, defend, and hold harmless Company or its designee from all claims arising under or pursuant to the Audit.

The tenant (Customer) at the location described below will be billed for any project constructed under this Program.

Tenant (Customer) and Owner Information		
Tenant (Customer) Name: Union Beach BOE		
Facility Name: Memorial School		
Facility Street Address: Morningside Ave		
City: Union Beach	State: NJ	Zip: 07735
Date: 5-6-22		
Owner Name: Union Beach BOE		
Owner Signature: [signature]	Owner Signatory Name: G. Gahles	
Owner Address: 1207 Florence Ave		
City: Union Beach	State: NJ	Zip: 07735
Owner Phone: 732-264-3133		

JCP&L Direct Install Program Representative Name: Willdan Energy Solutions

Return completed form by email or mail to:
JCP&L Direct Install Program c/o Willdan Energy Solutions 3910 Park Avenue, Suite 5
Edison, NJ 08820
Phone: 877-831-5419
Email: energysavenj@willdan.com

WILLDAN Direct Install

Customer Work Order (Page 1 of 5)

Tel: 1-877-831-5419 - Email: energysavenj@willdan.com

Jersey Central Power & Light
A FirstEnergy Company

JCP&L Account #		WORK ORDER #
100007407552	UNION BEACH BORO BD OF ED	470714-A

Sales Representative Name	Energy Assessment Date		Customer Phone	Tool Version
Brian McGrath	7/27/21	FLORENCE AVE UNION BEACH,NJ7735	(732) 264-3133	1.1
Installation Contractor			**Contact Person**	**Customer Email**
Willdan Lighting INC			Jamison Lauer	jlauer@gmail.com

ENERGY SAVINGS UPGRADES

LOCATION	PRODUCT DESCRIPTION	EXISTING PROD/MODEL #	EXIST. QTY	PROD/MODEL #	REPLACE. QTY	ID	UNIT PRICE (Installed)	TOTAL COST	CUSTOMER COST	QTY INSTALLED (IF DIFFERENT)	CUSTOMER TO INITIALS CHANGES
1)Back Rm - 1	LED T8 Tube with Ballast	2L4 T8 Electronic Ballast LOW PWR	3	2L 9.5W LED T8 Tube with Ballast - Normal	3		$88.00	$264.00			
2)Bathroom - 2	LED T8 Tube with Ballast	3L4 T8 Electronic Ballast LOW POWER	2	3L 9.5W LED T8 Tube with Ballast - Normal	2		$106.00	$212.00			
3)Office - 3	LED T8 Tube with Ballast	2L4 T8 Electronic Ballast LOW PWR	1	2L 9.5W LED T8 Tube with Ballast - Normal	1		$88.00	$88.00			
4)Office - 3	LED T8 Tube with Ballast	3L4 T8 Electronic Ballast LOW POWER	2	3L 9.5W LED T8 Tube with Ballast - Normal	2		$106.00	$212.00			
5)Office - 4	LED T8 Tube with Ballast	3L4 T8 Electronic Ballast LOW POWER	2	3L 9.5W LED T8 Tube with Ballast - Normal	2		$106.00	$212.00			
6)Office - 5	LED T8 Tube with Ballast	3L4 T8 Electronic Ballast LOW POWER	2	3L 9.5W LED T8 Tube with Ballast - Normal	2		$106.00	$212.00			
7)Office - 6	LED T8 Tube with Ballast	2L4 T8 Electronic Ballast LOW PWR	2	2L 9.5W LED T8 Tube with Ballast - Normal	2		$88.00	$176.00			
8)Hallway - 7	LED T8 Tube with Ballast	2L4 T8 Electronic Ballast LOW PWR	2	2L 9.5W LED T8 Tube with Ballast - Normal	2		$88.00	$176.00			
9)vestibule - 8	LED Screw-In	60W INC	3	LED A-Lamp 9W	3		$20.00	$60.00			
10)Hallway - 9	LED T8 Tube with Ballast	2L4 T8 Electronic Ballast LOW PWR	1	2L 9.5W LED T8 Tube with Ballast - Normal	1		$88.00	$88.00			
11)Office - 10	LED T8 Tube with Ballast	3L4' F48T12 Energy-Efficient Lamp / Standard Ballast or Lamp	1	3L 9.5W LED T8 Tube with Ballast - Normal	1		$106.00	$106.00			
12)Office - 10	LED T8 Tube with Ballast	3L4 T8 Electronic Ballast LOW POWER	1	3L 9.5W LED T8 Tube with Ballast - Normal	1		$106.00	$106.00			
13)Office - 11	LED T8 Tube with Ballast	3L4 T8 Electronic Ballast LOW POWER	2	3L 9.5W LED T8 Tube with Ballast - Normal	2		$106.00	$212.00			
14)Conference Rm - 12	LED T8 Tube with Ballast	3L4 T8 Electronic Ballast LOW POWER	4	3L 9.5W LED T8 Tube with Ballast - Normal	4		$106.00	$424.00			
15)Basement - BF	LED T8 Tube with Ballast	2L2' 17W T8 Electronic Ballast Energy LOW POWER	1	(3) 8w 2' T8 LED A-LOEB	1		$104.00	$104.00			

		Customer Initials
Cost of Installed Measures (Current Page):	$2,652.00	
Cost of Installed Measures (Other Pages):	$2,829.00	
Total Cost of Installed Measures:	$5,481.00	
Incentive:	$2,466.45	
Customer Payment Due upon Completion:	$3,014.55	

Terms and Condition

By signing the below I agree to the following:

1) I have reviewed the Energy Efficiency Assessment for the premises listed above. 2) I authorize energy efficiency related services work on the above listed premises. 3) I understand that all work identified on this Customer Work Order above in the section "JCP&L Program Incentive" is paid for by Willdan. I understand that I am responsible to pay Willdan or, if applicable the Installation Program Allies identified above, for that portion of the total cost identified above in the section "Customer Payment Due Upon Completion" at the time that the installation is completed. I further understand that I may pay Willdan, or if applicable the Installation Program Ally, by any of the following methods: credit card, money order, cashier's check, PayPal, or cash. 4) I understand that JCP&L does not endorse, guarantee or warrant any particular manufacturer or product, and that JCP&L provides no warranties, expressed or implied, for any products or services. Customer's reliance on warranties is limited to warranties provided by Willdan, or Installation Program Allies and that products installed under this DI Program are warranted for a limited time. After the lapse of this warranty period, I will be responsible for replacement of said products. The warranty periods are provided below. 5) I authorize access to the above listed address for the purpose of installing the energy-saving upgrades and inspecting them upon completion. 6) I agree to indemnify, defend, and hold Willdan, JCP&L, and Installation Program Allies, harmless from any claims, losses, expenses, liabilities, and costs for damage to or destruction of this property, or injuries to any person (including death) arising out of inappropriate/non-intended use of equipment installed as authorized by this agreement. 7) I agree that JCP&L may provide Customer information including Customer name, account number, electric consumption data and electric energy savings to its third-party evaluation contractor for DI Program evaluation purposes. The evaluation contractor has agreed to keep Customer information confidential. Customer Information may also be provided to the New Jersey Board of Public Utilities (NJBPU) Commission. Any Customer information provided to the NJBPU Commission will be aggregated with information about other customers and not personally identifiable. 8) The scope of work and pricing presented in this document is valid for no more than six (6) months after the signature date. After six (6) months, the project scope and/or pricing may be updated. 9) I understand all energy savings values are calculated based upon the New Jersey Technical Resource Manual ("TRM") for estimating savings for energy efficiency programs. The annual energy savings estimate presented in the Summary Report is based upon pre-determined sector hours listed in the TRM. Actual savings may vary depending on actual operating hours at the site. JCP&L DOES NOT MAKE ANY REPRESENTATIONS OF ANY KIND REGARDING THE RESULTS TO BE ACHIEVED BY THE ENERGY-SAVING MEASURES OR THE ADEQUACY OR SAFETY OF SUCH MEASURES, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. 10) I understand that if existing lighting that is not in service when upgraded through the DI Program, actual energy savings will also vary from the Summary Report. 11) If non-compatible emergency ballasts are found, Customer can elect to leave existing fixtures as is or replace ballasts at an additional cost. 12) Willdan reserves the right to cancel any DI project for any reason. 13) I have read, understand and am in compliance with all rules and regulations concerning this DI Program. I certify that all information provided is correct to the best of my knowledge. 14) By participating in , I agree to assign ownership of any Energy Efficiency resource credits resulting from my project(s) to JCP&L for the purpose of offering these credits into the markets operated by PJM Interconnection, Inc. ("PJM").

Warranty Periods

The energy savings upgrades are warranted from the date of installation as follows:

Lighting Parts & Labor	1 Year	LED Tubes, Ballasts & Integrated Fixtures**	5 Years
LED Screw-In Lamps & Smart Thermostats**	3 Years	Evaporator & Door Heater Controls inc. parts & labor	2 Years
Exit Signs	1 Year	EC Motors inc. parts & labor	1 Year
HVAC & HVAC controls	1 Year	Food Service Equipment	1 Year

**"Manufacturer's warranty

Notes

I accept the terms & Conditions above (Must Sign Before Installation):

Contractor Signature		Date	
Customer Signature	G. Gahles	Date	2-9-22
Print Name	G. Gahles	Title	B.A.

Energy Saving Upgrades have been completed to my satisfaction (After Installation):

Contractor Signature		Date	
Customer Signature		Date	
Print Name		Title	

Direct Install

Customer Work Order (Page 2 of 5)

Jersey Central Power & Light
A FirstEnergy Company

JCP&L Account #		Work Order #
100007407552	UNION BEACH BORO BD OF ED	470714-A

LOCATION	PRODUCT DESCRIPTION	EXISTING PROD/MODEL #	EXIST. QTY	PROD/MODEL #	REPLACE. QTY	ID	UNIT PRICE (Installed)	TOTAL COST	CUSTOMER COST	QTY INSTALLED (IF DIFFERENT)	CUSTOMER TO INITIAL & CHANGES
16)Basement - BF	LED T8 Tube with Ballast	2L4 T8 Electronic Ballast LOW PWR	7	2L 9.5W LED T8 Tube with Ballast - Normal	7		$86.00	$616.00			
17)Basement - BF	LED T8 Tube with Ballast	2L4' F48T12 Standard Ballast or Lamp	5	2L 9.5W LED T8 Tube with Ballast - Normal	5		$88.00	$440.00			
18)Basement - BF	LED T8 Tube with Ballast	2L8' Energy-Efficient Lamp / Standard Ballast or Lamp	3	4L 9.5W LED T8 Tube with Ballast - Normal	3		$153.00	$459.00			
19)Basement - BF	LED T8 Tube with Ballast	2L4' F48T12 Standard Ballast or Lamp	3	2L 9.5W LED T8 Tube with Ballast - Normal	3		$88.00	$264.00			
20)Exterior C	LED Fixture - Wall Pack	100W HPS	3	LED 30W Wall Pack	3		$350.00	$1,050.00			
21)											
22)											
23)											
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42)											
43)											
44)											

Cost of Installed Measures (Page 2 only): $2,829.00

Incentive Summary

UNION BEACH BORO BD OF ED

The Lighting Tier depends on the percentage of total MMBtu Energy Savings

You are in Lighting Tier 1

	kWh Savings	Therms Savings	Total MMBtu savings	% Of Total MMBtu	Cost	Electric Calculated Incentive (% of cost)	Electric Capped Incentive ($/kWh)	Gas Calculated Incentive	Gas Capped Incentive	Final Incentive (lesser of G or H, plus lessor of I or J)
Lighting	8,781.29	0.00	29.9618	100.00%	$5,481.00	$2,466.45	$3,512.52			$2,466.45
Electric HVAC	0.00	0.00	0.0000	0.00%	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Electric Other	0.00	0.00	0.0000	0.00%	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Gas	0.00	0.00	0.0000	0.00%	$0.00			$0.00	$0.00	$0.00
TOTAL	**8,781.29**		**29.9618**		**$5,481.00**		**$3,512.52**			**$2,466.45**
Final Incentive (% of Cost)										**45.00%**
$/kWh										

Energy Saving Lighting Upgrades	Est. Annual Cost Savings	Est. Annual Energy Savings (kWh)	Gas Savings (therms)	Total Installation Cost	Total Incentive	Your Contribution	Simple Payback Immediate
Lighting	$1,141.57			$5,481.00	$2,466.45	$3,014.55	31.69
TOTALS	**$1,141.57**	**0.00**	**$0.00**	**$5,481.00**	**$2,466.45**	**$3,014.55**	**31.69**

Electric HVAC Saving Upgrades	Est. Annual Cost Savings	Est. Annual Energy Savings (kWh)	Gas Savings (therms)	Total Installation Cost	Electric Incentive	Gas Incentive	Your Contribution	Simple Payback Immediate
Electric HVAC-AC	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
Electric HVAC-Heat Pump	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
Dual Enthalpy Economizer	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
Programmable Thermostats	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
Elec-HVAC - AC - Fuel Use Economizer	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
Demand Control Ventilation Using CO2 Sensors	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
Variable Frequency Drives	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
TOTALS	**$0.00**	**0.00**	**0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**0.00**

HVAC Others Saving Upgrades	Est. Annual Cost Savings	Est. Annual Energy Savings (kWh)	Gas Savings (therms)	Total Installation Cost	Electric Incentive	Gas Incentive	Your Contribution	Simple Payback Immediate
Faucet, Aerator, Spray Valve	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
Pipe Insulation	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
Electronically Commutated Motors For Refrigeration	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
TOTALS	**$0.00**	**0.00**	**$0.00**		**$0.00**	**$0.00**	**$0.00**	**0.00**

Gas Saving Upgrades	Est. Annual Cost Savings	Est. Annual Energy Savings (kWh)	Gas Savings (therms)	Total Installation Cost	Total Incentive	Your Contribution	Simple Payback Immediate
Gas Furnace/Boiler Replacement	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	0.00
Gas Furnace/Boiler Tune-up	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	0.00
Boiler Reset Controls	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	0.00
TOTALS	**$0.00**	**0.00**	**$0.00**		**$0.00**	**$0.00**	**0.00**

1) I have reviewed the Energy Efficiency Assessment for the premises listed above. 2) I authorize energy efficiency related services work on the above listed premises. 3) I understand that all work identified on this Customer Work Order above in the section "JCP&L Program Incentive" is paid for by Willdan. I understand that I am responsible to pay Willdan or, if applicable the Installation Program Allies identified above, for that portion of the total cost identified above in the section "Customer Payment Due Upon Completion" at the time that the installation is completed. I further understand that I may pay Willdan, or if applicable the Installation Program Ally, by any of the following methods: credit card, money order, cashier's check, PayPal, or cash. 4) I understand that JCP&L does not endorse, guarantee or warrant any particular manufacturer or product, and that JCP&L provides no warranties, expressed or implied, for any products or services. Customer's reliance on warranties is limited to warranties provided by Willdan, or Installation Program Allies and that products installed under this DI Program are warranted for a limited time. After the lapse of this warranty period, I will be responsible for replacement of said products. The warranty periods are provided below. 5) I authorize access to the above listed address for the purpose of installing the energy-saving upgrades and inspecting them upon completion. 6) I agree to indemnify, defend, and hold Willdan, JCP&L, and Installation Program Allies, harmless from any claims, losses, expenses, liabilities, and costs for damage to or destruction of this property, or injuries to any person (including death) arising out of inappropriate/non-intended use of equipment installed as authorized by this agreement. 7) I agree that JCP&L may provide Customer information including Customer name, account number, electric consumption data and electric energy savings to its third-party evaluation contractor for DI Program evaluation purposes. The evaluation contractor has agreed to keep Customer information confidential. Customer information may also be provided to the New Jersey Board of Public Utilities (NJBPU) Commission. Any Customer information provided to the NJBPU Commission will be aggregated with information about other customers and not personally identifiable. 8) The scope of work and pricing presented in this document is valid for no more than six (6) months after the signature date. After six (6) months, the project scope and/or pricing may be updated. 9) I understand all energy savings values are calculated based upon the New Jersey Technical Resource Manual ("TRM") for estimating savings for energy efficiency programs. The annual energy savings estimate presented in the Summary Report is based upon pre-determined sector hours listed in the TRM. Actual savings may vary depending on actual operating hours at the site. JCP&L DOES NOT MAKE ANY REPRESENTATIONS OF ANY KIND REGARDING THE RESULTS TO BE ACHIEVED BY THE ENERGY-SAVING MEASURES OR THE ADEQUACY OR SAFETY OF SUCH MEASURES, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. 10) I understand that if existing lighting that is not in service when upgraded through the DI Program, actual energy savings will also vary from the Summary Report. 11) If non-compatible emergency ballasts are found, Customer can elect to leave existing fixtures as is or replace ballasts at an additional cost. 12) Willdan reserves the right to cancel any DI project for any reason. 13) I have read, understand and am in compliance with all rules and regulations concerning this DI Program. I certify that all information provided is correct to the best of my knowledge. 14) By participating in , I agree to assign ownership of any Energy Efficiency resource credits resulting from my project(s) to JCP&L for the purpose of offering these credits into the markets operated by PJM Interconnection, Inc. ("PJM").

Jersey Central Power & Light
A FirstEnergy Company

Direct Install

Customer Installation Agreement
Tel: 1-877-831-5419 - http://sbdi.energysavenj.com

Account #			WORK ORDER #	
0		UNION BEACH BORO BD OF ED	470714-A	
Representative Name	Energy Assessment Date		Customer Phone	Tool Version
Brian McGrath	7/27/21	FLORENCE AVE	(732) 264-3133	1.1
Installation Contractor		UNION BEACH, NJ 7735	Contact Person	Customer Email
Willdan Lighting INC			Jamison Lauer	jlauer@gmail.com

Dear JCP&L Customer:
Thank you for your participation in the Direct Install ("DI") Program sponsored by JCP&L Company. This Customer Installation Agreement sets forth and confirms the understanding of the installation of Energy Efficiency measures as listed on the Customer Work Order (attached).

TERMS AND CONDITIONS:

1. Scope of Work. See attached Customer Work Order, the contents of which are hereinafter referred to as the "Scope of Work".
2. Electrical Violations. If electrical violations (as defined by the New Jersey County in which the install takes place) are found within Customer's establishment, Willdan must inform the owner, or the responsible Customer representative, of the life safety electrical hazard situation that exists before Willdan proceeds with the retrofit installation of the lighting fixtures. The existing violations must be corrected either by the owner, or by Willdan at an additional cost, which is not part of the DI Program. Willdan reserves the right to cancel any job for any reason.
3. Payment. Customer is responsible for paying that portion of the total cost identified above in the section "Customer Payment Due Upon Completion". All payments are due upon completion of the work. Upon receipt of full payment, title to the installed Energy Efficiency measures transfers to Customer.
4. Disposal. All DI Program related materials will be removed and disposed of in accordance with all federal, state and local regulations.
5. Schedule. Customer will allow reasonable access for purposes of installing Energy Efficiency measures per the Scope of Work during normal business hours.
6. Installation. Installation will commence within sixty (60) days of execution of this Customer Installation Agreement.
7. Taxes. Customer agrees that it is solely responsible for any taxes or fees that may be assessed as a result of installation of Energy Efficiency measures and shall indemnify Willdan and JCP&L for any tax related claims. In the event that Customer claims any exemption from any tax, it must provide appropriate documentation prior to installation of measures.
8. Willdan's entire liability and obligation under this agreement will not exceed the net customer cost. Under no circumstances will Willdan or JCP&L be liable for any special, incidental, indirect, punitive and/or consequential losses or damages of any kind or nature whatsoever (including, without limitation, for lost profits, time or revenue) for anything arising out of the performance or nonperformance of this agreement, whether claims for said losses or damages are premised on warranty, negligence, strict liability, contract or otherwise..
9. General Terms. This Customer Installation Agreement incorporates the Terms and Conditions agreed to on the Customer Work Order (attached).
10. The energy assessment and associated pricing is valid for a period of sixty (60) days from receipt of the proposal.
11. Governing Law, Jurisdiction & Venue. All matters of dispute between the parties shall be governed, construed, and enforced in accordance with the laws of the State of New Jersey for both substantive and procedural matters (without giving effect to conflict of laws principles) regardless of the theory upon which such matter is asserted. The parties expressly exclude the applicability of the United Nations Convention on Contracts for the International Sale of Goods. Any legal suit, action, or proceeding regarding, arising from or relating to the Customer Installation Agreement must be instituted in a State or Federal Court in the Sate of New Jersey. Customer waives any objection it may have now or hereafter regarding the jurisdiction or venue of any such suit, action or proceeding and hereby irrevocably submits to the jurisdiction of any such court in any such suit, action or proceeding.
12. Direct Install Do It Yourself Program. All measures listed as "DIY" or "No Cost" in the Customer Work Order are subject to the following conditions:
   a. The Total Cost is for material only; it does not include installation.
   b. The products provided are warranted by the manufacturer; refer to the manufacturer's warranty.
   c. The customer understands that there is a 15-day deadline from the Delivery Date for installing incentivized products. If the customer does not install the products within 15 days of delivery, the customer will be invoiced for the Program Incentive amount.
   d. If an existing ballast or fixture is found to be deficient by the Customer or Willdan, the deficiency must be rectified by the Customer, or by Willdan at an additional cost, which is not part of the Direct Install Program. Willdan reserves the right to cancel any job for any reason.

Payment Terms:	
Total Cost of Installed Measures:	**$5,481.00**
Less: Program Incentive	$2,466.45
Plus: Code Violation Fixing Fee	
Customer Payment Due Upon Completion:	**$3,014.55**

Warranty Periods

The energy savings upgrades are warranted from the date of installation as follows:

Lighting Part & Labor	1 Year	LED Tubes Ballasts & Integrated Fixtures **	5 Years
LED Screw-In Lamps & Smart Thermostats**	3 Years	Evaporator & Door Heater Controls inc. parts & Labor	2 Years
Exit Signs	1 Year	EC Motors inc. parts & Labor	1 Year
HVAC & HVAC controls	1 Year	Food Service Equipment	1 Year

** Manufacturer's warranty

Authorization for Installation of Energy Saving Upgrades(Must Sign Before Installation)

Print Name G. Gable

Customer Signature [signature] Date 2-9-22

Installation Contractor(Must Sign Before Installation)

Print Name

Signature Date

JCP&L programs are funded by a charge on your energy bill. JCP&L programs can help you reduce your energy consumption and save you money. To learn more about JCP&L and how you can participate, go to www.energysaveNJ.com.

JCP&L has contracted with Willdan Energy Solutions and its subsidiary Willdan Lighting and Electric, Inc. ("Willdan") to administer the DI Program. DI offers a range of LED lighting, commercial refrigeration, HVAC replacement and HVAC controls upgrades. For more information please call 1-877-831-5419 or email energysavenj@willdan.com

Jersey Central Power & Light Company (JCP&L)
Direct Install Program for Government and K-12 Public Schools
Non-Profit Facilities and Small Businesses

Customer Audit Access Agreement

with Attachment A - Owner Consent to Conduct Audit

Government / Non-Profit / Small Business Information				
Facility Name:				
Contact Name:				
Street:			Floor/Apt:	
Municipality:		Zip:		
Facility Phone:		Cell Phone:		
JCP&L Account Number:				
Type of Facility:	Municipal/State/Federal	Non-Profit	Small Business	K-12 Public Schools
Primary Building Use, NAICS description:				

*The North American Industry Classification System (NAICS) is the standard used by Federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy.

Building Information			
Same as Installation Address Bill to:	Owner	Tenant (Owner Permission Required; see attached)	
Name:			
Street:		Floor/Apt:	
Municipality:		Zip:	
Account Number:			

JCP&L is offering an energy conservation program (the "Program") to customers in its electric service territory that are government, K-12 Public Schools, qualified non-profit entities or small businesses with annual peak demands equal to or less than 200 kW. Customer is the Company's customer of record, i.e., the JCP&L electric account holder. Under the Program, Company is arranging the installation of certain energy conservation measures ("ECMs") at the facilities of eligible customers. Upon acceptance of the "Energy Efficiency Upgrade Proposal" by Customer, the work to be performed thereunder will be deemed the "Project."

This Customer Audit Access Agreement is entered into by _____ (the "Customer") and JCP&L's Direct Install Program Representative Willdan Energy Solutions (designee) for the benefit of Jersey Central Power & Light Company (the "Company" or "JCP&L"), each individually referred to as a "Party" and collectively referred to as the "Parties" in accordance with the following:

A. Customer desires for Company to perform a "walk though" energy audit (the "Audit") at Customer's facility (the "Facility") to determine whether Customer may benefit from participating in the Program.

B. Customer shall authorize and permit Company or its designee to enter the Facility to conduct the Audit subject to the terms and conditions below:

1. Customer hereby grants Company or its designee reasonable access to the Facility to perform the Audit at such date and time as the Parties shall mutually agree. The Audit shall be performed at no cost to Customer. In the event that Customer is not the owner of the Facility, Customer will obtain the consent of the owner as set forth in Attachment A - Owner Consent to Conduct Audit.

2. The Audit results will identify whether the Facility may be suitable any energy saving upgrades to lighting, refrigeration and/or ventilation/air conditioning. Company does not promise that the Audit will identify any or all energy savings measures that may be suitable for the Facility. Company does not warrant that, if Customer agrees to implement the recommendations of the Audit, Customer will realize energy savings. The information provided in the "Energy Efficiency Upgrade Proposal" is for informational purposes only and Customer's actual energy savings may vary based on numerous determining factors including but not limited to weather, changes to Customer utility rates, or Facility use and operating hours.

3. Customer agrees to indemnify, defend, and hold harmless Company, its employees and designees (each an "Indemnified Person") from and against any claim, dispute, complaint, suit, demand, judgment, liability, loss, injury, accident, fine, expense, penalty, damage, action, fee, cost, or charge of any kind or nature (including reasonable attorney fees) that may be imposed on, incurred by, or asserted against such Indemnified Person in any way relating to, arising out of or resulting from this Agreement except to the extent of gross negligence or intentional misconduct by the Indemnified Person.

4. Customer agrees that (i) it possesses all requisite power and authority to enter into this Agreement and to carry out the transactions contemplated herein; (ii) the execution, delivery, and performance of this Agreement have been duly authorized by, or are in accordance with, its organizational documents; (iii) this Agreement has been duly executed and delivered; and (iv) this Agreement constitutes the legal, valid, binding, and enforceable agreement of Customer.

5. Customer has obtained, to the extent it has deemed necessary or prudent, legal counsel to advise it on this Agreement.

6. Customer agrees that this Agreement constitutes the full, complete, and only agreement between the Parties and supersedes any previous representations or agreements with respect to the subject matter hereof. This Agreement shall not be amended except in writing signed by duly authorized representatives of both Parties.

7. JCP&L shall consider all information furnished by Customer to be confidential and shall not disclose any such information to any other person, or use such information itself for any purpose other than in connection with the Program, without Customer's prior written consent. Customer shall consider all information furnished by JCP&L to be confidential and shall not disclose any such information to any other person, or use such information itself for any purpose other than in connection with the Program, without JCP&L's prior written consent; provided, however, either Party may disclose such information as may be required to be disclosed by law or court order from a court of competent jurisdiction, and provided further that, unless otherwise prohibited by law, the Party whose information is required to be disclosed is given reasonable time to take legal action to quash such action and seek other protection. Customer expressly understands and agrees that JCP&L is required to report to New Jersey regulators on a periodic basis all Program data, including customer-specific information ("Regulatory Reporting") as well as to prepare and submit to New Jersey regulators a Program evaluation report (the "Program Evaluation Report"). Customer expressly further understands and agrees that both the Regulatory Reporting and the Program Evaluation Report may, among other participant and Project information, identify the Program participants by name and

Project address, identify the ECMs implemented by each Program participant and the energy and cost savings estimates for each Project.

8. JCP&L may participate in the PJM Capacity Market* through the demand reductions achieved by the ECMs installed as part of this Program. Customer acknowledges and agrees that, for purposes of participating in the PJM Capacity Market, JCP&L shall own the rights to all such demand reductions without cost or obligation to Customer. JCP&L's ownership of the Project's demand reductions does not affect Customer's ownership of the ECMs nor the energy savings derived from the ECMs.

*PJM Capacity Market. PJM Interconnection is the regional transmission operator that coordinates the m ovement of wholesale electricity in all or parts of 13 states including New Jersey. PJM operates a competitive wholesale electricity market and manages the high-voltage electricity grid to ensure reliability for more than 61 million people. PJM holds regular capacity auctions to ensure there is sufficient generating capacity available to meet customer needs. Load reductions from ECMs are allowed to participate in these auctions as 'negative' generation.

As required by PJM, JCP&L reserves the right to perform measurement and verification ("M&V") at all participating facilities. JCP&L M&V activities at the Facility may, in JCP&L's sole discretion, include but not be limited to, meter installation, calibration and maintenance of M&V equipment, data gathering and screening, verification of M&V reports and the use of customer energy and cost savings, and billing information. JCP&L will notify Customer if an ECM installed at the Facility requires M&V, will inform Customer of the JCP&L M&V activities, and will work with Customer to minimize any adverse effects on Customer's normal operations. JCP&L, or its subcontractor, may audit the Facility to verify the operation of all installed ECMs for up to four (4) years following installation to ensure compliance with PJM Capacity Market rules and regulations. Customer shall cooperate with and support JCP&L's ownership of the demand reductions as set forth in this Paragraph 8.

9. Customer agrees (A) That the laws of the State of New Jersey shall govern this Agreement and any dispute arising hereunder shall be litigated in a Federal or State Court located in the State of New Jersey, (B) TO WAIVE TO THE FULLEST EXTENT PERMITTED BY LAW THE RIGHT TO A TRIAL BY JURY.

10.In the event any provision of this Agreement shall for any reason be held to be invalid, illegal or unenforceable in any respect, the remaining provisions of this Agreement shall remain in full force and effect to the maximum extent possible.

11.This Agreement is neither intended to create, nor shall it be construed as creating, a joint venture, partnership or other form of business association between the Parties, or an agreement to enter into any business relationship.

Authorized Signature of Customer:	
Customer Name: Union Beach BOE	Title: B.A.
Signatory Name (Please Print): George Gahles	
Signature:	Date: 2-9-22

Return completed form by email or mail to:
JCP&L Direct Install Program c/o Willdan Energy Solutions 3910 Park Avenue, Suite 5
Edison, NJ 08820
Phone: 877-831-5419
Email: energysavenj@willdan.com

Attachment A - Owner Consent to Conduct Audit

The undersigned, a duly authorized representative of the owner of the Facility, does hereby:

1. Consent to Jersey Central Power & Light Company (or its designee) (the "Company") to enter the Facility to conduct a free energy audit ("Audit"),
2. Acknowledge that the purpose of the Audit is to identify potential measures that, if implemented, may result in energy savings to the owner or tenant occupying the Facility, and in consideration thereof, does further
3. Agree to indemnify, defend, and hold harmless Company or its designee from all claims arising under or pursuant to the Audit.

The tenant (Customer) at the location described below will be billed for any project constructed under this Program.

Tenant (Customer) and Owner Information		
Tenant (Customer) Name:		
Facility Name:		
Facility Street Address:		
City:	State:	Zip:
Date:		
Owner Name:		
Owner Signature:	Owner Signatory Name:	
Owner Address:		
City:	State:	Zip:
Owner Phone:		

JCP&L Direct Install Program Representative Name: Willdan Energy Solutions

Return completed form by email or mail to:
JCP&L Direct Install Program c/o Willdan Energy Solutions 3910 Park Avenue, Suite 5
Edison, NJ 08820
Phone: 877-831-5419
Email: energysavenj@willdan.com

WILLDAN Direct Install

Customer Work Order (Page 1 of 5)

Tel: 1-877-831-5419 - Email: energysaverj@willdan.com

Jersey Central Power & Light
A FirstEnergy Company

JCP&L Account #			
100010562419			
Sales Representative Name	Energy Assessment Date	UNION BEACH BORO	WORK ORDER #
Brian McGrath	8/1/21		432448-A
Installation Contractor		FLORENCE AVE	Customer Phone / Tool Version
Willdan Lighting & Electric Inc		UNION BEACH,NJ7735	(732) 264-1133 / 1.1
			Contact Person / Customer Email
			Jamison Lauer / jlauer@unionbeachschools.org

ENERGY SAVINGS UPGRADES

LOCATION	PRODUCT DESCRIPTION	EXISTING PROD/MODEL #	EXIST QTY	PROD/MODEL #	REPLACE. QTY	ID	UNIT PRICE (Installed)	TOTAL COST	CUSTOMER COST	QTY INSTALLED (IF DIFFERENT)	CUSTOMER TO INITIALS CHANGES
1)Hallway - 1	LED T8 Tube with Ballast	2L4 T8 Electronic Ballast LOW PWR	1	2L 9.5W LED T8 Tube with Ballast - Normal	1		$88.00	$88.00			
2)Mens RR - 2	LED T8 Tube with Ballast	4L4 T8 Electronic Ballast LOW PWR	1	4L 9.5W LED T8 Tube with Ballast - Normal	1		$153.00	$153.00			
3)Classroom 1 - 3	LED T8 Tube with Ballast	2L4 T8 Electronic Ballast LOW PWR	1	2L 9.5W LED T8 Tube with Ballast - Normal	1		$88.00	$88.00			
4)Classroom 1 - 3	LED T8 Tube with Ballast	2L4' F48T12 Standard Ballast or Lamp	14	2L 9.5W LED T8 Tube with Ballast - Normal	14		$88.00	$1,232.00			
5)Classroom 2 - 4	LED T8 Tube with Ballast	2L4' F48T12 Standard Ballast or Lamp	14	2L 9.5W LED T8 Tube with Ballast - Normal	14		$88.00	$1,232.00			
6)Classroom 2 - 4	LED T8 Tube with Ballast	2L4' F48T12 Standard Ballast or Lamp	1	2L 9.5W LED T8 Tube with Ballast - Normal	1		$88.00	$88.00			
7)Womens Rr - 5	LED T8 Tube with Ballast	3L4 T8 Electronic Ballast LOW POWER	1	3L 9.5W LED T8 Tube with Ballast - Normal	1		$106.00	$106.00			
8)RR - 6	LED T8 Tube with Ballast	4L4 T8 Electronic Ballast LOW PWR	1	4L 9.5W LED T8 Tube with Ballast - Normal	1		$153.00	$153.00			
9)RR - 6	LED T8 Tube with Ballast	2L2' 17W T8 Electronic Ballast Energy	1	(3) 8w 2' T8 LED A-LOEB	1		$150.00	$150.00			
10)RR - 6	LED T8 Tube with Ballast	2L4 T8 Electronic Ballast LOW PWR	1	2L 9.5W LED T8 Tube with Ballast - Normal	1		$88.00	$88.00			
11)Classroom 3 - 7	LED T8 Tube with Ballast	2L4' F48T12 Standard Ballast or Lamp	14	2L 9.5W LED T8 Tube with Ballast - Normal	14		$88.00	$1,232.00			
12)Classroom 4 - 8	LED T8 Tube with Ballast	2L4' F48T12 Standard Ballast or Lamp	14	2L 9.5W LED T8 Tube with Ballast - Normal	14		$88.00	$1,232.00			
13)Back Rooms - 9	LED T8 Tube with Ballast	4L4' F48T12 Standard Ballast or Lamp	3	4L 9.5W LED T8 Tube with Ballast - Normal	3		$153.00	$459.00			
14)Back Rooms - 9	LED T8 Tube with Ballast	2L4 T8 Electronic Ballast LOW PWR	2	2L 9.5W LED T8 Tube with Ballast - Normal	2		$88.00	$176.00			
15)Main Hall - 10	LED T8 Tube with Ballast	4L4' F48T12 Standard Ballast or Lamp	4	4L 9.5W LED T8 Tube with Ballast - Normal	4		$153.00	$612.00			

Cost of Installed Measures (Current Page):	$7,089.00
Cost of Installed Measures (Other Pages):	$4,024.00
Total Cost of Installed Measures:	$11,113.00
Incentive:	$5,000.85
Customer Payment Due upon Completion:	$6,112.15

Customer Initials

Terms and Condition

By signing the below I agree to the following:
1) I have reviewed the Energy Efficiency Assessment for the premises listed above. 2) I authorize energy efficiency related services work on the above listed premises. 3) I understand that all work identified on this Customer Work Order above in the section "JCP&L Program Incentive" is paid for by Willdan. I understand that I am responsible to pay Willdan or, if applicable the Installation Program Allies identified above, for that portion of the total cost identified above in the section "Customer Payment Due Upon Completion" at the time that the installation is completed. I further understand that I may pay Willdan, or if applicable the Installation Program Ally, by any of the following methods: credit card, money order, cashier's check, PayPal, or cash. 4) I understand that JCP&L does not endorse, guarantee or warrant any particular manufacturer or product, and that JCP&L provides no warranties, expressed or implied, for any products or services. Customer's reliance on warranties is limited to warranties provided by Willdan, or Installation Program Allies and that products installed under this DI Program are warranted for a limited time. After the lapse of this warranty period, I will be responsible for replacement of said products. The warranty periods are provided below. 5) I authorize access to the above listed address for the purpose of installing the energy-saving upgrades and inspecting them upon completion. 6) I agree to indemnify, defend, and hold Willdan, JCP&L, and Installation Program Allies, harmless from any claims, losses, expenses, liabilities, and costs for damage to or destruction of this property, or injuries to any person (including death) arising out of inappropriate/non-intended use of equipment installed as authorized by this agreement. 7) I agree that JCP&L may provide Customer Information confidential. Customer Information may also be provided to the New Jersey Board of Public Utilities (NJBPU) Commission. Any Customer information provided to the NJBPU Commission will be aggregated with information about other customers and not personally identifiable. 8) The scope of work and pricing presented in this document is valid for no more than six (6) months after the signature date. After six (6) months, the project scope and/or pricing may be updated. 9) I understand all energy savings values are calculated based upon the New Jersey Technical Resource Manual ("TRM") for estimating savings for energy efficiency programs. The annual energy savings estimate presented in the Summary Report is based upon pre-determined sector hours listed in the TRM. Actual savings may vary depending on actual operating hours at the site. JCP&L DOES NOT MAKE ANY REPRESENTATIONS OF ANY KIND REGARDING THE RESULTS TO BE ACHIEVED BY THE ENERGY-SAVING MEASURES OR THE ADEQUACY OR SAFETY OF SUCH MEASURES, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. 10) I understand that the energy savings estimate presented in the Summary Report also vary from the Summary Report. 11) If non-compatible emergency ballasts are found, Customer can elect to leave existing fixtures as is or replace ballasts at an additional cost. 12) Willdan reserves the right to cancel any DI project for any reason. 13) I have read, understand and am in compliance with all rules and regulations concerning this DI Program. I certify that all information provided is correct to the best of my knowledge. 14) By participating in , I agree to assign ownership of any Energy Efficiency resource credits resulting from my project(s) to JCP&L for the purpose of offering these credits into the markets operated by PJM Interconnection, Inc ("PJM").

Warranty Periods

The energy savings upgrades are warranted from the date of installation as follows:

Lighting Parts & Labor			
LED Screw-In Lamps & Smart Thermostats**	1 Year	LED Tubes, Ballasts & Integrated Fixtures**	5 Years
Exit Signs	3 Years	Evaporator & Door Heater Controls inc. parts & labor	2 Years
HVAC & HVAC controls	1 Year	EC Motors inc. parts & labor	1 Year
**Manufacturer's warranty	1 Year	Food Service Equipment	1 Year

Notes

Accept the terms & conditions above (Must sign before installation)

Contractor Signature		Date
Customer Signature		Date 2-9-22
Print Name	G. Gahler	Title B.A.

Energy Saving Upgrades have been completed to my satisfaction (After Installation)

Contractor Signature		Date
Customer Signature		Date
Print Name		Title

Jersey Central Power & Light
A FirstEnergy Company

Direct Install

Customer Work Order (Page 2 of 5)

JCP&L Account #				UNION BEACH BORO							WORK ORDER #	
100010562419											432448-A	
LOCATION	PRODUCT DESCRIPTION	EXISTING PROD/MODEL #	EXIST. QTY	PROD/MODEL #	REPLACE. QTY	ID	UNIT PRICE (Installed)	TOTAL COST	CUSTOMER COST	QTY INSTALLED (IF DIFFERENT)	CUSTOMER TO INITIALS CHANGES
16)Basement - BF	LED T8 Tube with Ballast	1L4'T8 Energy-Efficient Lamp / Energy-Efficient Magnetic	1	1L 9.5W LED T8 Tube with Ballast - Normal	1		$65.00	$65.00			
17)Basement - BF	LED T8 Direct Line Retrofit Kit with Reflector	2L8' Energy-Efficient Lamp / Energy-Efficient Magnetic	11	4 9.5W T8 New Tandem Fixture	11		$205.00	$2,255.00			
18)Basement - BF	LED T8 Tube with Ballast	2L4 T8 Electronic Ballast LOW PWR	1	2L 9.5W LED T8 Tube with Ballast - Normal	1		$88.00	$88.00			
19)Basement - BF	LED T8 Tube with Ballast	2L4' F48T12 Standard Ballast or Lamp	3	2L 9.5W LED T8 Tube with Ballast - Normal	3		$88.00	$264.00			
20)Basement - BF	LED T8 Tube with Ballast	2L4 T8 Electronic Ballast LOW PWR	1	2L 9.5W LED T8 Tube with Ballast - Normal	1		$88.00	$88.00			
21)Basement - BF	LED T8 Tube with Ballast	4L4' F48T12 Standard Ballast or Lamp	8	4L 9.5W LED T8 Tube with Ballast - Normal	8		$153.00	$1,224.00			
22)Basement - BF	LED Screw-In	100W INC	2	LED A-Lamp 9W	2		$20.00	$40.00			
23)											
24)											
25)											
26)											
27)											
28)											
29)											
30)											
31)											
32)											
33)											
34)											
35)											
36)											
37)											
38)											
39)											
40)											
41)											
42)											
43)											
44)											
							Cost of Installed Measures (Page 2 only):		$4,024.00		

Incentive Summary

UNION BEACH BORO

The Lighting Tier depends on the percentage of total MMBtu Energy Savings

You are in Lighting Tier 1

	kWh Savings	Therms Savings	Total MMBtu savings	% Of Total MMBtu	Cost	Electric Calculated Incentive (% of cost)	Electric Capped Incentive ($/kWh)	Gas Calculated Incentive	Gas Capped Incentive	Final Incentive (lesser of G or H, plus lessor of I or J)
Lighting	43,941.35	0.00	149.9279	100.00%	$11,113.00	$5,000.85	$17,576.54			$5,000.85
Electric HVAC	0.00	0.00	0.0000	0.00%	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Electric Other	0.00	0.00	0.0000	0.00%	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Gas	0.00	0.00	0.0000	0.00%	$0.00			$0.00	$0.00	$0.00
TOTAL	43,941.35		**149.9279**		**$11,113.00**		**$17,576.54**			**$5,000.85**
Final Incentive (% of Cost)										**45.00%**
$/kWh										

Energy Saving Lighting Upgrades	Est. Annual Cost Savings	Est. Annual Energy Savings (kWh)	Gas Savings (therms)	Total Installation Cost	Total Incentive	Your Contribution	Simple Payback Immediate
Lighting	$5,712.38			$11,113.00	$5,000.85	$6,112.15	12.84
TOTALS	**$5,712.38**	**0.00**	**$0.00**	**$11,113.00**	**$5,000.85**	**$6,112.15**	**12.84**

Electric HVAC Saving Upgrades	Est. Annual Cost Savings	Est. Annual Energy Savings (kWh)	Gas Savings (therms)	Total Installation Cost	Electric Incentive	Gas Incentive	Your Contribution	Simple Payback Immediate
Electric HVAC-AC	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
Electric HVAC-Heat Pump	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
Dual Enthalpy Economizer	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
Programmable Thermostats	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
Elec-HVAC - AC - Fuel Use Economizer	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
Demand Control Ventilation Using CO2 Sensors	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
Variable Frequency Drives	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
TOTALS	**$0.00**	**0.00**	**0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**0.00**

HVAC Others Saving Upgrades	Est. Annual Cost Savings	Est. Annual Energy Savings (kWh)	Gas Savings (therms)	Total Installation Cost	Electric Incentive	Gas Incentive	Your Contribution	Simple Payback Immediate
Faucet, Aerator, Spray Valve	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
Pipe Insulation	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
Electronically Commutated Motors For Refrigeration	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	$0.00	0.00
TOTALS	**$0.00**	**0.00**	**$0.00**		**$0.00**	**$0.00**	**$0.00**	**0.00**

Gas Saving Upgrades	Est. Annual Cost Savings	Est. Annual Energy Savings (kWh)	Gas Savings (therms)	Total Installation Cost	Total Incentive	Your Contribution	Simple Payback Immediate
Gas Furnace/Boiler Replacement	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	0.00
Gas Furnace/Boiler Tune-up	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	0.00
Boiler Reset Controls	$0.00	0.0000	0.0000	$0.00	$0.00	$0.00	0.00
TOTALS	**$0.00**	**0.00**	**$0.00**		**$0.00**	**$0.00**	**0.00**

1) I have reviewed the Energy Efficiency Assessment for the premises listed above. 2) I authorize energy efficiency related services work on the above listed premises. 3) I understand that all work identified on this Customer Work Order above in the section "JCP&L Program Incentive" is paid for by Willdan. I understand that I am responsible to pay Willdan or, if applicable the Installation Program Allies identified above, for that portion of the total cost identified above in the section "Customer Payment Due Upon Completion" at the time that the installation is completed. I further understand that I may pay Willdan, or if applicable the Installation Program Ally, by any of the following methods: credit card, money order, cashier's check, PayPal, or cash. 4) I understand that JCP&L does not endorse, guarantee or warrant any particular manufacturer or product, and that JCP&L provides no warranties, expressed or implied, for any products or services. Customer's reliance on warranties is limited to warranties provided by Willdan, or Installation Program Allies and that products installed under this DI Program are warranted for a limited time. After the lapse of this warranty period, I will be responsible for replacement of said products. The warranty periods are provided below. 5) I authorize access to the above listed address for the purpose of installing the energy-saving upgrades and inspecting them upon completion. 6) I agree to indemnify, defend, and hold Willdan, JCP&L, and Installation Program Allies, harmless from any claims, losses, expenses, liabilities, and costs for damage to or destruction of this property, or injuries to any person (including death) arising out of inappropriate/non-intended use of equipment installed as authorized by this agreement. 7) I agree that JCP&L may provide Customer information including Customer name, account number, electric consumption data and electric energy savings to its third-party evaluation contractor for DI Program evaluation purposes. The evaluation contractor has agreed to keep Customer information confidential. Customer information may also be provided to the New Jersey Board of Public Utilities (NJBPU) Commission. Any Customer information provided to the NJBPU Commission will be aggregated with information about other customers and not personally identifiable. 8) The scope of work and pricing presented in this document is valid for no more than six (6) months after the signature date. After six (6) months, the project scope and/or pricing may be updated. 9) I understand all energy savings values are calculated based upon the New Jersey Technical Resource Manual ("TRM") for estimating savings for energy efficiency programs. The annual energy savings estimate presented in the Summary Report is based upon pre-determined sector hours listed in the TRM. Actual savings may vary depending on actual operating hours at the site. JCP&L DOES NOT MAKE ANY REPRESENTATIONS OF ANY KIND REGARDING THE RESULTS TO BE ACHIEVED BY THE ENERGY-SAVING MEASURES OR THE ADEQUACY OR SAFETY OF SUCH MEASURES, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. 10) I understand that if existing lighting that is not in service when upgraded through the DI Program, actual energy savings will also vary from the Summary Report. 11) If non-compatible emergency ballasts are found, Customer can elect to leave existing fixtures as is or replace ballasts at an additional cost. 12) Willdan reserves the right to cancel any DI project for any reason. 13) I have read, understand and am in compliance with all rules and regulations concerning this DI Program. I certify that all information provided is correct to the best of my knowledge. 14) By participating in , I agree to assign ownership of any Energy Efficiency resource credits resulting from my project(s) to JCP&L for the purpose of offering these credits into the markets operated by PJM Interconnection, Inc. ("PJM").

Jersey Central Power & Light
A FirstEnergy Company

Direct Install

Customer Installation Agreement
Tel: 1-877-831-5419 - http://sbdi.energysavenj.com

Account #			WORK ORDER #	
0		UNION BEACH BORO	432448-A	
Representative Name	Energy Assessment Date		Customer Phone	Tool Version
Brian McGrath	8/1/21	FLORENCE AVE	(732) 264-1133	1.1
Installation Contractor		UNION BEACH, NJ 7735	Contact Person	Customer Email
Willdan Lighting & Electric Inc			Jamison Lauer	jlauer@unionbeachschools.org

Dear JCP&L Customer:
Thank you for your participation in the Direct Install ("DI") Program sponsored by JCP&L Company. This Customer Installation Agreement sets forth and confirms the understanding of the installation of Energy Efficiency measures as listed on the Customer Work Order (attached).

TERMS AND CONDITIONS:

1. Scope of Work. See attached Customer Work Order, the contents of which are hereinafter referred to as the "Scope of Work".
2. Electrical Violations. If electrical violations (as defined by the New Jersey County in which the Install takes place) are found within Customer's establishment, Willdan must inform the owner, or the responsible Customer representative, of the life safety electrical hazard situation that exists before Willdan proceeds with the retrofit installation of the lighting fixtures. The existing violations must be corrected either by the owner, or by Willdan at an additional cost, which is not part of the DI Program. Willdan reserves the right to cancel any job for any reason.
3. Payment. Customer is responsible for paying that portion of the total cost identified above in the section "Customer Payment Due Upon Completion". All payments are due upon completion of the work. Upon receipt of full payment, title to the installed Energy Efficiency measures transfers to Customer.
4. Disposal. All DI Program related materials will be removed and disposed of in accordance with all federal, state and local regulations.
5. Schedule. Customer will allow reasonable access for purposes of installing Energy Efficiency measures per the Scope of Work during normal business hours.
6. Installation. Installation will commence within sixty (60) days of execution of this Customer Installation Agreement.
7. Taxes. Customer agrees that it is solely responsible for any taxes or fees that may be assessed as a result of installation of Energy Efficiency measures and shall indemnify Willdan and JCP&L for any tax related claims. In the event that Customer claims any exemption from any tax, it must provide appropriate documentation prior to installation of measures.
8. Willdan's entire liability and obligation under this agreement will not exceed the net customer cost. Under no circumstances will Willdan or JCP&L be liable for any special, incidental, indirect, punitive and/or consequential losses or damages of any kind or nature whatsoever (including, without limitation, for lost profits, time or revenue) for anything arising out of the performance or nonperformance of this agreement, whether claims for said losses or damages are premised on warranty, negligence, strict liability, contract or otherwise..
9. General Terms. This Customer Installation Agreement incorporates the Terms and Conditions agreed to on the Customer Work Order (attached).
10. The energy assessment and associated pricing is valid for a period of sixty (60) days from receipt of the proposal.
11. Governing Law, Jurisdiction & Venue. All matters of dispute between the parties shall be governed, construed, and enforced in accordance with the laws of the State of New Jersey for both substantive and procedural matters (without giving effect to conflict of laws principles) regardless of the theory upon which such matter is asserted. The parties expressly exclude the applicability of the United Nations Convention on Contracts for the International Sale of Goods. Any legal suit, action, or proceeding regarding, arising from or relating to the Customer Installation Agreement must be instituted in a State or Federal Court in the Sate of New Jersey. Customer waives any objection it may have now or hereafter regarding the jurisdiction or venue of any such suit, action or proceeding and hereby irrevocably submits to the jurisdiction of any such court in any such suit, action or proceeding.
12. Direct Install Do It Yourself Program. All measures listed as "DIY" or "No Cost" in the Customer Work Order are subject to the following conditions:
   a. The Total Cost is for material only; it does not include installation.
   b. The products provided are warranted by the manufacturer; refer to the manufacturer's warranty.
   c. The customer understands that there is a 15-day deadline from the Delivery Date for installing incentivized products. If the customer does not install the products within 15 days of delivery, the customer will be invoiced for the Program Incentive amount.
   d. If an existing ballast or fixture is found to be deficient by the Customer or Willdan, the deficiency must be rectified by the Customer, or by Willdan at an additional cost, which is not part of the Direct Install Program. Willdan reserves the right to cancel any job for any reason.

Payment Terms:	
Total Cost of Installed Measures:	**$11,113.00**
Less: Program Incentive	$5,000.85
Plus: Code Violation Fixing Fee	
Customer Payment Due Upon Completion:	**$6,112.15**

Warranty Periods

The energy savings upgrades are warranted from the date of installation as follows:

Lighting Part & Labor	1 Year	LED Tubes Ballasts & Integrated Fixtures **	5 Years
LED Screw-in Lamps & Smart Thermostats**	3 Years	Evaporator & Door Heater Controls inc. parts & Labor	2 Years
Exit Signs	1 Year	EC Motors inc. parts & Labor	1 Year
HVAC & HVAC controls	1 Year	Food Service Equipment	1 Year

** Manufacturer's warranty

Authorization for Installation of Energy Saving Upgrades(Must Sign Before Installation)

Print Name G. Gaines

Customer Signature [signature] Date 2-9-22

Installation Contractor(Must Sign Before Installation)

Print Name

Signature Date

JCP&L programs are funded by a charge on your energy bill. JCP&L programs can help you reduce your energy consumption and save you money. To learn more about JCP&L and how you can participate, go to www.energysaveNJ.com.

JCP&L has contracted with Willdan Energy Solutions and its subsidiary Willdan Lighting and Electric, Inc. ("Willdan") to administer the DI Program. DI offers a range of LED lighting, commercial refrigeration, HVAC replacement and HVAC controls upgrades. For more information please call 1-877-831-5419 or email energysavenj@willdan.com

Project address, identify the ECMs implemented by each Program participant and the energy and cost savings estimates for each Project.

8. JCP&L may participate in the PJM Capacity Market* through the demand reductions achieved by the ECMs installed as part of this Program. Customer acknowledges and agrees that, for purposes of participating in the PJM Capacity Market, JCP&L shall own the rights to all such demand reductions without cost or obligation to Customer. JCP&L's ownership of the Project's demand reductions does not affect Customer's ownership of the ECMs nor the energy savings derived from the ECMs.
*PJM Capacity Market. PJM Interconnection is the regional transmission operator that coordinates the m ovement of wholesale electricity in all or parts of 13 states including New Jersey. PJM operates a competitive wholesale electricity market and manages the high-voltage electricity grid to ensure reliability for more than 61 million people. PJM holds regular capacity auctions to ensure there is sufficient generating capacity available to meet customer needs. Load reductions from ECMs are allowed to participate in these auctions as
'negative' generation.
As required by PJM, JCP&L reserves the right to perform measurement and verification ("M&V") at all participating facilities. JCP&L M&V activities at the Facility may, in JCP&L's sole discretion, include but not be limited to, meter installation, calibration and maintenance of M&V equipment, data gathering and screening, verification of M&V reports and the use of customer energy and cost savings, and billing information. JCP&L will notify Customer if an ECM installed at the Facility requires M&V, will inform Customer of the JCP&L M&V activities, and will work with Customer to minimize any adverse effects on Customer's normal operations. JCP&L, or its subcontractor, may audit the Facility to verify the operation of all installed ECMs for up to four (4) years following installation to ensure compliance with PJM Capacity Market rules and regulations. Customer shall cooperate with and support JCP&L's ownership of the demand reductions as set forth in this Paragraph 8.

9. Customer agrees (A) That the laws of the State of New Jersey shall govern this Agreement and any dispute arising hereunder shall be litigated in a Federal or State Court located in the State of New Jersey, (B) TO WAIVE TO THE FULLEST EXTENT PERMITTED BY LAW THE RIGHT TO A TRIAL BY JURY.

10. In the event any provision of this Agreement shall for any reason be held to be invalid, illegal or unenforceable in any respect, the remaining provisions of this Agreement shall remain in full force and effect to the maximum extent possible.

11. This Agreement is neither intended to create, nor shall it be construed as creating, a joint venture, partnership or other form of business association between the Parties, or an agreement to enter into any business relationship.

Authorized Signature of Customer:	
Customer Name: Union Beach BOE	Title: B.A.
Signatory Name (Please Print): G. Fahler	
Signature: [signature]	Date: 2-9-22

Return completed form by email or mail to:
JCP&L Direct Install Program c/o Willdan Energy Solutions 3910 Park Avenue, Suite 5
Edison, NJ 08820
Phone: 877-831-5419
Email: energysavenj@willdan.com

Attachment A - Owner Consent to Conduct Audit

The undersigned, a duly authorized representative of the owner of the Facility, does hereby:

1. Consent to Jersey Central Power & Light Company (or its designee) (the "Company") to enter the Facility to conduct a free energy audit ("Audit"),
2. Acknowledge that the purpose of the Audit is to identify potential measures that, if implemented, may result in energy savings to the owner or tenant occupying the Facility, and in consideration thereof, does further
3. Agree to indemnify, defend, and hold harmless Company or its designee from all claims arising under or pursuant to the Audit.

The tenant (Customer) at the location described below will be billed for any project constructed under this Program.

Tenant (Customer) and Owner Information		
Tenant (Customer) Name:		
Facility Name:		
Facility Street Address:		
City:	State:	Zip:
Date:		
Owner Name:		
Owner Signature:	Owner Signatory Name:	
Owner Address:		
City:	State:	Zip:
Owner Phone:		

JCP&L Direct Install Program Representative Name: Willdan Energy Solutions

Return completed form by email or mail to:
JCP&L Direct Install Program c/o Willdan Energy Solutions 3910 Park Avenue, Suite 5
Edison, NJ 08820
Phone: 877-831-5419
Email: energysavenj@willdan.com

APPENDIX C
PROPOSED EQUIPMENT

ACCESSORY KIT INSTALLATION INSTRUCTIONS

ECONOMIZER DAMPER AND HOOD

MODELS 2EE04710824 / 2EE04710924 / 2EE04711024 / 2EE04711124 1EH0417 / 1EH0418

For 15, 17.5, 20, and 25 ton rooftop units

WARNING: Cancer and Reproductive Harm – www.P65Warnings.ca.gov.

General

This instruction provides the necessary information to field-install economizer dampers and hood assembly on 15, 17.5, 20, and 25 ton single package rooftop units. Table 1 lists the compatible units.

Table 1: Compatible units

Kit	Compatible units			
2EE04710924 (Smart Equipment Economizer) 2EE04711124 (BAS Economizer)	ZF 210-300 ZJ/ZR/ZT180-300 XP 180-240	ZS -18 through -25 ZW/ZK/ZV-15 through 25 XA -15-20	J15ZJ/ZR/ZT J18ZJ/ZF/ZT J20ZJ/ZR/ZF/ZT J25ZJ/ZR/ZF	ZS T18, T25 ZW/ZK/ZT T15, T25 XAT15, T20
2EE04710824 (Smart Equipment Economizer) 2EE04711024 (BAS Economizer)	ZF180	ZS-15	J15ZF	ZST15

The damper accessory provides the return air and outdoor air dampers and actuator for economizer operations. This kit contains all rain hood components.

Table 2 lists the kit contents. Verify the contents of the kit before you begin the installation. See Figure 1 for the item locations.

Table 2: Economizer kit contents

Item	Quantity	Description
A	1	Fresh air hood with three filters
B	1.	Fresh air adapter panel (20 and 25 ton units)
C	1	Economizer damper
D	1.	Re turn air/out door air (RA/OA) divider
E	1	Top flange
F	1	Damper extension (20 and 25 ton units)
		Bag of screws

Required tools

- 5/16 in. hex socket driver
- 7/16 in. hex socket driver
- 3/8 in. hex socket driver
- Drill for self-drilling screws
- Socket drive extension
- Hammer

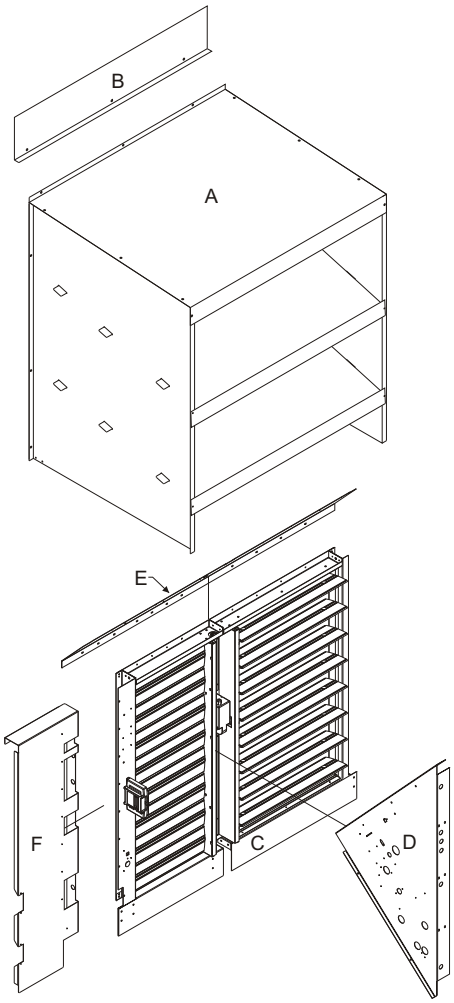


Figure 1 - Item locations

Installation

The following sections outline the installation procedures. Read all the instructions before you begin the installation.

Installing the economizer damper

⚠ CAUTION

When you install dampers, use care to avoid damage to filters or coils located in the adjacent compartment.

1. Remove the four access panels. Two outdoor air (OA) panels, one return air (RA) panel, and one filter panel. See Figure 2.
   a. Use a 7/16 in. hex socket to loosen the screws that secure the rotating latches.
   b. Use a 5/16 in. hex socket to remove the four screws on the bottom of each panel. See Figures 2, 3, and 4.

Note: Retain the O rings that provide the seal between the panel and unit bottom.

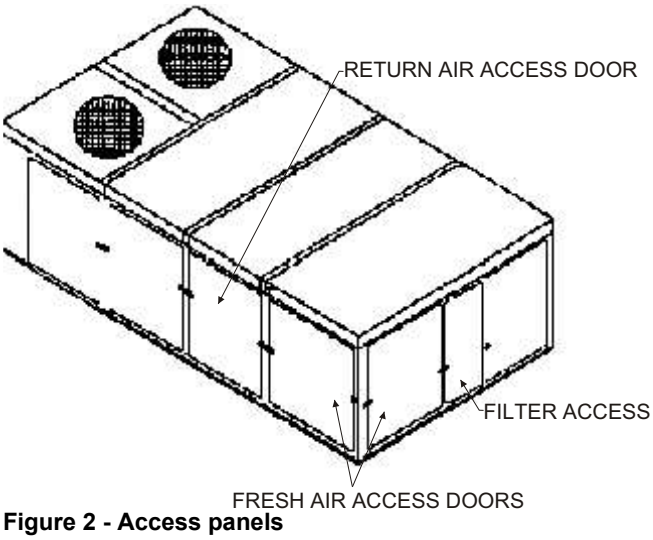


Figure 2 - Access panels

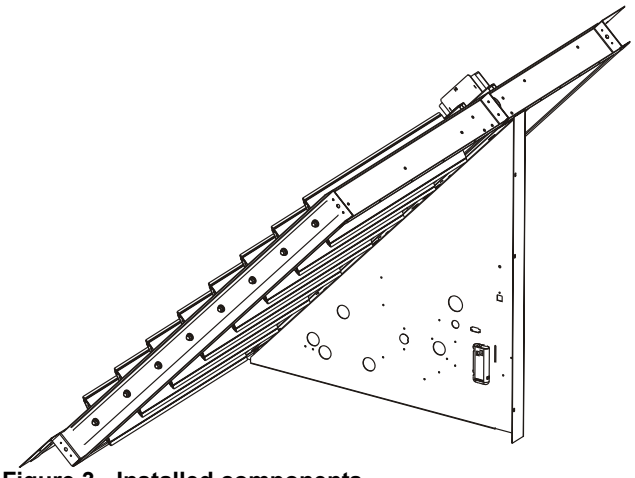


Figure 3 - Installed components

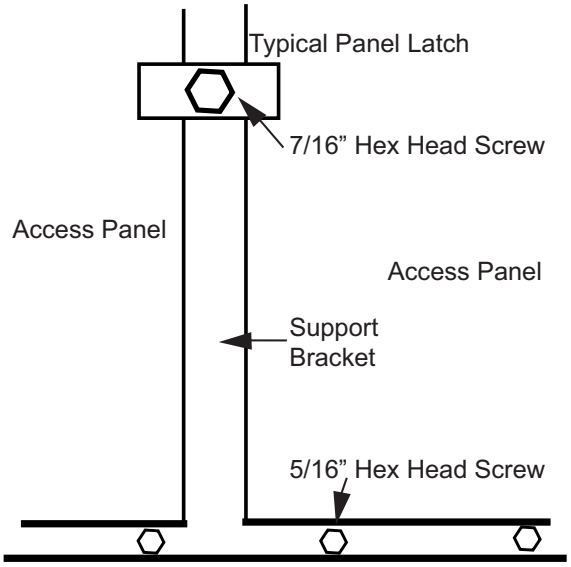


Figure 4 - Panel latch

⚠WARNING

If the return air duct cover is not in place, install a covering over the open hole to prevent personal injury or equipment damage.

2. On 20 and 25 ton rooftop units: Remove the support brackets. See Figure 5.
   a. Use a 5/16 in. hex socket to remove the top screws that secure the support bracket located between the return air and outdoor air compartments.
   b. Use a 5/16 in. hex socket to remove the top screws that secure the corner support bracket.
   c. Use a 3/8 in. hex socket to remove the two inside top and bottom screws. Save the screws and bracket for later use. See Figure 6.

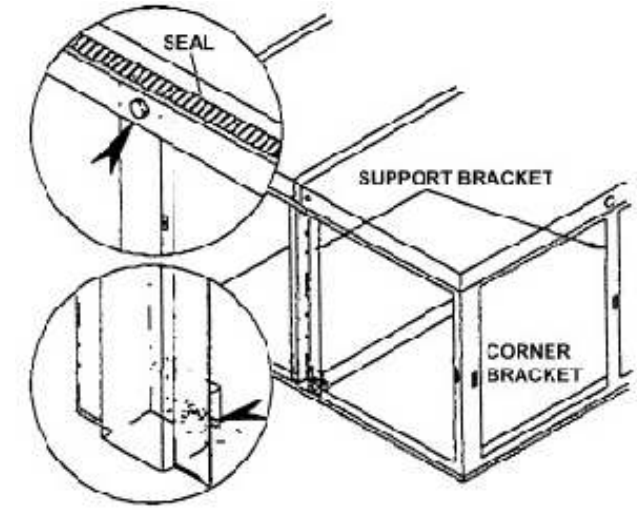


Figure 5 - Removing the support bracket

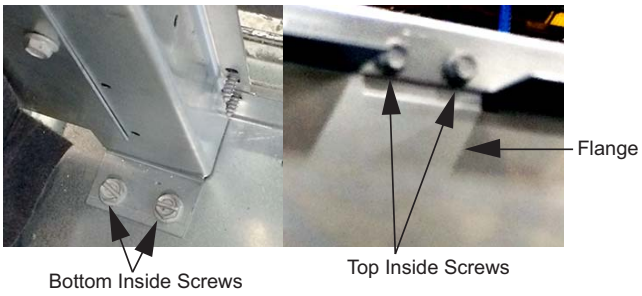


Figure 6 - Top and bottom inside screws

> **⚠ CAUTION**
>
> Lift the roof when you remove the support bracket to prevent tearing the roof seal.

3. If in place, remove the RA duct panel that covers the RA opening. See Figure 7.

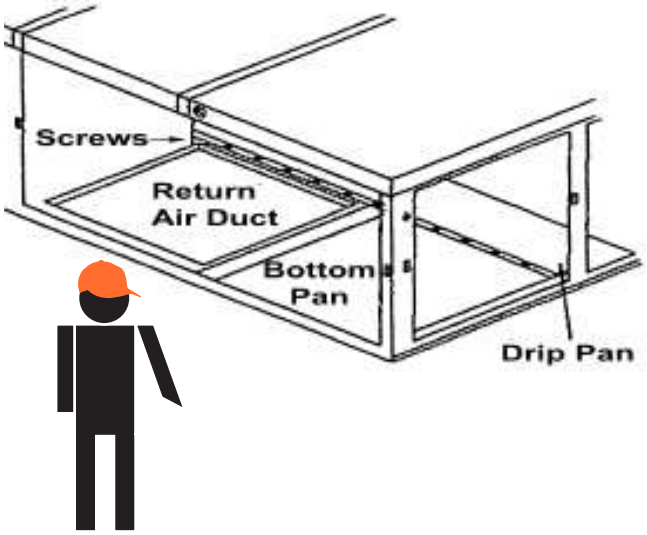


Figure 7 - RA duct and screw locations

4. Install the top flange.
   a. Inside the top lip, align the holes of the top flange with the holes in the lip.
   b. Use the self-drilling screws provided to secure the top flange to the lip. Install the screws from outside the unit. See Figure 8.

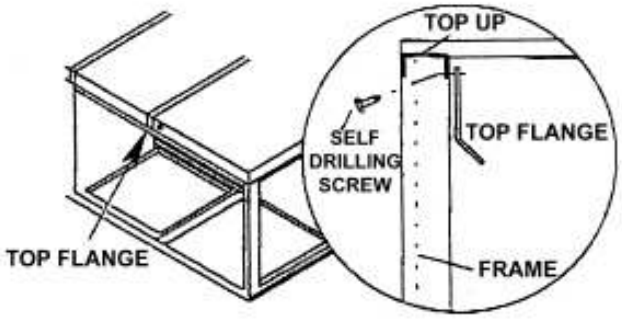


Figure 8 - Installing the top flange

5. Position yourself in front of the unit with the OA section on your right and RA section on your left. See Figure 7.
6. Lay the economizer damper down with the economizer control board and actuator on top. Place the end of the damper beyond the bottom track to the filters racks.
7. Lift the economizer damper up past the top flange and pull the bottom of the damper into the bottom track. Rest the damper on the top flange. See Figure 9.
8. Fasten the damper to the top flange using the pilot holes and self-drilling screws provided. See Figure 9.

   You do not need to fasten the damper to the bottom track.

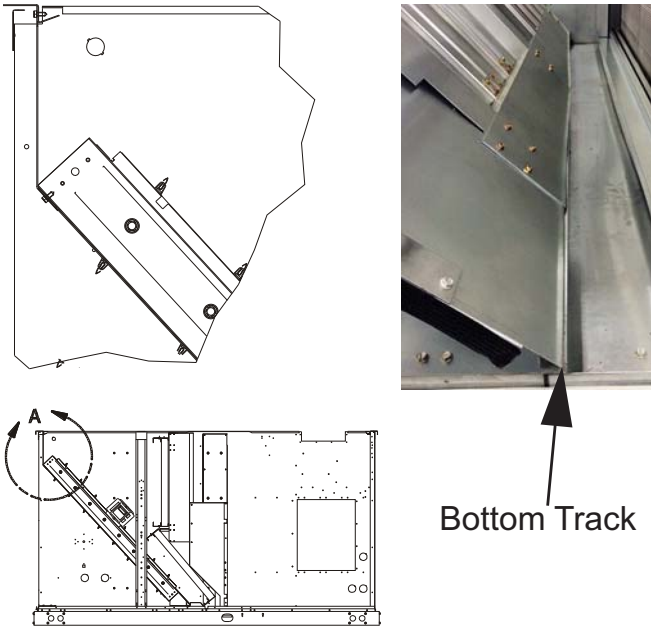


Figure 9 - Securing the damper to the top flange

9. On 20 and 25 ton units: install the two support brackets previously removed. See Figure 10.

> **⚠ CAUTION**
>
> Lift the roof when you remove the support bracket to prevent tearing the roof seal.

   a. Align the bottom holes, lift the roof, and rotate the bracket to a vertical position.

   b. Use the screws previously removed from each bracket to secure.

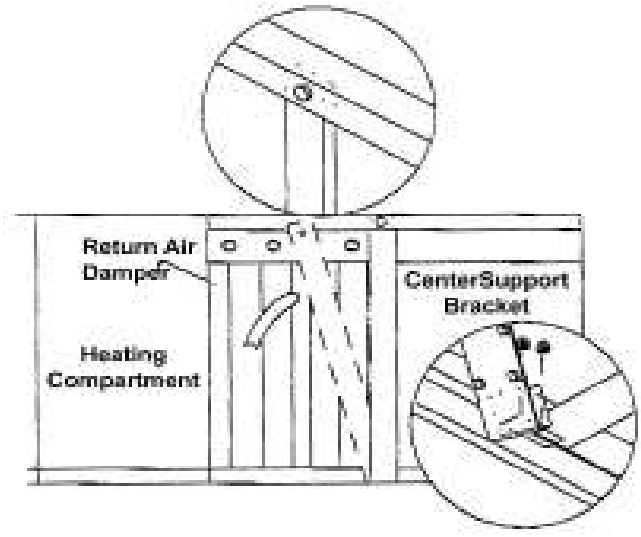


Figure 10 - Re-installing the center support bracket

10. Secure the economizer damper:
   - Measure and cut a length of 1/8 in. foam tape to fit the long edge of the damper frame that rests against the access panel. See Figure 15.

11. Use a 5/16 in. driver to remove the two screws located in the floor flange between the RA and OA compartments. Save the screws for later use. See Figure 11.

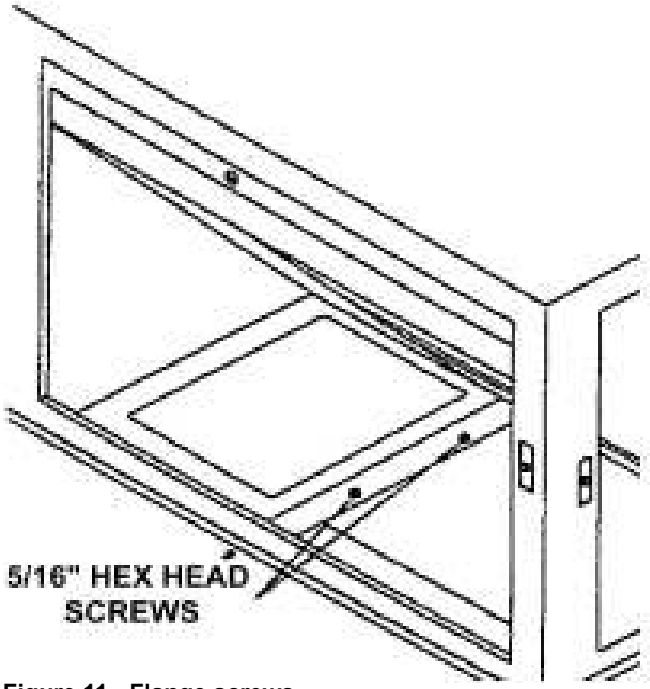


Figure 11 - Flange screws

12. Install the RA/OA divider:
   a. Remove the RA/OA divider from its packing material.

   b. Measure and cut a length of 1/8 in. foam tape to fit on the diagonal edge of the RA/OA divider. See Figure 12.

Figure 12 - Applying foam tape to the divider

c. Slide the divider into position against the economizer damper. Place the divider the right side of the support bracket.

d. Use the two screws removed previously to secure the RA/OA divider to the floor flange. See Figure 13.

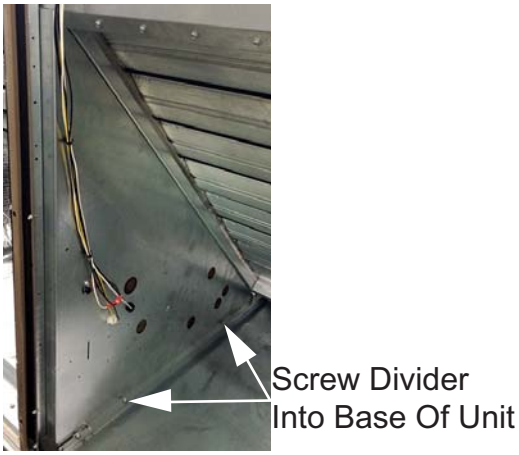


Figure 13 - Attaching the divider to the base

e. Use two self-drilling screws to secure the OA/RA divider to the support bracket. See Figure 14.

f. Use four self-drilling screws to secure the RA/OA divider to the economizer damper frame using the pilot holes provided.

g. Fill the gap at the base of the divider with the ¾ in. foam tape provided.

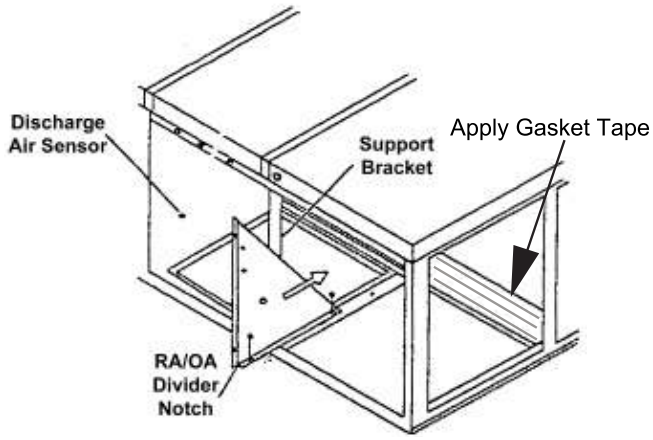


Figure 14 - Installing the divider

h. On single enthalpy units: mount the enthalpy sensor to the metal surface on the RA/OA divider.

On dual enthalpy units: mount the second enthalpy sensor on the opposite surface in the return air. Use two self-tapping screws to secure. See Figure 17.

Figure 15 - Installing cable assemblies

13. Mount the sensor and wire harness. For BAS economizers (2EE04711024 and 2EE04711124) skip step 13 and continue with step 14.

a. Cut the wire tie that secures the cable harness to the damper.

b. Insert the P27/4 pin, S28/3, S30/2 pin, and S31/2 pin connector to the unit economizer plug near the filters.

c. Uncoil the remaining wiring harness and route it through the round hole in the top flange. Allow the wires to hang in the OA compartment.

See Figure 18 for wiring grommet locations.

d. Make all the wiring connections listed in Table 3.

e. Locate the discharge air sensor mounting location on the heating section wall. Mount the sensor bracket provided with one self-tapping sheet metal screw. See Figure 17.

f. Use tie wraps to bundle the wires and secure to the top flange and RA/OA divider. See Figure 15.

Important: When using the wire harness, insert a loop between the two tie wraps so that the wire harness does not rub on the damper frames during operation. See Figure 16.

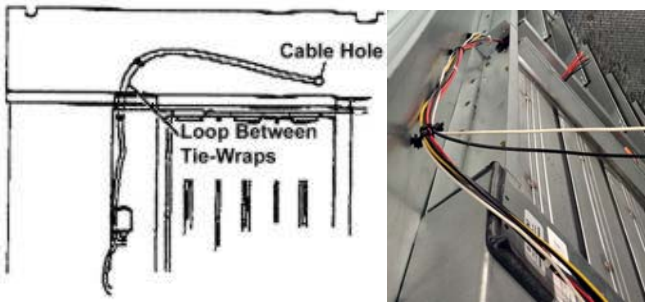


Figure 16 - Routing cables

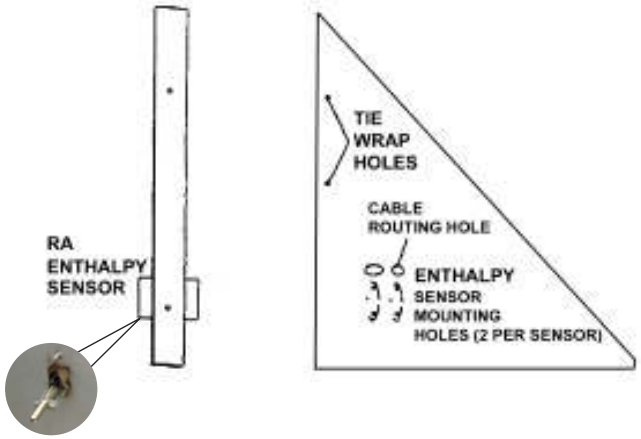


Figure 17 - Component location on RA/OA

Table 3: Sensor connection table

Sensor type (terminal)	All units (wire color)	Terminal location	Logic module
OAH	Field supplied	24V OAH Com	Eco Board
RAH	823 / Red 825 / White 824 / Black	TB4-3 RAT+ RAT-	UCB
SAT	371 / White 373 / Black	SAT+ SAT-	S27
RAT	375 / White 377 / Black	RAT+ RAT-	S27
SA BUS	896 / Black 895 / White 894/ Red		S28
PWR	355 / Brown 356 / Red		S30
DMP ACTUATOR	355 / Brown 356 / Red		S30

Table 3: Sensor connection table

EX FAN	362 / Brown 360 / Gray		S31

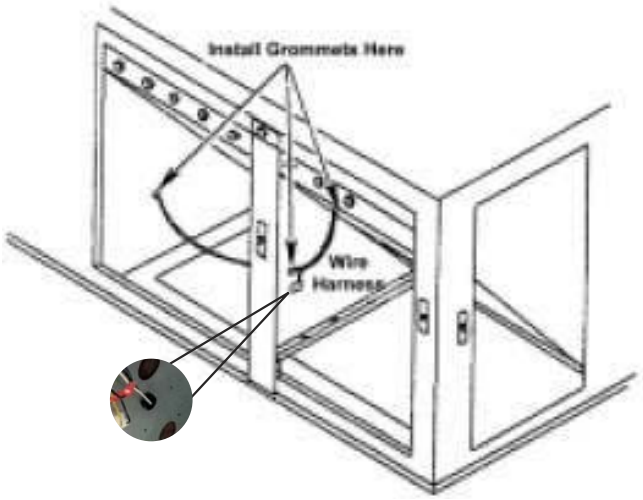


Figure 18 - Grommet Installation Locations

14. For 20 and 25 ton units only:
    a. Remove the blank-off section from the packaging.
    b. Measure and cut a length of 1/8 in foam tape to fit on the long edge of the blank-off section that contacts the access panel.
    c. Insert the blank-off section through the side access opening of the OA compartment. See Figure 19.
    d. Use the pilot holes on the top flange for the self drilling screws provided to secure the top of the blank-off section to the top flange.
    e. Install ¾ in. foam tape around the cut-out for the vertical support bracket.

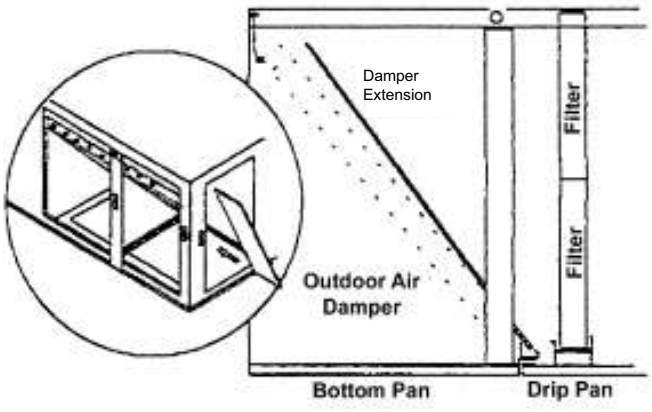


Figure 19 - Installing the damper extension

The damper assembly is complete. Proceed to *Assembling the economizer hood* on page 7.

Assembling the economizer hood

Read all the instructions before you assemble the economizer hood.

> **⚠ CAUTION**
>
> Take care when using cordless drivers so that the screws do not strip the metal take holes.

1. Take the fresh air access door with hood assembly and place it back in position.
2. Secure the assembly in place with the hardware provided. See Figure 20

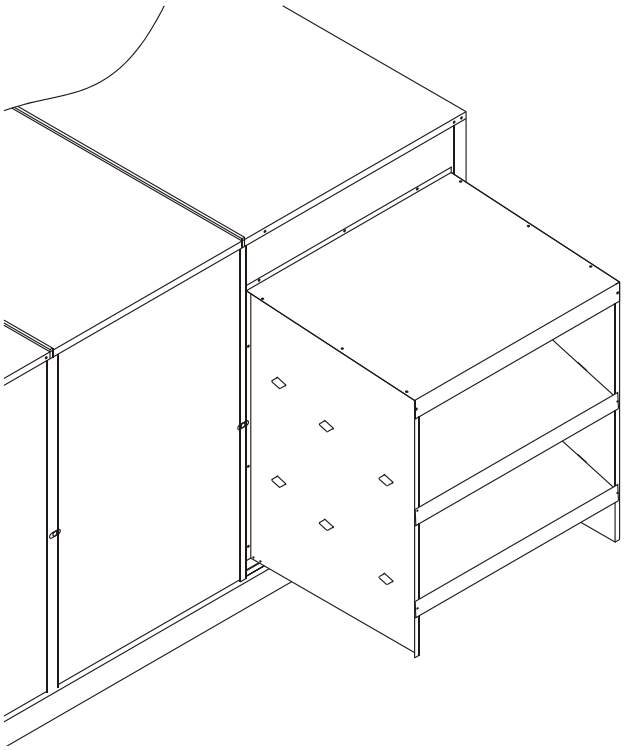
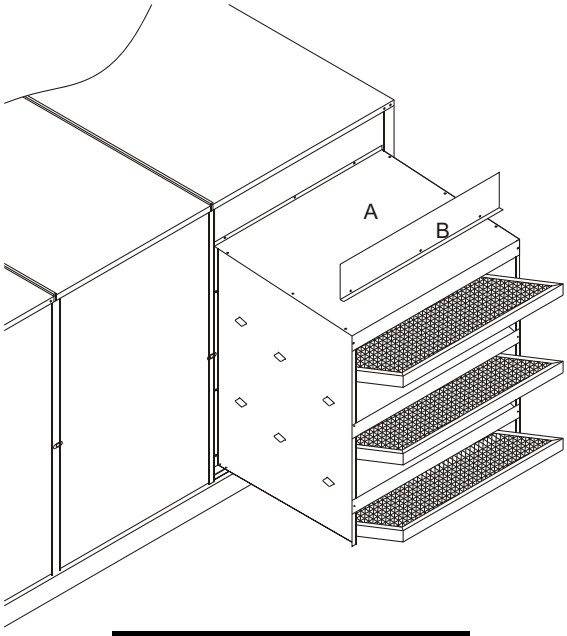


Figure 20 - Installing the assembled fresh air hood

3. On 20 and 25 ton units: Install the fresh air adapter panel under the unit top panel and over the flange of the fresh air hood top. See Figure 21.
4. Secure the adapter panel with the two 10-½ in. x 16 screws provided.



Item	Description
A	Fresh air hood top
B	Fresh air adapter panel

Figure 21 - Installing the adapter panel

1183427-UAI-E-0320
Supersedes: 1183427-UAI-D-0220

York International Corporation
5005 York Drive
Norman, OK 73069

A smart way to save on your air conditioning system costs.

i-CON 2400

Air Conditioning Electricity Economizer

i-con is a microprocessor-based, electricity-saving control for commercial air conditioning systems. *i-con 2400* reduces compressor run time, excessive cycling and electrical usage, when installed on any new or existing air conditioning compressor. *i-con 2400* uses intelligent Dynamic Cycle Management (DCM) technology to save energy by adjusting the compressor run pattern to match the system's "cooling load".

Features

- For systems 4 Tons and Larger
- Dynamic Cycle Management (DCM) technology reduces electricity consumption—typically 10% to 20%
- Illuminated LCD display shows electricity consumption savings, operating modes and system diagnostics
- Short payback period—typically 12 to 24 months
- UL listed, "Energy Management Equipment"
- Increased savings without replacing or upgrading costly system components
- "State-of-the-art" microprocessor-based control
- No Additional Sensors Required
- Simple installation by qualified installer
- Limited programming required and no follow-up visits required
- Maximum efficiency year-round
- Reduces maintenance and extends compressor life
- Fail-safe operation with anti short cycle protection included
- Guaranteed to reduce electricity consumption
- 10-year replacement warranty for breakdowns or defects

Intelligent Control Systems LLC

208 Rte 109, Ste 211, Farmingdale, NY 11735, USA • Telephone 516-340-1011 • Fax: (888) 711-0750

www.icssaves.com • sales@icssaves.com

i-CON 2400

Air Conditioning Electricity Economizer

Specifications

Mounting:
Any position via molded-on 1/2” Electrical Fitting
Size:
4”H x 4”W x 2 1/2”D
Operating Humidity:
5% - 95% Non-Condensing
Operating Temperature Range:
-10°F - +120°F
Power Input:
24/115/220 VAC @ 5W
Control Circuit:
24 VAC/DC, 115/220 VAC
Relay Contact:
10A @ 220 VAC General Purpose
UL cUL Listed:
“Energy Management Equipment”
Made in USA

i-con uses Dynamic Cycle Management (DCM) technology to determine the cooling demand and thermal characteristics of the entire air conditioning system by analyzing the compressor’s cycle pattern and dynamically modifying that cycle to provide the required cooling in the most efficient manner. This is accomplished in real-time by delaying the start of the next compressor “on” cycle determined by the cooling demand analysis. These new cycle patterns are less frequent and more efficient. This improved process augments the existing controls and will not cause the compressor to run unless the existing thermostat calls for it resulting in improved electrical efficiency. the i-con microprocessor allows the control to precisely determine the most efficient compressor cycles.
Field testing of the *i-con 2400* has demonstrated that this intelligent modification of the compressor cycling with DCM technology leads to significant electricity savings. These savings have been confirmed on both properly sized and maintained systems as well as on oversized systems and those not properly maintained. Just as computer control has increased the gas mileage of automobiles, *i-con 2400* with DCM Technology improves the electricity utilization of air conditioning systems by supplementing the antiquated on/off control action of the thermostat with the analysis and control capabilities of a computer.
Installation by a qualified air conditioning service technician is recommended and normally takes less than 1 hour. *i-con 2400* typically reduces electricity consumption 10% to 20% and has decreased compressor cycling 30% or more. After installation, the *i-con 2400* includes an anti-short cycling feature to provide additional protection for the compressor and does not require any maintenance or seasonal programming.

Intelligent Control Systems LLC

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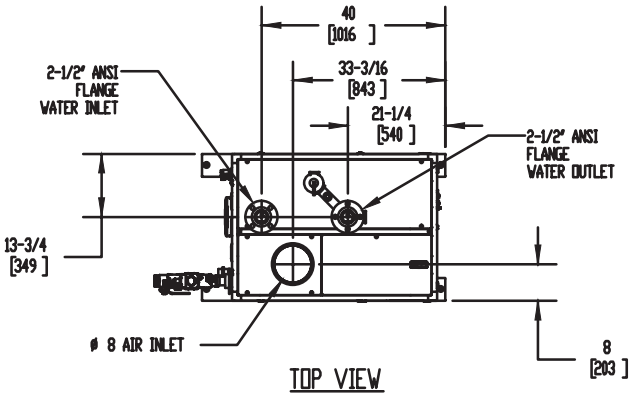
TORUS 1250 VERTICAL

Category II or Category IV Appliance
(see Installation and Operation Manual for venting information)

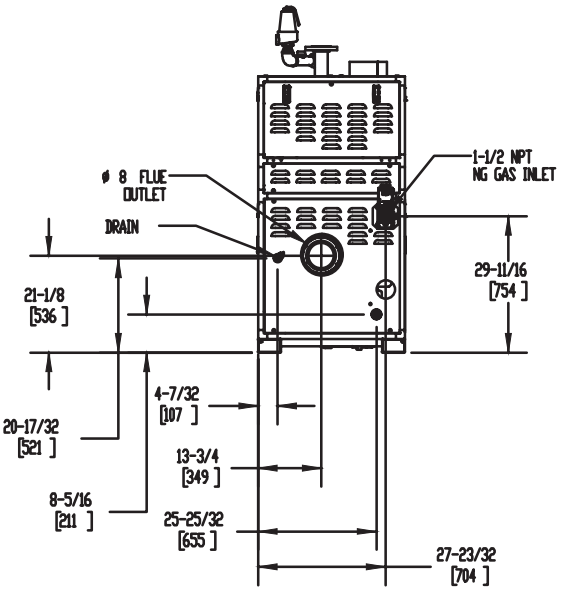
CODE OPTIONS

CSD-1	FIRMWARE W/REMOTE TEST MANUAL RESET LWCO

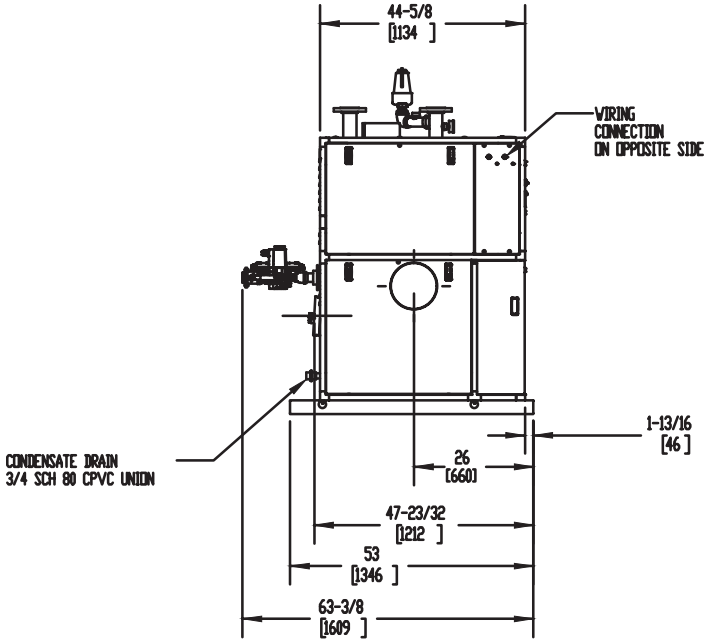
INDOOR UNIT



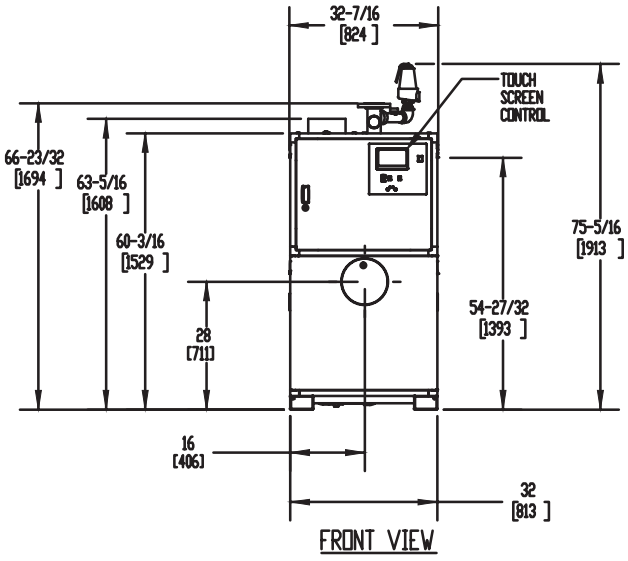
TOP VIEW



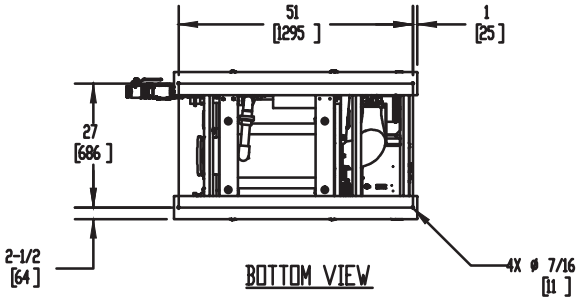
BACK VIEW



LEFT SIDE VIEW



FRONT VIEW



BOTTOM VIEW

Notes:
1. Dimensions are approximate and should not be used to "rough-in" equipment.
2. Dimensions are subject to change without notice.
3. All dimensions are in inches (mm).
4. ⊕ Symbol indicates center of gravity.

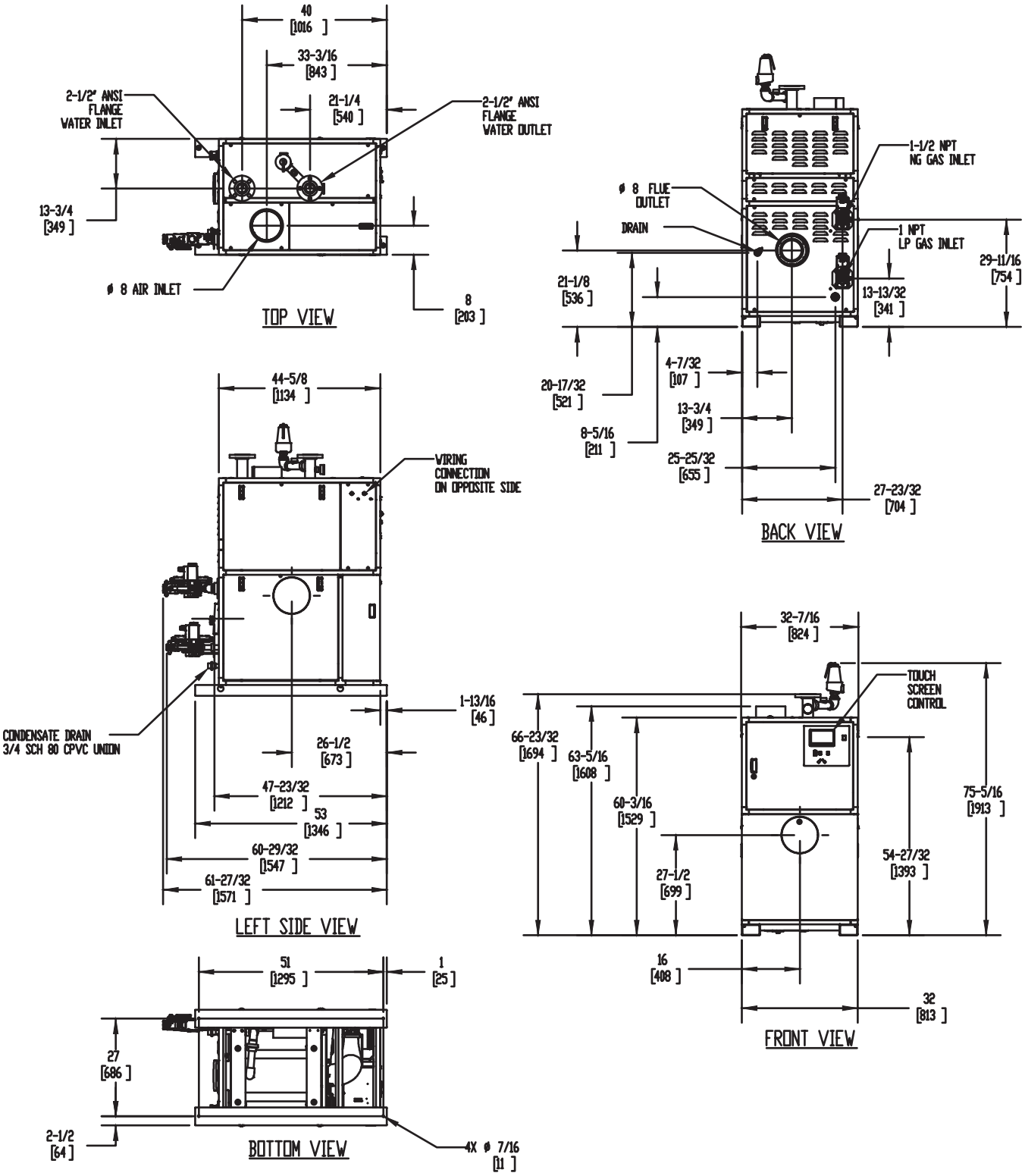
TORUS 1250 VERTICAL

Category II or Category IV Appliance
(see Installation and Operation Manual for venting information)

CODE OPTIONS

CSD-1	FIRMWARE W/REMOTE TEST MANUAL RESET LWCO

DUAL FUEL UNIT



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BOILER CERTIFIED RATINGS & CAPACITIES

Fuel Type	Natural/Propane Gas	**Boiler FLA**	17.14*
Input BTU/hr.	1,250,000 / 366 kW	**Boiler HP**	36.04
Output BTU/hr.	1,206,250 / 353 kW	**Min. Gas Pressure Required**	4" W.C.
Electrical Requirements	120 VAC/60 Hz/1PH	**Max. Gas Pressure Allowed**	14" W.C.
		Operating Weight	1084 lbs / 492 kg

BOILER TRIM & CONTROLS

Main Gas Valve	Dungs MBC	**Air Switch**	Huba
Firing Valve	1" Apollo	**Flow Switch**	SIKA
Ignition Control	Fenwal	**Blocked Flue Switch**	Cleveland NS2
Operating Control	HeatNet®	**Blower Motor**	Ametek
High Limit	Jumo	**L.W.C.O.**	800
Main Ball Valve	1 1/2" Apollo	**Relief Valve (WB)**	1" x 1-1/4" set @ 50 psi
Pump contactor strongly recommended for water heater applications.		**Relief Valve (WW)**	1" x 1" set @ 125 psi

A.S.M.E.

ASME Sect IV Fire Side Htg Surface	100.17 Sq. Ft. / 9.31 Sq. M.	**Design Data**	Max. 160 psig & 210°F
		Water Volume	11 gal. / 41.6 Liters
ASME Sect IV Water Side Htg Surface	92.93 Sq. Ft. / 8.63 Sq. M.		

* Add circulator amps.

BOILER TEMPERATURE RISE / PRESSURE DROP (Based on Full Input)

20°F / 11.1°C				30°F / 16.7°C				40°F / 22.2°C				50°F / 27.8°C				60°F / 33.3°C			
Flow Rate		Pressure Drop		Flow Rate		Pressure Drop		Flow Rate		Pressure Drop		Flow Rate		Pressure Drop		Flow Rate		Pressure Drop	
GPM	L/s	Ft	kPa	GPM	L/s	Ft	kPa	GPM	L/s	Ft	kPa	GPM	L/s	Ft	kPa	GPM	L/s	Ft	kPa
120.7	7.6	15.4	45.9	80.4	5.1	7.3	21.7	60.3	3.8	4.7	13.9	48.3	3.0	3.6	10.7	40.2	2.5	3.0	9.1

WATER HEATER HOURLY RECOVERY CAPACITY (GPH & LPH)

40°F	22°C	60°F	33°C	80°F	44°C	100°F	56°C	120°F	67°C	140°F	78°C
3639	13755	2426	9170	1819	6878	1456	5502	1213	4585	1040	3930

Flow GPM		Temp. Rise** (°F)		Vent Length (Equiv. Ft.)		Air Inlet Length (Equiv. Ft.)	
Min	Max	Min	Max	Min	Max	Min	Max
40.2	120.7	20	60	8	160	0	160

** Min/Max delta t reflects boiler operation at full input. For applications requiring operation above/below these parameters please consult factory.

REP FIRM _____

SUBMITTED BY _____

JOB NAME _____

ARCHITECT _____

ENGINEER _____

CONTRACTOR _____

DATE _____

TORUS 1250 VERTICAL

Category II or Category IV Appliance
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TORUS 1500 VERTICAL

Category II or Category IV Appliance
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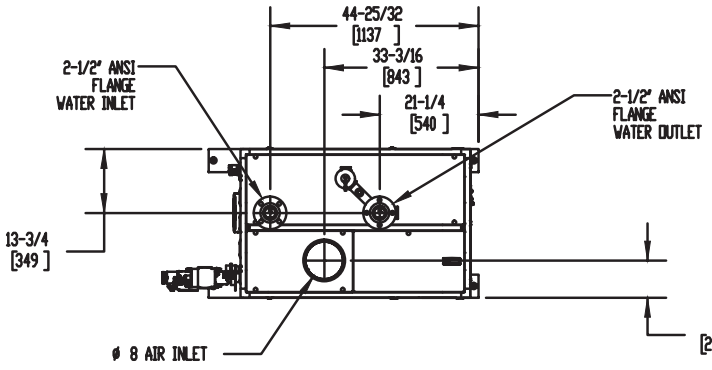
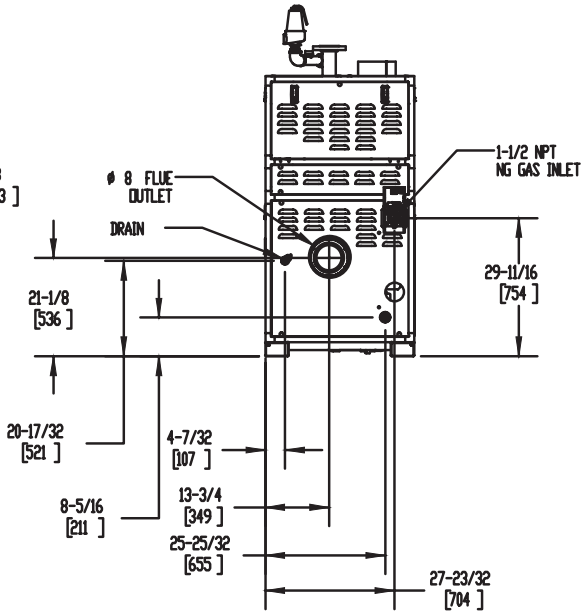
CODE OPTIONS

CSD-1	FIRMWARE W/REMOTE TEST MANUAL RESET LWCO

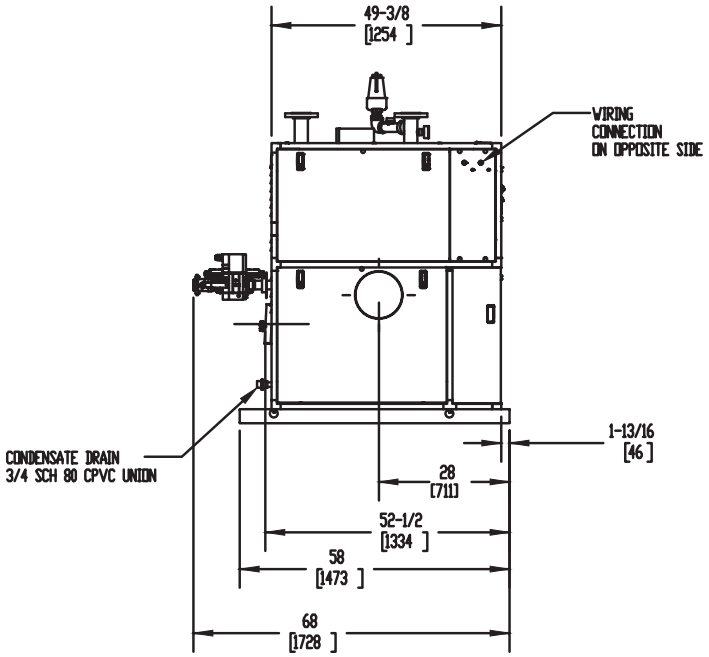
INDOOR UNIT



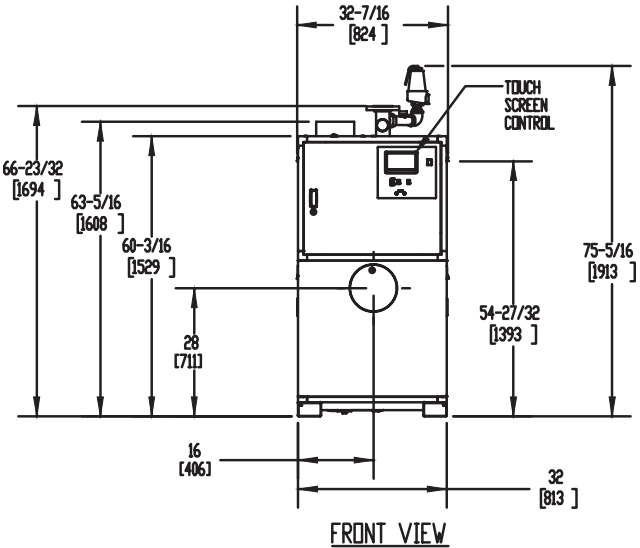
TOP VIEW



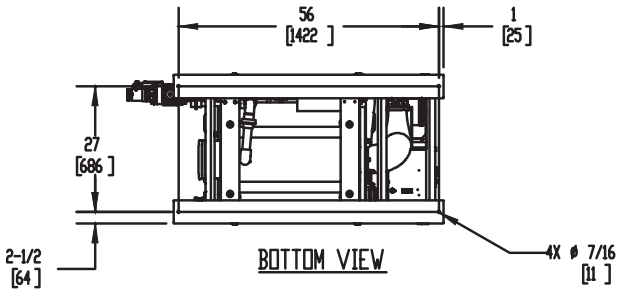
BACK VIEW



LEFT SIDE VIEW



FRONT VIEW



BOTTOM VIEW

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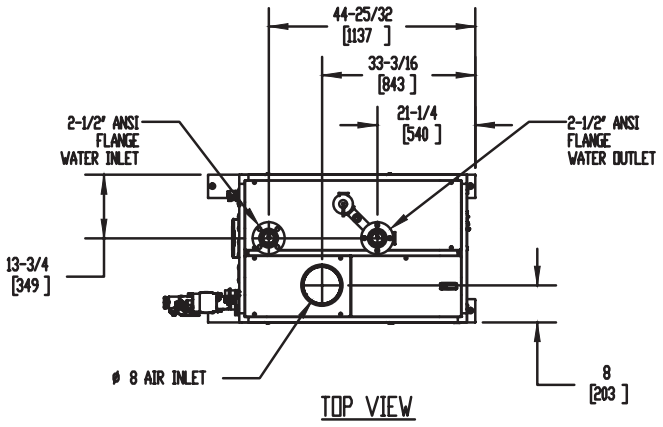
TORUS 1500 VERTICAL

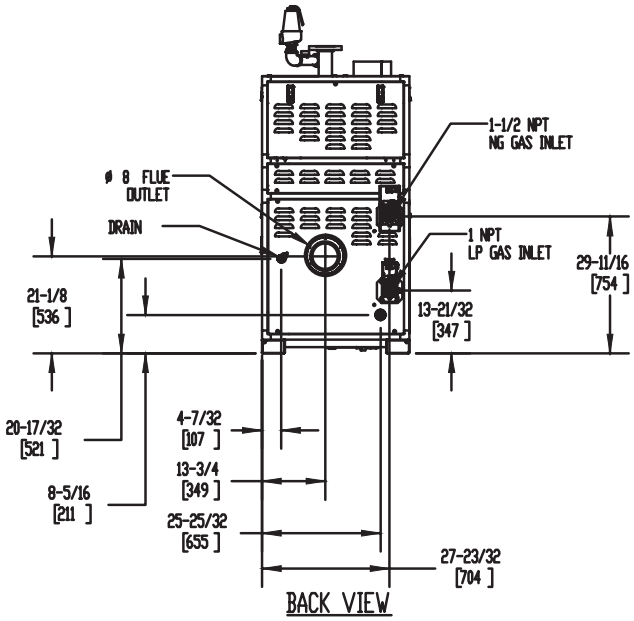
Category II or Category IV Appliance
(see Installation and Operation Manual for venting information)

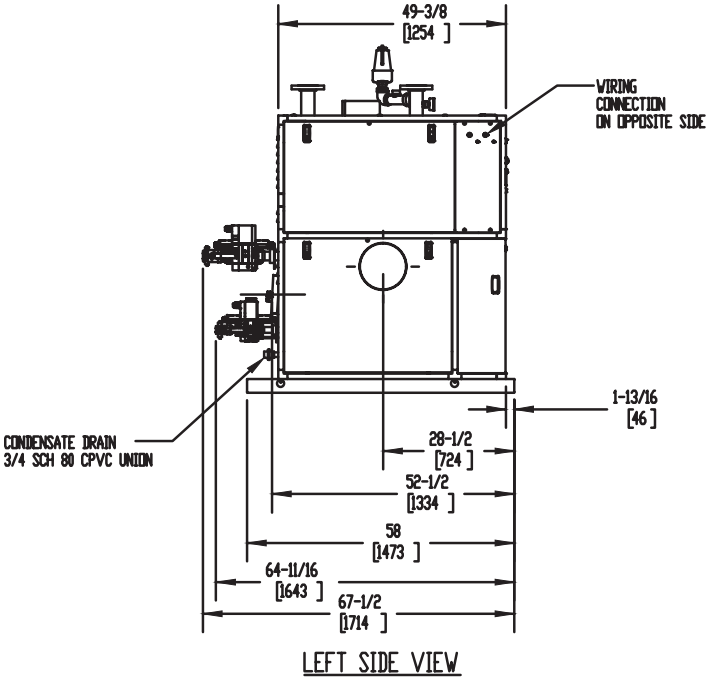
CODE OPTIONS

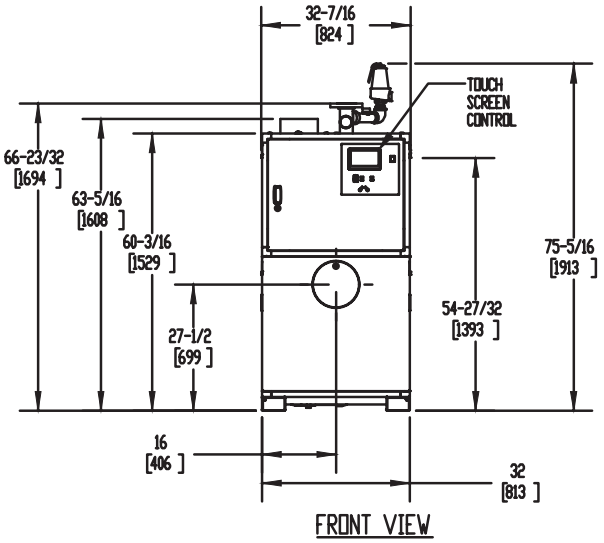
CSD-1	FIRMWARE W/REMOTE TEST MANUAL RESET LWCO

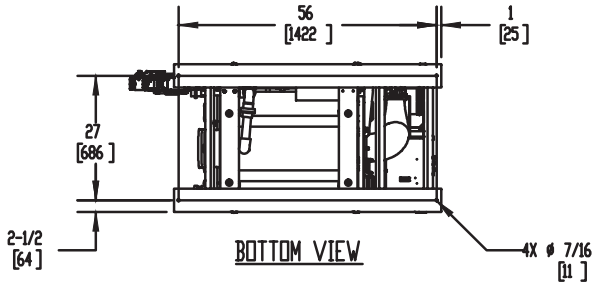
DUAL FUEL UNIT











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2. Dimensions are subject to change without notice.
3. All dimensions are in inches (mm).
4. ⊕ Symbol indicates center of gravity.

BOILER CERTIFIED RATINGS & CAPACITIES

Fuel Type	Natural/Propane Gas	**Boiler FLA**	21.0*
Input BTU/hr.	1,500,000 / 440 kW	**Boiler HP**	43.25
Output BTU/hr.	1,447,500 / 424 kW	**Min. Gas Pressure Required**	4" W.C.
Electrical Requirements	120 VAC/60 Hz/1PH	**Max. Gas Pressure Allowed**	14" W.C.
		Operating Weight	1183 lbs / 537 kg

BOILER TRIM & CONTROLS

Main Gas Valve	Dungs MBC	**Air Switch**	Huba
Firing Valve	1" Apollo	**Flow Switch**	SIKA
Ignition Control	Fenwal	**Blocked Flue Switch**	Cleveland NS2
Operating Control	HeatNet®	**Blower Motor**	Ametek
High Limit	Jumo	**L.W.C.O.**	800
Main Ball Valve	1 1/2" Apollo	**Relief Valve (WB)**	1" x 1-1/4" set @ 50 psi
Pump contactor strongly recommended for water heater applications.		**Relief Valve (WW)**	1" x 1" set @ 125 psi

A.S.M.E.

ASME Sect IV Fire Side Htg Surface	119.8 Sq. Ft. / 11.13 Sq. M.	**Design Data**	Max. 160 psig & 210°F
		Water Volume	13 gal. / 49.2 Liters
ASME Sect IV Water Side Htg Surface	111.08 Sq. Ft. / 10.32 Sq. M.		

* Add circulator amps.

BOILER TEMPERATURE RISE / PRESSURE DROP (Based on Full Input)

20°F / 11.1°C				30°F / 16.7°C				40°F / 22.2°C				50°F / 27.8°C				60°F / 33.3°C			
Flow Rate		Pressure Drop		Flow Rate		Pressure Drop		Flow Rate		Pressure Drop		Flow Rate		Pressure Drop		Flow Rate		Pressure Drop	
GPM	L/s	Ft	kPa	GPM	L/s	Ft	kPa	GPM	L/s	Ft	kPa	GPM	L/s	Ft	kPa	GPM	L/s	Ft	kPa
144.8	9.1	16.4	49.0	96.5	6.1	8.1	24.2	72.4	4.6	5.0	14.9	57.9	3.7	3.5	10.4	48.3	3.0	2.6	7.8

WATER HEATER HOURLY RECOVERY CAPACITY (GPH & LPH)

40°F	22°C	60°F	33°C	80°F	44°C	100°F	56°C	120°F	67°C	140°F	78°C
4367	16506	2911	11004	2183	8253	1747	6603	1456	5502	1248	4716

Flow GPM		Temp. Rise** (°F)		Vent Length (Equiv. Ft.)		Air Inlet Length (Equiv. Ft.)	
Min	Max	Min	Max	Min	Max	Min	Max
48.3	144.8	20	60	8	160	0	160

** Min/Max delta t reflects boiler operation at full input. For applications requiring operation above/below these parameters please consult factory.

REP FIRM _____

SUBMITTED BY _____

JOB NAME _____

ARCHITECT _____

ENGINEER _____

CONTRACTOR _____

DATE _____

TORUS 1500 VERTICAL

Category II or Category IV Appliance
(see Installation and Operation Manual for venting information)

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TORUS 2000 VERTICAL

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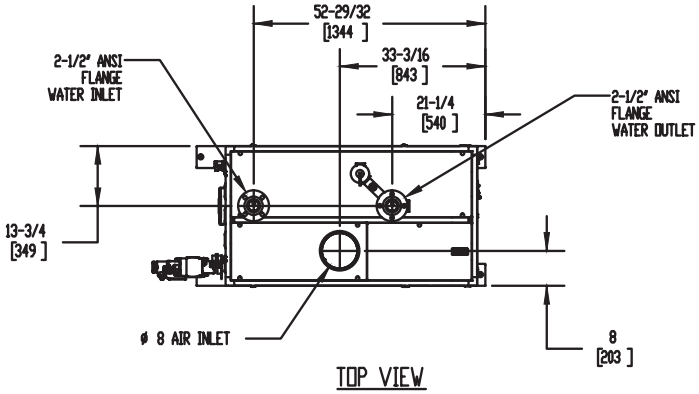
(see Installation and Operation Manual for venting information)

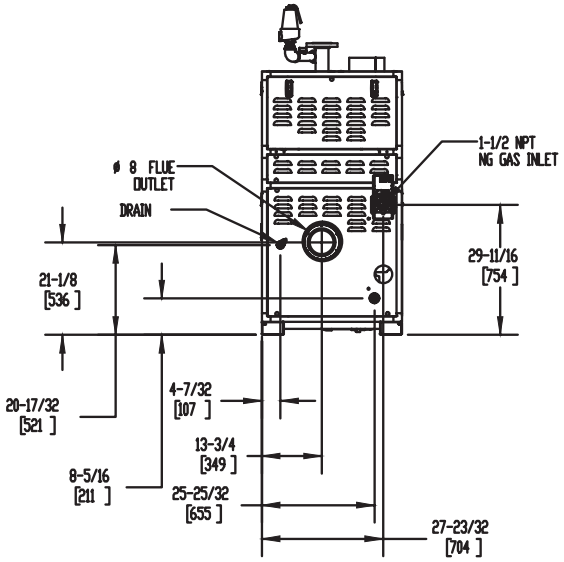
CODE OPTIONS

CSD-1	FIRMWARE W/REMOTE TEST MANUAL RESET LWCO

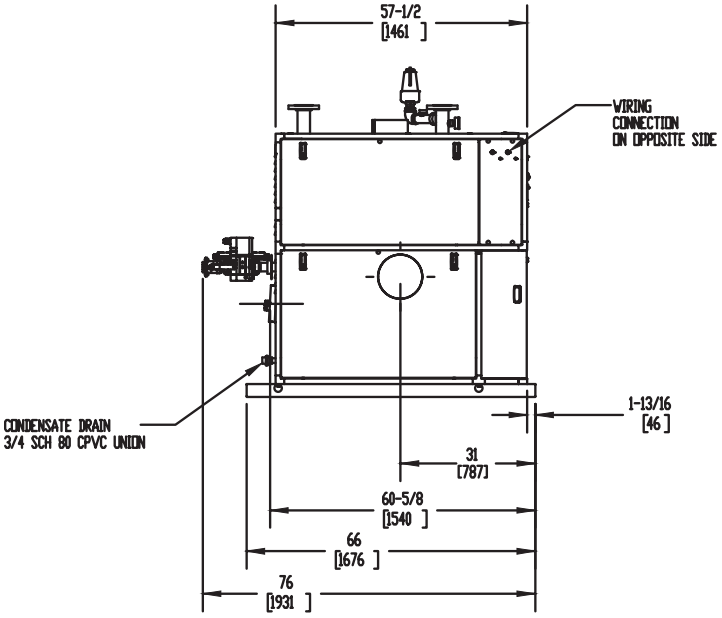
INDOOR UNIT



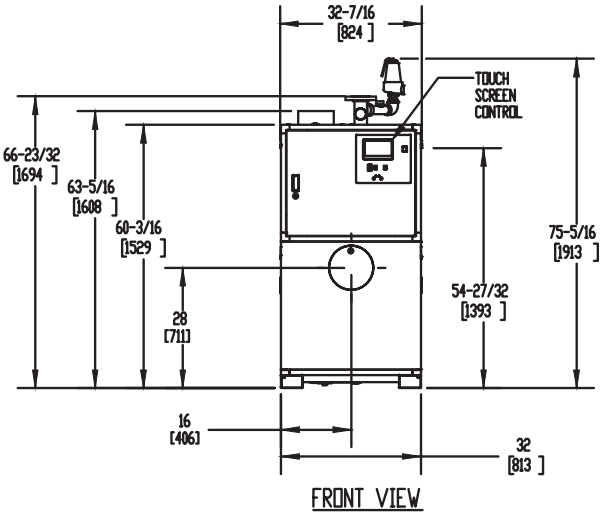
TOP VIEW



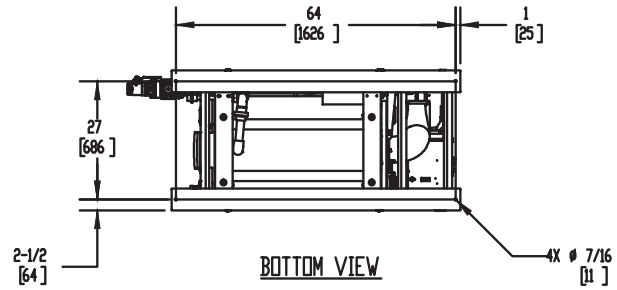
BACK VIEW



LEFT SIDE VIEW



FRONT VIEW



BOTTOM VIEW

Notes:
1. Dimensions are approximate and should not be used to "rough-in" equipment.
2. Dimensions are subject to change without notice.
3. All dimensions are in inches (mm).
4. ⊕ Symbol indicates center of gravity.

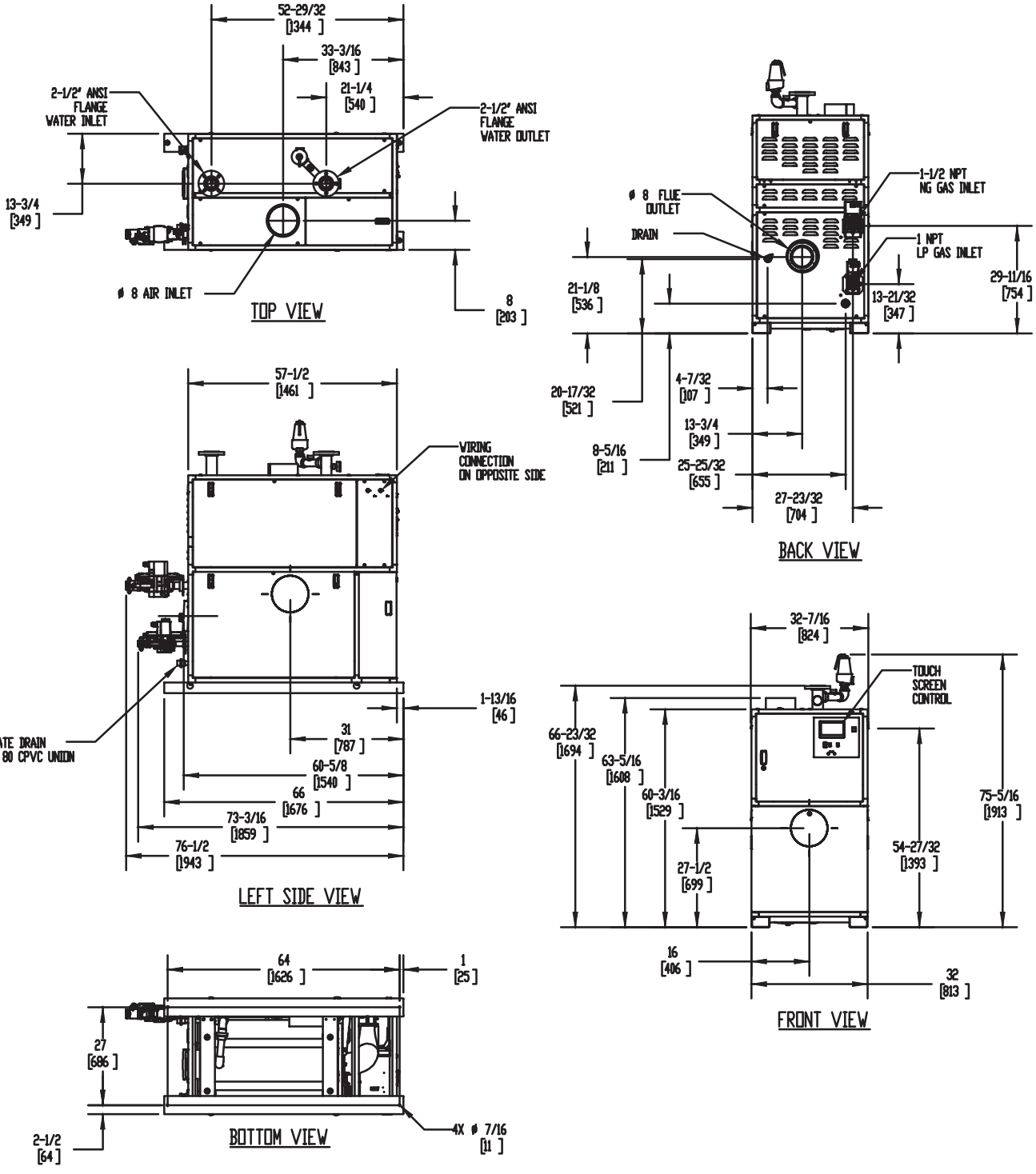
TORUS 2000 VERTICAL

Category II or Category IV Appliance
(see Installation and Operation Manual for venting information)

CODE OPTIONS

CSD-1	FIRMWARE W/REMOTE TEST MANUAL RESET LWCO

DUAL FUEL UNIT



Notes:
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2. Dimensions are subject to change without notice.
3. All dimensions are in inches (mm).
4. ⊕ Symbol indicates center of gravity.

BOILER CERTIFIED RATINGS & CAPACITIES

Fuel Type	Natural/Propane Gas	**Boiler FLA**	25.6
Input BTU/hr.	1,999,000 / 586 kW	**Boiler HP**	57.66
Output BTU/hr.	1,929,035 / 565 kW	**Min. Gas Pressure Required**	4" W.C.
Electrical Requirements	230 VAC/60 Hz/1PH	**Max. Gas Pressure Allowed**	14" W.C.
		Operating Weight	1388 lbs / 630 kg

BOILER TRIM & CONTROLS

Main Gas Valve	Dungs MBC	**Air Switch**	Huba
Firing Valve	1 1/2" Apollo	**Flow Switch**	SIKA
Ignition Control	Fenwal	**Blocked Flue Switch**	Cleveland NS2
Operating Control	HeatNet®	**Blower Motor**	Ametek
High Limit	Jumo	**L.W.C.O.**	800
Main Ball Valve	1 1/2" Apollo	**Relief Valve (WB)**	1" x 1-1/4" set @ 50 psi
Pump contactor strongly recommended for water heater applications.		**Relief Valve (WW)**	1" x 1" set @ 125 psi

A.S.M.E.

ASME Sect IV Fire Side Htg Surface	153.19 Sq. Ft. / 14.23 Sq. M.	**Design Data**	Max. 160 psig & 210°F
		Water Volume	16.9 gal. / 64 Liters
ASME Sect IV Water Side Htg Surface	141.93 Sq. Ft. / 13.19 Sq. M.		

* Add circulator amps.

BOILER TEMPERATURE RISE / PRESSURE DROP (Based on Full Input)

20°F / 11.1°C				30°F / 16.7°C				40°F / 22.2°C				50°F / 27.8°C				60°F / 33.3°C			
Flow Rate		Pressure Drop		Flow Rate		Pressure Drop		Flow Rate		Pressure Drop		Flow Rate		Pressure Drop		Flow Rate		Pressure Drop	
GPM	L/s	Ft	kPa	GPM	L/s	Ft	kPa	GPM	L/s	Ft	kPa	GPM	L/s	Ft	kPa	GPM	L/s	Ft	kPa
193.0	12.2	20.1	60.1	128.7	8.1	9.9	29.7	96.5	6.1	6.1	18.2	77.2	4.9	4.2	12.5	64.3	4.1	3.1	9.2

WATER HEATER HOURLY RECOVERY CAPACITY (GPH & LPH)

40°F	22°C	60°F	33°C	80°F	44°C	100°F	56°C	120°F	67°C	140°F	78°C
5819	21997	3880	14665	2910	10999	2328	8799	1940	7332	1663	6285

Flow GPM		Temp. Rise** (°F)		Vent Length (Equiv. Ft.)		Air Inlet Length (Equiv. Ft.)	
Min	Max	Min	Max	Min	Max	Min	Max
64.3	193.0	20	60	8	160	0	160

** Min/Max delta t reflects boiler operation at full input. For applications requiring operation above/below these parameters please consult factory.

REP FIRM _____

SUBMITTED BY _____

JOB NAME _____

ARCHITECT _____

ENGINEER _____

CONTRACTOR _____

DATE _____

TORUS 2000 VERTICAL

Category II or Category IV Appliance
(see Installation and Operation Manual for venting information)

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RELIABLE. BOLD. INNOVATIVE.

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Westfield, MA 01085
(413) 564-5515

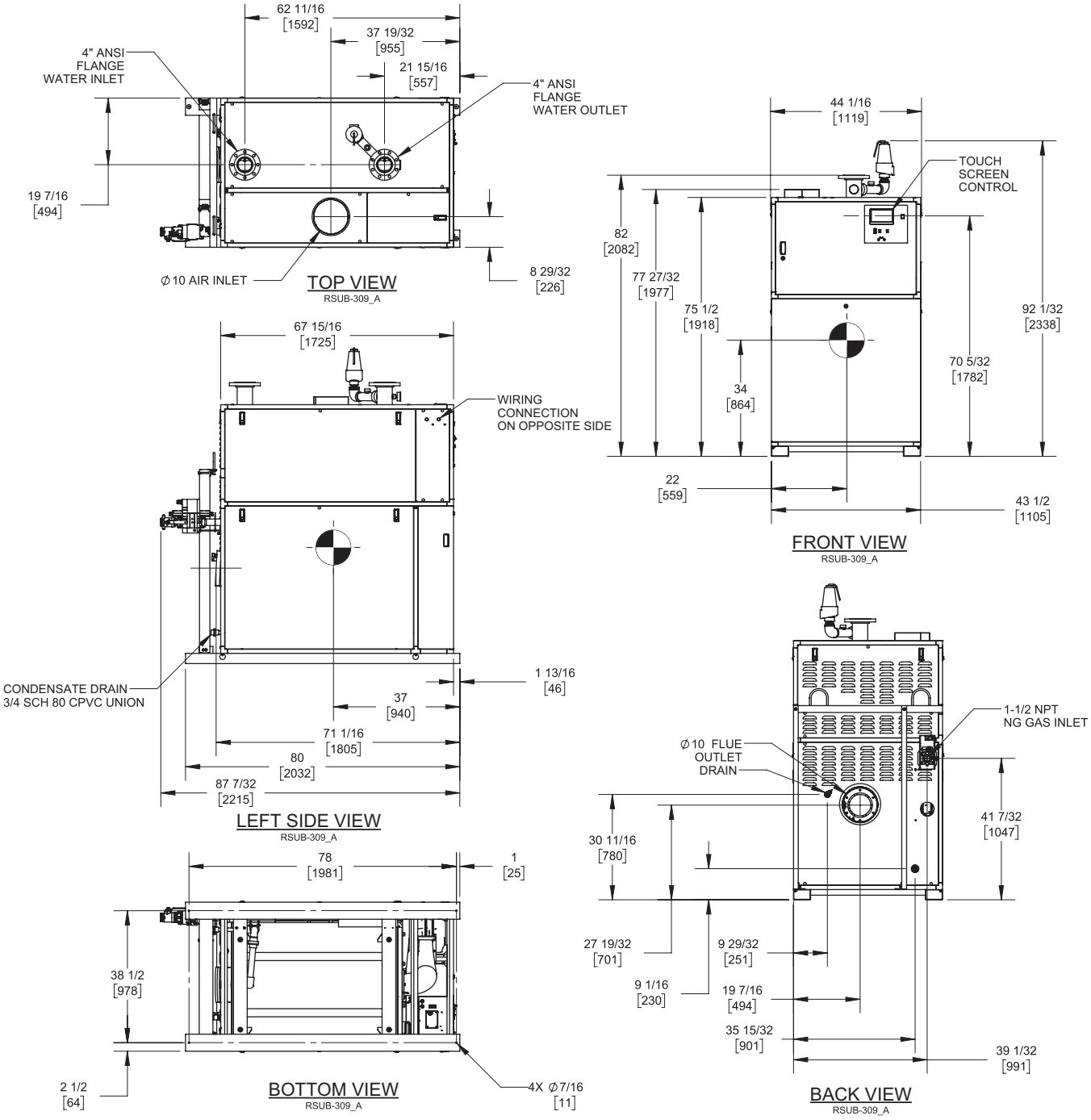
TORUS 2500 VERTICAL

Category II or Category IV Appliance
(see Installation and Operation Manual for venting information)

CODE OPTIONS

CSD-1	FIRMWARE W/REMOTE TEST MANUAL RESET LWCO

INDOOR UNIT



Notes:
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2. Dimensions are subject to change without notice.
3. All dimensions are in inches (mm).
4. ◒ Symbol indicates center of gravity.

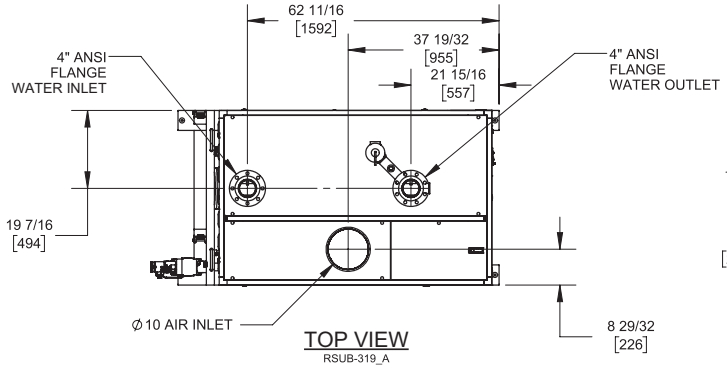
TORUS 2500 VERTICAL

Category II or Category IV Appliance
(see Installation and Operation Manual for venting information)

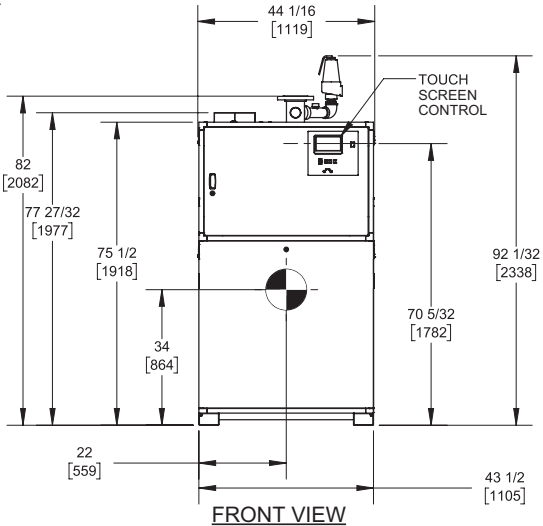
CODE OPTIONS

CSD-1	FIRMWARE W/REMOTE TEST MANUAL RESET LWCO

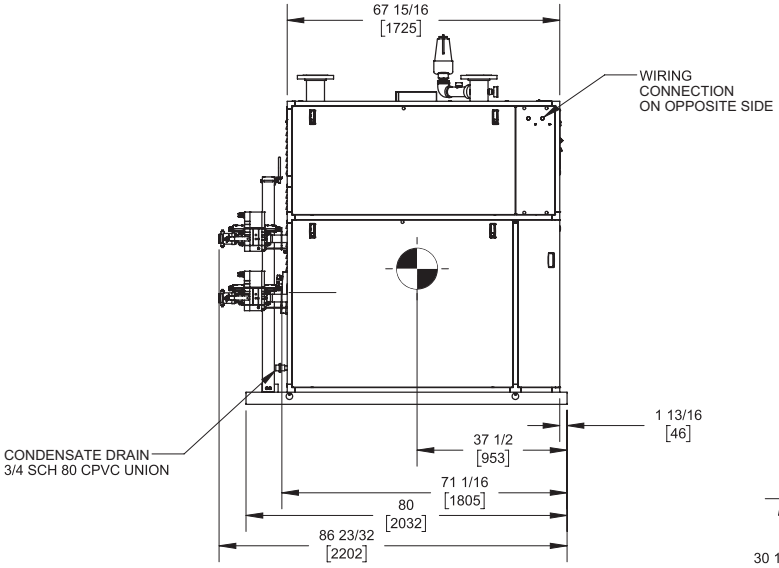
DUAL FUEL UNIT



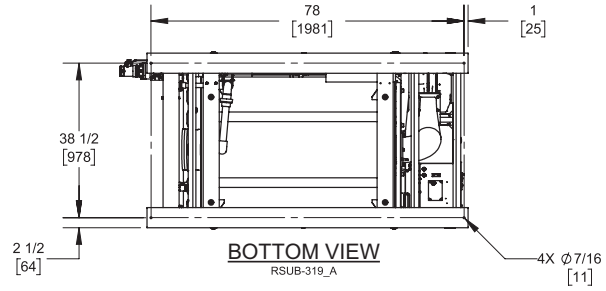
TOP VIEW
RSUB-319_A



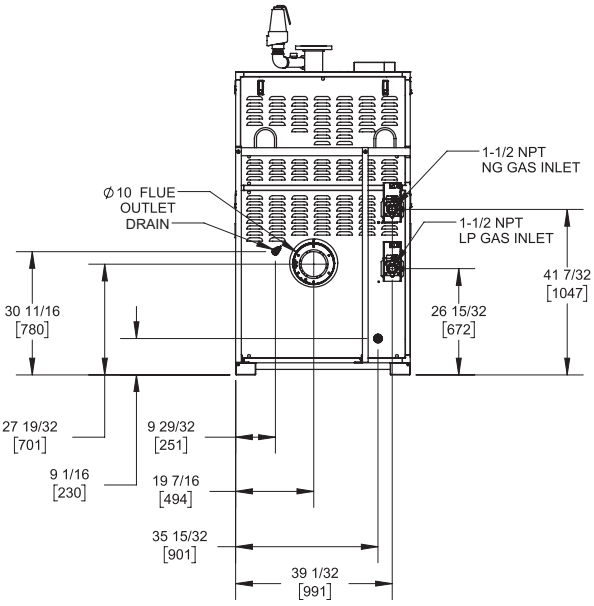
FRONT VIEW
RSUB-319_A



LEFT SIDE VIEW
RSUB-319_A



BOTTOM VIEW
RSUB-319_A



BACK VIEW
RSUB-319_A

Notes:
1. Dimensions are approximate and should not be used to "rough-in" equipment.
2. Dimensions are subject to change without notice.
3. All dimensions are in inches (mm).
4. ⊕ Symbol indicates center of gravity.

BOILER CERTIFIED RATINGS & CAPACITIES

Fuel Type	Natural/Propane Gas	**Boiler FLA**	15.05*
Input BTU/hr.	2,500,000 / 733 kW	**Boiler HP**	72.45
Output BTU/hr.	2,435,000 / 713 kW	**Min. Gas Pressure Required**	4" W.C.
Electrical Requirements	230 VAC/60 Hz/3PH	**Max. Gas Pressure Allowed**	14" W.C.
		Operating Weight	2311 lbs / 1048 kg

BOILER TRIM & CONTROLS

Main Gas Valve	Dungs MBC	**Air Switch**	Huba
Firing Valve	1 1/2" Apollo	**Flow Switch**	SIKA
Ignition Control	Fenwal	**Blocked Flue Switch**	Cleveland NS2
Operating Control	HeatNet®	**Blower Motor**	Ametek
High Limit	Jumo	**L.W.C.O.**	800
Main Ball Valve	1 1/2" Apollo	**Relief Valve (WB)**	1" x 1 1/2" set @ 50 psi
Pump contactor strongly recommended for water heater applications.		**Relief Valve (WW)**	1 1/2" x 1 1/2" set @ 125 psi

A.S.M.E.

ASME Sect IV Fire Side Htg Surface	300.69 Sq. Ft. / 27.94 Sq. M.	**Design Data**	Max. 160 psig & 210°F
		Water Volume	24.9 gal. / 94.3 Liters
ASME Sect IV Water Side Htg Surface	277.23 Sq. Ft. / 25.76 Sq. M.		

* Add circulator amps.

BOILER TEMPERATURE RISE / PRESSURE DROP (Based on Full Input)

20°F / 11.1°C				30°F / 16.7°C				40°F / 22.2°C				50°F / 27.8°C				60°F / 33.3°C			
Flow Rate		Pressure Drop		Flow Rate		Pressure Drop		Flow Rate		Pressure Drop		Flow Rate		Pressure Drop		Flow Rate		Pressure Drop	
GPM	L/s	Ft	kPa	GPM	L/s	Ft	kPa	GPM	L/s	Ft	kPa	GPM	L/s	Ft	kPa	GPM	L/s	Ft	kPa
237.3	15.0	15.5	46.5	158.2	10.0	8.8	26.4	118.6	7.5	5.9	17.7	94.9	6.0	4.4	13.0	79.1	5.0	3.4	10.0

WATER HEATER HOURLY RECOVERY CAPACITY (GPH & LPH)

40°F	22°C	60°F	33°C	80°F	44°C	100°F	56°C	120°F	67°C	140°F	78°C
7278	27511	4852	18340	3639	13755	2911	11004	2426	9170	2079	7860

Flow GPM		Temp. Rise** (°F)		Vent Length (Equiv. Ft.)		Air Inlet Length (Equiv. Ft.)	
Min	Max	Min	Max	Min	Max	Min	Max
79.1	237.3	20	60	10	160	0	160

** Min/Max delta t reflects boiler operation at full input. For applications requiring operation above/below these parameters please consult factory.

REP FIRM _____

SUBMITTED BY _____

JOB NAME _____

ARCHITECT _____

ENGINEER _____

CONTRACTOR _____

DATE _____

TORUS 2500 VERTICAL

Category II or Category IV Appliance
(see Installation and Operation Manual for venting information)

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A Division of Mestek, Inc.
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(413) 564-5515

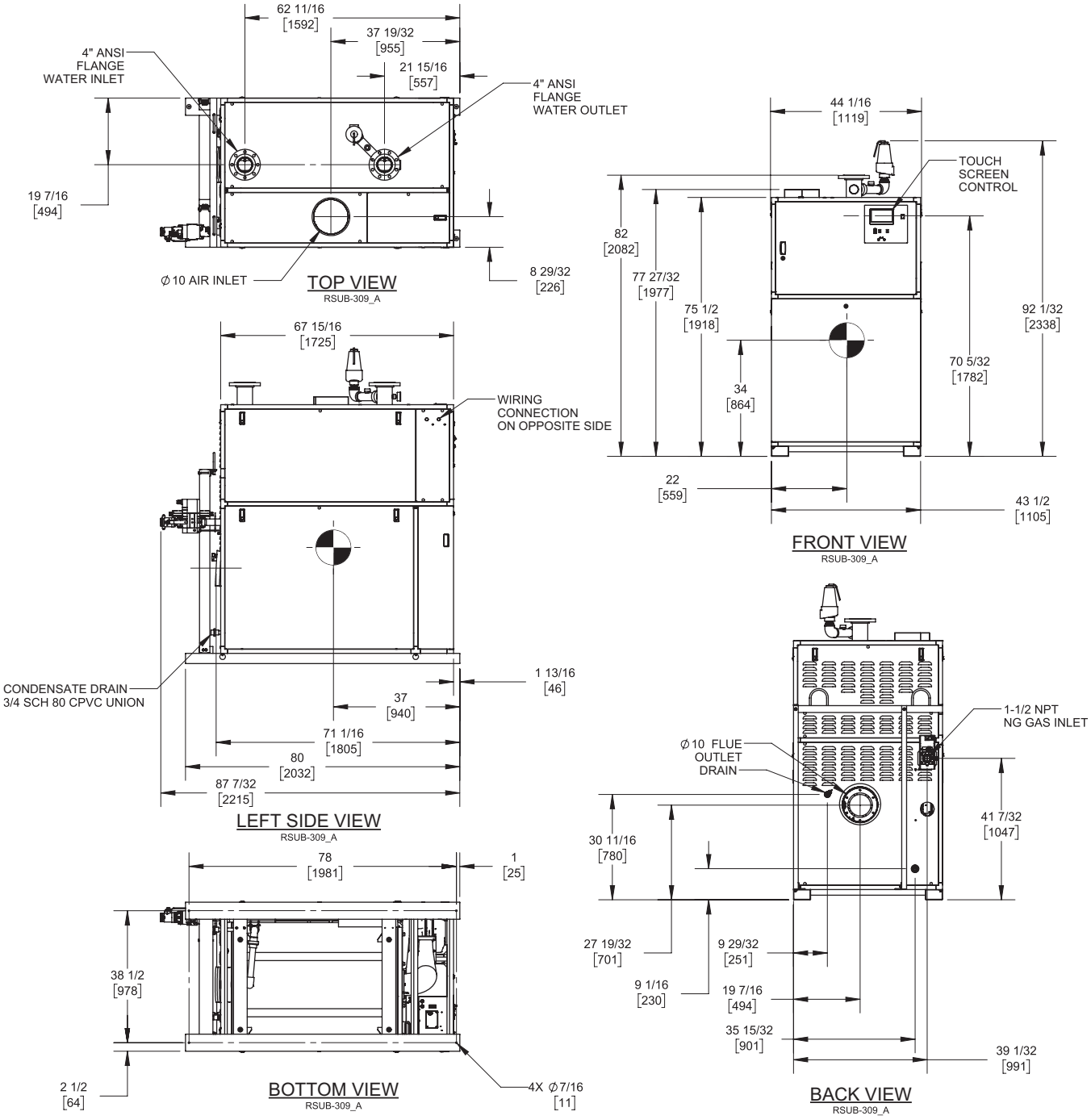
TORUS 3000 VERTICAL

Category II or Category IV Appliance
(see Installation and Operation Manual for venting information)

CODE OPTIONS

CSD-1	FIRMWARE W/REMOTE TEST MANUAL RESET LWCO

INDOOR UNIT



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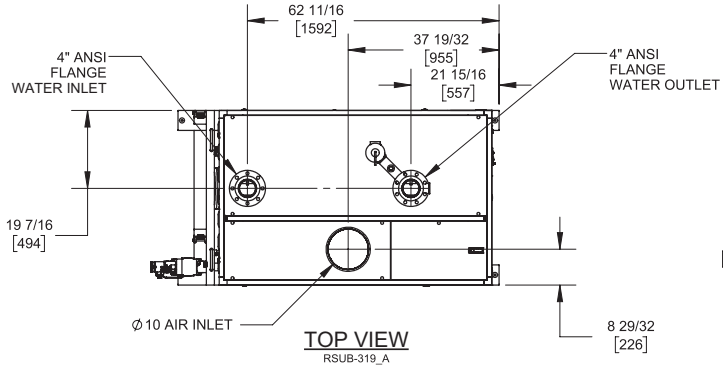
TORUS 3000 VERTICAL

Category II or Category IV Appliance
(see Installation and Operation Manual for venting information)

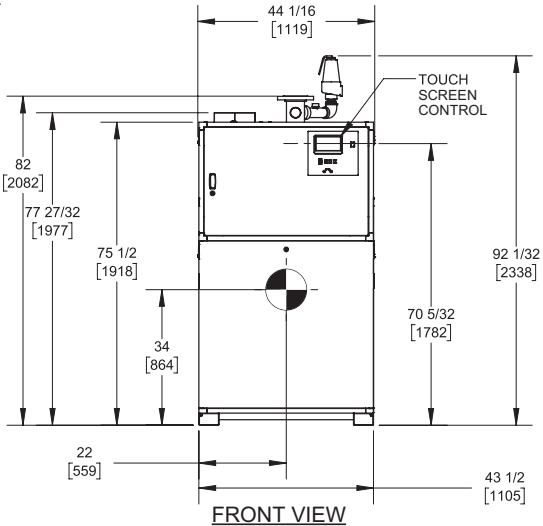
CODE OPTIONS

CSD-1	FIRMWARE W/REMOTE TEST MANUAL RESET LWCO

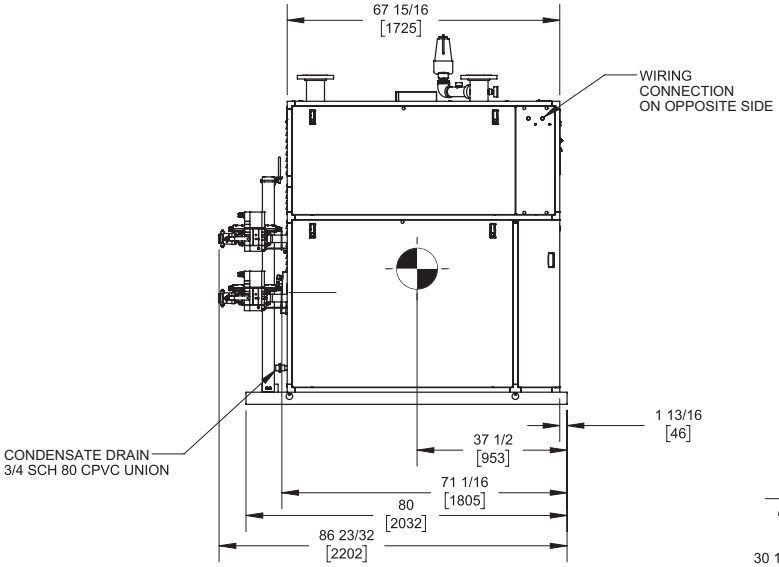
DUAL FUEL UNIT



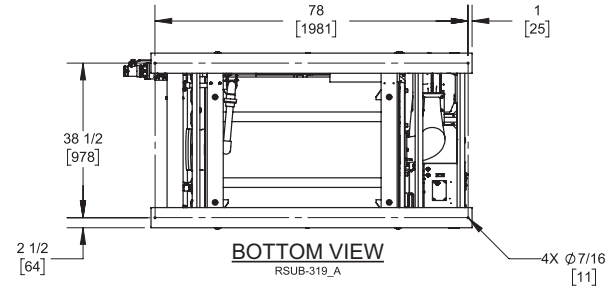
TOP VIEW
RSUB-319_A



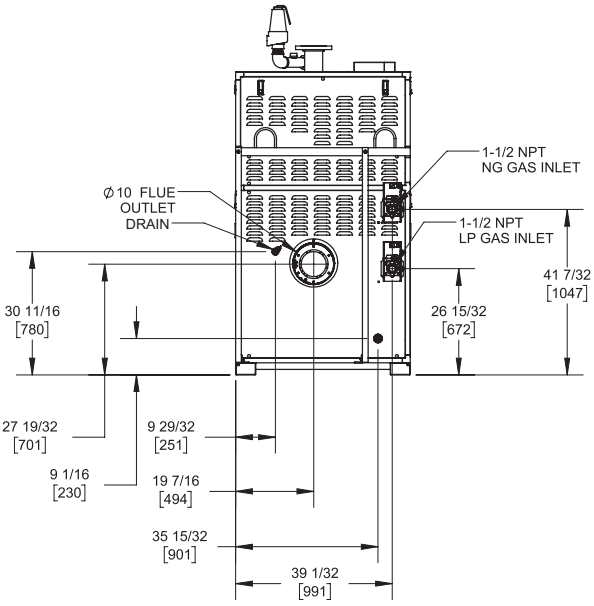
FRONT VIEW
RSUB-319_A



LEFT SIDE VIEW
RSUB-319_A



BOTTOM VIEW
RSUB-319_A



BACK VIEW
RSUB-319_A

Notes:
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3. All dimensions are in inches (mm).
4. ⊕ Symbol indicates center of gravity.

BOILER CERTIFIED RATINGS & CAPACITIES

Fuel Type	Natural/Propane Gas	**Boiler FLA**	15.05*
Input BTU/hr.	3,000,000 / 879 kW	**Boiler HP**	87.39
Output BTU/hr.	2,925,000 / 857 kW	**Min. Gas Pressure Required**	4" W.C.
Electrical Requirements	230 VAC/60 Hz/3PH	**Max. Gas Pressure Allowed**	14" W.C.
		Operating Weight	2311 lbs / 1048 kg

BOILER TRIM & CONTROLS

Main Gas Valve	Dungs MBC	**Air Switch**	Huba
Firing Valve	1 1/2" Apollo	**Flow Switch**	SIKA
Ignition Control	Fenwal	**Blocked Flue Switch**	Cleveland NS2
Operating Control	HeatNet®	**Blower Motor**	Ametek
High Limit	Jumo	**L.W.C.O.**	800
Main Ball Valve	1 1/2" Apollo	**Relief Valve (WB)**	1" x 1 1/2" set @ 50 psi
Pump contactor strongly recommended for water heater applications.		**Relief Valve (WW)**	1 1/2" x 1 1/2" set @ 125 psi

A.S.M.E.

ASME Sect IV Fire Side Htg Surface	300.69 Sq. Ft. / 27.94 Sq. M.	**Design Data**	Max. 160 psig & 210°F
		Water Volume	24.9 gal. / 94.3 Liters
ASME Sect IV Water Side Htg Surface	277.23 Sq. Ft. / 25.76 Sq. M.		

* Add circulator amps.

BOILER TEMPERATURE RISE / PRESSURE DROP (Based on Full Input)

20°F / 11.1°C				30°F / 16.7°C				40°F / 22.2°C				50°F / 27.8°C				60°F / 33.3°C			
Flow Rate		Pressure Drop		Flow Rate		Pressure Drop		Flow Rate		Pressure Drop		Flow Rate		Pressure Drop		Flow Rate		Pressure Drop	
GPM	L/s	Ft	kPa	GPM	L/s	Ft	kPa	GPM	L/s	Ft	kPa	GPM	L/s	Ft	kPa	GPM	L/s	Ft	kPa
292.6	18.5	21.0	62.7	195.1	12.3	11.8	35.3	146.3	9.2	7.9	23.7	117.0	7.4	5.8	17.4	97.5	6.2	4.5	13.5

WATER HEATER HOURLY RECOVERY CAPACITY (GPH & LPH)

40°F	22°C	60°F	33°C	80°F	44°C	100°F	56°C	120°F	67°C	140°F	78°C
8824	33353	5882	22235	4412	16676	3529	13341	2941	11118	2521	9529

Flow GPM		Temp. Rise** (°F)		Vent Length (Equiv. Ft.)		Air Inlet Length (Equiv. Ft.)	
Min	Max	Min	Max	Min	Max	Min	Max
97.5	292.6	20	60	10	160	0	160

** Min/Max delta t reflects boiler operation at full input. For applications requiring operation above/below these parameters please consult factory.

REP FIRM _____

SUBMITTED BY _____

JOB NAME _____

ARCHITECT _____

ENGINEER _____

CONTRACTOR _____

DATE _____

TORUS 3000 VERTICAL

Category II or Category IV Appliance
(see Installation and Operation Manual for venting information)

RBI®
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A Division of Mestek, Inc.
Westfield, MA 01085
(413) 564-5515

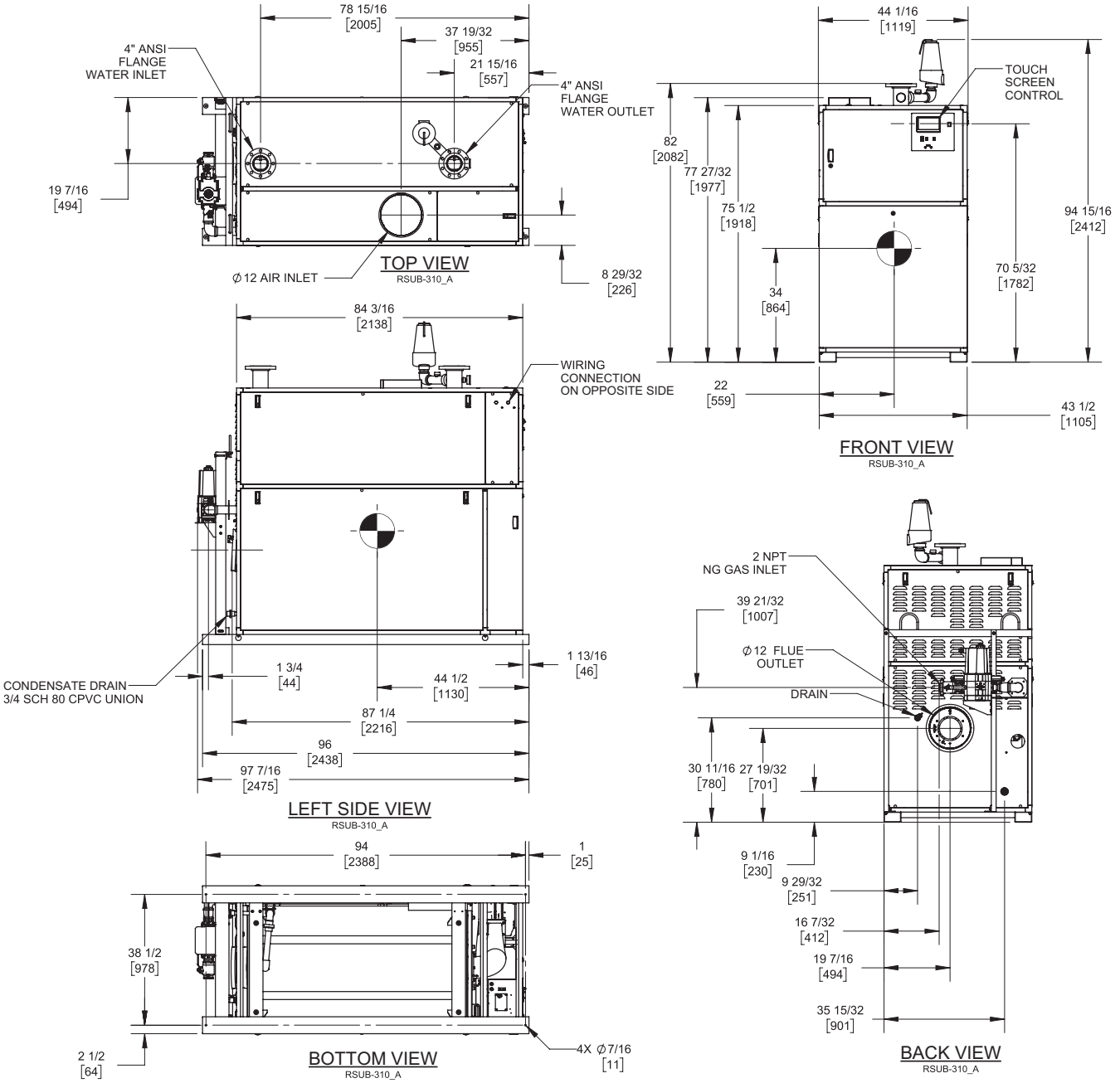
TORUS 4000 VERTICAL

Category II or Category IV Appliance
(see Installation and Operation Manual for venting information)

CODE OPTIONS

CSD-1	FIRMWARE W/REMOTE TEST MANUAL RESET LWCO

INDOOR UNIT



Notes:
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3. All dimensions are in inches (mm).
4. ⊕ Symbol indicates center of gravity.

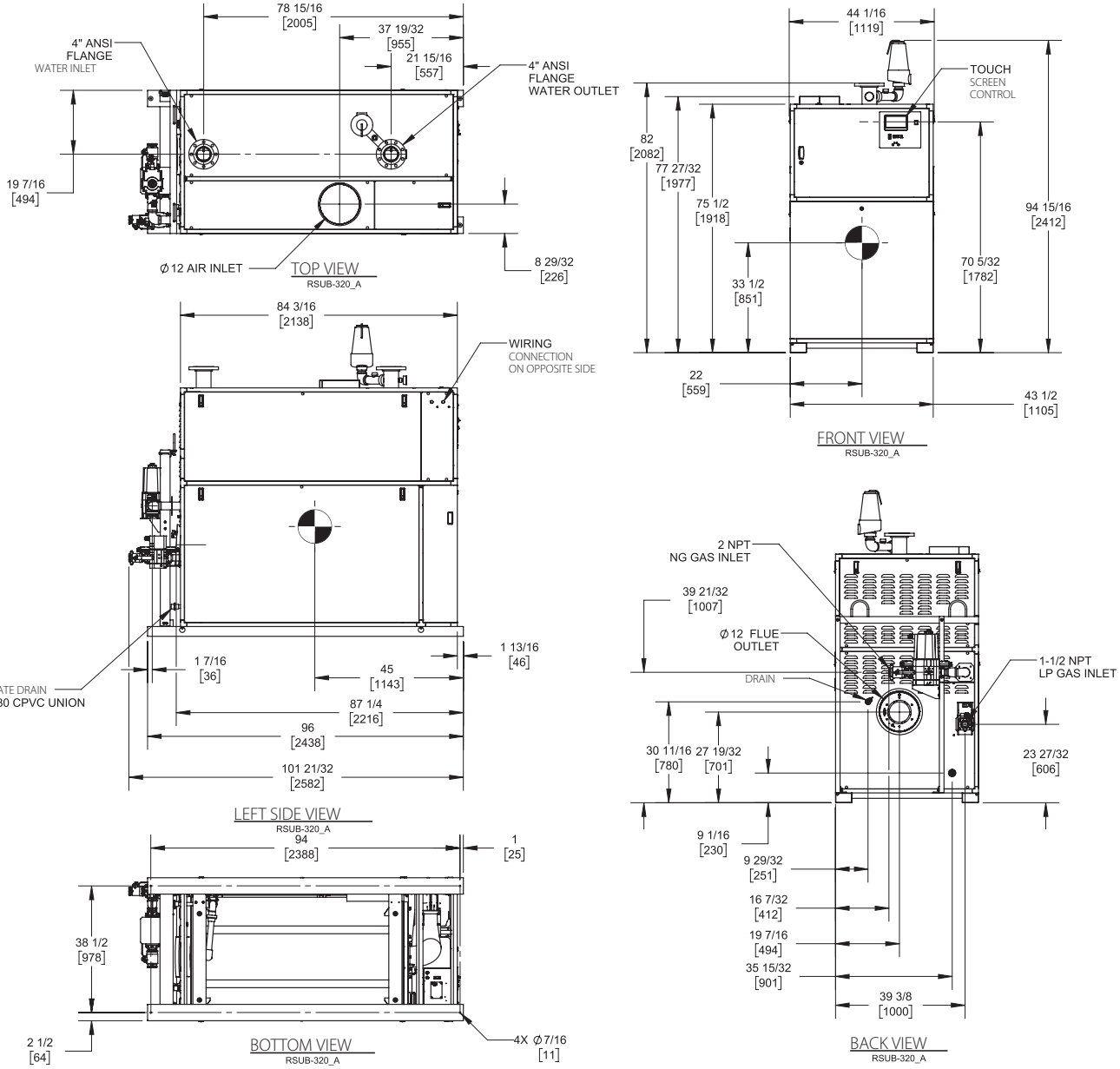
TORUS 4000 VERTICAL

Category II or Category IV Appliance
(see Installation and Operation Manual for venting information)

CODE OPTIONS

CSD-1	FIRMWARE W/REMOTE TEST MANUAL RESET LWCO

DUAL FUEL UNIT



Notes:
1. Dimensions are approximate and should not be used to "rough-in" equipment.
2. Dimensions are subject to change without notice.
3. All dimensions are in inches (mm).
4. ⊕ Symbol indicates center of gravity.

BOILER CERTIFIED RATINGS & CAPACITIES

Fuel Type	Natural/Propane Gas	**Boiler FLA**	19.9*
Input BTU/hr.	4,000,000 / 1172kW	**Boiler HP**	116.52
Output BTU/hr.	3,900,000 / 1143 kW	**Min. Gas Pressure Required**	4" W.C.
Electrical Requirements	230 VAC/60 Hz/3PH	**Max. Gas Pressure Allowed**	14" W.C.
		Operating Weight	2866 lbs / 1300 kg

BOILER TRIM & CONTROLS

Main Gas Valve	Dungs MBC	**Air Switch**	Huba
Firing Valve	2" Apollo	**Flow Switch**	SIKA
Ignition Control	Fenwal	**Blocked Flue Switch**	Cleveland NS2
Operating Control	HeatNet®	**Blower Motor**	Ametek
High Limit	Jumo	**L.W.C.O.**	800
Main Ball Valve	2" Apollo	**Relief Valve (WB)**	1" x 1 1/2" set @ 50 psi
Pump contactor strongly recommended for water heater applications.		**Relief Valve (WW)**	1 1/2" x 1 1/2" set @ 125 psi

A.S.M.E.

ASME Sect IV Fire Side Htg Surface	402.93 Sq. Ft. / 37.43 Sq. M.	**Design Data**	Max. 160 psig & 210°F
		Water Volume	41.3 gal. / 156.3 Liters
ASME Sect IV Water Side Htg Surface	371.25 Sq. Ft. / 34.49 Sq. M.		

* Add circulator amps.

BOILER TEMPERATURE RISE / PRESSURE DROP (Based on Full Input)

20°F / 11.1°C				30°F / 16.7°C				40°F / 22.2°C				50°F / 27.8°C				60°F / 33.3°C			
Flow Rate		Pressure Drop		Flow Rate		Pressure Drop		Flow Rate		Pressure Drop		Flow Rate		Pressure Drop		Flow Rate		Pressure Drop	
GPM	L/s	Ft	kPa	GPM	L/s	Ft	kPa	GPM	L/s	Ft	kPa	GPM	L/s	Ft	kPa	GPM	L/s	Ft	kPa
390.2	24.6	19.9	59.6	260.1	16.4	10.1	30.2	195.1	12.3	6.5	19.3	156.1	9.8	4.7	14.0	130.1	8.2	3.7	10.9

WATER HEATER HOURLY RECOVERY CAPACITY (GPH & LPH)

40°F	22°C	60°F	33°C	80°F	44°C	100°F	56°C	120°F	67°C	140°F	78°C
11765	44471	7843	29647	5882	22235	4706	17788	3922	14824	3361	12706

Flow GPM		Temp. Rise** (°F)		Vent Length (Equiv. Ft.)		Air Inlet Length (Equiv. Ft.)	
Min	Max	Min	Max	Min	Max	Min	Max
130.1	390.2	20	60	12	160	0	160

** Min/Max delta t reflects boiler operation at full input. For applications requiring operation above/below these parameters please consult factory.

REP FIRM _____

SUBMITTED BY _____

JOB NAME _____

ARCHITECT _____

ENGINEER _____

CONTRACTOR _____

DATE _____

TORUS 4000 VERTICAL

Category II or Category IV Appliance
(see Installation and Operation Manual for venting information)

RBI®
RELIABLE. BOLD. INNOVATIVE.

A Division of Mestek, Inc.
Westfield, MA 01085
(413) 564-5515

Date
03/05/2021
Project Name
OM Union Beach BOE 3-5-21
Project Number
Client / Purchaser

Submittal Summary Page

Qty	Tag #	Model #	Description
2		ZJ180N40D4A1AAA1A1	15 Ton, York Large Sunline Single Packaged R-410A Air Conditioner, Four Stage Cooling, 12.2 EER, 400 MBH Input Aluminized Steel, Two Stage Gas Heat, 460-3-60, Single Wall Construction • Includes fresh air hood with baffle that can be set for 10, 15, or 25% outside air. • 5 HP High Static Belt Drive Blower • 2" Throwaway Filters • Smart Equipment Controller including Discharge Air, Return Air, and Outdoor Air Temperature Sensors. • Standard Condenser Coil • Standard Evaporator Coil • Standard Access Doors • Galvanized Steel Drain Pan
2		2EC0402	Kit, Dual Enthalpy Field Installed (Includes two humidity sensors)
2		2EE04710924	Dry Bulb Economizer (Hood Kit included for field assembly and installation)
1		Freight	Freight

Equipment start-up and commissioning by a factory trained technician is recommended.
Contact your supplying distributor or sales representative for additional information & guidance.

WARNING: Cancer and Reproductive Harm - www.P65Warnings.ca.gov

Large Sunline 15-25 Ton Package

York Single Package R-410A Air Conditioner

Project Name: **OM Union Beach BOE 3-5-21**

Unit Model #: **ZJ180N40D4A1AAA1A1**

Quantity: **2**

System: **ZJ180N40D4A1AAA1A1**

No Performance Data Available

Run Performance to view metrics

15 Ton

- York Sunline Units are Manufactured at an ISO 9001 Registered Facility and Each Rooftop is Completely Computer-Run Tested Prior to Shipment.

Unit Features

- Four Stage Cooling
- 400 MBH Input Aluminized Steel, Two Stage Gas Heat
- Unit Cabinet Constructed of Powder Painted Steel, Certified At 750 Hours Salt Spray Test (ASTM B-117 Standards).
- Either Supply and/or Return can be Field Converted from Vertical to Horizontal Configuration without Cutting Panels
- Full Perimeter Base Rails with Built in Rigging Capabilities
- Four Independent Refrigerant Circuits for Efficient Part Load Operation with Scroll Compressors
- 5 HP High Static Belt Drive Blower
- Solid Core Liquid Line Filter Driers
- Unit Ships with 2" Throwaway Filters
- Replacement Filters: For 2" filters 12 - (12" x 24" x 2") OR For 4" filters 2 - (20" X 24" x 4") AND 4 - (24" X 24" x 4")
- Single Point Power Connection
- Through-the-Curb and Through-The-Base Utility Connections
- Short Circuit Current: 5kA RMS Symmetrical
- Standard Condenser Coil
- Standard Evaporator Coil
- Crane Required to Unload Unit
- Galvanized Steel Drain Pan
- Standard Access Doors

Standard Unit Controller: Smart Equipment Control Board

- Safety Monitoring - Monitors the High and Low-Pressure Switches, the Freezestats, the Gas Valve, if Applicable, and the Temperature Limit Switch on Gas and Electric Heat Units. The Unit Control Board will Alarm on Ignition Failures, Safety Lockouts and Repeated Limit Switch Trips.
- An Integrated Low-Ambient Control, Anti-Short Cycle Protection, Lead-Lag, Fan On and Fan off Delays, Low Voltage Protection, On-Board Diagnostic and Fault Code Display. Allows all units to operate in the cooling mode down to 0 °F outdoor ambient without additional components or intervention.

BAS Controller

- Smart Equipment Controller including Discharge Air, Return Air, and Outdoor Air Temperature Sensors.

Warranty

- One (1) Year Limited Warranty on the Complete Unit
- Five (5) Year Warranty - Compressors and Electric Heater Elements
- Ten (10) Year Warranty - Aluminized Steel Tubular Heat Exchangers

Large Sunline 15-25 Ton Package

York Single Package R-410A Air Conditioner

Project Name: **OM Union Beach BOE 3-5-21** Unit Model #: **ZJ180N40D4A1AAA1A1**

Quantity: **2** System: **ZJ180N40D4A1AAA1A1**

Factory Installed Options

ZJ180N40D4A1AAA1A1

Equipment Options		Option(s) Selected
Product Category:	**ZJ**	York Large Sunline Single Packaged R-410A Air Conditioner 12.2 EER
Nominal Cooling Capacity:	**180**	15 Ton Four Stage Cooling
Heat Type and Nominal Heat Capacity:	**N40**	400 MBH Input Aluminized Steel, Two Stage Gas Heat
Blower Option:	**D**	5 HP High Static Belt Drive Blower
Voltage:	**4**	460-3-60
Outside Air Option:	**A**	Includes fresh air hood with baffle that can be set for 10, 15, or 25% outside air.
Service Options:	**1**	
Sensor Options:	**A**	
Controls:	**A**	Smart Equipment Controller including Discharge Air, Return Air, and Outdoor Air Temperature Sensors.
Refrigeration:	**A**	Standard Condenser Coil Standard Evaporator Coil
Additional Options:	**1**	2" Throwaway Filters
Cabinet Options:	**A**	Single Wall Construction Standard Access Doors Galvanized Steel Drain Pan
Product Generation:	**1**	

Field Installed Accessories

- ○ 1BD0404 - Burglar Bars (51.0 lbs)
- ○ 1CG0421 - Coil Guard (15.0 lbs)
- ○ 1CV0406 - Concentric Diffuser,Flush Mount,18X36
- ○ 1CV0407 - Concentric Diffuser,Flush Mount,24X28
- ○ 1CV0415 - Concentric Diffuser,Side Discharge,18X36
- ○ 1CV0416 - Concentric Diffuser,Side Discharge,24X48
- ○ 1CV0421 - Concentric Diffuser,Specialty,28X28
- ○ 1CV0422 - Concentric Diffuser,Specialty,30X30
- ○ 1CV0423 - Concentric Diffuser,Specialty,36X36
- ○ 1CV0427 - Concentric Diffuser,Specialty,28X28
- ○ 1EH0418 - Economizer Hood Kit-W/ Fresh Air Hood & Panel and Qty of 3 - 28" x 32 1/4" x 1" inch Filter (68.0 lbs)
- ○ 1FE0410 - Flue Extension Kit (37.0 lbs)
- ○ 1GP0403 - Gas Piping Kit (11.0 lbs)
- ○ 1HG0412 - Hail Guard Kit (48.0 lbs)
- ○ 1LD0460 - High Speed Drive Kit (8.0 lbs)
- ○ 1NP0418 - Natural Gas to Propane Conversion Kit (2-Stage) (1.0 lbs)
- ○ 1RC0437 - Roof Curb - 14" High, Flat, Uninsulated, Full Perimeter (Shipped Knocked Down) (185.0 lbs)
- ○ 1RC0497 - Roof Curb 14” High Full Perimeter Transition Curb with wood nailer. Allow replacement of ZF180 / J15ZF / ZS-15 / ZST15 with other Large Sunline product. (135.0 lbs)
- ○ 1RD0413 - Barometric Relief Damper with Hood Kit (Downflow Unit or Duct Mounted) (47.0 lbs)
- ○ 1WS0404 - Wood Skid - Allows unit to be handled with 90 inch forks (210.0 lbs)

Large Sunline 15-25 Ton Package

York Single Package R-410A Air Conditioner

Project Name: **OM Union Beach BOE 3-5-21** Unit Model #: **ZJ180N40D4A1AAA1A1**

Quantity: **2** System: **ZJ180N40D4A1AAA1A1**

- ○ 2AP0402 - Air Proving Switch (1.0 lbs)
- ○ 2DF0403 - Dirty Filter Switch (1.0 lbs)
- ● 2EE04710924 - Dry Bulb Economizer (Hood Kit included for field assembly and installation) (200.0 lbs)
- ○ 2AQ04700524 - CO^2 Space Sensor - Wall Mount Accessory (5.0 lbs)
- ○ 2AQ04700624 - CO^2 Unit Mount Accessory (4.6 lbs)
- ○ 2EE04711124 - BAS Ready Dry Bulb Economizer (Hood Kit included for field assembly and installation)
- ○ 2ET077001124 - Honeywell T7350, 2 Heat / 4 Cool, Auto/Man Changeover, Electronic 7 Day Programmable (2.0 lbs)
- ○ 2LA04704533 - Low Ambient Kit (2.0 lbs)
- ○ 2MD04704924 - Motorized Damper (Hood Kit included for field assembly and installation) (275.0 lbs)
- ○ 2SD04700724 - Smoke Detector Kit w/ Mounting Hardware for Supply or Return Air (Horizontal/Downflow) (17.0 lbs)
- ○ S1-03102529000 - Non-Networking Wall Sensor – Allows remote sensing and control from single or multiple zones. (0.2 lbs)
- ○ S1-03102529004 - Non-Networking Wall Sensor with Over-ride button – Allows remote sensing and control from single or multiple zones. Override allows setpoint to be overridden for 2 hour time period. (0.2 lbs)
- ○ S1-03102529006 - Non-Networking Wall Sensor with Setpoint Adjustment and Over-ride Button – Allows remote sensing and control from single or multiple zones. Allows setpoint to be adjusted ± 5º F. Override allows setpoint to be overridden for 2 hour time period. (0.2 lbs)
- ○ S1-ADDWIRE - Add-a-Wire allows 5-wire thermostats to use only 4 wires. (0.3 lbs)
- ○ S1-CTSDTS - CTS Wired Temperature Sensor for thermostat | Duct *Also works for LX Series (0.3 lbs)
- ○ S1-CTSHTS - CTS Hardwired Temperature Sensor for CTS Thermostats *Works with LX series as well (0.2 lbs)
- ○ S1-CTSPLATE - Wall Plate for CTS Thermostats *Also works for new platform LX series models below (0.0 lbs)
- ○ S1-CTSWFTS - CTS Temperature Sensor with WiFi for CTS Thermostats *Also works with LX Series (0.1 lbs)
- ○ S1-LXLOCK - Locking Ring For LX-Series Thermostats (0.4 lbs)
- ○ S1-LXPLATE - Wall Plate For LX-Series Thermostats (0.0 lbs)
- ○ S1-LXWFM - For LX Series Thermostats - WiFi Communication (1.0 lbs)
- ○ S1-MP-PRTKIT-0P - MAP (Multiple Access Portal) Gateway Kit- Replacement MAP gateway protective case, lanyard and communication cable. Use only to replace worn or damaged components. (0.3 lbs)
- ○ S1-NSB8BHN041-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, No Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN043-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, No Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN141-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, Warmer/Cooler Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN143-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, Warmer/Cooler Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN240-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, Full Display, WHITE, JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN241-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, Full Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BHN243-0 - Wall Temperature and 3% Relative Humidity Combined Sensor, Full Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BPN240-0 - Wall Temperature and 2% Relative Humidity Combined Sensor, Full Display, WHITE, JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BPN241-0 - Wall Temperature and 2% Relative Humidity Combined Sensor, Full Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BPN243-0 - Wall Temperature and 2% Relative Humidity Combined Sensor, Full Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN041-0 - Wall Temperature Sensor, No Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN043-0 - Wall Temperature Sensor, No Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN141-0 - Wall Temperature Sensor, Warmer/Cooler Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN143-0 - Wall Temperature Sensor, Warmer/Cooler Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN240-0 - Wall Temperature Sensor, Full Display, WHITE, JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN241-0 - Wall Temperature Sensor, Full Display, WHITE, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-NSB8BTN243-0 - Wall Temperature Sensor, Full Display, BLACK, NO JCI LOGO, NS8000 Series (0.4 lbs)
- ○ S1-SE-COM1001-0 - Field Installed Communication Card for Simplicity SE control. Can be field configurable for BACnet, N2 or ModBUS MSTP (0.0 lbs)

Large Sunline 15-25 Ton Package

York Single Package R-410A Air Conditioner

Project Name: **OM Union Beach BOE 3-5-21** Unit Model #: **ZJ180N40D4A1AAA1A1**

Quantity: **2** System: **ZJ180N40D4A1AAA1A1**

- ○ S1-TEC3012-14-000 - 7 DAY PROGRAMMABLE THERMOSTAT, ZIGBEE PRO WIRELESS COMMUNICATION, FCU/VAV, ON/OFF OR FLOATING, DEHUMID, FULL COLOR, WHITE, JCI LOGO (0.8 lbs)
- ○ S1-TEC3012-16-000 - 7 DAY PROGRAMMABLE THERMOSTAT, ZIGBEE PRO WIRELESS COMMUNICATION, FCU/VAV, ON/OFF OR FLOATING, DEHUMID, FULL COLOR, WHITE, NO LOGO (0.8 lbs)
- ○ S1-TEC3013-14-000 - 7 DAY PROGRAMMABLE THERMOSTAT, ZIGBEE PRO WIRELESS COMMUNICATION, FCU/VAV, ON/OFF OR FLOATING, OCC & DEHUMID, FULL COLOR, WHITE, JCI LOGO (0.8 lbs)
- ○ S1-TEC3013-16-000 - 7 DAY PROGRAMMABLE THERMOSTAT, ZIGBEE PRO WIRELESS COMMUNICATION, FCU/VAV, ON/OFF OR FLOATING, OCC & DEHUMID, FULL COLOR, WHITE, NO LOGO (0.8 lbs)
- ○ S1-TEC3022-14-000 - 7 DAY PROGRAMMABLE THERMOSTAT, ZIGBEE PRO WIRELESS COMMUNICATION, FCU/VAV, 0-10VDC PROP, DEHUMID, FULL COLOR, WHITE, JCI LOGO (0.8 lbs)
- ○ S1-TEC3022-16-000 - 7 DAY PROGRAMMABLE THERMOSTAT, ZIGBEE PRO WIRELESS COMMUNICATION, FCU/VAV, 0-10VDC PROP, DEHUMID, FULL COLOR, WHITE, NO LOGO (0.8 lbs)
- ○ S1-TEC3023-14-000 - 7 DAY PROGRAMMABLE THERMOSTAT, ZIGBEE PRO WIRELESS COMMUNICATION, FCU/VAV, 0-10VDC PROP, OCC & DEHUMID, FULL COLOR, WHITE, JCI LOGO (0.8 lbs)
- ○ S1-TEC3023-16-000 - 7 DAY PROGRAMMABLE THERMOSTAT, ZIGBEE PRO WIRELESS COMMUNICATION, FCU/VAV, 0-10VDC PROP, OCC & DEHUMID, FULL COLOR, WHITE, NO LOGO (0.8 lbs)
- ○ S1-TEC3030-14-000 - 7 DAY PROGRAMMABLE THERMOSTAT, ZIGBEE PRO WIRELESS COMMUNICATION, RTU/HEAT PUMP WITH ECON,FULL COLOR, WHITE, JCI LOGO (0.8 lbs)
- ○ S1-TEC3030-16-000 - 7 DAY PROGRAMMABLE THERMOSTAT, ZIGBEE PRO WIRELESS COMMUNICATION, RTU/HEAT PUMP WITH ECON, AND FULL COLOR, WHITE, NO LOGO (0.8 lbs)
- ○ S1-TEC3031-14-000 - 7 DAY PROGRAMMABLE THERMOSTAT, ZIGBEE PRO WIRELESS COMMUNICATION, RTU/HEAT PUMP WITH ECON, OCC SENSOR, FULL COLOR, WHITE, JCI LOGO (0.8 lbs)
- ○ S1-TEC3031-16-000 - 7 DAY PROGRAMMABLE THERMOSTAT, ZIGBEE PRO WIRELESS COMMUNICATION, RTU/HEAT PUMP WITH ECON, OCC SENSOR, FULL COLOR, WHITE, NO LOGO (0.8 lbs)
- ○ S1-TEC3612-14-000 - 7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, FCU/VAV, ON/OFF OR FLOATING, DEHUMID, FULL COLOR, WHITE, JCI LOGO (0.8 lbs)
- ○ S1-TEC3612-16-000 - 7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, FCU/VAV, ON/OFF OR FLOATING, DEHUMID, FULL COLOR, WHITE, NO LOGO (1.0 lbs)
- ○ S1-TEC3613-14-000 - 7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, FCU/VAV, ON/OFF OR FLOATING, OCC & DEHUMID, FULL COLOR, WHITE, JCI LOGO (0.8 lbs)
- ○ S1-TEC3613-16-000 - 7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, FCU/VAV, ON/OFF OR FLOATING, OCC & DEHUMID, FULL COLOR, WHITE, NO LOGO (0.8 lbs)
- ○ S1-TEC3622-14-000 - 7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, FCU/VAV, 0-10VDC PROP, DEHUMID, FULL COLOR, WHITE, JCI LOGO (0.8 lbs)
- ○ S1-TEC3622-16-000 - 7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, FCU/VAV, 0-10VDC PROP, DEHUMID, FULL COLOR, WHITE, NO LOGO (0.8 lbs)
- ○ S1-TEC3623-14-000 - 7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, FCU/VAV, 0-10VDC PROP, OCC & DEHUMID, FULL COLOR, WHITE, JCI LOGO (0.8 lbs)
- ○ S1-TEC3623-16-000 - 7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, FCU/VAV, 0-10VDC PROP, OCC & DEHUMID, FULL COLOR, WHITE, NO LOGO (0.8 lbs)
- ○ S1-TEC3630-14-000 - 7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, RTU/HEAT PUMP WITH ECON,FULL COLOR, WHITE, JCI LOGO (0.8 lbs)
- ○ S1-TEC3630-16-000 - 7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, RTU/HEAT PUMP WITH ECON,FULL COLOR, WHITE, NO LOGO (0.8 lbs)

- ○ S1-TEC3631-14-000 - 7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, RTU/HEAT PUMP WITH ECON, OCC SENSOR, FULL COLOR, WHITE, JCI LOGO (0.8 lbs)
- ○ S1-TEC3631-16-000 - 7 DAY PROGRAMMABLE THERMOSTAT, OPTIONAL MSTP OR N2 COMMUNICATION, RTU/HEAT PUMP WITH ECON, OCC SENSOR, FULL COLOR, WHITE, NO LOGO (0.8 lbs)
- ○ S1-YK-MAP1810-0P - MAP (Multiple Access Portal) Gateway- For use with SimplicitySE Control. (0.2 lbs)
- ○ S1-YK-MAP1810-0S - Stationary MAP Gateway (Includes MAP Gateway, Field Bus Adapter, Mounting Bracket and 100 to 240 VAC Power Supply). US-compatible counties. (1.9 lbs)
- ● 2EC0402 - Kit, Dual Enthalpy Field Installed (Includes two humidity sensors) (1.0 lbs)

Large Sunline 15-25 Ton Package

York Single Package R-410A Air Conditioner

Project Name: **OM Union Beach BOE 3-5-21** Unit Model #: **ZJ180N40D4A1AAA1A1**

Quantity: **2** System: **ZJ180N40D4A1AAA1A1**

Consolidated Drawing

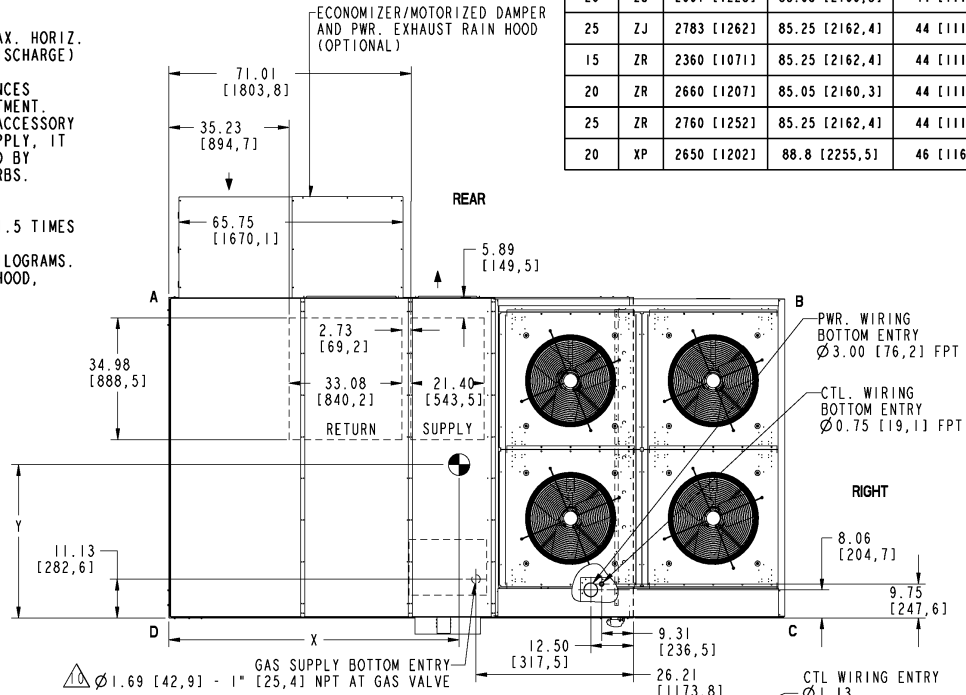
NOTES:
1. FOR OUTDOOR USE ONLY.
2. WEIGHTS SHOWN ARE FOR COOLING ONLY UNITS.
3. MIN. CLEARANCES TO BE:
   RIGHT SIDE: 36 [914,4]
   LEFT SIDE: 24 [609,6] (LESS ECONOMIZER)
   36 [914,4] (WITH ECONOMIZER)
   FRONT: 36 [914,4]
   REAR: 24 [609,6] (LESS ECONOMIZER)
   49 [1244,6] (WITH ECONOMIZER)
   TOP: 72 [1828,8] WITH 36 [914,4] MAX. HORIZ. OVERHANG (FOR CONDENSER AIR DISCHARGE)
   BOTTOM: 0 [0]
4. FOR SMALLER SERVICE AND OPERATIONAL CLEARANCES CONTACT YOUR APPLICATION ENGINEERING DEPARTMENT.
5. DOWNFLOW DUCTS DESIGNED TO BE ATTACHED TO ACCESSORY ROOF CURB ONLY. IF UNIT IS MOUNTED SIDE SUPPLY, IT IS RECOMMENDED THAT THE DUCTS ARE SUPPORTED BY CROSS BRACES, AS DONE ON ACCESSORY ROOF CURBS.
6. SIDE DUCT FLANGES ARE 0.875" [22,2] HIGH. BOTTOM DUCTS DO NOT HAVE FLANGES.
7. MINIMUM CONDENSATION TRAP HEIGHT SHALL BE 1.5 TIMES THE LOWEST NEGATIVE STATIC.
8. DIMENSIONS IN [ ] ARE IN MILLIMETERS OR KILOGRAMS.
9. OPTIONAL COIL GUARD, GAS HEAT, ECONOMIZER HOOD, DISCONNECT SWITCH, CONVENIENCE OUTLET, AND OUTLET/INLET HOOD SHOWN.

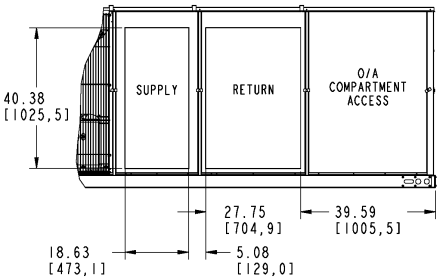
⚠10 EXCEPT XP (HEAT PUMP) UNITS

DIRECTION OF AIRFLOW

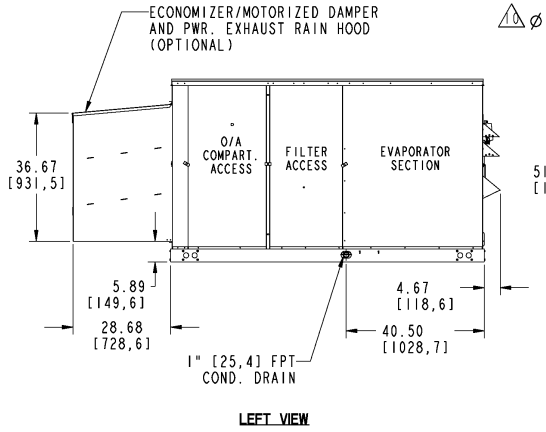
CENTER OF GRAVITY

TONNAGE	UNIT	OPERATING WEIGHT (LBS) (BASE UNIT)	CENTER OF GRAVITY LOCATION (BASE UNIT)		4 POINT CORNER LOADS (LBS) (BASE UNIT)			
			X	Y	A	B	C	D
15	ZJ	2609 [1183]	85.25 [2162,4]	44 [1117,6]	467 [212]	781 [354]	852 [387]	510 [231]
17.5	ZJ	2665 [1209]	85.25 [2162,4]	44 [1117,6]	477 [216]	797 [362]	870 [395]	520 [236]
20	ZJ	2697 [1223]	85.05 [2160,3]	44 [1117,6]	485 [220]	805 [365]	878 [398]	529 [240]
25	ZJ	2783 [1262]	85.25 [2162,4]	44 [1117,6]	498 [226]	833 [378]	908 [412]	544 [247]
15	ZR	2360 [1071]	85.25 [2162,4]	44 [1117,6]	422 [191]	706 [320]	770 [349]	461 [209]
20	ZR	2660 [1207]	85.05 [2160,3]	44 [1117,6]	478 [217]	794 [360]	866 [393]	522 [237]
25	ZR	2760 [1252]	85.25 [2162,4]	44 [1117,6]	494 [224]	826 [375]	901 [409]	539 [245]
20	XP	2650 [1202]	88.8 [2255,5]	46 [1168,4]	462 [210]	863 [392]	863 [392]	462 [210]

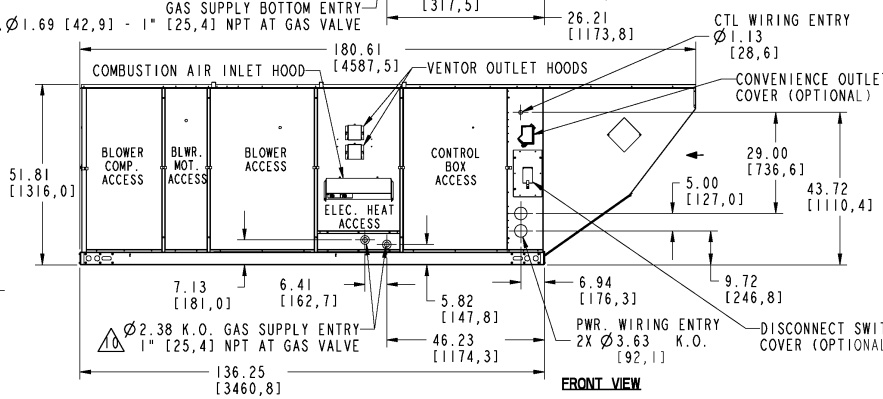




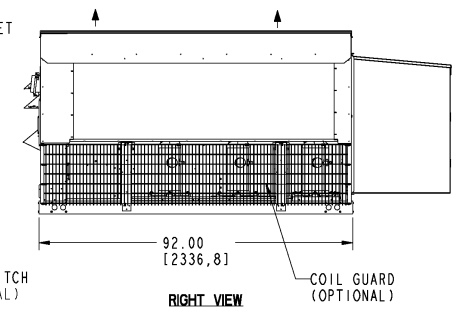
REAR (PARTIAL) VIEW
(WITH SIDE DUCT PANELS INSTALLED)



LEFT VIEW



FRONT VIEW



RIGHT VIEW

Large Sunline 15-25 Ton Package

York Single Package R-410A Air Conditioner

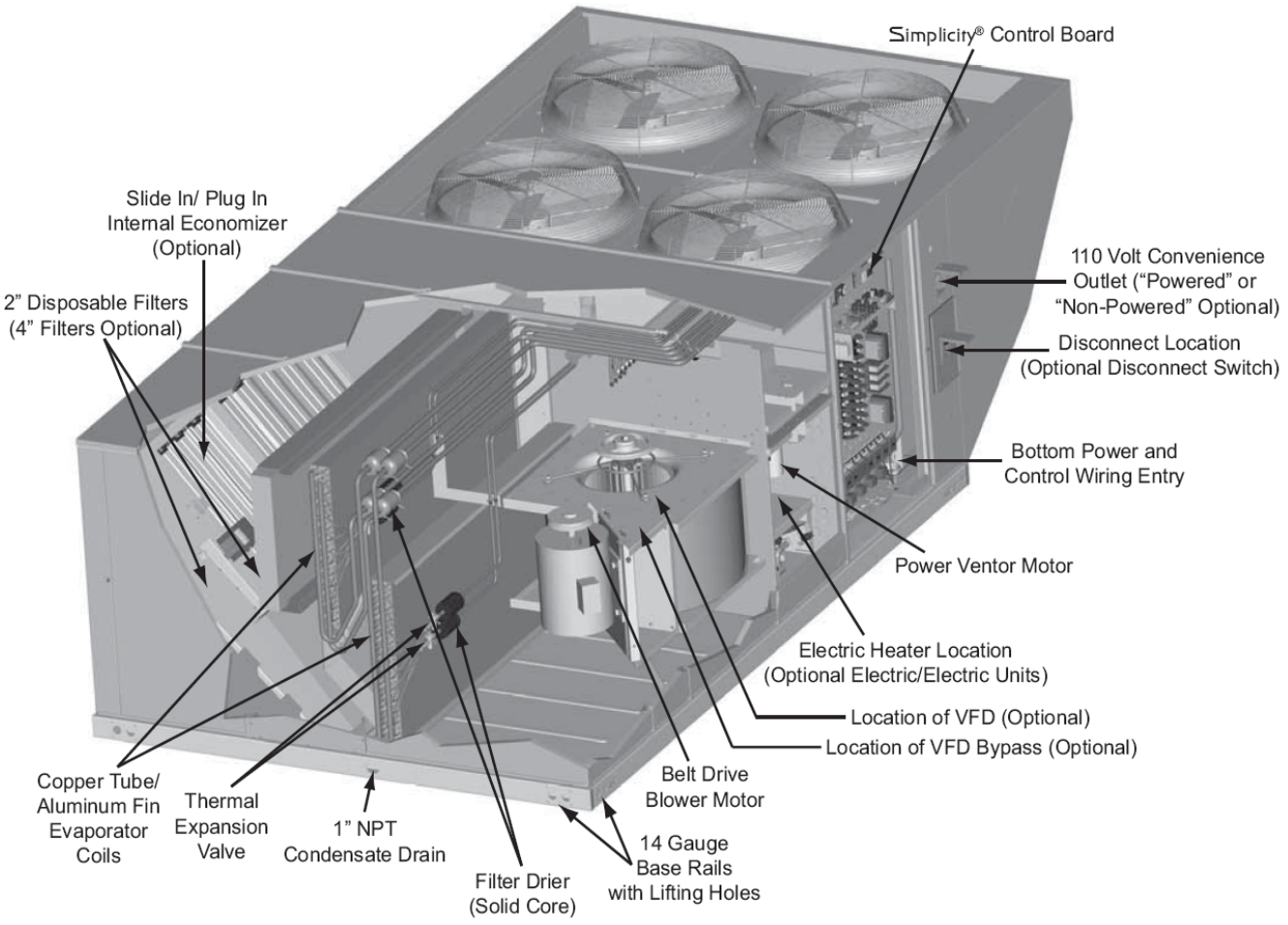
Project Name: **OM Union Beach BOE 3-5-21**

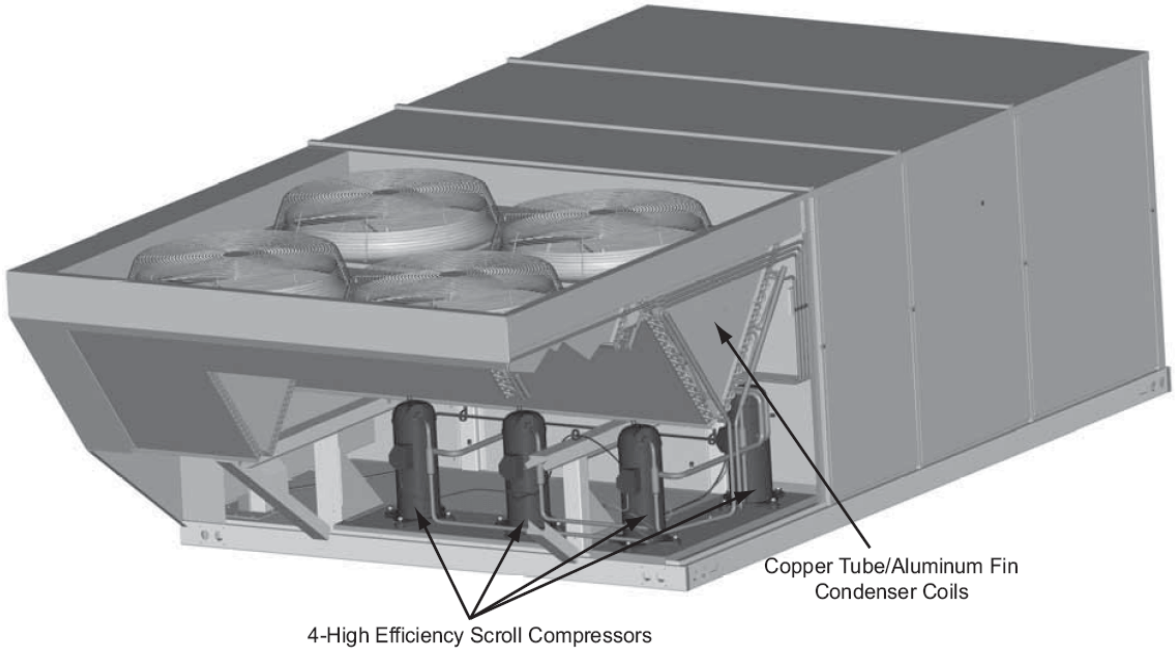
Unit Model #: **ZJ180N40D4A1AAA1A1**

Quantity: **2**

System: **ZJ180N40D4A1AAA1A1**

Component Locations





Large Sunline 15-25 Ton Package

York Single Package R-410A Air Conditioner

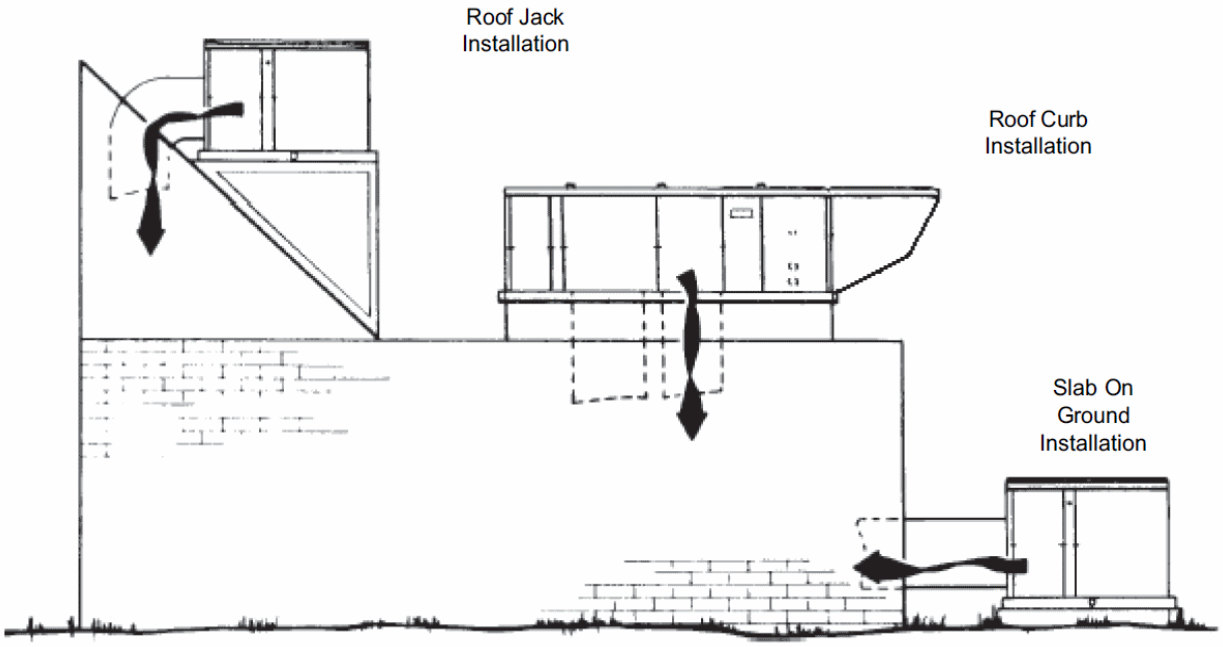
Project Name: **OM Union Beach BOE 3-5-21**

Unit Model #: **ZJ180N40D4A1AAA1A1**

Quantity: **2**

System: **ZJ180N40D4A1AAA1A1**

Typical Application



Large Sunline 15-25 Ton Package

York Single Package R-410A Air Conditioner

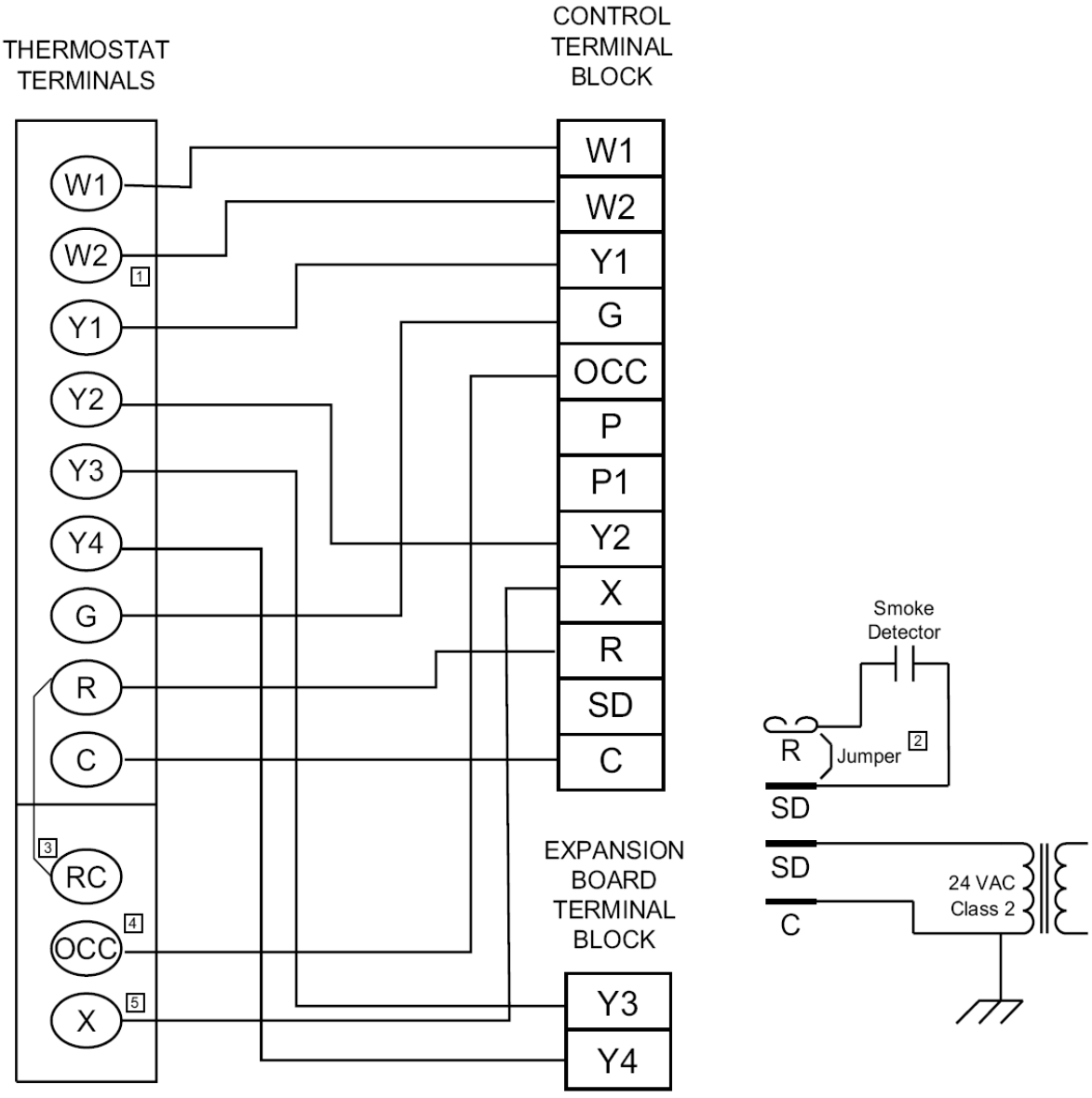
Project Name: **OM Union Beach BOE 3-5-21**

Unit Model #: **ZJ180N40D4A1AAA1A1**

Quantity: **2**

System: **ZJ180N40D4A1AAA1A1**

Typical Control Diagram



1. Second stage heating not required on single stage heating units.
2. Jumper is required if there is no Smoke Detector circuit.
3. Jumper is required for any combination of R, RC, or RH.
4. OCC is an output from the thermostat to indicate the Occupied condition.
5. X is an input to the thermostat to display Error Status conditions.

Large Sunline 15-25 Ton Package

York Single Package R-410A Air Conditioner

Project Name: **OM Union Beach BOE 3-5-21**

Unit Model #: **ZJ180N40D4A1AAA1A1**

Quantity: **2**

System: **ZJ180N40D4A1AAA1A1**

Seismic Certification

835356-UAD-A-0112

SPECIAL SEISMIC CERTIFICATION
OF NON-STRUCTURAL
COMPONENTS AND SYSTEMS

CERTIFICATE OF COMPLIANCE

Dynamic Certification Laboratories has qualified the listed packaged rooftop units as CERTIFIED for seismic applications in accordance with the following codes and standards:

CBC 2010, IBC 2009, ICC-ES AC-156 2010, ASCE 7-05

The following model designations are included in this certification. A complete list of certified models, options, and installation methods are detailed in report number 90300-1108b by Dynamic Certification Laboratories, provided by the equipment manufacturer upon request.

Unitary Product Group Packaged Rooftop Units (UPG)

Seismic Qualification Testing was conducted in accordance with and in strict adherence to the standards set forth within the American Society of Civil Engineers (ASCE 7) by the independent approval agency, Dynamic Certification Laboratories. The above referenced equipment is APPROVED for seismic applications when properly installed and used as intended.

The basis of this certification is through testing of the active and energized components per AC156. This certification covers multiple UPG brands, including York, Johnson Controls, Coleman, Luxaire, Evcon and Fraser-Johnston.

The seismic values are obtained from the Maximum Considered Earthquake Short Period Spectral Response Acceleration, Sds, as determined by the ASCE 7 seismic maps. Various installation locations/isolation configurations are covered under this certification, limited by the Sds value stated in the following table. A seismic importance factor, Ip, of 1.5 applies to this certification to include essential facility requirements and life safety applications for post event functionality. The units are approved for both a rigid and flexible mount configuration.

Maximum Design Sds Values of UPG Packaged Rooftop Units				
Series	**Size**	**Tons**	**Sds (g)**	**Fp/Wp**
ZF/ZS 180/J**ZF/T*	180 (48”)	15	2.0	1.5
ZF/ZS/J**ZF/T*	210, 240, 300 (53”)	17.5, 20, 25	2.0	1.5
XP/XA/J**XP/T*180	180 (53”)	15	2.0	1.5
XP/XA/J**XP/T*240	240 (53”)	20	2.0	1.5
ZJ/ZW/J**ZJ/T*	180, 210, 240, 300 (53”)	15, 17.5, 20, 25	2.0	1.5
ZR/ZK 180/J**ZR/T*	240, 300 (53”)	15, 20, 25	2.0	1.5

Dynamic Certification Laboratories 1315 Greg Street, Suite 109, Sparks, NV 89431 – ph: 775-358-5085 www.shaketest.com

Large Sunline 15-25 Ton Package

York Single Package R-410A Air Conditioner

Project Name: **OM Union Beach BOE 3-5-21**

Unit Model #: **ZJ180N40D4A1AAA1A1**

Quantity: **2**

System: **ZJ180N40D4A1AAA1A1**

Seismic Certification

DCL Dynamic Certification Laboratories

SPECIAL SEISMIC CERTIFICATION
OF NON-STRUCTURAL
COMPONENTS AND SYSTEMS

Johnson Controls

CERTIFICATE OF COMPLIANCE

Table of Seismic Design Parameters					
Site Class	**F_a**	**I_p**	**a_p**	**R_p**	**z/h**
D	1.0	1.5	2.5	6.0	1.0

Site and Project Requirements

It is the responsibility of the Design Professional of Record to:

- Provide engineering for the anchorage and restraint of the unit
- Validate Certification Design Parameters with actual site conditions
- Provide engineering of all equipment support structures
- Confirm component configuration

Certification Issued by: Dynamic Certification Laboratories
Document Control Number: 90300-1108b-1
Issue Date: 12/19/11

REGISTERED PROFESSIONAL ENGINEER
AHMAD M. ITANI
S5220
EXP. 6/30/2012
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Johnson Controls, Incorporated

Dynamic Certification Laboratories 1315 Greg Street, Suite 109, Sparks, NV 89431 ph: 775-358-5085 www.shaketest.com

Date
03/05/2021
Project Name
OM Union Beach BOE 3-5-21
Project Number
Client / Purchaser

Guide Specification Summary Page

Product Series	Models and Unit Tags
Large Sunline 15-25 Ton Package	ZJ180N40D4A1AAA1A1

GENERAL

York Sunline Magnum units are convertible single package units. ZJ models have four independent refrigerant circuits, for efficient part load operation and maximum comfort control. Although the units are primarily designed for curb mounting on a roof, they can also be slab-mounted at ground level or set on steel beams above a finished roof. Cooling only, cooling with gas heat and cooling with electric heat models are available with a wide variety of factory-mounted options and field-installed accessories to make them suitable for almost every application. All units are self-contained and assembled on full perimeter base rails with holes in the four corners for overhead rigging. Every unit is completely piped, wired, charged and tested at the factory to simplify the field installation and to provide years of dependable operation. All models (including those with an economizer) are suitable for either bottom or horizontal duct connections. Models with power exhaust are suitable for bottom duct connections only. For bottom duct, remove the sheet metal panels from the supply and return air openings through the base of the unit. or horizontal duct, replace the supply and return air panels on the rear of the unit with a side duct flange accessory. All supply air blowers are equipped with a belt drive that can be adjusted to meet exact requirements of the job. A high static drive option is available for applications with a higher CFM and/or static pressure requirement.

ZJ/ZR/XP240 models have 4 condenser fan motors. All compressors include crankcase heat and internal pressure relief. Every refrigerant circuit includes an expansion valve, a liquid line filter-drier, a discharge line high pressure switch and a suction line with a freezestat and low pressure/loss of charge switch. The unit control circuit includes a 75 VA transformer, a 24-volt circuit breaker and a relay board with two compressor lockout circuits, a terminal strip for thermostat wiring, plus an additional set of pin connectors to simplify the interface of additional field controls. All units have long lasting powder paint cabinets with 750 hour salt spray test approval under ASTM-B117 procedures. All models are CSA approved. All models include a 1-year limited warranty on the complete unit. Compressors and electric heater elements carry an additional 4-year warranty. Alunimized steel tubular heat exchangers carry an additional 9-year warranty.

DESCRIPTION

ZJ units shall be factory-assembled, single packaged, ZJ***N Electric Cooling/Gas Heat, ZJ***C/E Electric Cooling/Optional Electric Heat, designed for outdoor mounted installation. The 15 ton unit shall have a minimum EER rating of 12.2.

They shall have built-in field convertible duct connections for down discharge supply/return or horizontal discharge supply/ return, and be available with factory installed options or field installed accessories. The units shall be factory wired, piped, charged with R-410A refrigerant and factory tested prior to shipment. All unit wiring shall be both numbered and color coded. All units shall be manufactured in a facility certified to ISO 9001 standards and the cooling performance shall be rated in accordance with DOE and AHRI test procedures. Units shall be CSA listed, classified to ANSIZ21.47 standards, UL 1995/ CAN/CSA No. 236-M90 conditions.

UNIT CABINET

Unit cabinet shall be constructed of galvanized steel, with exterior surfaces coated with a non-chalking, powdered paint finish, certified at 750 hours salt spray test per ASTM-B117 standards. Indoor blower section shall be insulated with a minimum 1/2" thick insulation, coated on the airside. Aluminum foil faced insulation shall be used in the furnace compartment and be fastened with ridged fasteners to prevent insulation from entering the air stream. Cabinet panels shall be "large" size, easily removable for servicing and maintenance. Full perimeter base rails shall be provided to assure reliable transit of equipment, overhead rigging and proper sealing on roof curb applications. Disposable 2" filters shall be furnished and be accessible through a removable access door, sealed airtight. Units filter track shall be designed to accommodate either 2" or 4" filters. Fan performance measuring ports shall be provided on the outside of the cabinet to allow accurate air measurements of evaporator fan performance without removing panels or creating air by-pass of the coils. Condensate pan shall be internally sloped and conform to ASHRAE 62-89 selfdraining standards. Condensate connection shall be a minimum of 1" I.D. female and be a ridged mount connection. Unit shall incorporate a fixed outdoor air damper with an outdoor air intake opening covered with a bird screen and a rain hood painted to match the exterior of the unit.

INDOOR (EVAPORATOR) FAN ASSEMBLY

Fan shall be a belt drive assembly and include an adjustable- pitch motor pulley. Job site selected (B.H.P.) brake horsepower shall not exceed the motors nameplate horsepower rating, plus the service factor. Units shall be designed not to operate above service factor. Fan wheel shall be double-inlet type with forward-curved blades, dynamically balanced to operate smoothly throughout the entire range of operation. Airflow design shall be constant air volume.

OUTDOOR (CONDENSER) FAN ASSEMBLY

The outdoor fans shall be of the direct-driven propeller type, discharge air vertically, have aluminum blades riveted to corrosion resistant steel spider brackets and shall be dynamically balanced for smooth operation. The 4 outdoor fan motors shall be totally enclosed with permanently lubricated bearings, internally protected against overload conditions and staged independently.

REFRIGERANT COMPONENTS

Compressors:

a. Shall be Scroll compressors internally protected with internal high-pressure relief and over temperature protection.
b. Shall have internal spring isolation and sound muffling to minimize vibration and noise, and be externally isolated on a dedicated, independent mounting.

Coils:

a. Evaporator and condenser coils shall have aluminum plate fins mechanically bonded to seamless internally enhanced copper tubes with all joints brazed. Special Phenolic coating shall be available as a factory option
b. Evaporator and Condenser coils shall be of the direct expansion, draw-thru, design

Refrigerant Circuit and Refrigerant Safety Components shall include:

- Balance-port thermostatic expansion valve with independent circuit feed system.
- Filter drier/strainer to eliminate any moisture or foreign matter.
- Accessible service gage connections on both suction and discharge lines to charge, evacuate, and measure refrigerant pressure during any necessary servicing or troubleshooting, without losing charge.
- The refrigeration system shall provide at least 15° F of sub-cooling at design conditions.
- All models shall have four independent circuits.

Unit Controls:

a. Unit shall be complete with self-contained low-voltage control circuit protected by a resettable circuit breaker on the 24-volt transformer side
b. Unit shall incorporate a lockout circuit which provides reset capability at the space thermostat or base unit, should any of the following standard safety devices trip and shut off compressor
c. Loss-of-charge/Low-pressure switch. (1) High-pressure switch, (2) Freeze-protection thermostat, evaporator coil. If any of the above safety devices trip, a LED (light-emitting diode) indicator shall flash a diagnostic code that indicates which safety switch has tripped
d. Unit shall incorporate "AUTO RESET" compressor over temperature, over current protection
e. Unit shall operate with conventional thermostat designs and have a low voltage terminal strip for easy hook-up
f. Unit control board shall have on-board diagnostics and fault code display
g. Standard controls shall include anti-short cycle and low voltage protection, and permit cooling operation down to 0 °F
h. Control board shall monitor each refrigerant safety switch independently
i. Control board shall retain last 5 fault codes in non volatile memory, which will not be lost in the event of a power loss

GAS HEATING SECTION

Shall be designed with induced draft combustion with post purge logic and energy saving direct spark ignition, redundant main gas valve. Ventor wheel shall be constructed of stainless steel for corrosion resistance. The heat exchanger shall be of the tubular type, constructed of T1-40 aluminized steel for corrosion resistance and allowing minimum mixed air entering temperature of 25 °F. Burners shall be of the in-shot type, constructed of aluminum coated steel and contain air mixture adjustments. All gas piping shall enter the unit cabinet at a single location through either the side or curb, without any field modifications. An integrated control board shall provide timed control of evaporator fan functioning and burner ignition. Heating section shall be provided with the following minimum protection:

a. Primary and auxiliary high-temperature limit switches.
b. Induced draft motor speed sensor.
c. Flame roll out switch (automatic reset).
d. Flame proving controls. Unit shall have two independent stages of capacity.

UNIT OPERATING CHARACTERISTICS

Unit shall be capable of starting and running at 125° F outdoor temperature, exceeding maximum load criteria of AHRI Standard 340/360. The compressor, with standard controls, shall be capable of operation down to 25° F outdoor temperature. Accessory low ambient kit shall be available for operation to 0° F.Unit shall be provided with fan time delay to prevent cold air delivery befofre heat exchanger warms up.

ELECTRICAL REQUIREMENTS

All unit power wiring shall enter unit cabinet at a single factory provided location and be capable of side or bottom entry, to minimize roof penetrations and avoid unit field modifications. Separate side and bottom openings shall be provided for the control wiring.

STANDARD LIMITED WARRANTIES

- Compressor 5 Years
- Heat Exchanger 10 Years
- Other Parts 1 Year

OPTIONAL OUTDOOR AIR

Shall be made available by either/or:

OTHER FACTORY INSTALLED OPTIONS

- **BAS Controls** - Smart Equipment with BAS communication (BACnet MS/TP, Modbus, and Johnson Controls N2) Option, CPC, HONEYWELL, NOVAR, VERASYS, FDD
- **High Static Drive**

FIELD INSTALLED OPTIONS

Date
03/05/2021
Project Name
OM Union Beach BOE 3-5-21
Project Number
Client / Purchaser

Control Summary Page

Control	Models and Unit Tags
Standard Simplicity Control	ZJ180N40D4A1AAA1A1

23 09 23 Direct- digital Control system for HVAC

23 09 23. 13 Decentralized, Rooftop Units:

23 09 23. 13.A. Unit Control Board

1. ASHRAE 62- 2001compliant. BTL certified.
2. Shall accept 20-30 VAC input power, 50/60Hz. 24 VAC nominal.
3. Operating temperature range from -40F to 158F; 10-90% RH (non-condensing UI), and -4F to 158F; 10-90% Rh (non-condensing), with a storage temperature range from -40F to 194F; 5-95% RH (non-condensing).
4. Shall include an option of and Economizer microprocessor controller which communicates directly with the Unit Control Board and has 8 Analog outputs, 2 Analog inputs, 2 Binary outputs, 3 Binary outputs.
5. Controller shall accept the followinginputs: space temperature, return air temperature sensor, setpointadjustment, outdoor air temperature, indoor air quality, outdoor air quality, indoor relative humidity, compressor lock- out, fire/smoke shutdown, single and dual enthalpy,fan status, remote time clock, SA Bus communicated temperature/humidity/CO2 values from Network sensors, FC Bus Network Overrides for space temperature, outdoor air temperature, space humidity, outdoor air quality, Indoor air quality, System purge.
6. Shall accept a single CO_2 sensor or multiple CO_2 sensors networked together via communication bus in the conditioned space, and be Demand Control 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 showingthe status of activity on the communication bus, and processor operation.
11. Unit shall incorporate a lockout circuit which provides reset capability at the space thermostat or base unit should any of the following standard safety devices trip and shut off compressor. If any of these safety devices trip, the LCD screen will display alarm message indicating the specific safety device that caused the lockout.
    a. Loss of charge/Low-pressure switch.
    b. High-pressure switch.
    c. Freeze condition sensor on evaporator coil.
12. Unit control board must support each usage case:
    a. Conventional thermostat with low voltage input terminals for easy installation
    b. Communicating network sensors in the occupied space to provide feedback on space conditions for unit control board to compare with associated setpoints
    c. Communication via BACnet MS/TP, Modbus RTU, N2 protocols for integration into a building automation/management system
13. Anti-short cycle and low voltage protection features included.
14. Internal occupied/unoccupied scheduling
15. Unit control board shall permit cooling operation down to a selectable value as low as 0 degrees F.
16. Shall allow for start-up, commissioning, troubleshooting, parameter adjustment, setpoint adjustment via onboard display and navigable menu with no additional interface tool or controls technician required.
17. The unit control board shall run a self-test diagnostics algorithm at startup that operated the cooling cycle, heating cycle, fan operation. A status report shall be provided upon completion of the diagnostic self-test.
18. Utilize any wi-fi enabled smart device to access the HVAC or multiple HVAC units if communication wiring between them is present (FC Bus or SA Bus). Remote access shall allow complete ability to perform start-up, commissioning, troubleshooting, parameter adjustment, setpoint adjustment.
19. Local embedded trending and scheduling. Trending data and occupancy scheduling predefined from the factory. Occupancy schedule to be modified via control board joystick menu navigation and remotely using a smart device (cellular phone, laptop, tablet)
20. A menu on the onboard screen shall display the unit status and allow changing parameters where applicable. These include but are not limited to:
    a. Demand Ventilation Mode – enable or disable
    b. Operational Setpoint – display current value
    c. Supply Air Temperature (SAT) – display current value
    d. Return Air Temperature (RAT) – display current value

e. Operational Supply Humidity (OprSH) – display current value as provided by a 0-10VDS input, SA Bus Network Sensor, or FC Bus communicated value

f. Return Air Humidity (RAH) – display current value

g. Operational outdoor Air Temperature (OprOAT) – enthalpy calculated from OAH 0-10VDC input to Economizer board and OprOAT only if economizer is present

h. Operational Outdoor Air Humidity (OprOAH) – the buffered outdoor air humidity. May be from economizer boards OAH 0-10VDC input or FC Bus communicated value

i. Operational outdoor Air Quality (OprOAQ) – the buffered outdoor air quality in use. May be from economizer boards OAQ 0-10VDC input or FC Bus communicated value

j Operational Indoor Air Quality (OprIAQ) – the buffered indoor air quality in use. May be from economizer board IAQ 0-10VDC input, SA Bus Network Sensor, or FC Bus communicated value

21. A menu shall display and allow modification to the following operations and settings:
    a. HVAC Zone Fan
    b. Cooling
    c. Heating
    d. Economizer
    e. Demand Ventilation
    f. Power Exhaust
    g. Sensors
    h. Network
22. A menu shall display and allow modification to the following operations and settings:
    a. HVAC Zone – Occupied status
    b. Indoor Fan status
    c. Cooling status
    d. Heating status
    e. Economizer indication whether free-cooling is available or not
    f. Enabling or disabling of Demand Ventilation
    g. Power Exhaust
        1) Enable/disable hot-gas reheat if available
        2) Warmup/Cooldown
        3) Title 24 Load Shed
        4) Defrost
23. A menu shall display and allow modification to the following operations and settings:
    a. Firmware version (of UCB, Economizer, other peripheral boards)
    b. Setting time zone
    c. Network information
        1) Device name that will appear on the FC Bus
        2) Selection of communication protocol
        3) Operational Baud Rate
        4) Device ID
24. A menu shall display and allow modification to the following operations and settings:
    a. Version of firmware
    b. Ability to Load new firmware
    c. Create a backup file of the firmware and parameter setting via USB port
    d. Restore factory default parameter values and setup
    e. Full and Partial Cloning of parameter setpoints from or to other units
    f. Data trend exporting
25. A menu shall display and allow modification to the following operations and settings:

a. Unit serial number, model number and name
b. Ability to reset Lockouts
c. Controller name
d. Displays the current values of all setpoints in use
e. Displays all current values for the indoor and outdoor zones
f. Displays current values related to:
    1) Indoor Fan
    2) Cooling
    3) Heating
    4) Heat Pump operation
    5) Economizer operation
    6) Power Exhaust
    7) Demand Ventilation
    8) Air monitoring station
    9) Hot Gas Reheat
    10) Smoke Control
g. Current information for inputs; including
    1) Sensors
    2) Coil Sensors
    3) Thermostat
    4) Binary Inputs
    5) Unit Protection
    6) Network Inputs
    7) All outputs (relay and binary)
h. Self-Test
    1) A patented self-test system that runs through a series of algorithms to provide a report of all functioning characteristics of the system at time of startup and commissioning.

23 09 23. 13.B. Auxiliary Control Boards

1. ASHRAE 62- 2001 compliant. BTL certified.
2. Economizer controller CEC Title 24 Compliant
    a. Display alarms if the following occur
        1) Economizer is economizing when conditions do not support
        2) Economizer is not economizing when conditions do support
        3) Damper Stuck
        4) Excess Outdoor Air
        5) Failed Sensor
3. Refrigeration Fault Detection & Diagnostics
    a. There is insufficient refrigerant in any circuit
    b. There is excessive refrigerant in any circuit
    c. There is excessive refrigerant flow
    d. There is insufficient refrigerant flow (restriction)
    e. Inefficient compressor
    f. Insufficient High-side heat transfer
    g. Excessive High-side heat transfer (low ambient control problem, low ΔP)
    h. Insufficient Low-side heat transfer
    i. Excessive Low-side heat transfer

j. Sensor fault- The liquid temperature is greater than the condenser temperature (Could also be triggered if refrigerant level is very low in the system)
k. Sensor fault- Sensor data is not available
l. The unit is off
m. The ambient temperature is too low
n. The ambient temperature is too high
o. The return air wet-bulb temperature is too low
p. The return air wet-bulb temperature is too high
q. Sensor fault- The condensing temperature is lower than the ambient temperature (Could also be triggered when the condenser is wet)
r. The suction line temperature is less than the evaporator temperature
s. The evaporator temperature is greater than the ambient temperature
t. The liquid temperature is lower than the ambient temperature
u. Sensor fault- Suction temperature or ambient temperature is invalid
v. Sensor fault- The return air dry-bulb or wet-bulb temperature is invalid
w. Sensor fault- The liquid pressure or suction pressure is invalid
x. Sensor fault- The suction line temperature is invalid
y. The return air dry-bulb temperature is too low
z. The return air dry-bulb temperature is too high
aa. The Efficiency Index is below 75% of ideal
bb. The Capacity Index is below 75% of ideal

23 09 23. 13.C Remote Accessibility:

1. ASHRAE 62- 2001 compliant. BTL certified.
2. Provide the ability to adjust parameter values, setpoints, limits remotely
3. Connectivity to an Ethernet network via static IP address or Dynamic Name Server (DNS)
4. Allow a maximum of 100 devices on the same FC bus trunk and accessed by one remote device

START-UP & SERVICE DATA INSTRUCTION

COMMERCIAL PACKAGE UNITS

3.0 To 40.0 TONS

START-UP CHECKLIST

Date: _____

Job Name: _____

Customer Name: _____

Address: _____

City: _____ State: _____ Zip: _____

Model Number: _____ Serial Number: _____

Qualified Start-up Technician: _____ Signature: _____

HVAC Contractor: _____ Phone: _____

Address: _____

Contractor's E-mail Address: _____

Electrical Contractor: _____ Phone: _____

Distributor Name: _____ Phone: _____

WARRANTY STATEMENT

Johnson Controls/UPG is confident that this equipment will operate to the owner's satisfaction if the proper procedures are followed and checks are made at initial start-up. This confidence is supported by the 30 day dealer protection coverage portion of our standard warranty policy which states that Johnson Controls/UPG will cover parts and labor on new equipment start-up failures that are caused by a defect in factory workmanship or material, for a period of 30 days from installation. Refer to current standard warranty policy and warranty manual found on UPGnet for details.

In the event that communication with Johnson Controls/UPG is required regarding technical and/or warranty concerns, all parties to the discussion should have a copy of the equipment start-up sheet for reference. A copy of the original start-up sheet should be filed with the Technical Services Department.

The packaged unit is available in constant or variable air volume versions with a large variety of custom options and accessories available. Therefore, some variation in the startup procedure will exist depending upon the products capacity, control system, options and accessories installed.

This start-up sheet covers all startup check points common to all package equipment. In addition it covers essential startup check points for a number of common installation options. Depending upon the particular unit being started not all sections of this startup sheet will apply. Complete those sections applicable and use the notes section to record any additional information pertinent to your particular installation.

Warranty claims are to be made through the distributor from whom the equipment was purchased.

EQUIPMENT STARTUP

Use the local LCD or Mobile Access Portal (MAP) Gateway to complete the start-up.

A copy of the completed start-up sheet should be kept on file by the distributor providing the equipment and a copy sent to:

Johnson Controls/UPG
Technical Services Department
5005 York Drive
Norman, OK 73069

SAFETY WARNINGS

The inspections and recording of data outlined in this procedure are required for start-up of Johnson Controls/UPG's packaged products. Industry recognized safety standards and practices must be observed at all times. General industry knowledge and experience are required to assure technician safety. It is the responsibility of the technician to assess all potential dangers and take all steps warranted to perform the work in a safe manner. By addressing those potential dangers, prior to beginning any work, the technician can perform the work in a safe manner with minimal risk of injury.

⚠WARNING

Lethal voltages are present during some start-up checks. Extreme caution must be used at all times.

⚠WARNING

Moving parts may be exposed during some startup checks. Extreme caution must be used at all times.

NOTE: Read and review this entire document before beginning any of the startup procedures.

DESIGN APPLICATION INFORMATION

This information will be available from the specifying engineer who selected the equipment. If the system is a VAV system the CFM will be the airflow when the remote VAV boxes are in the full open position and the frequency drive is operating at 60 HZ. **Do not proceed with the equipment start-up without the design CFM information.**

Design Supply Air CFM: _____ Design Return Air CFM:_____

Design Outdoor Air CFM At Minimum Position: _____

Total External Static Pressure: _____

Supply Static Pressure: _____

Return Static Pressure: _____

Design Building Static Pressure: _____

Outside Air Dilution: Economizer Position Percentage: _____ CFM: _____

Supply Gas Pressure After Regulator W/o Heat Active _____ Inches_____

ADDITIONAL APPLICATION NOTES FROM SPECIFYING ENGINEER:

REFERENCE

General Inspection	Completed	See Notes
Unit inspected for shipping, storage, or rigging damage	☐	☐
Unit installed with proper clearances	☐	☐
Unit installed within slope limitations	☐	☐
Refrigeration system checked for gross leaks (presence of oil)	☐	☐
Terminal screws and wiring connections checked for tightness	☐	☐
Filters installed correctly and clean	☐	☐
Economizer hoods installed in operating position	☐	☐
Condensate drain trapped properly, refer to Installation Manual	☐	☐
Economizer damper linkage tight	☐	☐
Gas Heat vent hood installed	☐	☐
All field wiring (power and control) complete	☐	☐

Air Moving Inspection	Completed	See Notes
Alignment of drive components	☐	☐
Belt tension adjusted properly	☐	☐
Blower pulleys tight on shaft, bearing set screws tight, wheel tight to shaft	☐	☐
Pressure switch or transducer tubing installed properly	☐	☐

Exhaust Inspection Powered ☐ Barometric Relief ☐	Completed	See Notes
Check hub for tightness	☐	☐
Check fan blade for clearance	☐	☐
Check for proper rotation	☐	☐
Check for proper mounting (screen faces towards unit)	☐	☐
Prove operation by increasing minimum setting on economizer	☐	☐

Economizer Inspection Standard ☐ BAS ☐	Completed	See Notes
CO_2 sensor installed Yes ☐ No ☐	☐	☐
Check economizer setting (Reference SSE Control Board LCD menu location)	☐	☐
Prove economizer open/close through SSE Board Setting	☐	☐

Reheat Mode Normal ☐ or Alternate ☐ Not Applicable ☐
Humidity Sensor (2SH0401) _____

Operating Measurements - Air Flow

Fan operates with proper rotation	ID Fans ☐	Exh. Fans ☐	Cond. Fans ☐
Pressure drop across dry evaporator coil (At maximum design CFM) [1]			IWC
External Static Pressure			IWC
Return Static Pressure			IWC
Supply Static Pressure			IWC
Supply Air CFM Using Dry Coil Chart			CFM
Final Adjusted Supply Air CFM[2]			CFM

1. Consult the proper airflow to pressure drop table to obtain the actual airflow at the measured pressure differential.
2. Was a motor pulley adjustment or change required to obtain the correct airflow?
   Was it necessary to increase of decrease the airflow to meet the design conditions?
   If the motor pulley size was changed, measure the outside diameters of the motor and blower pulleys and record those diameters here;

Blower Motor HP _____ FLA_____ RPM_____

Pulley Pitch Diameter _____Turns Out_____ Final Turns Out_____

Blower Pulley Pitch Diameter _____ Fixed Sheave_____

ELECTRICAL DATA

T1 - T2 _____ Volts T2 - T3 _____ Volts

Control Voltage _____ Volts T1 - T3 _____ Volts

Device	Nameplate	Measured List All Three Amperages
Supply Fan Motor[1, 2]	AMPS	AMPS
Exhaust Motor (Dampers 100%)	AMPS	AMPS
Condenser Fan #1	AMPS	AMPS
Condenser Fan #2 (if equipped)	AMPS	AMPS
Condenser Fan #3 (if equipped)	AMPS	AMPS
Condenser Fan #4 (if equipped)	AMPS	AMPS
Compressor #1	AMPS	AMPS
Compressor #2 (if equipped)	AMPS	AMPS
Compressor #3 (if equipped)	AMPS	AMPS
Compressor #4 (if equipped)	AMPS	AMPS

1. VAV units with heat section - simulate heat call to drive VAV boxes and VFD/IGV to maximum design airflow position.
2. VAV units without heat section - VAV boxes must be set to maximum design airflow position.

OPERATING MEASUREMENTS - COOLING

Stage	Discharge Pressure	Discharge Temp.	Liquid Line Temp.[1]	Subcooling[2]	Suction Pressure	Suction Temp.	Superheat
First	#	°	°	°	#	°	°
Second (if equipped)	#	°	°	°	#	°	°
Third (if equipped)	#	°	°	°	#	°	°
Fourth (if equipped)	#	°	°	°	#	°	°
Reheat 1st Stage	#	°	°	°	#	°	°

1. Liquid temperature should be taken before filter/drier.
2. Subtract 10 psi from discharge pressure for estimated liquid line pressure

Outside air temperature	_____	°F db	_____	°F wb	_____ %RH
Return Air Temperature	_____	°F db	_____	°F wb	_____ %RH
Mixed Air Temperature	_____	°F db	_____	°F wb	_____ %RH
Supply Air Temperature	_____	°F db	_____	°F wb	_____ %RH

REFRIGERANT SAFETIES

Action	Completed	See Notes
Prove Compressor Rotation (3 phase only) by gauge pressure	☐	☐
Prove High Pressure Safety, All Systems	☐	☐
Prove Low Pressure Safety, All Systems	☐	☐

OPERATING MEASUREMENTS - GAS HEATING

Fuel Type: ☐ Natural Gas ☐ LP Gas

Action		Completed	See Notes
Check for gas leaks		☐	☐
Prove Ventor Motor Operation		☐	☐
Prove Primary Safety Operation		☐	☐
Prove Auxiliary Safety Operation		☐	☐
Prove Rollout Switch Operation		☐	☐
Prove Smoke Detector Operation		☐	☐
Manifold Pressure	Stage 1	IWC	☐
	Stage 2 (If Equipped)	IWC	☐
	Stage 3 (If Equipped)	IWC	☐
Supply gas pressure at full fire		IWC	☐
Check temperature rise[1]	☐ measured at full fire	°F	☐

1. $\frac{\text{Input X Eff. (BTU output)}}{\text{1.08 X Temp. Rise}}$

OPERATIONAL MEASUREMENTS - STAGING CONTROLS

Verify Proper Operation of Heating/Cooling Staging Controls	
Create a cooling demand at the Thermostat, BAS System or Simplicity SE Verify that cooling/economizer stages are energized.	☐
Create a heating demand at the Thermostat, BAS System or Simplicity SE Verify that heating stages are energized.	☐
Verify Proper Operation of the Variable Frequency Drive (If Required)	
Verify that motor speed modulates with duct pressure change.	☐

FINAL - INSPECTION

Verify that all operational control set points have been set to desired value Scroll through all setpoints and change as may be necessary to suit the occupant requirements.	☐
Verify that all option parameters are correct Scroll through all option parameters and ensure that all installed options are enabled in the software and all others are disabled in the software. (Factory software settings should match the installed options)	☐
Verify that all access panels have been closed and secured	☐

OBSERVED PRODUCT DIFFICIENCIES & CONCERNS:

KTEB-232-UV-IS-L-P

T8 ELECTRONIC BALLAST

Version D1

DESCRIPTION

2×F32T8 | 120-277 Multi-Voltage | HPF | Instant Start

STARTING METHOD: Instant
LAMP CONNECTION: Parallel
INPUT VOLTAGE: 120-277VAC ±10%
INPUT FREQUENCY: 50/60 Hz
POWER FACTOR: High
WARRANTY: 5 Years

PRODUCT FEATURES

- **2014 DOE Compliant**
- Sound Rated: A
- Maximum Ambient Temperature: 105ºF, 40ºC
- Maximum Case Temperature: 167ºF, 75ºC
- Meets FCC Part 18 (Class A) Non-Consumer Limits
- Meets ANSI Standard C82.11 and C62.41
- UL, cUL Listed Class P, Type 1 Outdoor
- Anti-Striation Circuitry
- Type HL

ELECTRICAL SPECIFICATIONS

LAMP TYPE	NO. OF LAMPS	INPUT VOLTS	INPUT WATTS	INPUT CURRENT (AMPS)	POWER FACTOR	BALLAST FACTOR	BALLAST EFFICACY FACTOR	MAX THD%	CREST FACTOR	MIN START TEMP	WIRING DIAGRAM
F32T8 (32W)	2	120	48.5	0.42	>0.9	0.78	1.61	10	<1.7	0°F, -18°C	F2-4
		277	48.0	0.18	>0.9	0.78	1.63	10	<1.7	0°F, -18°C	F2-4
	1	120	30.0	0.25	>0.9	0.92	3.06	10	<1.7	0°F, -18°C	F1-4
		277	30.3	0.12	>0.9	0.92	3.04	12	<1.7	0°F, -18°C	F1-4
F32T8 (30W)	2	120	45.8	0.39	>0.9	0.78	1.70	10	<1.7	60°F, 16°C	F2-4
		277	45.2	0.17	>0.9	0.78	1.73	12	<1.7	60°F, 16°C	F2-4
	1	120	29.0	0.24	>0.9	0.92	3.17	10	<1.7	60°F, 16°C	F1-4
		277	29.0	0.11	>0.9	0.92	3.17	15	<1.7	60°F, 16°C	F1-4
F32T8 (28W)	2	120	44.9	0.38	>0.9	0.78	1.74	10	<1.7	60°F, 16°C	F2-4
		277	44.5	0.17	>0.9	0.78	1.75	12	<1.7	60°F, 16°C	F2-4
	1	120	27.8	0.23	>0.9	0.92	3.31	10	<1.7	60°F, 16°C	F1-4
		277	28.1	0.11	>0.9	0.92	3.28	15	<1.7	60°F, 16°C	F1-4
F32T8 (25W)	2	120	43.6	0.36	>0.9	0.78	1.79	10	<1.7	60°F, 16°C	F2-4
		277	43.2	0.16	>0.9	0.78	1.81	12	<1.7	60°F, 16°C	F2-4
	1	120	26.4	0.22	>0.9	0.92	3.48	10	<1.7	60°F, 16°C	F1-4
		277	27.0	0.10	>0.9	0.92	3.41	15	<1.7	60°F, 16°C	F1-4
F25T8	2	120	43.6	0.36	>0.9	0.80	1.83	10	<1.7	0°F, -18°C	F2-4
		277	43.2	0.16	>0.9	0.80	1.85	12	<1.7	0°F, -18°C	F2-4
	1	120	26.4	0.22	>0.9	0.94	3.56	10	<1.7	0°F, -18°C	F1-4
		277	27.0	0.10	>0.9	0.94	3.48	15	<1.7	0°F, -18°C	F1-4
F17T8	2	120	27.2	0.22	>0.9	0.80	2.94	10	<1.7	0°F, -18°C	F2-4
		277	27.5	0.11	>0.9	0.80	2.91	12	<1.7	0°F, -18°C	F2-4
	1	120	19.0	0.16	>0.9	1.05	5.53	12	<1.7	0°F, -18°C	F1-4
		277	19.4	0.08	>0.9	1.05	5.41	15	<1.7	0°F, -18°C	F1-4
F40T8	1	120	37.4	0.31	>0.9	0.90	2.41	10	<1.7	0°F, -18°C	F1-4
		277	37.0	0.14	>0.9	0.90	2.43	12	<1.7	0°F, -18°C	F1-4

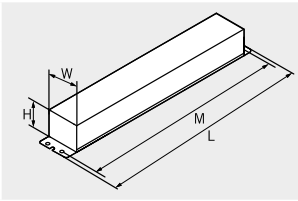
KTEB-232-UV-IS-L-P

T8 ELECTRONIC BALLAST

Version D1

PHYSICAL SPECIFICATIONS

CASE DIMENSIONS



LENGTH	9.50”
WIDTH	1.30”
HEIGHT	1.18”
MOUNTING	9.00”
CASE STYLE	L4

STANDARD LEAD LENGTH*

WHITE	25”
BLACK	25”
BLUE	31”
RED	45”

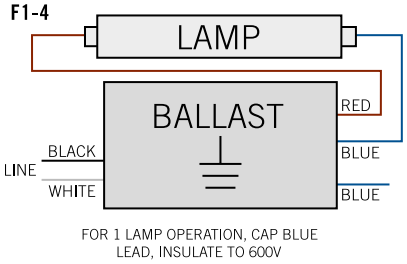
* Consult Keystone for special lead length requirements.

CASE MATERIAL: Steel

Lead wires are
18 AWG 105 C/600V,
solid copper.

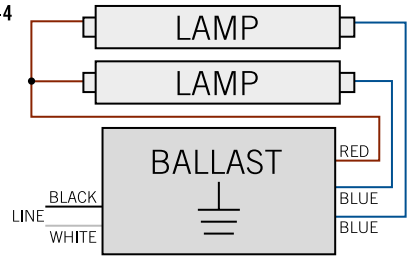
WIRING DIAGRAMS

F1-4



FOR 1 LAMP OPERATION, CAP BLUE LEAD, INSUTLATE TO 600V

F2-4



ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KTEB-232-UV-IS-L-P-CP	Carton Pack	10	Quick Ship
KTEB-232-UV-IS-L-P-DP	Distributor Pack		

NOTE: Version D1 (Manufacturing Revision). Prior versions of this ballast exist. Spec sheets for prior versions available upon request. Contact Keystone for details.

CATALOG NUMBER BREAKDOWN

KTEB-232-UV-IS-L-P-CP

KTEB	232	UV	IS	L	P	CP
Keystone Technologies Electronic Ballast	2 Lamps, 32 Watts	Universal Voltage	Instant Start	Low Ballast Factor	Premium Series	Packaging Style

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KTEB-232-UV-IS-N-P

T8 ELECTRONIC BALLAST

Version D1

DESCRIPTION

2 x F32T8 | 120-277 Multi-Voltage | HPF | Instant Start

STARTING METHOD: Instant Start
LAMP CONNECTION: Parallel
INPUT VOLTAGE: 120-277Vac ±10%
INPUT FREQUENCY: 50/60 Hz
POWER FACTOR: High
WARRANTY: 5 Years

- **2014 DOE Compliant**
- Sound Rated: A
- Maximum Case Temperature: 167°F, 75°C
- Meets FCC Part 18 (Class A) Non-Consumer Limits
- Meets ANSI Standard C82.11 and C62.41
- Max. Output Voltage: 600V
- Max. Voltage to Ground: 600V
- UL, cUL Listed Class P, Type 1 Outdoor
- Anti-Striation Circuitry
- Type HL

ELECTRICAL SPECIFICATIONS

LAMP TYPE	NO. OF LAMPS	INPUT VOLTS	INPUT WATTS	NOMINAL LINE AMPS	POWER FACTOR	BALLAST FACTOR	BALLAST EFFICACY FACTOR	MAX THD (%)	CREST FACTOR	MIN. START TEMP.	WIRING DIAGRAM
F32T8 (32W)	2	120V	54.4	0.48	>0.90	0.88	1.62	10	<1.70	0°F/-18°C	F2-4
		277V	53.5	0.21	>0.90	0.88	1.64	10	<1.70	0°F/-18°C	F2-4
	1	120V	35.2	0.29	>0.90	1.04	2.96	10	<1.70	0°F/-18°C	F1-4
		277V	35.3	0.13	>0.90	1.04	2.95	12	<1.70	0°F/-18°C	F1-4
F32T8 (30W)	2	120V	52.2	0.44	>0.90	0.88	1.69	10	<1.70	60°F/16°C	F2-4
		277V	51.7	0.20	>0.90	0.88	1.70	12	<1.70	60°F/16°C	F2-4
	1	120V	32.5	0.27	>0.90	1.04	3.20	10	<1.70	60°F/16°C	F1-4
		277V	32.4	0.12	>0.90	1.04	3.21	15	<1.70	60°F/16°C	F1-4
F32T8 (28W)	2	120V	50.2	0.43	>0.90	0.88	1.75	10	<1.70	60°F/16°C	F2-4
		277V	49.5	0.19	>0.90	0.88	1.78	12	<1.70	60°F/16°C	F2-4
	1	120V	31.0	0.26	>0.90	1.05	3.38	10	<1.70	60°F/16°C	F1-4
		277V	30.9	0.12	>0.90	1.05	3.40	15	<1.70	60°F/16°C	F1-4
F32T8 (25W)	2	120V	45.1	0.40	>0.90	0.89	1.97	10	<1.70	60°F/16°C	F2-4
		277V	44.7	0.17	>0.90	0.89	1.99	12	<1.70	60°F/16°C	F2-4
	1	120V	30.0	0.26	>0.90	1.05	3.50	10	<1.70	60°F/16°C	F1-4
		277V	30.0	0.12	>0.90	1.05	3.50	15	<1.70	60°F/16°C	F1-4
F25T8	2	120V	43.5	0.36	>0.90	0.89	2.05	10	<1.70	0°F/-18°C	F2-4
		277V	43.1	0.16	>0.90	0.89	2.06	12	<1.70	0°F/-18°C	F2-4
	1	120V	28.2	0.25	>0.90	1.05	3.72	10	<1.70	0°F/-18°C	F1-4
		277V	28.0	0.12	>0.90	1.05	3.75	15	<1.70	0°F/-18°C	F1-4
F17T8	2	120V	30.7	0.26	>0.90	0.91	2.96	10	<1.70	0°F/-18°C	F2-4
		277V	30.9	0.12	>0.90	0.91	2.94	12	<1.70	0°F/-18°C	F2-4
	1	120V	22.0	0.19	>0.90	1.07	4.86	12	<1.70	0°F/-18°C	F1-4
		277V	22.0	0.09	>0.90	1.07	4.86	15	<1.70	0°F/-18°C	F1-4
F15T8	2	120V	27.0	0.23	>0.90	0.66	2.44	10	<1.70	0°F/-18°C	F2-4
		277V	27.0	0.10	>0.90	0.66	2.44	15	<1.70	0°F/-18°C	F2-4
	1	120V	18.3	0.15	>0.90	0.82	4.48	12	<1.70	0°F/-18°C	F1-4
		277V	18.7	0.07	>0.90	0.82	4.38	18	<1.70	0°F/-18°C	F1-4
F40T8	1	120V	42.7	0.36	>0.90	1.00	2.34	10	<1.70	0°F/-18°C	F1-4
		277V	42.3	0.16	>0.90	1.00	2.36	15	<1.70	0°F/-18°C	F1-4
PLL 25W	2	120V	48.5	0.41	>0.90	0.90	1.86	10	<1.70	0°F/-18°C	P2-3
		277V	48.0	0.18	>0.90	0.90	1.88	12	<1.70	0°F/-18°C	P2-3
	1	120V	30.9	0.26	>0.90	1.02	3.30	10	<1.70	0°F/-18°C	P2-3
		277V	30.9	0.12	>0.90	1.02	3.30	15	<1.70	0°F/-18°C	P2-3

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KTEB-232-UV-IS-N-P

T8 ELECTRONIC BALLAST

Version D1

ELECTRICAL SPECIFICATIONS

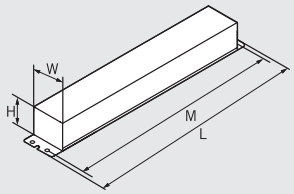
CONTINUED FROM PAGE 1

LAMP TYPE	NO. OF LAMPS	INPUT VOLTS	INPUT WATTS	NOMINAL LINE AMPS	POWER FACTOR	BALLAST FACTOR	BALLAST EFFICACY FACTOR	MAX THD (%)	CREST FACTOR	MIN. START TEMP.	WIRING DIAGRAM
PLL 28W	2	120V	56.2	0.47	>0.90	0.93	1.65	10	<1.70	0°F/-18°C	P2-3
		277V	56.0	0.21	>0.90	0.93	1.66	12	<1.70	0°F/-18°C	P2-3
	1	120V	35.9	0.31	>0.90	1.09	3.04	10	<1.70	0°F/-18°C	P2-3
		277V	35.9	0.13	>0.90	1.09	3.04	15	<1.70	0°F/-18°C	P2-3
PLL 40W	1	120V	38.5	0.33	>0.90	0.83	2.16	10	<1.70	0°F/-18°C	P2-3
		277V	38.2	0.14	>0.90	0.83	2.17	15	<1.70	0°F/-18°C	P2-3

Will also operate equivalent U-bend lamps.

PHYSICAL SPECIFICATIONS

CASE DIMENSIONS



LENGTH	9.50”
WIDTH	1.30”
HEIGHT	1.18”
MOUNTING	9.00”
CASE STYLE	L4

STANDARD LEAD LENGTHS*

BLACK	25”
WHITE	25”
BLUE	31”
RED	45”

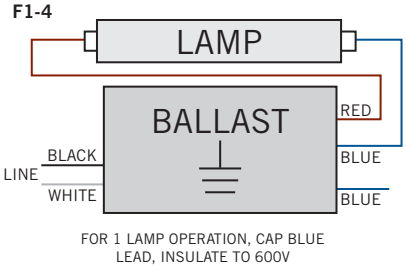
*Consult Keystone for special lead length requirements.

Lead wires are 18 AWG 105°C/600V, solid copper.

CASE MATERIAL: Steel

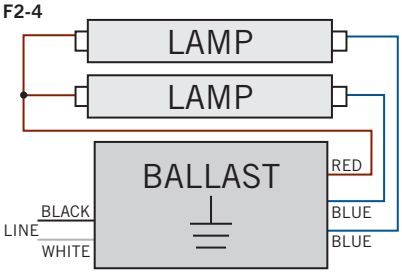
WIRING DIAGRAMS

F1-4

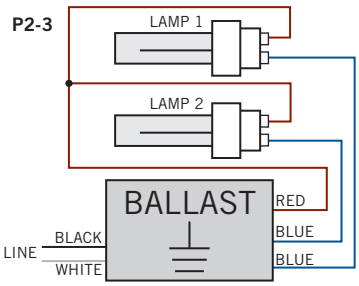


FOR 1 LAMP OPERATION, CAP BLUE LEAD, INSULATE TO 600V

F2-4



P2-3



CAP OFF BLUE LEAD FOR 1 LAMP APPLICATION

Instant start T8 ballasts require the use of either shunted sockets or a sockets with a manual wire shunt (or “bridge”).

ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KTEB-232-UV-IS-N-P-DP	Distributor Pack	10	Quick Ship
KTEB-232-UV-IS-N-P-CP	Carton Pack	10	Active

NOTE: Version D1 (Manufacturing Revision). Prior versions of this ballast exist. Spec sheets for prior versions available upon request. Contact Keystone for details.

CATALOG NUMBER BREAKDOWN

KTEB-232-UV-IS-N-P-DP

KTEB	232		UV	IS	N	P	DP
Keystone Technologies Electronic Ballast	2 Lamp	Wattage	Universal Voltage	Instant Start	Normal Ballast Factor	Premium Series	Packaging Style

KTEB-332-UV-IS-L-P

T8 ELECTRONIC BALLAST

Version D1

DESCRIPTION

3×F32T8 | 120-277 Multi-Voltage | HPF | Instant Start

STARTING METHOD: Instant
LAMP CONNECTION: Parallel
INPUT VOLTAGE: 120-277VAC ±10%
INPUT FREQUENCY: 50/60 Hz
POWER FACTOR: High
WARRANTY: 5 Years

PRODUCT FEATURES

- **2014 DOE Compliant**
- Sound Rated: A
- Maximum Ambient Temperature: 105ºF, 40ºC
- Maximum Case Temperature: 167ºF, 75ºC
- Meets FCC Part 18 (Class A) Non-Consumer Limits
- Meets ANSI Standard C82.11 and C62.41
- UL, cUL Listed Class P, Type 1 Outdoor
- Anti-Striation Circuitry
- Type HL

ELECTRICAL SPECIFICATIONS

LAMP TYPE	NO. OF LAMPS	INPUT VOLTS	INPUT WATTS	INPUT CURRENT (AMPS)	POWER FACTOR	BALLAST FACTOR	BALLAST EFFICACY FACTOR	MAX THD%	CREST FACTOR	MIN START TEMP	WIRING DIAGRAM
F32T8 (32W)	3	120	73.5	0.63	>0.9	0.78	1.06	10	<1.7	0°F, -18°C	F3-2
		277	72.1	0.27	>0.9	0.78	1.08	10	<1.7	0°F, -18°C	F3-2
	2	120	55.7	0.47	>0.9	0.90	1.62	10	<1.7	0°F, -18°C	F2-5
		277	55.1	0.20	>0.9	0.90	1.63	12	<1.7	0°F, -18°C	F2-5
F32T8 (30W)	3	120	67.0	0.57	>0.9	0.78	1.16	10	<1.7	60°F, 16°C	F3-2
		277	66.0	0.25	>0.9	0.78	1.18	12	<1.7	60°F, 16°C	F3-2
	2	120	50.1	0.42	>0.9	0.90	1.80	10	<1.7	60°F, 16°C	F2-5
		277	49.8	0.19	>0.9	0.90	1.81	12	<1.7	60°F, 16°C	F2-5
F32T8 (28W)	3	120	66.2	0.56	>0.9	0.78	1.18	10	<1.7	60°F, 16°C	F3-2
		277	65.2	0.24	>0.9	0.78	1.20	12	<1.7	60°F, 16°C	F3-2
	2	120	47.7	0.42	>0.9	0.90	1.89	10	<1.7	60°F, 16°C	F2-5
		277	48.7	0.19	>0.9	0.90	1.85	12	<1.7	60°F, 16°C	F2-5
F32T8 (25W)	3	120	57.7	0.50	>0.9	0.78	1.35	10	<1.7	60°F, 16°C	F3-2
		277	57.3	0.22	>0.9	0.78	1.36	12	<1.7	60°F, 16°C	F3-2
	2	120	46.6	0.39	>0.9	0.90	1.93	10	<1.7	60°F, 16°C	F2-5
		277	46.4	0.17	>0.9	0.90	1.94	12	<1.7	60°F, 16°C	F2-5
F25T8	3	120	57.7	0.48	>0.9	0.78	1.35	10	<1.7	0°F, -18°C	F3-2
		277	57.3	0.21	>0.9	0.78	1.36	12	<1.7	0°F, -18°C	F3-2
	2	120	42.9	0.36	>0.9	0.90	2.10	10	<1.7	0°F, -18°C	F2-5
		277	42.8	0.16	>0.9	0.90	2.10	12	<1.7	0°F, -18°C	F2-5
F17T8	3	120	40.6	0.33	>0.9	0.80	1.97	10	<1.7	0°F, -18°C	F3-2
		277	40.7	0.15	>0.9	0.80	1.97	12	<1.7	0°F, -18°C	F3-2
	2	120	31.1	0.26	>0.9	0.92	2.96	10	<1.7	0°F, -18°C	F2-5
		277	31.3	0.12	>0.9	0.92	2.94	12	<1.7	0°F, -18°C	F2-5
F40T8	2	120	66.4	0.57	>0.9	0.84	1.27	10	<1.7	0°F, -18°C	F2-5
		277	65.4	0.24	>0.9	0.84	1.28	12	<1.7	0°F, -18°C	F2-5

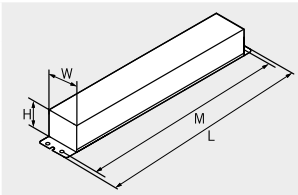
KTEB-332-UV-IS-L-P

T8 ELECTRONIC BALLAST

Version D1

PHYSICAL SPECIFICATIONS

CASE DIMENSIONS



LENGTH	9.50”
WIDTH	1.30”
HEIGHT	1.18”
MOUNTING	9.00”
CASE STYLE	L4

STANDARD LEAD LENGTH*

WHITE	25”
BLACK	25”
BLUE	31”
RED	37”

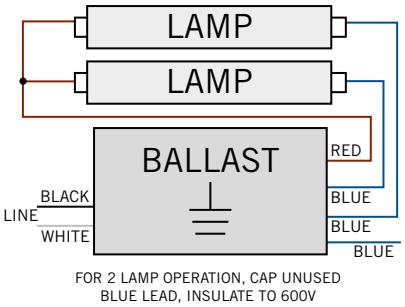
* Consult Keystone for special lead length requirements.

CASE MATERIAL: Steel

Lead wires are
18 AWG 105 C/600V,
solid copper.

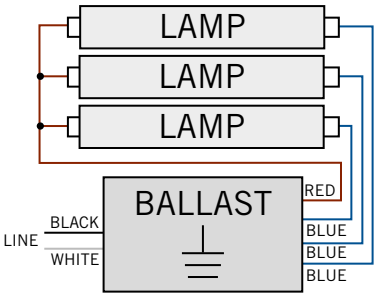
WIRING DIAGRAMS

F2-5



FOR 2 LAMP OPERATION, CAP UNUSED
BLUE LEAD, INSULATE TO 600V

F3-2



ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KTEB-332-UV-IS-L-P-CP	Carton Pack	10	Quick Ship
KTEB-332-UV-IS-L-P-DP	Distributor Pack		

NOTE: Version D1 (Manufacturing Revision). Prior versions of this ballast exist. Spec sheets for prior versions available upon request. Contact Keystone for details.

CATALOG NUMBER BREAKDOWN

KTEB-332-UV-IS-L-P-CP

KTEB	332		UV	IS	L	P	CP
Keystone Technologies Electronic Ballast	3 Lamps	32 Watts	Universal Voltage	Instant Start	Low Ballast Factor	Premium Series	Packaging Style

KTEB-432-UV-IS-L-P

T8 ELECTRONIC FLUORESCENT

NEMA Premium | RoHS Compliant | c UL us

PRODUCT FEATURES

STARTING METHOD: Instant	**INPUT VOLTAGE:** 120-277VAC ±10%	**WARRANTY:** 5 Years
LAMP CONNECTION: Parallel	**INPUT FREQUENCY:** 50/60 Hz	**POWER FACTOR:** High

- Sound Rated: A
- Minimum Starting Temperature: 0ºF, -18ºC
- Maximum Case Temperature: 167ºF, 75ºC
- Meets FCC Part 18 (Class A) Non-Consumer Limits
- Transient Protection Meets ANSI/IEEEC62.41 Cat. A
- Ballast frequency for all listed lamps: > 40kHz

ELECTRICAL SPECIFICATIONS

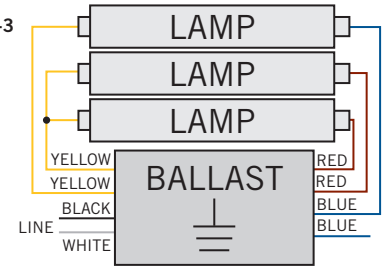
LAMP TYPE	NO. OF LAMPS	INPUT VOLTS	INPUT WATTS	INPUT CURRENT (AMPS)	POWER FACTOR	CREST FACTOR	BALLAST FACTOR	BALLAST EFFICACY FACTOR	MAX THD%	WIRING DIAGRAM
F32T8 32W	4	120	98.0	0.82	0.99	<1.70	0.78	0.80	10	F4-1
		277	96.0	0.35	0.98	<1.70	0.77	0.80	10	F4-1
	3	120	81.0	0.68	0.99	<1.70	0.87	1.07	10	F3-3
		277	78.0	0.28	0.97	<1.70	0.86	1.10	12	F3-3
F32T8 30W	4	120	92.0	0.77	0.99	<1.70	0.76	0.83	10	F4-1
		277	92.0	0.33	0.98	<1.70	0.75	0.82	10	F4-1
	3	120	75.0	0.63	0.99	<1.70	0.82	1.09	10	F3-3
		277	75.0	0.27	0.97	<1.70	0.81	1.08	12	F3-3
F32T8 28W	4	120	89.0	0.74	0.99	<1.70	0.78	0.88	10	F4-1
		277	89.0	0.32	0.98	<1.70	0.77	0.87	10	F4-1
	3	120	68.0	0.57	0.99	<1.70	0.79	1.16	10	F3-3
		277	74.0	0.27	0.97	<1.70	0.78	1.05	12	F3-3
F32T8 25W	4	120	81.0	0.68	0.99	<1.70	0.80	0.99	10	F4-1
		277	83.0	0.30	0.98	<1.70	0.81	0.98	10	F4-1
	3	120	67.0	0.56	0.99	<1.70	0.88	1.31	10	F3-3
		277	69.0	0.25	0.97	<1.70	0.90	1.30	12	F3-3
F25T8 25W	4	120	76.0	0.63	0.99	<1.70	0.75	0.99	10	F4-1
		277	77.0	0.28	0.98	<1.70	0.76	0.99	10	F4-1
	3	120	63.0	0.53	0.99	<1.70	0.82	1.30	10	F3-3
		277	63.0	0.23	0.97	<1.70	0.84	1.33	12	F3-3
F17T8 17W	4	120	56.0	0.47	0.99	<1.70	0.81	1.45	10	F4-1
		277	56.0	0.20	0.96	<1.70	0.81	1.45	12	F4-1
	3	120	47.0	0.39	0.99	<1.70	0.90	1.91	10	F3-3
		277	47.0	0.17	0.95	<1.70	0.90	1.91	15	F3-3
F40T8 40W	3	120	97.0	0.81	0.99	<1.70	0.79	0.81	10	F3-3
		277	98.0	0.35	0.98	<1.70	0.80	0.82	10	F3-3

KTEB-432-UV-IS-L-P

T8 ELECTRONIC FLUORESCENT

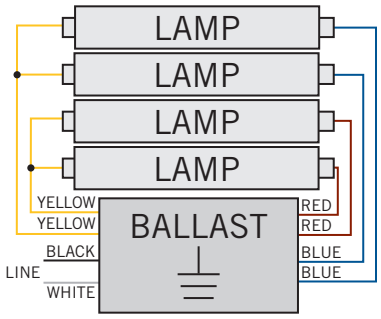
WIRING DIAGRAMS

F3-3



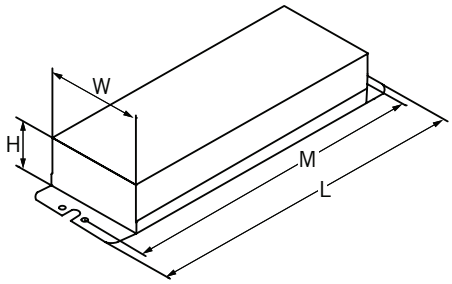
FOR 3 LAMP OPERATION, CAP UNUSED BLUE LEAD, INSULATE TO 600V

F4-1



Instant Start T8 ballasts require the use of Shunted lampholders/ sockets.

CASE STYLE/DIMENSIONS



CASE DIMENSIONS

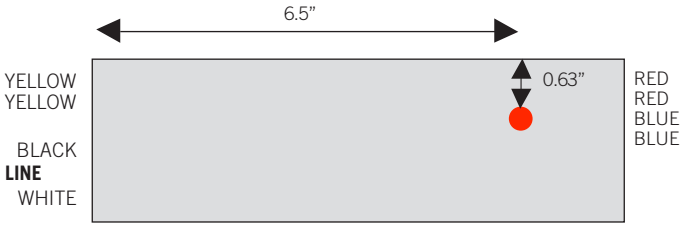
LENGTH: 9.50”
WIDTH: 1.38”
HEIGHT: 1.18”
MOUNTING: 8.90”
UNIT WEIGHT: 1.23 lbs

STANDARD LEAD LENGTHS*

BLACK: 25.00”
WHITE: 25.00”
BLUE: 31.00” X 31.00”
RED: 31.00” X 31.00”
YELLOW: 45.00” X 45.00”

*Consult Keystone for special lead length requirements.

HOT SPOT LOCATION



ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KTEB-432-UV-IS-L-P-CP	Carton	40	Quick Ship
KTEB-432-UV-IS-L-P-DP	Carton	10	Quick Ship

CATALOG NUMBER BREAKDOWN

KTEB-432-UV-IS-L-P

KTEB	4	32	UV	IS	L	P
Keystone Technologies Electronic Ballast	4 Lamps	32 Watts	Universal Voltage Input (120-277V)	Instant Start	Low Ballast Factor	NEMA Premium Series

Keystone Technologies, LLC • P.O. Box 246, Ambler PA 19002 • Phone (800) 464-2680 • Fax (215) 628-4412 • www.keystoneballast.com

SINCE 1945
KEYSTONE
ENGINEERED LIGHTING SOLUTIONS

KTEB-432-UV-IS-N-P

T8 ELECTRONIC FLUORESCENT

Version A1

4 x F32T8 | 120-277V Input | High Power Factor | Instant Start

STARTING METHOD: Instant Start
LAMP CONNECTION: Parallel
INPUT VOLTAGE: 120-277VAC ±10%
INPUT FREQUENCY: 50/60 Hz
POWER FACTOR: High
WARRANTY: 5 Years

PRODUCT FEATURES

- **2014 DOE Compliant**
- Sound Rated: A
- Maximum Case Temperature: 167ºF, 75ºC
- Meets FCC Part 18 (Class A) Non-Consumer Limits
- Meets ANSI Standard C82.11-2002 and C62.41-2002
- UL, cUL Listed, Class P, Type 1 Outdoor
- OCV: 600V
- Anti-Striation Circuitry
- Type HL

ELECTRICAL SPECIFICATIONS

LAMP TYPE	NO. OF LAMPS	INPUT VOLTS	INPUT WATTS	INPUT CURRENT (AMPS)	POWER FACTOR	CREST FACTOR	BALLAST FACTOR	BALLAST EFFICACY FACTOR	MAX THD (%)	MIN. START TEMP (ºF/ºC)	WIRING DIAGRAM
F32T8 (32W)	4	120	112	0.93	≥0.98	≤1.70	0.88	0.80	10	0/-18	F4-1
		277	108	0.40	≥0.98	≤1.70	0.88	0.81	10	0/-18	F4-1
	3	120	92	0.77	≥0.98	≤1.70	0.96	1.04	10	0/-18	F3-3
		277	89	0.34	≥0.98	≤1.70	0.96	1.07	10	0/-18	F3-3
F32T8 (30W)	4	120	101	0.85	≥0.98	≤1.70	0.88	0.87	10	0/-18	F4-1
		277	100	0.37	≥0.98	≤1.70	0.88	0.88	10	0/-18	F4-1
	3	120	84	0.71	≥0.98	≤1.70	0.96	1.14	10	0/-18	F3-3
		277	84	0.31	≥0.98	≤1.70	0.96	1.15	10	0/-18	F3-3
F32T8 (28W)	4	120	94	0.79	≥0.98	≤1.70	0.88	0.93	10	0/-18	F4-1
		277	94	0.35	≥0.98	≤1.70	0.88	0.93	10	0/-18	F4-1
	3	120	77	0.65	≥0.98	≤1.70	0.96	1.24	10	0/-18	F3-3
		277	77	0.29	≥0.98	≤1.70	0.96	1.25	10	0/-18	F3-3
F32T8 (25W)	4	120	88	0.74	≥0.98	≤1.70	0.88	1.00	10	0/-18	F4-1
		277	88	0.33	≥0.98	≤1.70	0.88	1.00	10	0/-18	F4-1
	3	120	74	0.62	≥0.98	≤1.70	0.96	1.29	10	0/-18	F3-3
		277	73	0.27	≥0.98	≤1.70	0.96	1.31	10	0/-18	F3-3
F25T8	4	120	87	0.72	≥0.98	≤1.70	0.89	1.02	10	0/-18	F4-1
		277	85	0.32	≥0.98	≤1.70	0.89	1.05	10	0/-18	F4-1
	3	120	72	0.60	≥0.98	≤1.70	0.96	1.33	10	0/-18	F3-3
		277	71	0.26	≥0.98	≤1.70	0.96	1.35	10	0/-18	F3-3
F17T8	4	120	59	0.49	≥0.98	≤1.70	0.93	1.57	10	0/-18	F4-1
		277	58	0.22	≥0.98	≤1.70	0.93	1.59	10	0/-18	F4-1
	3	120	50	0.41	≥0.98	≤1.70	0.92	1.86	10	0/-18	F3-3
		277	49	0.18	≥0.97	≤1.70	0.92	1.87	10	0/-18	F3-3
F40T8	3	120	114	0.95	≥0.98	≤1.70	0.96	0.84	10	32/0	F3-3
		277	109	0.41	≥0.98	≤1.70	0.96	0.88	10	32/0	F3-3

* Will also operate equivalent U-bend lamps.

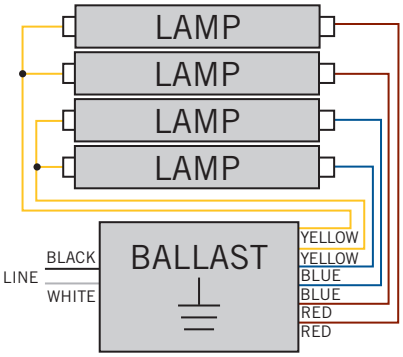
KTEB-432-UV-IS-N-P

T8 ELECTRONIC FLUORESCENT

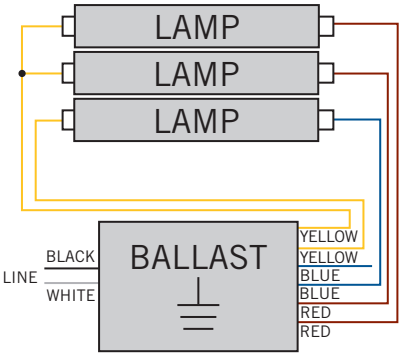
Version A1

WIRING DIAGRAM

F4-1

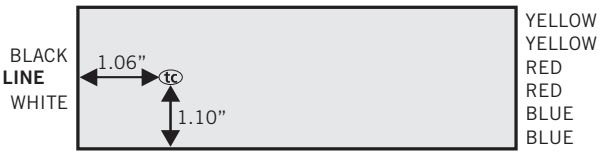


F3-3



FOR 3 LAMP OPERATION, CAP ANY BLUE LEAD, INSULATE TO 600V.

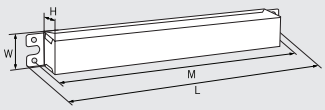
HOT SPOT LOCATION



Actual tc point is noted on each ballast label.

PHYSICAL SPECIFICATIONS

CASE DIMENSIONS



LENGTH	9.50"
WIDTH	1.30"
HEIGHT	1.10"
MOUNTING	8.90"
CASE STYLE	L11

STANDARD LEAD LENGTHS*

WHITE	25"
BLACK	25"
YELLOW	46"
RED	31"
BLUE	31"

*Consult Keystone for special lead length requirements.

Lead wires are 18 AWG 105ºC/600V, solid copper.

CASE MATERIAL: Metal

ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KTEB-432-UV-IS-N-P-DP	Distributor Pack	10	Quick Ship
KTEB-432-UV-IS-N-P-CP	Carton Pack	20	Active

NOTE: Version A1 (Manufacturing Revision). Prior versions of this ballast exist. Spec sheets for prior versions available upon request. Contact Keystone for details.

CATALOG NUMBER BREAKDOWN

KTEB-432-UV-IS-N-P-DP

KTEB	432	UV	IS	N	P	DP
Keystone Technologies Electronic Ballast	4 Lamp	Wattage	120-277V Universal Input	Instant Start	Normal Light Output	Premium Series	Packaging Style

A19-13-E26-827-DIM

RAB | Residential

Project:	Type:	Prepared By:	Date:

UPC: 019813834023

Features and Benefits

Energy efficient replacement for incandescent and halogen lamps

Constructed from durable plastic which lowers risk of breakage

Rated for use in enclosed and open fixtures in dry or damp locations (>15W A19 is Open fixture rated)

Frosted lens produces smooth diffuse light

Longer lifespan compared to legacy equivalents minimizes replacement and maintenance costs

ENERGY STAR Compliant

Dimmable with common dimmer types (check compatibility list)

Technical Specifications

Performance

Product Type:
A-Line

Input Wattage:
13.5W

Typical Lumen Output:
1100

Efficacy:
82 lm/W

Color Temperature:
2700K Soft White

CRI:
80

L70 Lifespan:
15,000 Hours

Dimmable:
Yes, down to 10%

Construction

Bulb Shape:
A19

Base Type:
E26

Beam Angle:
230°

For Use Outdoors in Open Fixtures:
No

Other

Equivalency:
75W Incandescent

Warranty (Years):
RAB warrants that our LED products will be free from defects in materials and workmanship for a period of three (3) 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 rablighting.com/warranty.

Electrical

Power Factor:
0.7

Operating Temperature:
-20°C - 45°C

Input Voltage:
120V

Technical Specifications (continued)

Electrical

Operating Frequency:

60 Hz

Electrical Characteristics

Input Current @ 120V:

183mA

Compliance

UL Listed:

Yes

ENERGY STAR V2.0:

This product is ENERGY STAR® Version 2.0 Certified

Energy Star Model Number:

A10011

Energy Star ID:

2357498

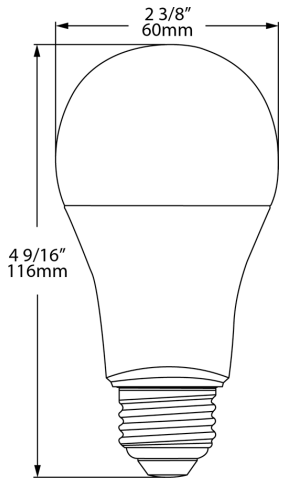
CEC Status:

Not lawful for sale in California

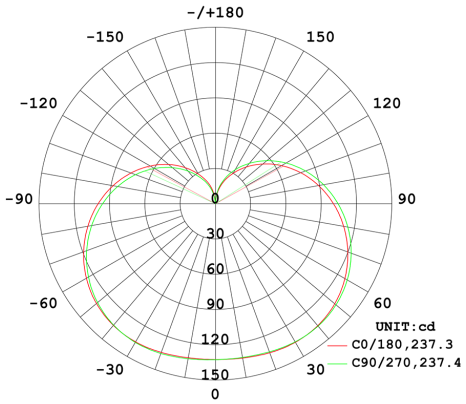
Case and Pallet Dimensions

	QTY	LENGTH (in)	WIDTH (in)	HEIGHT (in)
CASE	12	5.2	5.5	15.4
PALLET	2016	48.1	46.9	39.8

Dimension



Light Distribution



SINCE 1945 KEYSTONE | SMARTDRIVE LED PLUG & PLAY WITH BALLAST

KT-LED8T8-24GC-840-S

T8 LED LAMP

DESCRIPTION

8W T8 LED | 4000K | >80 CRI | High Efficiency | Ballast Compatible

RoHS Compliant | 5 YEAR WARRANTY

LAMP TYPE: Linear
BULB TYPE: T8 LED
BASE TYPE: G13 (Medium Bi-Pin)
WATTAGE: 8W
COLOR TEMPERATURE: 4000K
COLOR RENDERING INDEX (CRI): >80
WARRANTY: 5 Years

PRODUCT FEATURES

- **Compatible with Most Instant and Program Start Electronic T8 Ballasts, Contact Keystone for Ballast Compatibility List**
- Direct Replacement for F17T8 Fluorescent Lamps
- UL Listed; Listed on DLC QPL
- 50,000+ Hour Lifetime
- Environmentally Friendly: No Mercury Used
- Instant Startup
- Frosted Lens Eliminates Pixelation
- Operating Temperature: -20ºC/-4ºF to 45ºC/113ºF
- 100+ Lumens per Watt (Bare Lamp Efficacy)
- Suitable for Dry and Damp Locations
- Improved Lamp Durability with Shatterproof Coated Glass
- NSF Listed: NSF/ANSI Standard 2 - Food Equipment

OPERATING SPECIFICATIONS

ELECTRICAL AND PERFORMANCE CHARACTERISTICS

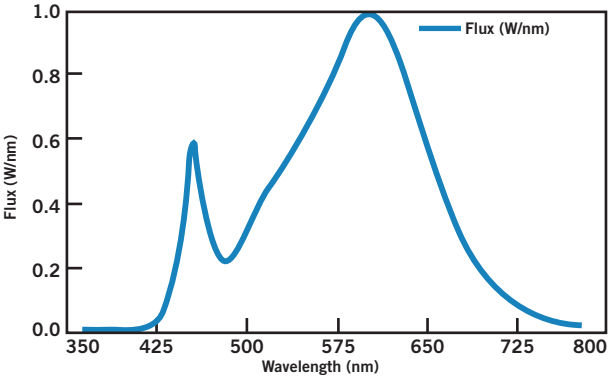
Input Voltage	CRI	Bare Lamp Wattage	Nominal Lamp Lumens	System Wattage*			Initial Lumens*			Beam Angle	Nominal Bare Lamp Efficacy	Power Factor	Max. THD
				0.78BF	0.88BF	1.18BF	0.78BF	0.88BF	1.18BF				
Ballast Dependent	>80	8W	1150 lm	9.3W	10.4W	14.3W	1110 lm	1235 lm	1610 lm	220º	127.0	>0.9	20%

** Nominal values. Actual values may vary depending on electronic ballast used.*

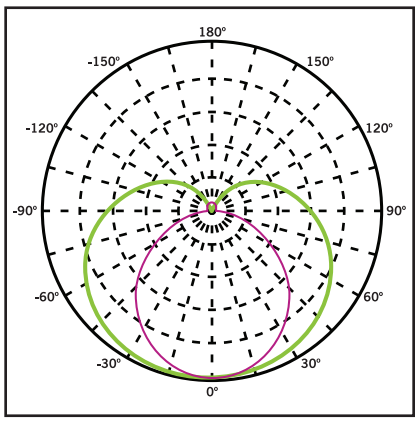
RATED LIFE

L70 (Hours)	50,000

SPECTRAL DISTRIBUTION



POLAR CANDELA DISTRIBUTION



Maximum Candela = 1248.55
Located at Horizontal Angle = 0, Vertical Angle 0

1. **Violet** Vertical Plane through Horizontal Angles (90-270)
2. **Green** Vertical Plane through Horizontal Angles (0-180)

Beam Angle: 220º

Visible Light Area: 325º

Keystone Technologies • 1390 Welsh Road, North Wales, PA 19454 • Phone (800) 464-2680 • Fax (888) 966-0556 • **www.keystonetech.com**

SINCE 1945 KEYSTONE | SMARTDRIVE LED PLUG & PLAY WITH BALLAST

KT-LED8T8-24GC-840-S

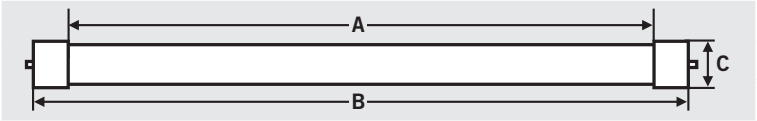
T8 LED LAMP

WIRING

Plug and Play: Simply replace the existing fluorescent lamp with Keystone Smart Drive LED lamp. No changes to the existing fluorescent ballast wiring needed. For ballast compability questions, please contact Keystone.

PHYSICAL CHARACTERISTICS

LAMP DIMENSIONS



A (Illuminated Length)	20.68"
B (Body Length)	23.19"
C (Diameter)	1.00"

NOMINAL LENGTH: 24" **BASE TYPE:** G13 (Medium Bi-Pin)

ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KT-LED8T8-24GC-840-S-CP	Carton Pack (Egg Crate Packaging)	25	Quick Ship
KT-LED8T8-24GC-840-S-DP	Distributor Pack (Individual Cartons)	20	Quick Ship

CATALOG NUMBER BREAKDOWN

KT-LED8T8-24GC-840-S-CP

KT	LED	8	T8	24	GC	840	S	CP
Keystone Technologies	LED Lamp	Wattage	Lamp Type	Nominal Length (Inches)	Shatterproof Coated Glass	800 Series	Color Temp.	Smart Drive Series	Packaging Style

SINCE 1945 KEYSTONE | SMARTDRIVE LED PLUG & PLAY WITH BALLAST

KT-LED15T8-48GC-840-S

T8 LED LAMP

DESCRIPTION

15W T8 LED | 4000K | >80 CRI | High Efficiency | Ballast Compatible

DLC | NSF | cULus LISTED | RoHS Compliant | 5 YEAR WARRANTY

LAMP TYPE: Linear
BULB TYPE: T8 LED
BASE TYPE: G13 (Medium Bi-Pin)
WATTAGE: 15W
COLOR TEMPERATURE: 4000K
COLOR RENDERING INDEX (CRI): >80
WARRANTY: 5 Years

PRODUCT FEATURES

- **Compatible with Most Instant and Program Start Electronic T8 Ballasts, Contact Keystone for Ballast Compatibility List**
- Direct Replacement for the Following Fluorescent Lamps: F32T8/32W, F32T8/30W, F32T8/28W, F32T8/25W
- UL Listed; Listed on DLC Qualified Product List
- 50,000+ Hour Lifetime
- Environmentally Friendly: No Mercury Used
- Instant Startup
- Frosted Lens Eliminates Pixelation
- Operating Temperature: -20ºC/-4ºF to 45ºC/113ºF
- 110+ Lumens per Watt (Bare Lamp Efficacy)
- Suitable for Dry and Damp Locations
- Improved Lamp Durability with Shatterproof Coated Glass
- NSF Listed: NSF/ANSI Standard 2 - Food Equipment

OPERATING SPECIFICATIONS

ELECTRICAL AND PERFORMANCE CHARACTERISTICS

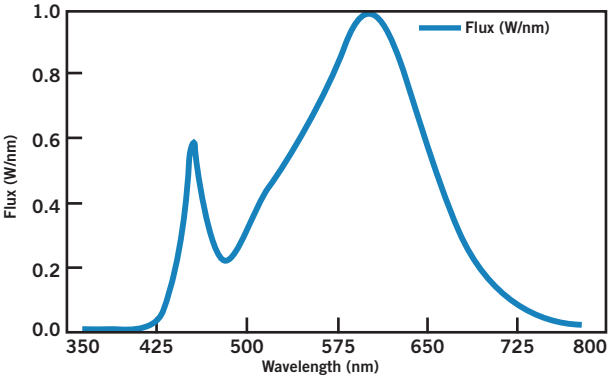
Input Voltage	CRI	Bare Lamp Wattage	Nominal Lamp Lumens	System Wattage*			Initial Lumens*			Visisble Light Area	Nominal Bare Lamp Efficacy	Power Factor	Max. THD
				0.78BF	0.88BF	1.18BF	0.78BF	0.88BF	1.18BF				
Ballast Dependent	>80	15W	2200 lm	15.8W	17.5W	24.1W	1965 lm	2185 lm	2825 lm	325º	147	>0.9	20%

** Nominal values. Actual values may vary depending on electronic ballast used.*

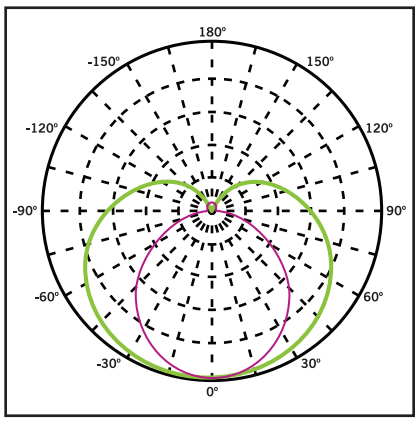
RATED LIFE

L70 (Hours)	50,000

SPECTRAL DISTRIBUTION



POLAR CANDELA DISTRIBUTION



Maximum Candela = 1248.55
Located at Horizontal Angle = 0, Vertical Angle 0

1. **Violet** Vertical Plane through Horizontal Angles (90-270)
2. **Green** Vertical Plane through Horizontal Angles (0-180)

Beam Angle: 220º

Visible Light Area: 325º

Keystone Technologies • 1390 Welsh Road, North Wales, PA 19454 • Phone (800) 464-2680 • Fax (888) 966-0556 • **www.keystonetech.com**

SINCE 1945 KEYSTONE | SMARTDRIVE LED PLUG & PLAY WITH BALLAST

KT-LED15T8-48GC-840-S

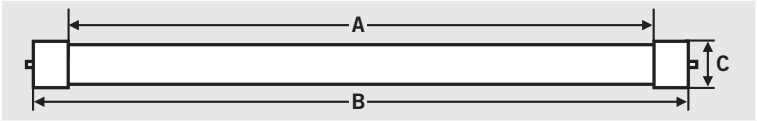
T8 LED LAMP

WIRING

Plug and Play: Simply replace the existing fluorescent lamp with Keystone Smart Drive LED lamp. No changes to the existing fluorescent ballast wiring needed. For ballast compability questions, please contact Keystone.

PHYSICAL CHARACTERISTICS

LAMP DIMENSIONS



A (Illuminated Length)	44.70”
B (Body Length)	47.15”
C (Diameter)	1.00”

NOMINAL LENGTH: 48” **BASE TYPE:** G13 (Medium Bi-Pin)

ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KT-LED15T8-48GC-840-S-CP	Carton Pack (Egg Crate Packaging)	25	Quick Ship
KT-LED15T8-48GC-840-S-DP	Distributor Pack (Individual Cartons)	20	Quick Ship

CATALOG NUMBER BREAKDOWN

KT-LED15T8-48GC-840-S-CP

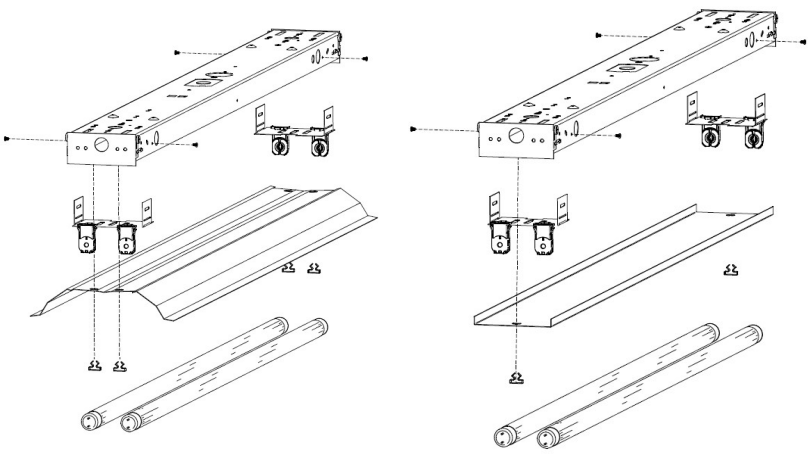
KT	LED15T8	48	GC	840	S	CP
Keystone Technologies	LED Lamp	Wattage	Lamp Type	Nominal Length (Inches)	Shatterproof Coated Glass	800 Series	Color Temp.	Smart Drive Series	Packaging Style

TECHBRITE

SAVING ENERGY IN THE BEST POSSIBLE LIGHT

PROJECT NAME:
NOTES:
PART NUMBER:
DATE:

RETRO STRIP—LED TUBES



PRODUCT DESCRIPTION:

TechBrite's most popular industrial retrofit kit, the LED Tube Retro Strip, is a simple installation process. It includes all the items needed to convert an existing strip fixture to a CSA-approved LED tube fixture. Replace your existing T12 or T8 fixtures with the LED Tube Retro Strip from TechBrite. The LED Tube Retro Strip is designed specifically for 4 foot LED tubes up to 22w and is available for 4 or 8 foot fixtures. The 4 foot retro features 1, 2 or 3 lamp options. The 8 foot retro features 2, 4 or 6 lamp options. This kit is sold with or without LED tubes and available with ballast cover or reflector. The TechBrite LED Tube Retro Strip is a fast, easy, and economical solution to upgrading existing fixtures.

FEATURES:

- Retro kit includes : sockets, socket bracket, channel cover, screws, quarterturns
- Quick & simple installation
- Tool-less channel cover for easy installation
- Energy & operational savings
- Available in 4' and 8' options
- Save install time with optional prewiring
- Limited warranty: 5 years on luminaire

PERFORMANCE SPECIFICATION:

Lumens	3 Lamp Max (4') / 6 Lamp Max (8')
Watts	4' = 66w Max / 8' = 132w Max
LPW	See TLED Specification
Color	See TLED Specification
CRI	See TLED Specification
L70	See TLED Specification
L85	See TLED Specification
Max Ambient Temp	See TLED Specification
Min Ambient Temp	See TLED Specification
Dimming	See TLED Specification
Driver Voltage	See TLED Specification
Chip	See TLED Specification
Driver	See TLED Specification

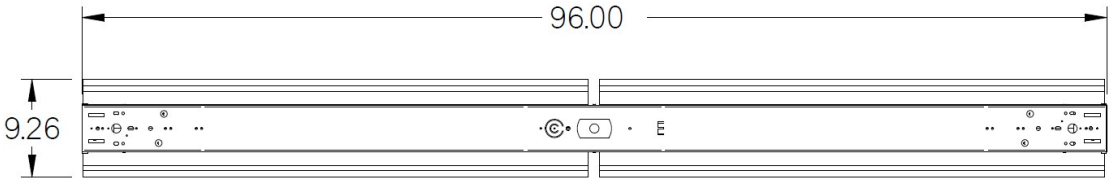
C US MADE IN THE USA MADE OF US AND IMPORTED PARTS

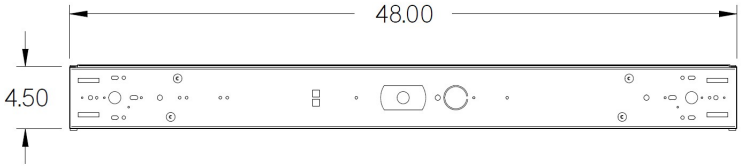
TECHBRITE
SAVING ENERGY IN THE BEST POSSIBLE LIGHT

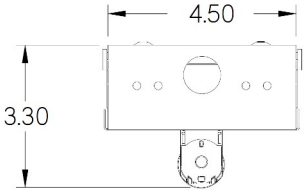
Retro Strip—LED Tubes

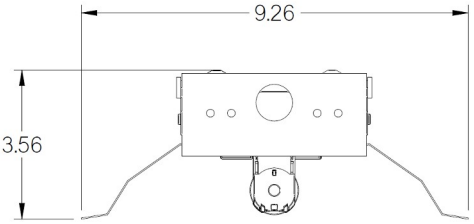
Commercial/Industrial

DIMENSIONS:









* Channel dimensions shown for reference only. Existing fixture may not correspond with dimension shown.

ORDERING CHART:

Series		Length		Width		# of Tubes		Type		Socket Type		Reflector		Wiring*	
R	Retro	**4**	4 Foot	**4**	4.25" Ballast Cvr	**Four Foot**		**SS**	LED Tubes	**X**	Shunted	**BCXX**	Ballast Cvr	**00P0**	Pre
		8	8 Foot	**5**	5" Ballast Cvr	**1**	1 lamp			**U**	Unshunted	**WRXX**	White	**0000**	None
				9	9" Reflector	**2**	2 lamp					**MRXX**	Miro 4		
						3	3 lamp					**XXXX**	None		
						Eight Foot									
						2	2 lamp								
						4	4 lamp								
						6	6 lamp								

ADDERS:

Lamp Type	
BLANK	Wired single end with unshunted sockets
WOE	Wired opposing ends with shunted sockets

* Prewired includes: wire & disconnect
* No wiring includes: disconnect & no wires

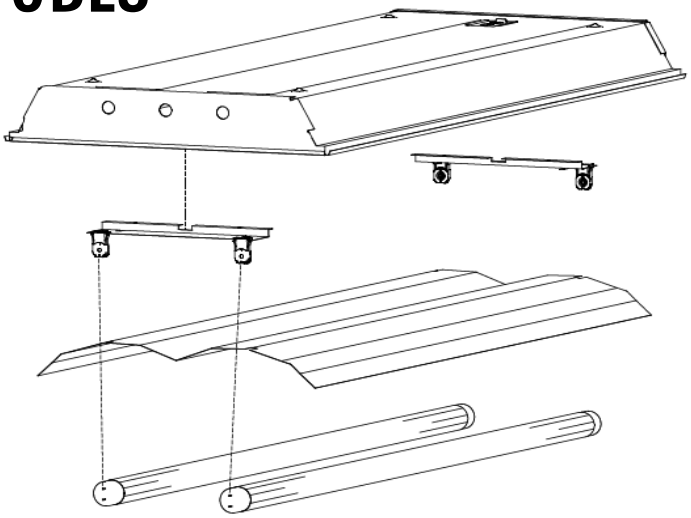
FREQUENTLY ORDERED PART NUMBERS:

Part Number	Description	Dimensions	Weight
R442SSUBCXX00P0	4' Retro Strip - LED Tubes 2 Lamp - Ballast Cover	48.00 x 4.50 x 3.56	2.91 lbs
R492SSUWRXX00P0	4' Retro Strip - LED Tubes 2 Lamp - White Reflector	48.00 x 9.26 x 3.56	1.64 lbs
R842SSUBCXX00P0	8' Retro Strip - LED Tubes 2 Lamp - Ballast Cover	48.00 x 4.50 x 3.56	5.82 lbs
R892SSUWRX00P0	8' Retro Strip - LED Tubes 2 Lamp - White Reflector	48.00 x 9.26 x 3.56	3.28 lbs
R844SSUBCXX00P0	8' Retro Strip - LED Tubes 4 Lamp - Ballast Cover	48.00 x 4.50 x 3.56	5.88 lbs
R894SSUWRXX00P0	8' Retro Strip - LED Tubes 4 Lamp - White Reflector	48.00 x 9.26 x 3.56	3.35 lbs

TECHBRITE
SAVING ENERGY IN THE BEST POSSIBLE LIGHT

PROJECT NAME:
NOTES:
PART NUMBER:
DATE:

RETRO TROFFER—LED TUBES



PRODUCT DESCRIPTION:

Over 1 million kits sold! The LED Tube Retro Troffer is the easiest to install retro kit in the industry. The TechBrite LED Tube Retro Kit includes all of the items needed convert an existing troffer fixture to a UL approved retrofitted fixture. The kit contains sockets rated for direct wire voltage, ensuring a proper, safe installation with direct voltage TLEDs or ballast driven TLEDs. The aluminum reflector provides increased lumen output and covers the line/ load electrical connection. The TechBrite LED Tube Retro Troffer Kit is a fast, easy, and economical solution to upgrading existing troffer fixtures.

FEATURES:

- Fits most prismatic lens troffers (2x2 or 2x4)
- Available in 2x2 & 2x4
- Pinch fit reflector for quick installation
- Kit includes: reflector, sockets, mounting brackets, mounting screws, and LED tubes (optional)
- Limited warranty: 5 years on luminaire

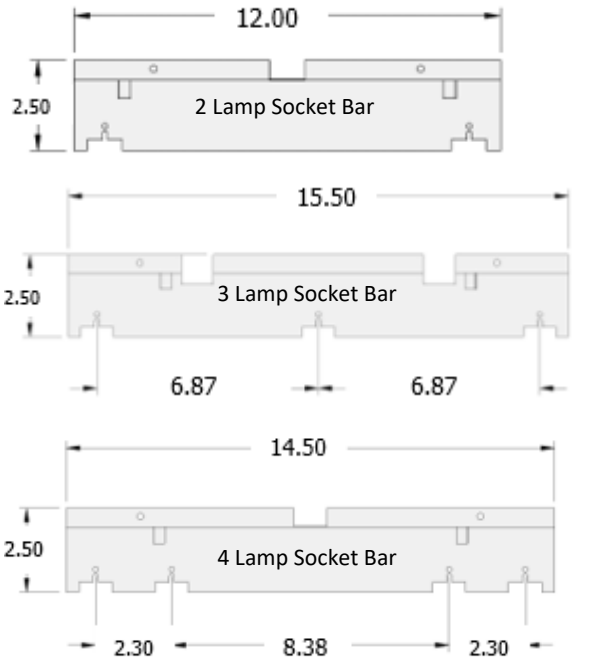
PERFORMANCE SPECIFICATION:

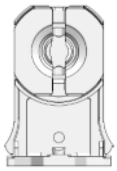
Lumens	6 Lamp Max—2x4 & 2x2
Watts	2x4=132w Max / 2x2=54w Max
LPW	See TLED Specification
Color	See TLED Specification
CRI	See TLED Specification
L70	See TLED Specification
L85	See TLED Specification
Max Ambient Temp	See TLED Specification
Min Ambient Temp	See TLED Specification
Dimming	See TLED Specification
Driver Voltage	See TLED Specification
Chip	See TLED Specification
Driver	See TLED Specification

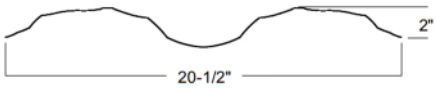
Retro Troffer—LED Tubes

Commercial/Industrial

DIMENSIONS:







Reflector Profile

Socket Bar Profile

ORDERING CHART:

Series		Length		Width		# of Tubes		Type		Socket Type		Reflector		Wiring*	
R	Retro	**2**	2 Foot	**21**	2X2	**2**	2 lamp	**SS**	LED Tubes	**X**	Shunted	**WXX**	White	**00P0**	Prewired
		4	4 Foot	**21**	2X4	**3**	3 lamp			**U**	Unshunted	**MXX**	Miro 4	**0000**	No Wiring
						4	4 lamp								
						6	6 lamp								

* Prewired includes: wire & disconnect
* No wiring includes: disconnect & no wires

ADDER:

Lamp Type	
BLANK	Wired single end with unshunted sockets
WOE	Wired opposing ends with shunted sockets

Retro Troffer—LED Tubes

Commercial/Industrial

FREQUENTLY ORDERED PART NUMBERS:

Part Number	Description	Dimensions	Weight
R2212SSUWXX00P0	2' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	1.31 (lbs)
R2213SSUWXX00P0	2' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	1.44 (lbs)
R2214SSUWXX00P0	2' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	1.44 (lbs)
R2212SSUMXX00P0	2' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	1.31 (lbs)
R2213SSUMXX00P0	2' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	1.44 (lbs)
R2214SSUMXX00P0	2' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	1.44 (lbs)
R4212SSUWXX00P0	4' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	2.18 (lbs)
R4213SSUWXX00P0	4' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	2.30 (lbs)
R4214SSUWXX00P0	4' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	2.30 (lbs)
R4212SSUMXX00P0	4' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	2.18 (lbs)
R4213SSUMXX00P0	4' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	2.30 (lbs)
R4214SSUMXX00P0	4' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	2.30 (lbs)

KTEB-232-UV-IS-L-P

T8 ELECTRONIC BALLAST

Version D1

DESCRIPTION

2×F32T8 | 120-277 Multi-Voltage | HPF | Instant Start

STARTING METHOD: Instant
LAMP CONNECTION: Parallel
INPUT VOLTAGE: 120-277VAC ±10%
INPUT FREQUENCY: 50/60 Hz
POWER FACTOR: High
WARRANTY: 5 Years

PRODUCT FEATURES

- **2014 DOE Compliant**
- Sound Rated: A
- Maximum Ambient Temperature: 105ºF, 40ºC
- Maximum Case Temperature: 167ºF, 75ºC
- Meets FCC Part 18 (Class A) Non-Consumer Limits
- Meets ANSI Standard C82.11 and C62.41
- UL, cUL Listed Class P, Type 1 Outdoor
- Anti-Striation Circuitry
- Type HL

ELECTRICAL SPECIFICATIONS

LAMP TYPE	NO. OF LAMPS	INPUT VOLTS	INPUT WATTS	INPUT CURRENT (AMPS)	POWER FACTOR	BALLAST FACTOR	BALLAST EFFICACY FACTOR	MAX THD%	CREST FACTOR	MIN START TEMP	WIRING DIAGRAM
F32T8 (32W)	2	120	48.5	0.42	>0.9	0.78	1.61	10	<1.7	0°F, -18°C	F2-4
		277	48.0	0.18	>0.9	0.78	1.63	10	<1.7	0°F, -18°C	F2-4
	1	120	30.0	0.25	>0.9	0.92	3.06	10	<1.7	0°F, -18°C	F1-4
		277	30.3	0.12	>0.9	0.92	3.04	12	<1.7	0°F, -18°C	F1-4
F32T8 (30W)	2	120	45.8	0.39	>0.9	0.78	1.70	10	<1.7	60°F, 16°C	F2-4
		277	45.2	0.17	>0.9	0.78	1.73	12	<1.7	60°F, 16°C	F2-4
	1	120	29.0	0.24	>0.9	0.92	3.17	10	<1.7	60°F, 16°C	F1-4
		277	29.0	0.11	>0.9	0.92	3.17	15	<1.7	60°F, 16°C	F1-4
F32T8 (28W)	2	120	44.9	0.38	>0.9	0.78	1.74	10	<1.7	60°F, 16°C	F2-4
		277	44.5	0.17	>0.9	0.78	1.75	12	<1.7	60°F, 16°C	F2-4
	1	120	27.8	0.23	>0.9	0.92	3.31	10	<1.7	60°F, 16°C	F1-4
		277	28.1	0.11	>0.9	0.92	3.28	15	<1.7	60°F, 16°C	F1-4
F32T8 (25W)	2	120	43.6	0.36	>0.9	0.78	1.79	10	<1.7	60°F, 16°C	F2-4
		277	43.2	0.16	>0.9	0.78	1.81	12	<1.7	60°F, 16°C	F2-4
	1	120	26.4	0.22	>0.9	0.92	3.48	10	<1.7	60°F, 16°C	F1-4
		277	27.0	0.10	>0.9	0.92	3.41	15	<1.7	60°F, 16°C	F1-4
F25T8	2	120	43.6	0.36	>0.9	0.80	1.83	10	<1.7	0°F, -18°C	F2-4
		277	43.2	0.16	>0.9	0.80	1.85	12	<1.7	0°F, -18°C	F2-4
	1	120	26.4	0.22	>0.9	0.94	3.56	10	<1.7	0°F, -18°C	F1-4
		277	27.0	0.10	>0.9	0.94	3.48	15	<1.7	0°F, -18°C	F1-4
F17T8	2	120	27.2	0.22	>0.9	0.80	2.94	10	<1.7	0°F, -18°C	F2-4
		277	27.5	0.11	>0.9	0.80	2.91	12	<1.7	0°F, -18°C	F2-4
	1	120	19.0	0.16	>0.9	1.05	5.53	12	<1.7	0°F, -18°C	F1-4
		277	19.4	0.08	>0.9	1.05	5.41	15	<1.7	0°F, -18°C	F1-4
F40T8	1	120	37.4	0.31	>0.9	0.90	2.41	10	<1.7	0°F, -18°C	F1-4
		277	37.0	0.14	>0.9	0.90	2.43	12	<1.7	0°F, -18°C	F1-4

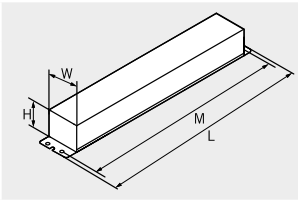
KTEB-232-UV-IS-L-P

T8 ELECTRONIC BALLAST

Version D1

PHYSICAL SPECIFICATIONS

CASE DIMENSIONS



LENGTH	9.50”
WIDTH	1.30”
HEIGHT	1.18”
MOUNTING	9.00”
CASE STYLE	L4

STANDARD LEAD LENGTH*

WHITE	25”
BLACK	25”
BLUE	31”
RED	45”

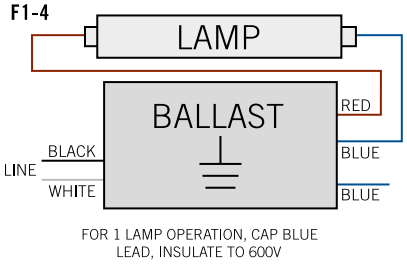
* Consult Keystone for special lead length requirements.

CASE MATERIAL: Steel

Lead wires are
18 AWG 105 C/600V,
solid copper.

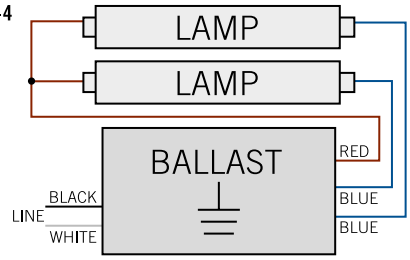
WIRING DIAGRAMS

F1-4



FOR 1 LAMP OPERATION, CAP BLUE LEAD, INSUTLATE TO 600V

F2-4



ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KTEB-232-UV-IS-L-P-CP	Carton Pack	10	Quick Ship
KTEB-232-UV-IS-L-P-DP	Distributor Pack		

NOTE: Version D1 (Manufacturing Revision). Prior versions of this ballast exist. Spec sheets for prior versions available upon request. Contact Keystone for details.

CATALOG NUMBER BREAKDOWN

KTEB-232-UV-IS-L-P-CP

KTEB	232	UV	IS	L	P	CP
Keystone Technologies Electronic Ballast	2 Lamps, 32 Watts	Universal Voltage	Instant Start	Low Ballast Factor	Premium Series	Packaging Style

Keystone Technologies • 208 Progress Drive, Montgomeryville, PA 18936 • Phone (800) 464-2680 • Fax (888) 966-0556 • **www.keystoneballast.com**

KTEB-232-UV-IS-N-P

T8 ELECTRONIC BALLAST

Version D1

DESCRIPTION

2 x F32T8 | 120-277 Multi-Voltage | HPF | Instant Start

STARTING METHOD: Instant Start
LAMP CONNECTION: Parallel
INPUT VOLTAGE: 120-277Vac ±10%
INPUT FREQUENCY: 50/60 Hz
POWER FACTOR: High
WARRANTY: 5 Years

- **2014 DOE Compliant**
- Sound Rated: A
- Maximum Case Temperature: 167°F, 75°C
- Meets FCC Part 18 (Class A) Non-Consumer Limits
- Meets ANSI Standard C82.11 and C62.41
- Max. Output Voltage: 600V
- Max. Voltage to Ground: 600V
- UL, cUL Listed Class P, Type 1 Outdoor
- Anti-Striation Circuitry
- Type HL

ELECTRICAL SPECIFICATIONS

LAMP TYPE	NO. OF LAMPS	INPUT VOLTS	INPUT WATTS	NOMINAL LINE AMPS	POWER FACTOR	BALLAST FACTOR	BALLAST EFFICACY FACTOR	MAX THD (%)	CREST FACTOR	MIN. START TEMP.	WIRING DIAGRAM
F32T8 (32W)	2	120V	54.4	0.48	>0.90	0.88	1.62	10	<1.70	0°F/-18°C	F2-4
		277V	53.5	0.21	>0.90	0.88	1.64	10	<1.70	0°F/-18°C	F2-4
	1	120V	35.2	0.29	>0.90	1.04	2.96	10	<1.70	0°F/-18°C	F1-4
		277V	35.3	0.13	>0.90	1.04	2.95	12	<1.70	0°F/-18°C	F1-4
F32T8 (30W)	2	120V	52.2	0.44	>0.90	0.88	1.69	10	<1.70	60°F/16°C	F2-4
		277V	51.7	0.20	>0.90	0.88	1.70	12	<1.70	60°F/16°C	F2-4
	1	120V	32.5	0.27	>0.90	1.04	3.20	10	<1.70	60°F/16°C	F1-4
		277V	32.4	0.12	>0.90	1.04	3.21	15	<1.70	60°F/16°C	F1-4
F32T8 (28W)	2	120V	50.2	0.43	>0.90	0.88	1.75	10	<1.70	60°F/16°C	F2-4
		277V	49.5	0.19	>0.90	0.88	1.78	12	<1.70	60°F/16°C	F2-4
	1	120V	31.0	0.26	>0.90	1.05	3.38	10	<1.70	60°F/16°C	F1-4
		277V	30.9	0.12	>0.90	1.05	3.40	15	<1.70	60°F/16°C	F1-4
F32T8 (25W)	2	120V	45.1	0.40	>0.90	0.89	1.97	10	<1.70	60°F/16°C	F2-4
		277V	44.7	0.17	>0.90	0.89	1.99	12	<1.70	60°F/16°C	F2-4
	1	120V	30.0	0.26	>0.90	1.05	3.50	10	<1.70	60°F/16°C	F1-4
		277V	30.0	0.12	>0.90	1.05	3.50	15	<1.70	60°F/16°C	F1-4
F25T8	2	120V	43.5	0.36	>0.90	0.89	2.05	10	<1.70	0°F/-18°C	F2-4
		277V	43.1	0.16	>0.90	0.89	2.06	12	<1.70	0°F/-18°C	F2-4
	1	120V	28.2	0.25	>0.90	1.05	3.72	10	<1.70	0°F/-18°C	F1-4
		277V	28.0	0.12	>0.90	1.05	3.75	15	<1.70	0°F/-18°C	F1-4
F17T8	2	120V	30.7	0.26	>0.90	0.91	2.96	10	<1.70	0°F/-18°C	F2-4
		277V	30.9	0.12	>0.90	0.91	2.94	12	<1.70	0°F/-18°C	F2-4
	1	120V	22.0	0.19	>0.90	1.07	4.86	12	<1.70	0°F/-18°C	F1-4
		277V	22.0	0.09	>0.90	1.07	4.86	15	<1.70	0°F/-18°C	F1-4
F15T8	2	120V	27.0	0.23	>0.90	0.66	2.44	10	<1.70	0°F/-18°C	F2-4
		277V	27.0	0.10	>0.90	0.66	2.44	15	<1.70	0°F/-18°C	F2-4
	1	120V	18.3	0.15	>0.90	0.82	4.48	12	<1.70	0°F/-18°C	F1-4
		277V	18.7	0.07	>0.90	0.82	4.38	18	<1.70	0°F/-18°C	F1-4
F40T8	1	120V	42.7	0.36	>0.90	1.00	2.34	10	<1.70	0°F/-18°C	F1-4
		277V	42.3	0.16	>0.90	1.00	2.36	15	<1.70	0°F/-18°C	F1-4
PLL 25W	2	120V	48.5	0.41	>0.90	0.90	1.86	10	<1.70	0°F/-18°C	P2-3
		277V	48.0	0.18	>0.90	0.90	1.88	12	<1.70	0°F/-18°C	P2-3
	1	120V	30.9	0.26	>0.90	1.02	3.30	10	<1.70	0°F/-18°C	P2-3
		277V	30.9	0.12	>0.90	1.02	3.30	15	<1.70	0°F/-18°C	P2-3

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KTEB-232-UV-IS-N-P

T8 ELECTRONIC BALLAST

Version D1

ELECTRICAL SPECIFICATIONS

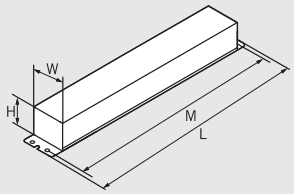
CONTINUED FROM PAGE 1

LAMP TYPE	NO. OF LAMPS	INPUT VOLTS	INPUT WATTS	NOMINAL LINE AMPS	POWER FACTOR	BALLAST FACTOR	BALLAST EFFICACY FACTOR	MAX THD (%)	CREST FACTOR	MIN. START TEMP.	WIRING DIAGRAM
PLL 28W	2	120V	56.2	0.47	>0.90	0.93	1.65	10	<1.70	0°F/-18°C	P2-3
		277V	56.0	0.21	>0.90	0.93	1.66	12	<1.70	0°F/-18°C	P2-3
	1	120V	35.9	0.31	>0.90	1.09	3.04	10	<1.70	0°F/-18°C	P2-3
		277V	35.9	0.13	>0.90	1.09	3.04	15	<1.70	0°F/-18°C	P2-3
PLL 40W	1	120V	38.5	0.33	>0.90	0.83	2.16	10	<1.70	0°F/-18°C	P2-3
		277V	38.2	0.14	>0.90	0.83	2.17	15	<1.70	0°F/-18°C	P2-3

Will also operate equivalent U-bend lamps.

PHYSICAL SPECIFICATIONS

CASE DIMENSIONS



LENGTH	9.50”
WIDTH	1.30”
HEIGHT	1.18”
MOUNTING	9.00”
CASE STYLE	L4

STANDARD LEAD LENGTHS*

BLACK	25”
WHITE	25”
BLUE	31”
RED	45”

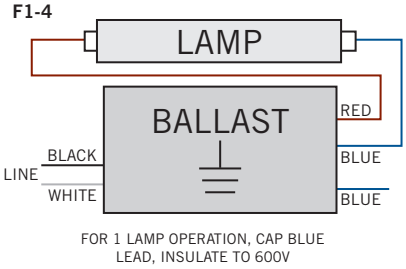
*Consult Keystone for special lead length requirements.

Lead wires are 18 AWG 105°C/600V, solid copper.

CASE MATERIAL: Steel

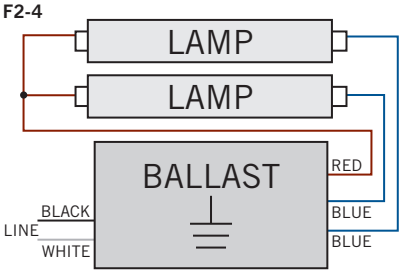
WIRING DIAGRAMS

F1-4

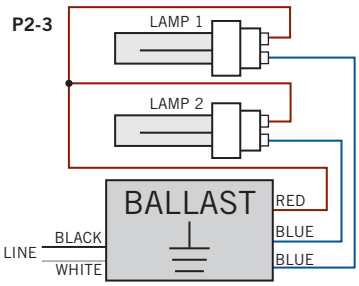


FOR 1 LAMP OPERATION, CAP BLUE LEAD, INSULATE TO 600V

F2-4



P2-3



CAP OFF BLUE LEAD FOR 1 LAMP APPLICATION

Instant start T8 ballasts require the use of either shunted sockets or a sockets with a manual wire shunt (or “bridge”).

ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KTEB-232-UV-IS-N-P-DP	Distributor Pack	10	Quick Ship
KTEB-232-UV-IS-N-P-CP	Carton Pack	10	Active

NOTE: Version D1 (Manufacturing Revision). Prior versions of this ballast exist. Spec sheets for prior versions available upon request. Contact Keystone for details.

CATALOG NUMBER BREAKDOWN

KTEB-232-UV-IS-N-P-DP

KTEB	232		UV	IS	N	P	DP
Keystone Technologies Electronic Ballast	2 Lamp	Wattage	Universal Voltage	Instant Start	Normal Ballast Factor	Premium Series	Packaging Style

KTEB-332-UV-IS-L-P

T8 ELECTRONIC BALLAST

Version D1

DESCRIPTION

3×F32T8 | 120-277 Multi-Voltage | HPF | Instant Start

STARTING METHOD: Instant
LAMP CONNECTION: Parallel
INPUT VOLTAGE: 120-277VAC ±10%
INPUT FREQUENCY: 50/60 Hz
POWER FACTOR: High
WARRANTY: 5 Years

PRODUCT FEATURES

- **2014 DOE Compliant**
- Sound Rated: A
- Maximum Ambient Temperature: 105ºF, 40ºC
- Maximum Case Temperature: 167ºF, 75ºC
- Meets FCC Part 18 (Class A) Non-Consumer Limits
- Meets ANSI Standard C82.11 and C62.41
- UL, cUL Listed Class P, Type 1 Outdoor
- Anti-Striation Circuitry
- Type HL

ELECTRICAL SPECIFICATIONS

LAMP TYPE	NO. OF LAMPS	INPUT VOLTS	INPUT WATTS	INPUT CURRENT (AMPS)	POWER FACTOR	BALLAST FACTOR	BALLAST EFFICACY FACTOR	MAX THD%	CREST FACTOR	MIN START TEMP	WIRING DIAGRAM
F32T8 (32W)	3	120	73.5	0.63	>0.9	0.78	1.06	10	<1.7	0°F, -18°C	F3-2
		277	72.1	0.27	>0.9	0.78	1.08	10	<1.7	0°F, -18°C	F3-2
	2	120	55.7	0.47	>0.9	0.90	1.62	10	<1.7	0°F, -18°C	F2-5
		277	55.1	0.20	>0.9	0.90	1.63	12	<1.7	0°F, -18°C	F2-5
F32T8 (30W)	3	120	67.0	0.57	>0.9	0.78	1.16	10	<1.7	60°F, 16°C	F3-2
		277	66.0	0.25	>0.9	0.78	1.18	12	<1.7	60°F, 16°C	F3-2
	2	120	50.1	0.42	>0.9	0.90	1.80	10	<1.7	60°F, 16°C	F2-5
		277	49.8	0.19	>0.9	0.90	1.81	12	<1.7	60°F, 16°C	F2-5
F32T8 (28W)	3	120	66.2	0.56	>0.9	0.78	1.18	10	<1.7	60°F, 16°C	F3-2
		277	65.2	0.24	>0.9	0.78	1.20	12	<1.7	60°F, 16°C	F3-2
	2	120	47.7	0.42	>0.9	0.90	1.89	10	<1.7	60°F, 16°C	F2-5
		277	48.7	0.19	>0.9	0.90	1.85	12	<1.7	60°F, 16°C	F2-5
F32T8 (25W)	3	120	57.7	0.50	>0.9	0.78	1.35	10	<1.7	60°F, 16°C	F3-2
		277	57.3	0.22	>0.9	0.78	1.36	12	<1.7	60°F, 16°C	F3-2
	2	120	46.6	0.39	>0.9	0.90	1.93	10	<1.7	60°F, 16°C	F2-5
		277	46.4	0.17	>0.9	0.90	1.94	12	<1.7	60°F, 16°C	F2-5
F25T8	3	120	57.7	0.48	>0.9	0.78	1.35	10	<1.7	0°F, -18°C	F3-2
		277	57.3	0.21	>0.9	0.78	1.36	12	<1.7	0°F, -18°C	F3-2
	2	120	42.9	0.36	>0.9	0.90	2.10	10	<1.7	0°F, -18°C	F2-5
		277	42.8	0.16	>0.9	0.90	2.10	12	<1.7	0°F, -18°C	F2-5
F17T8	3	120	40.6	0.33	>0.9	0.80	1.97	10	<1.7	0°F, -18°C	F3-2
		277	40.7	0.15	>0.9	0.80	1.97	12	<1.7	0°F, -18°C	F3-2
	2	120	31.1	0.26	>0.9	0.92	2.96	10	<1.7	0°F, -18°C	F2-5
		277	31.3	0.12	>0.9	0.92	2.94	12	<1.7	0°F, -18°C	F2-5
F40T8	2	120	66.4	0.57	>0.9	0.84	1.27	10	<1.7	0°F, -18°C	F2-5
		277	65.4	0.24	>0.9	0.84	1.28	12	<1.7	0°F, -18°C	F2-5

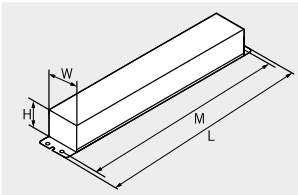
KTEB-332-UV-IS-L-P

T8 ELECTRONIC BALLAST

Version D1

PHYSICAL SPECIFICATIONS

CASE DIMENSIONS



LENGTH	9.50”
WIDTH	1.30”
HEIGHT	1.18”
MOUNTING	9.00”
CASE STYLE	L4

STANDARD LEAD LENGTH*

WHITE	25”
BLACK	25”
BLUE	31”
RED	37”

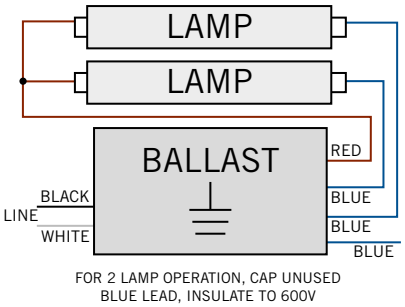
* Consult Keystone for special lead length requirements.

CASE MATERIAL: Steel

Lead wires are
18 AWG 105 C/600V,
solid copper.

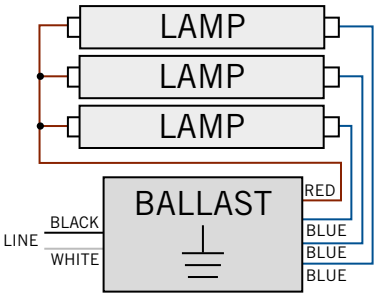
WIRING DIAGRAMS

F2-5



FOR 2 LAMP OPERATION, CAP UNUSED
BLUE LEAD, INSULATE TO 600V

F3-2



ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KTEB-332-UV-IS-L-P-CP	Carton Pack	10	Quick Ship
KTEB-332-UV-IS-L-P-DP	Distributor Pack		

NOTE: Version D1 (Manufacturing Revision). Prior versions of this ballast exist. Spec sheets for prior versions available upon request. Contact Keystone for details.

CATALOG NUMBER BREAKDOWN

KTEB-332-UV-IS-L-P-CP

KTEB	332		UV	IS	L	P	CP
Keystone Technologies Electronic Ballast	3 Lamps	32 Watts	Universal Voltage	Instant Start	Low Ballast Factor	Premium Series	Packaging Style

KEYSTONE
SINCE 1945
ENGINEERED LIGHTING SOLUTIONS

KTEB-332-UV-IS-N-P

T8 ELECTRONIC BALLAST

Version D1

c UL us | RoHS Compliant | 5 YEAR WARRANTY

DESCRIPTION

3 x F32T8 | 120-277 Multi-Voltage | High Power Factor | Instant Start

STARTING METHOD: Instant Start
LAMP CONNECTION: Parallel
INPUT VOLTAGE: 120-277Vac ±10%
INPUT FREQUENCY: 50/60 Hz
POWER FACTOR: High
WARRANTY: 5 Years

- **2014 DOE Compliant**
- Sound Rated: A
- Maximum Case Temperature: 167ºF, 75ºC
- Meets FCC Part 18 (Class A) Non-Consumer Limits
- Meets ANSI Standard C82.11 and C62.41
- Max. Output Voltage: 600V
- Max. Voltage to Ground: 600V
- UL, cUL Listed Class P, Type 1 Outdoor
- Anti-Striation Circuitry
- Type HL

ELECTRICAL SPECIFICATIONS

LAMP TYPE	NO. OF LAMPS	INPUT VOLTS	INPUT WATTS	NOMINAL LINE AMPS	POWER FACTOR	BALLAST FACTOR	BALLAST EFFICACY FACTOR	MAX THD (%)	CREST FACTOR	MIN. START TEMP.	WIRING DIAGRAM
F32T8 (32W)	3	120V	83.6	0.73	>0.90	0.88	1.05	10	<1.70	0ºF/-18ºC	F3-2
		277V	82.6	0.30	>0.90	0.88	1.07	10	<1.70	0ºF/-18ºC	F3-2
	2	120V	62.5	0.53	>0.90	1.03	1.65	10	<1.70	0ºF/-18ºC	F2-5
		277V	61.6	0.23	>0.90	1.03	1.67	10	<1.70	0ºF/-18ºC	F2-5
F32T8 (30W)	3	120V	76.6	0.64	>0.90	0.88	1.15	10	<1.70	60ºF/16ºC	F3-2
		277V	76.1	0.28	>0.90	0.88	1.16	12	<1.70	60ºF/16ºC	F3-2
	2	120V	58.9	0.50	>0.90	1.03	1.75	10	<1.70	60ºF/16ºC	F2-5
		277V	58.2	0.22	>0.90	1.03	1.77	12	<1.70	60ºF/16ºC	F2-5
F32T8 (28W)	3	120V	74.9	0.60	>0.90	0.88	1.17	10	<1.70	60ºF/16ºC	F3-2
		277V	73.5	0.26	>0.90	0.88	1.20	10	<1.70	60ºF/16ºC	F3-2
	2	120V	57.0	0.48	>0.90	1.03	1.81	10	<1.70	60ºF/16ºC	F2-5
		277V	56.4	0.21	>0.90	1.03	1.83	10	<1.70	60ºF/16ºC	F2-5
F32T8 (25W)	3	120V	63.7	0.57	>0.90	0.88	1.38	10	<1.70	60ºF/16ºC	F3-2
		277V	62.8	0.25	>0.90	0.88	1.40	12	<1.70	60ºF/16ºC	F3-2
	2	120V	52.6	0.44	>0.90	1.04	1.98	10	<1.70	60ºF/16ºC	F2-5
		277V	52.4	0.20	>0.90	1.04	1.98	12	<1.70	60ºF/16ºC	F2-5
F25T8	3	120V	63.7	0.55	>0.90	0.89	1.40	10	<1.70	0ºF/-18ºC	F3-2
		277V	62.8	0.23	>0.90	0.89	1.42	12	<1.70	0ºF/-18ºC	F3-2
	2	120V	48.2	0.40	>0.90	1.05	2.18	10	<1.70	0ºF/-18ºC	F2-5
		277V	47.8	0.18	>0.90	1.05	2.20	12	<1.70	0ºF/-18ºC	F2-5
F17T8	3	120V	45.6	0.38	>0.90	0.91	2.00	10	<1.70	0ºF/-18ºC	F3-2
		277V	45.4	0.17	>0.90	0.91	2.00	12	<1.70	0ºF/-18ºC	F3-2
	2	120V	34.8	0.29	>0.90	1.07	3.07	10	<1.70	0ºF/-18ºC	F2-5
		277V	35.0	0.14	>0.90	1.07	3.06	12	<1.70	0ºF/-18ºC	F2-5
F40T8	2	120V	77.3	0.66	>0.90	0.97	1.33	10	<1.70	0ºF/-18ºC	F2-5
		277V	76.6	0.28	>0.90	0.97	1.27	12	<1.70	0ºF/-18ºC	F2-5
PLL 25W	3	120V	72.5	0.61	>0.90	0.86	1.19	10	<1.70	0ºF/-18ºC	P3-1
		277V	71.9	0.26	>0.90	0.86	1.20	12	<1.70	0ºF/-18ºC	P3-1
	2	120V	54.7	0.46	>0.90	1.01	1.85	10	<1.70	0ºF/-18ºC	P3-1
		277V	54.1	0.20	>0.90	1.01	1.87	12	<1.70	0ºF/-18ºC	P3-1
PLL 28W	3	120V	82.4	0.70	>0.90	0.92	1.11	10	<1.70	0ºF/-18ºC	P3-1
		277V	80.5	0.29	>0.90	0.92	1.14	12	<1.70	0ºF/-18ºC	P3-1
	2	120V	64.3	0.54	>0.90	1.05	1.63	10	<1.70	0ºF/-18ºC	P3-1
		277V	63.3	0.23	>0.90	1.05	1.66	12	<1.70	0ºF/-18ºC	P3-1
PLL 40W	2	120V	68.1	0.57	>0.90	0.74	1.09	10	<1.70	0ºF/-18ºC	P3-1
		277V	67.4	0.24	>0.90	0.74	1.10	12	<1.70	0ºF/-18ºC	P3-1

Will also operate equivalent U-bend lamps.

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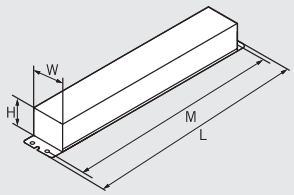
KEYSTONE
SINCE 1945
ENGINEERED LIGHTING SOLUTIONS

KTEB-332-UV-IS-N-P
T8 ELECTRONIC BALLAST

Version D1

PHYSICAL SPECIFICATIONS

CASE DIMENSIONS



LENGTH	9.50”
WIDTH	1.30”
HEIGHT	1.18”
MOUNTING	9.00”
CASE STYLE	L4

STANDARD LEAD LENGTHS*

BLACK	25”
WHITE	25”
BLUE	31”
RED	37”

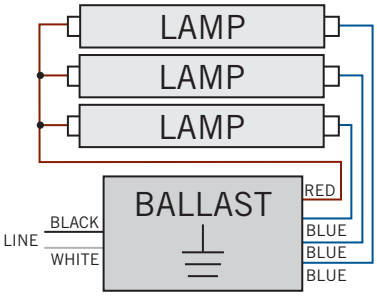
*Consult Keystone for special lead length requirements.

Lead wires are 18 AWG 105ºC/600V, solid copper.

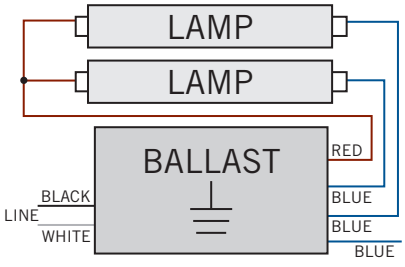
CASE MATERIAL: Steel

WIRING DIAGRAMS

F3-2

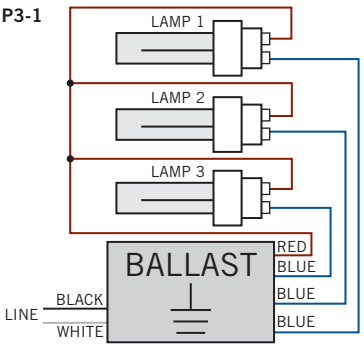


F2-5



FOR 2 LAMP OPERATION, CAP UNUSED BLUE LEAD, INSULATE TO 600V

P3-1



CAP OFF ANY BLUE LEAD FOR 2 LAMP APPLICATION

Instant start T8 ballasts require the use of either shunted sockets or a sockets with a manual wire shunt (or “bridge”).

ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KTEB-332-UV-IS-N-P-DP	Distributor Pack	10	Quick Ship
KTEB-332-UV-IS-N-P-CP	Carton Pack	10	Active

NOTE: Version D1 (Manufacturing Revision). Prior versions of this ballast exist. Spec sheets for prior versions available upon request. Contact Keystone for details.

CATALOG NUMBER BREAKDOWN

KTEB-332-UV-IS-N-P-DP

KTEB	3	32	UV	IS	N	P	DP
Keystone Technologies Electronic Ballast	3 Lamp	Wattage	Universal Voltage	Instant Start	Normal Ballast Factor	Premium Series	Packaging Style

SINCE 1945
KEYSTONE
ENGINEERED LIGHTING SOLUTIONS

KTEB-432-UV-IS-N-P

T8 ELECTRONIC FLUORESCENT

Version A1

4 x F32T8 | 120-277V Input | High Power Factor | Instant Start

STARTING METHOD: Instant Start
LAMP CONNECTION: Parallel
INPUT VOLTAGE: 120-277VAC ±10%
INPUT FREQUENCY: 50/60 Hz
POWER FACTOR: High
WARRANTY: 5 Years

PRODUCT FEATURES

- **2014 DOE Compliant**
- Sound Rated: A
- Maximum Case Temperature: 167ºF, 75ºC
- Meets FCC Part 18 (Class A) Non-Consumer Limits
- Meets ANSI Standard C82.11-2002 and C62.41-2002
- UL, cUL Listed, Class P, Type 1 Outdoor
- OCV: 600V
- Anti-Striation Circuitry
- Type HL

ELECTRICAL SPECIFICATIONS

LAMP TYPE	NO. OF LAMPS	INPUT VOLTS	INPUT WATTS	INPUT CURRENT (AMPS)	POWER FACTOR	CREST FACTOR	BALLAST FACTOR	BALLAST EFFICACY FACTOR	MAX THD (%)	MIN. START TEMP (ºF/ºC)	WIRING DIAGRAM
F32T8 (32W)	4	120	112	0.93	≥0.98	≤1.70	0.88	0.80	10	0/-18	F4-1
		277	108	0.40	≥0.98	≤1.70	0.88	0.81	10	0/-18	F4-1
	3	120	92	0.77	≥0.98	≤1.70	0.96	1.04	10	0/-18	F3-3
		277	89	0.34	≥0.98	≤1.70	0.96	1.07	10	0/-18	F3-3
F32T8 (30W)	4	120	101	0.85	≥0.98	≤1.70	0.88	0.87	10	0/-18	F4-1
		277	100	0.37	≥0.98	≤1.70	0.88	0.88	10	0/-18	F4-1
	3	120	84	0.71	≥0.98	≤1.70	0.96	1.14	10	0/-18	F3-3
		277	84	0.31	≥0.98	≤1.70	0.96	1.15	10	0/-18	F3-3
F32T8 (28W)	4	120	94	0.79	≥0.98	≤1.70	0.88	0.93	10	0/-18	F4-1
		277	94	0.35	≥0.98	≤1.70	0.88	0.93	10	0/-18	F4-1
	3	120	77	0.65	≥0.98	≤1.70	0.96	1.24	10	0/-18	F3-3
		277	77	0.29	≥0.98	≤1.70	0.96	1.25	10	0/-18	F3-3
F32T8 (25W)	4	120	88	0.74	≥0.98	≤1.70	0.88	1.00	10	0/-18	F4-1
		277	88	0.33	≥0.98	≤1.70	0.88	1.00	10	0/-18	F4-1
	3	120	74	0.62	≥0.98	≤1.70	0.96	1.29	10	0/-18	F3-3
		277	73	0.27	≥0.98	≤1.70	0.96	1.31	10	0/-18	F3-3
F25T8	4	120	87	0.72	≥0.98	≤1.70	0.89	1.02	10	0/-18	F4-1
		277	85	0.32	≥0.98	≤1.70	0.89	1.05	10	0/-18	F4-1
	3	120	72	0.60	≥0.98	≤1.70	0.96	1.33	10	0/-18	F3-3
		277	71	0.26	≥0.98	≤1.70	0.96	1.35	10	0/-18	F3-3
F17T8	4	120	59	0.49	≥0.98	≤1.70	0.93	1.57	10	0/-18	F4-1
		277	58	0.22	≥0.98	≤1.70	0.93	1.59	10	0/-18	F4-1
	3	120	50	0.41	≥0.98	≤1.70	0.92	1.86	10	0/-18	F3-3
		277	49	0.18	≥0.97	≤1.70	0.92	1.87	10	0/-18	F3-3
F40T8	3	120	114	0.95	≥0.98	≤1.70	0.96	0.84	10	32/0	F3-3
		277	109	0.41	≥0.98	≤1.70	0.96	0.88	10	32/0	F3-3

* Will also operate equivalent U-bend lamps.

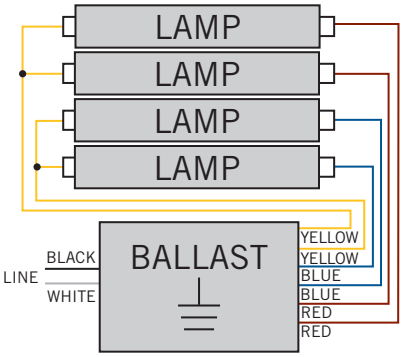
KTEB-432-UV-IS-N-P

T8 ELECTRONIC FLUORESCENT

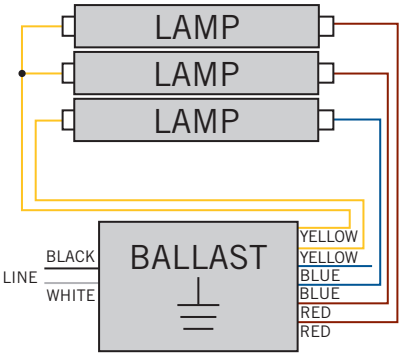
Version A1

WIRING DIAGRAM

F4-1

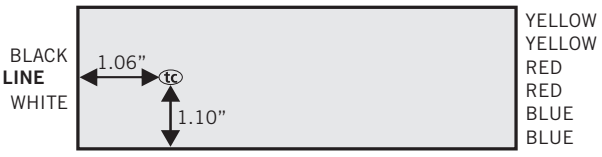


F3-3



FOR 3 LAMP OPERATION, CAP ANY BLUE LEAD, INSULATE TO 600V.

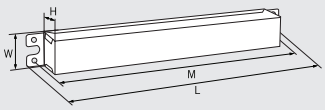
HOT SPOT LOCATION



Actual tc point is noted on each ballast label.

PHYSICAL SPECIFICATIONS

CASE DIMENSIONS



LENGTH	9.50"
WIDTH	1.30"
HEIGHT	1.10"
MOUNTING	8.90"
CASE STYLE	L11

STANDARD LEAD LENGTHS*

WHITE	25"
BLACK	25"
YELLOW	46"
RED	31"
BLUE	31"

*Consult Keystone for special lead length requirements.

Lead wires are 18 AWG 105ºC/600V, solid copper.

CASE MATERIAL: Metal

ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KTEB-432-UV-IS-N-P-DP	Distributor Pack	10	Quick Ship
KTEB-432-UV-IS-N-P-CP	Carton Pack	20	Active

NOTE: Version A1 (Manufacturing Revision). Prior versions of this ballast exist. Spec sheets for prior versions available upon request. Contact Keystone for details.

CATALOG NUMBER BREAKDOWN

KTEB-432-UV-IS-N-P-DP

KTEB	432	UV	IS	N	P	DP
Keystone Technologies Electronic Ballast	4 Lamp	Wattage	120-277V Universal Input	Instant Start	Normal Light Output	Premium Series	Packaging Style

SINCE 1945
KEYSTONE
LIGHT MADE EASY

XFIT | TRADITIONAL WALL PACK FIXTURES

KT-WPLED35-M1-8CSB-VDIM

TRADITIONAL 35W NON-CUTOFF LED WALL PACK

DESCRIPTION

Traditional 35W Non-Cutoff LED Wall Pack | 120–277V Input | 3000–5000K | Medium-Size Bronze Housing | Glass Lens

APPLICATION

Building Mount for exterior illumination (perimeters, pathways, loading docks, and other general security lighting requirements)

c UL us LISTED | DLC PREMIUM | 5 YEAR WARRANTY | COLOR SELECT | TRUSTED NLB WARRANTY

PRODUCT FEATURES

- Traditional design matches appearance and light distribution pattern of legacy HID, optimized for one-for-one replacements
- Heavy-duty, die-cast aluminum housing with (5) available 1/2" threaded conduit hubs: (1) on back and (1) on all four sides
- Powered by Keystone 0–10V dimming LED drivers
- Keystone Color Select Technology: Adjustable CCT (3000K, 4000K, or 5000K)
- Built-in dusk-to-dawn photocell behind translucent 3/4" threaded plug with anti-yellowing agent
- Borosilicate glass lens diffuses light source and provides uniform distribution
- Covers footprint of mid-size HID wallpacks
- Ambient operating temperature: –40ºC/–40ºF to 50ºC/122ºF
- UL listed for wet locations, IP65
- 0–10V dimming, 10% min
- Power Factor: >0.95
- THD: <20%
- LED chip lifetime: L70 >100,000 hrs @ 25ºC/77ºF ambient fixture temp
- Meets FCC Part 15, Part B, Class A standards for conducted and radiated emissions
- Fixture impact rating IK06
- Compatible with Keystone LED Emergency Backups

ELECTRICAL SPECIFICATIONS

Catalog Number	Wattage	Lumens	Lumens Below 90º	Dimming	CCT*	Efficacy	CRI	Housing Color	Input Voltage	Rated Life	Legacy Equivalent
KT-WPLED35-M1-8CSB-VDIM	35W	4885 lm	4400 lm	0–10V	3000K	140 lm/W	>80	Bronze	120–277V	50,000 hrs	150W MH
		5460 lm	4910 lm		4000K	156 lm/W					
		5010 lm	4505 lm		5000K	143 lm/W					

** Color Uniformity: CCT (Correlated Color Temperature) range as per guidelines outlined in ANSI C78.377-2017*

SINCE 1945 KEYSTONE LIGHT MADE EASY

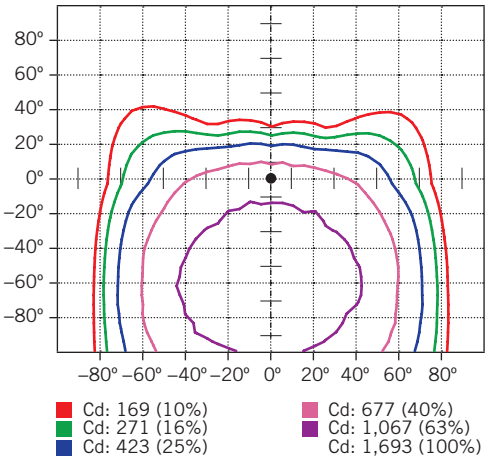
XFIT | TRADITIONAL WALL PACK FIXTURES

KT-WPLED35-M1-8CSB-VDIM

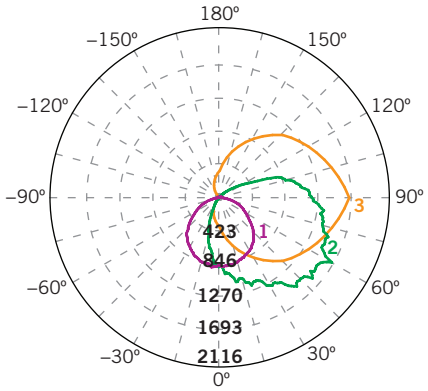
TRADITIONAL 35W NON-CUTOFF LED WALL PACK

PHOTOMETRIC SPECIFICATIONS

ISOCANDELA PLOT



LUMINOUS INTENSITY DISTRIBUTION



Average diffuse angle (50%): **111.0°**

1 **Violet** C0–C180

2 **Green** C90–C270

3 **Orange** G60

Unit: cd

FLUX DISTRIBUTION

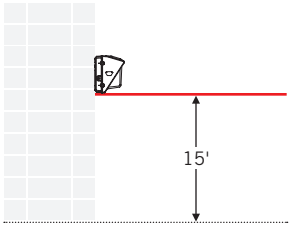
Zone	Lumens	% Luminaire
Forward Light	3,845 lm	79.5%
0°–30°	591 lm	12.2%
30°–60°	1,673 lm	34.6%
60°–80°	1,166 lm	24.1%
80°–90°	416 lm	8.6%
Back Light	507 lm	10.5%
0°–30°	210 lm	4.4%
30°–60°	227 lm	4.7%
60°–80°	59 lm	1.2%
80°–90°	10 lm	0.2%
Up Light	481 lm	9.9%
90°–100°	215 lm	4.4%
100°–180°	267 lm	5.5%

BUG* Rating	
Asymmetrical Luminare Types	
Type I, II, III, IV	B1 U3 G3
Quadrilateral Symmetrical Luminare Types	
Type V, Area Light	B1 U3 G3

* ***B****acklight,* ***U****plight,* ***G****lare*

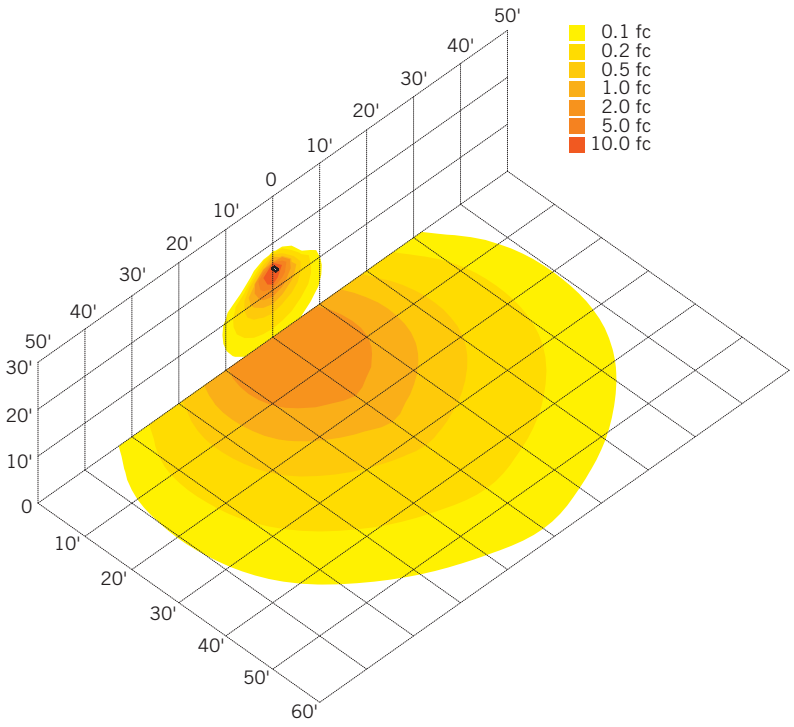
MOUNTING

Side view



LIGHT DISTRIBUTION PATTERN

Isometric view from above; Luminaire mounted at 15'



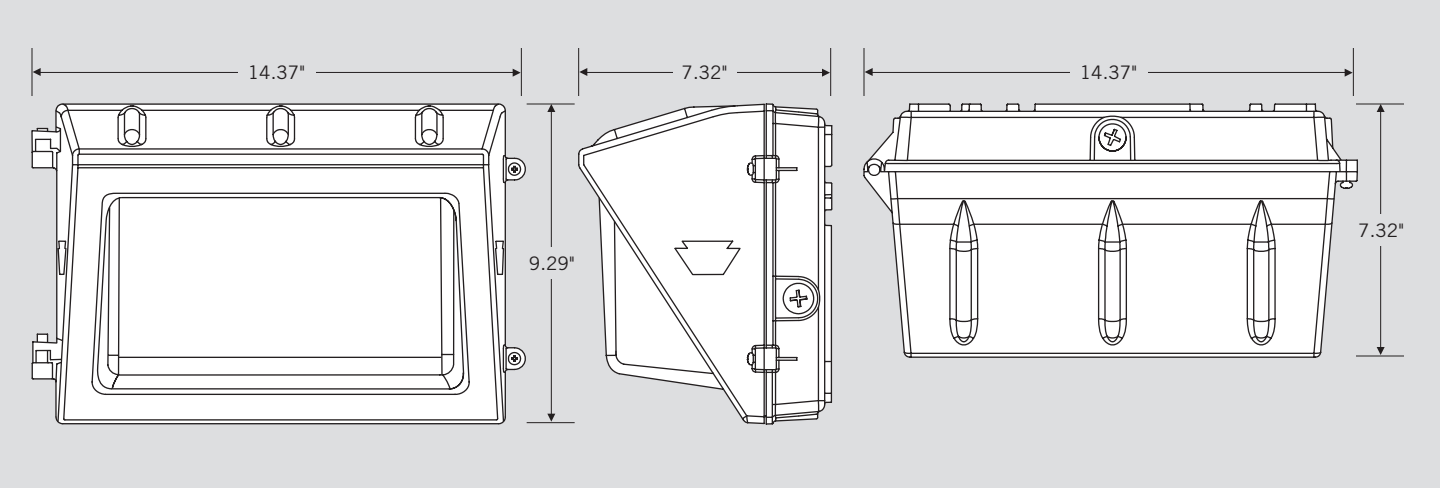
SINCE 1945 KEYSTONE LIGHT MADE EASY

XFIT | TRADITIONAL WALL PACK FIXTURES

KT-WPLED35-M1-8CSB-VDIM

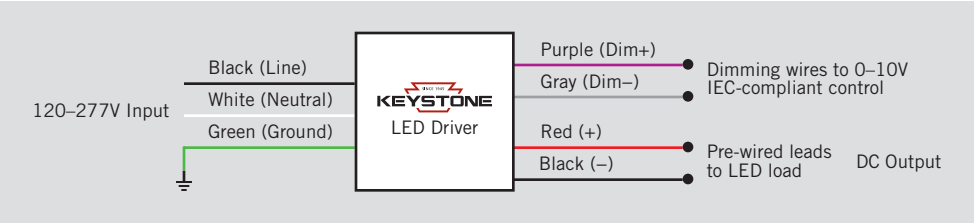
TRADITIONAL 35W NON-CUTOFF LED WALL PACK

PHYSICAL SPECIFICATIONS



GENERAL SETUP INSTRUCTIONS

GENERAL WIRING DIAGRAM



Caution: Before installing, make certain that AC power to the fixture is off.

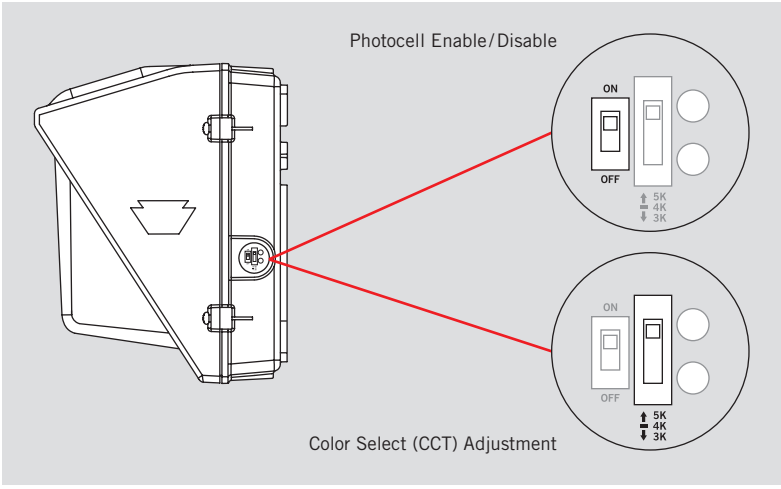
Caution: The electrical rating of this product is 120–277V. Installer must confirm that there is 120–277V at the fixture before installation.

PHOTOCELL ENABLE/DISABLE

This fixture is equipped with a dusk-to-dawn photocell behind the translucent knock-out (KO) cover. Adjust the dip switch to enable (ON) or disable (OFF) the photocell function (see illustrations to the right). Fixture comes preset with photocell enabled unless otherwise noted.

COLOR SELECT (CCT) ADJUSTMENT

This fixture is equipped with Color Select technology. There is an adjustable dip switch behind the translucent knock-out (KO) cover to change CCT between 5000K, 4000K, and 3000K (see illustrations to the right). Fixture comes preset at 5000K unless otherwise noted.



SINCE 1945
KEYSTONE
LIGHT MADE EASY

XFIT | TRADITIONAL WALL PACK FIXTURES

KT-WPLED35-M1-8CSB-VDIM

TRADITIONAL 35W NON-CUTOFF LED WALL PACK

ACCESSORY (SOLD SEPARATELY)

Catalog Number	Description
KTSP-10KV-C	Wallpack 10kV Surge Protector, Compact Design

ORDERING INFORMATION

CATALOG NUMBER	PACK QTY.	EASY CODE	UPC
KT-WPLED35-M1-8CSB-VDIM	1	SXE-77	843654129013

CATALOG NUMBER BREAKDOWN

KT-WPLED35-M1-8CSB-VDIM

1 2 3 4 5 6 7 8 9 10 11

1 Keystone Technologies
2 Fixture Type
3 LED Lamp
4 Max Wattage
5 Size
6 Style
7 CRI
8 Color
9 Color Select Designation
10 Dimming
11 Additional Options

2 Fixture Type

F	Flood
WP	Wallpack

5 Size

S	Small
M	Medium
L	Large

6 Style

1	Non-Cutoff
2	Full-Cutoff

7 CRI

8	>80
9	>90

8 Color

40	4000K
50	5000K
CS	Color Select

9 Color Select Designation

A	3500K, 4000K, 5000K
B	3000K, 4000K, 5000K
C	3000K, 3500K, 4000K, 5000K
D	4000K, 5000K

10 Dimming

VDIM	0–10V

11 Additional Options

	No option
/MW	Microwave occupancy Sensor Installed
/EMRG-12	12W Emergency Battery Backup Installed

A19-9-E26-927-DIM

RAB | Residential

Project:	Type:	Prepared By:	Date:

UPC: 019813748054

Features and Benefits

- Produces rich and vibrant colors >90CRI
- Energy efficient replacement for incandescent and halogen lamps
- Constructed from durable plastic which lowers risk of breakage
- Rated for use in enclosed and open fixtures in dry or damp locations
- Frosted lens produces smooth diffuse light
- Longer lifespan compared to legacy equivalents minimizes replacement and maintenance costs
- ENERGY STAR Compliant, Title 20 Compliant
- Dimmable with common dimmer types (check compatibility list)

Technical Specifications

Performance

Product Type:
A-Line

Input Wattage:
9W

Typical Lumen Output:
800

Efficacy:
84 lm/W

Color Temperature:
2700K Soft White

CRI:
90

L70 Lifespan:
25,000 Hours

Dimmable:
Yes, down to 10%

Construction

Bulb Shape:
A19

Base Type:
E26

Beam Angle:
230°

For Use Outdoors in Open Fixtures:
No

Other

Equivalency:
60W Incandescent

Warranty (Years):
RAB warrants that our LED products will be free from defects in materials and workmanship for a period of four (4) 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 rablighting.com/warranty.

Electrical

Power Factor:
0.9

Operating Temperature:
-20°C - 45°C

Input Voltage:
120V

Technical Specifications (continued)

Electrical

Operating Frequency:

60 Hz

Electrical Characteristics

Flicker:

<30%

Compliance

UL Listed:

Yes

ENERGY STAR V2.0:

This product is ENERGY STAR® Version 2.0 Certified

Energy Star ID:

2330069

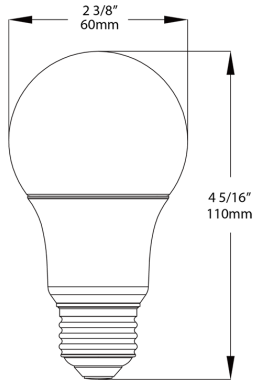
CEC Status:

Lawful for sale in California

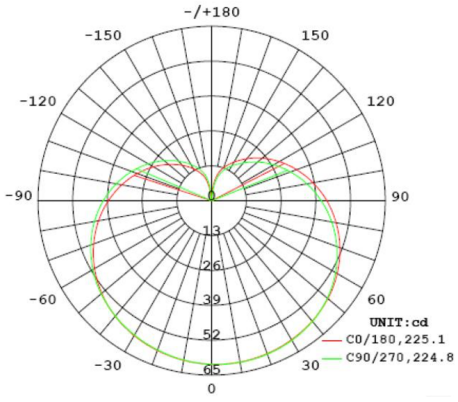
Case and Pallet Dimensions

	QTY	LENGTH (in)	WIDTH (in)	HEIGHT (in)
CASE	12	10	7.6	5.2
PALLET	3456	45.4	40	47.1

Dimension



Light Distribution



SINCE 1945 KEYSTONE | SMARTDRIVE LED PLUG & PLAY WITH BALLAST

KT-LED8T8-24GC-840-S

T8 LED LAMP

DESCRIPTION

8W T8 LED | 4000K | >80 CRI | High Efficiency | Ballast Compatible

RoHS Compliant | 5 YEAR WARRANTY

LAMP TYPE: Linear
BULB TYPE: T8 LED
BASE TYPE: G13 (Medium Bi-Pin)
WATTAGE: 8W
COLOR TEMPERATURE: 4000K
COLOR RENDERING INDEX (CRI): >80
WARRANTY: 5 Years

PRODUCT FEATURES

- **Compatible with Most Instant and Program Start Electronic T8 Ballasts, Contact Keystone for Ballast Compatibility List**
- Direct Replacement for F17T8 Fluorescent Lamps
- UL Listed; Listed on DLC QPL
- 50,000+ Hour Lifetime
- Environmentally Friendly: No Mercury Used
- Instant Startup
- Frosted Lens Eliminates Pixelation
- Operating Temperature: -20ºC/-4ºF to 45ºC/113ºF
- 100+ Lumens per Watt (Bare Lamp Efficacy)
- Suitable for Dry and Damp Locations
- Improved Lamp Durability with Shatterproof Coated Glass
- NSF Listed: NSF/ANSI Standard 2 - Food Equipment

OPERATING SPECIFICATIONS

ELECTRICAL AND PERFORMANCE CHARACTERISTICS

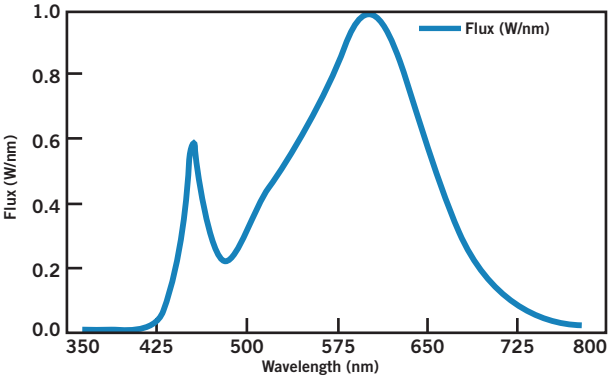
Input Voltage	CRI	Bare Lamp Wattage	Nominal Lamp Lumens	System Wattage*			Initial Lumens*			Beam Angle	Nominal Bare Lamp Efficacy	Power Factor	Max. THD
				0.78BF	0.88BF	1.18BF	0.78BF	0.88BF	1.18BF				
Ballast Dependent	>80	8W	1150 lm	9.3W	10.4W	14.3W	1110 lm	1235 lm	1610 lm	220º	127.0	>0.9	20%

** Nominal values. Actual values may vary depending on electronic ballast used.*

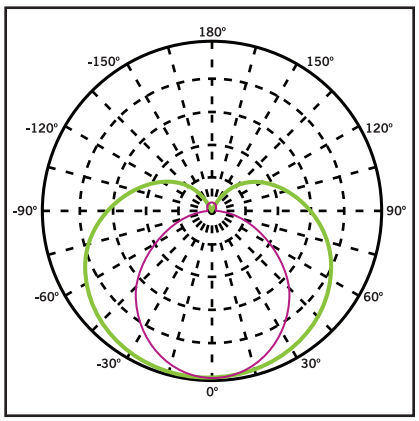
RATED LIFE

L70 (Hours)	50,000

SPECTRAL DISTRIBUTION



POLAR CANDELA DISTRIBUTION



Maximum Candela = 1248.55
Located at Horizontal Angle = 0, Vertical Angle 0

1. **Violet** Vertical Plane through Horizontal Angles (90-270)
2. **Green** Vertical Plane through Horizontal Angles (0-180)

Beam Angle: 220º

Visible Light Area: 325º

Keystone Technologies • 1390 Welsh Road, North Wales, PA 19454 • Phone (800) 464-2680 • Fax (888) 966-0556 • **www.keystonetech.com**

SINCE 1945 KEYSTONE | SMARTDRIVE LED PLUG & PLAY WITH BALLAST

KT-LED8T8-24GC-840-S

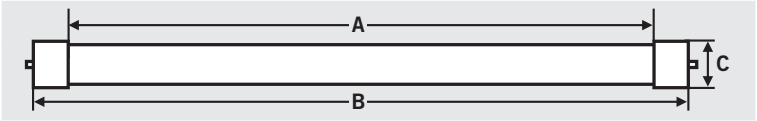
T8 LED LAMP

WIRING

Plug and Play: Simply replace the existing fluorescent lamp with Keystone Smart Drive LED lamp. No changes to the existing fluorescent ballast wiring needed. For ballast compability questions, please contact Keystone.

PHYSICAL CHARACTERISTICS

LAMP DIMENSIONS



A (Illuminated Length)	20.68"
B (Body Length)	23.19"
C (Diameter)	1.00"

NOMINAL LENGTH: 24" **BASE TYPE:** G13 (Medium Bi-Pin)

ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KT-LED8T8-24GC-840-S-CP	Carton Pack (Egg Crate Packaging)	25	Quick Ship
KT-LED8T8-24GC-840-S-DP	Distributor Pack (Individual Cartons)	20	Quick Ship

CATALOG NUMBER BREAKDOWN

KT-LED8T8-24GC-840-S-CP

KT	LED	8	T8	24	GC	840	S	CP
Keystone Technologies	LED Lamp	Wattage	Lamp Type	Nominal Length (Inches)	Shatterproof Coated Glass	800 Series	Color Temp.	Smart Drive Series	Packaging Style

SINCE 1945 KEYSTONE | SMARTDRIVE LED PLUG & PLAY WITH BALLAST

KT-LED15T8-48GC-840-S

T8 LED LAMP

DESCRIPTION

15W T8 LED | 4000K | >80 CRI | High Efficiency | Ballast Compatible

DLC | NSF | cULus LISTED | RoHS Compliant | 5 YEAR WARRANTY

LAMP TYPE: Linear
BULB TYPE: T8 LED
BASE TYPE: G13 (Medium Bi-Pin)
WATTAGE: 15W
COLOR TEMPERATURE: 4000K
COLOR RENDERING INDEX (CRI): >80
WARRANTY: 5 Years

PRODUCT FEATURES

- **Compatible with Most Instant and Program Start Electronic T8 Ballasts, Contact Keystone for Ballast Compatibility List**
- Direct Replacement for the Following Fluorescent Lamps: F32T8/32W, F32T8/30W, F32T8/28W, F32T8/25W
- UL Listed; Listed on DLC Qualified Product List
- 50,000+ Hour Lifetime
- Environmentally Friendly: No Mercury Used
- Instant Startup
- Frosted Lens Eliminates Pixelation
- Operating Temperature: -20ºC/-4ºF to 45ºC/113ºF
- 110+ Lumens per Watt (Bare Lamp Efficacy)
- Suitable for Dry and Damp Locations
- Improved Lamp Durability with Shatterproof Coated Glass
- NSF Listed: NSF/ANSI Standard 2 - Food Equipment

OPERATING SPECIFICATIONS

ELECTRICAL AND PERFORMANCE CHARACTERISTICS

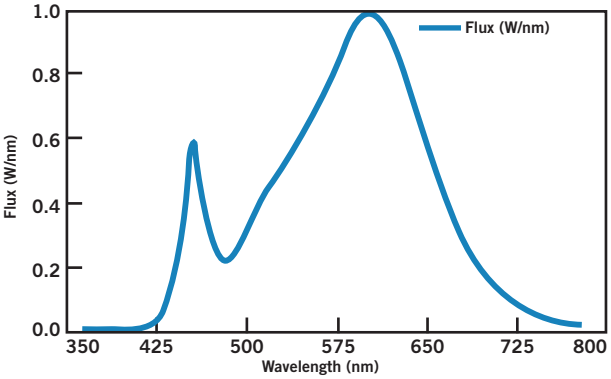
Input Voltage	CRI	Bare Lamp Wattage	Nominal Lamp Lumens	System Wattage*			Initial Lumens*			Visisble Light Area	Nominal Bare Lamp Efficacy	Power Factor	Max. THD
				0.78BF	0.88BF	1.18BF	0.78BF	0.88BF	1.18BF				
Ballast Dependent	>80	15W	2200 lm	15.8W	17.5W	24.1W	1965 lm	2185 lm	2825 lm	325º	147	>0.9	20%

** Nominal values. Actual values may vary depending on electronic ballast used.*

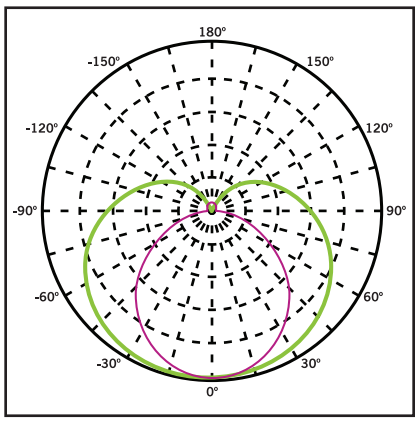
RATED LIFE

L70 (Hours)	50,000

SPECTRAL DISTRIBUTION



POLAR CANDELA DISTRIBUTION



Maximum Candela = 1248.55
Located at Horizontal Angle = 0, Vertical Angle 0

1. **Violet** Vertical Plane through Horizontal Angles (90-270)
2. **Green** Vertical Plane through Horizontal Angles (0-180)

Beam Angle: 220º

Visible Light Area: 325º

Keystone Technologies • 1390 Welsh Road, North Wales, PA 19454 • Phone (800) 464-2680 • Fax (888) 966-0556 • **www.keystonetech.com**

SINCE 1945 KEYSTONE | SMARTDRIVE LED PLUG & PLAY WITH BALLAST

KT-LED15T8-48GC-840-S

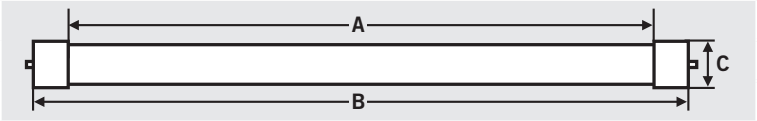
T8 LED LAMP

WIRING

Plug and Play: Simply replace the existing fluorescent lamp with Keystone Smart Drive LED lamp. No changes to the existing fluorescent ballast wiring needed. For ballast compability questions, please contact Keystone.

PHYSICAL CHARACTERISTICS

LAMP DIMENSIONS



A (Illuminated Length)	44.70”
B (Body Length)	47.15”
C (Diameter)	1.00”

NOMINAL LENGTH: 48” **BASE TYPE:** G13 (Medium Bi-Pin)

ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KT-LED15T8-48GC-840-S-CP	Carton Pack (Egg Crate Packaging)	25	Quick Ship
KT-LED15T8-48GC-840-S-DP	Distributor Pack (Individual Cartons)	20	Quick Ship

CATALOG NUMBER BREAKDOWN

KT-LED15T8-48GC-840-S-CP

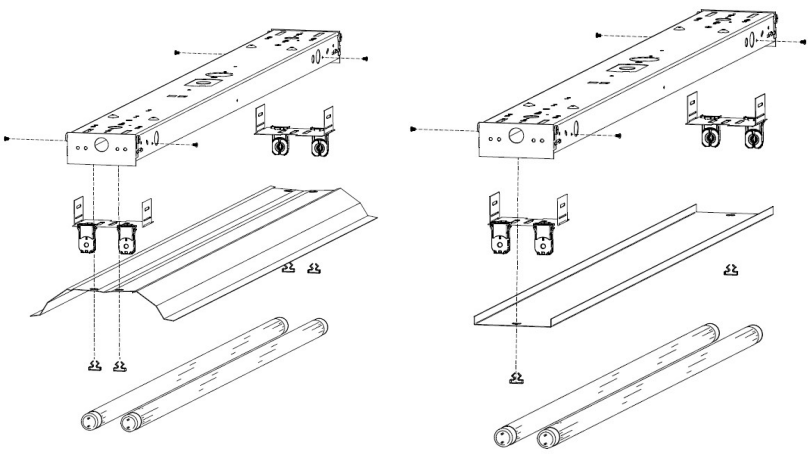
KT	LED15T8	48	GC	840	S	CP
Keystone Technologies	LED Lamp	Wattage	Lamp Type	Nominal Length (Inches)	Shatterproof Coated Glass	800 Series	Color Temp.	Smart Drive Series	Packaging Style

TECHBRITE

SAVING ENERGY IN THE BEST POSSIBLE LIGHT

PROJECT NAME:
NOTES:
PART NUMBER:
DATE:

RETRO STRIP—LED TUBES



PRODUCT DESCRIPTION:

TechBrite's most popular industrial retrofit kit, the LED Tube Retro Strip, is a simple installation process. It includes all the items needed to convert an existing strip fixture to a CSA-approved LED tube fixture. Replace your existing T12 or T8 fixtures with the LED Tube Retro Strip from TechBrite. The LED Tube Retro Strip is designed specifically for 4 foot LED tubes up to 22w and is available for 4 or 8 foot fixtures. The 4 foot retro features 1, 2 or 3 lamp options. The 8 foot retro features 2, 4 or 6 lamp options. This kit is sold with or without LED tubes and available with ballast cover or reflector. The TechBrite LED Tube Retro Strip is a fast, easy, and economical solution to upgrading existing fixtures.

FEATURES:

- Retro kit includes : sockets, socket bracket, channel cover, screws, quarterturns
- Quick & simple installation
- Tool-less channel cover for easy installation
- Energy & operational savings
- Available in 4' and 8' options
- Save install time with optional prewiring
- Limited warranty: 5 years on luminaire

PERFORMANCE SPECIFICATION:

Lumens	3 Lamp Max (4') / 6 Lamp Max (8')
Watts	4' = 66w Max / 8' = 132w Max
LPW	See TLED Specification
Color	See TLED Specification
CRI	See TLED Specification
L70	See TLED Specification
L85	See TLED Specification
Max Ambient Temp	See TLED Specification
Min Ambient Temp	See TLED Specification
Dimming	See TLED Specification
Driver Voltage	See TLED Specification
Chip	See TLED Specification
Driver	See TLED Specification

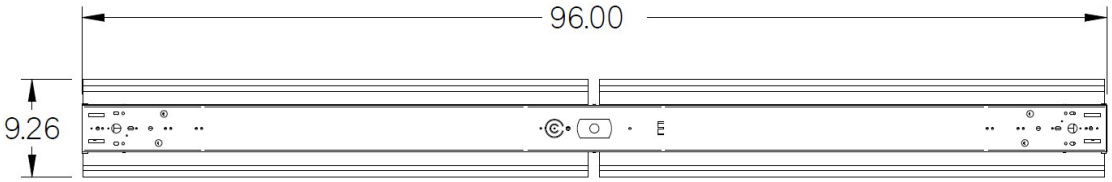
C US MADE IN THE USA MADE OF US AND IMPORTED PARTS

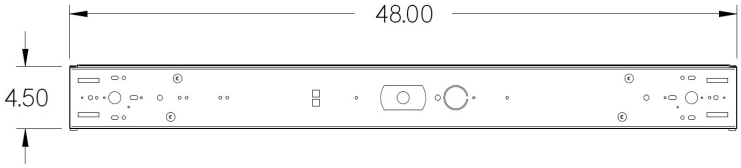
TECHBRITE
SAVING ENERGY IN THE BEST POSSIBLE LIGHT

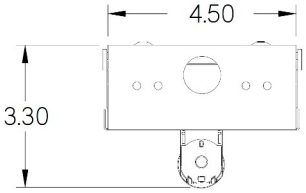
Retro Strip—LED Tubes

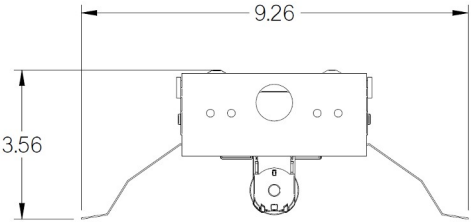
Commercial/Industrial

DIMENSIONS:









* Channel dimensions shown for reference only. Existing fixture may not correspond with dimension shown.

ORDERING CHART:

Series		Length		Width		# of Tubes		Type		Socket Type		Reflector		Wiring*	
R	Retro	**4**	4 Foot	**4**	4.25" Ballast Cvr	**Four Foot**		**SS**	LED Tubes	**X**	Shunted	**BCXX**	Ballast Cvr	**00P0**	Pre
		8	8 Foot	**5**	5" Ballast Cvr	**1**	1 lamp			**U**	Unshunted	**WRXX**	White	**0000**	None
				9	9" Reflector	**2**	2 lamp					**MRXX**	Miro 4		
						3	3 lamp					**XXXX**	None		
						Eight Foot									
						2	2 lamp								
						4	4 lamp								
						6	6 lamp								

ADDERS:

Lamp Type	
BLANK	Wired single end with unshunted sockets
WOE	Wired opposing ends with shunted sockets

* Prewired includes: wire & disconnect
* No wiring includes: disconnect & no wires

FREQUENTLY ORDERED PART NUMBERS:

Part Number	Description	Dimensions	Weight
R442SSUBCXX00P0	4' Retro Strip - LED Tubes 2 Lamp - Ballast Cover	48.00 x 4.50 x 3.56	2.91 lbs
R492SSUWRXX00P0	4' Retro Strip - LED Tubes 2 Lamp - White Reflector	48.00 x 9.26 x 3.56	1.64 lbs
R842SSUBCXX00P0	8' Retro Strip - LED Tubes 2 Lamp - Ballast Cover	48.00 x 4.50 x 3.56	5.82 lbs
R892SSUWRX00P0	8' Retro Strip - LED Tubes 2 Lamp - White Reflector	48.00 x 9.26 x 3.56	3.28 lbs
R844SSUBCXX00P0	8' Retro Strip - LED Tubes 4 Lamp - Ballast Cover	48.00 x 4.50 x 3.56	5.88 lbs
R894SSUWRXX00P0	8' Retro Strip - LED Tubes 4 Lamp - White Reflector	48.00 x 9.26 x 3.56	3.35 lbs

KTEB-232-UV-IS-L-P

T8 ELECTRONIC BALLAST

Version D1

DESCRIPTION

2×F32T8 | 120-277 Multi-Voltage | HPF | Instant Start

STARTING METHOD: Instant
LAMP CONNECTION: Parallel
INPUT VOLTAGE: 120-277VAC ±10%
INPUT FREQUENCY: 50/60 Hz
POWER FACTOR: High
WARRANTY: 5 Years

PRODUCT FEATURES

- **2014 DOE Compliant**
- Sound Rated: A
- Maximum Ambient Temperature: 105ºF, 40ºC
- Maximum Case Temperature: 167ºF, 75ºC
- Meets FCC Part 18 (Class A) Non-Consumer Limits
- Meets ANSI Standard C82.11 and C62.41
- UL, cUL Listed Class P, Type 1 Outdoor
- Anti-Striation Circuitry
- Type HL

ELECTRICAL SPECIFICATIONS

LAMP TYPE	NO. OF LAMPS	INPUT VOLTS	INPUT WATTS	INPUT CURRENT (AMPS)	POWER FACTOR	BALLAST FACTOR	BALLAST EFFICACY FACTOR	MAX THD%	CREST FACTOR	MIN START TEMP	WIRING DIAGRAM
F32T8 (32W)	2	120	48.5	0.42	>0.9	0.78	1.61	10	<1.7	0°F, -18°C	F2-4
		277	48.0	0.18	>0.9	0.78	1.63	10	<1.7	0°F, -18°C	F2-4
	1	120	30.0	0.25	>0.9	0.92	3.06	10	<1.7	0°F, -18°C	F1-4
		277	30.3	0.12	>0.9	0.92	3.04	12	<1.7	0°F, -18°C	F1-4
F32T8 (30W)	2	120	45.8	0.39	>0.9	0.78	1.70	10	<1.7	60°F, 16°C	F2-4
		277	45.2	0.17	>0.9	0.78	1.73	12	<1.7	60°F, 16°C	F2-4
	1	120	29.0	0.24	>0.9	0.92	3.17	10	<1.7	60°F, 16°C	F1-4
		277	29.0	0.11	>0.9	0.92	3.17	15	<1.7	60°F, 16°C	F1-4
F32T8 (28W)	2	120	44.9	0.38	>0.9	0.78	1.74	10	<1.7	60°F, 16°C	F2-4
		277	44.5	0.17	>0.9	0.78	1.75	12	<1.7	60°F, 16°C	F2-4
	1	120	27.8	0.23	>0.9	0.92	3.31	10	<1.7	60°F, 16°C	F1-4
		277	28.1	0.11	>0.9	0.92	3.28	15	<1.7	60°F, 16°C	F1-4
F32T8 (25W)	2	120	43.6	0.36	>0.9	0.78	1.79	10	<1.7	60°F, 16°C	F2-4
		277	43.2	0.16	>0.9	0.78	1.81	12	<1.7	60°F, 16°C	F2-4
	1	120	26.4	0.22	>0.9	0.92	3.48	10	<1.7	60°F, 16°C	F1-4
		277	27.0	0.10	>0.9	0.92	3.41	15	<1.7	60°F, 16°C	F1-4
F25T8	2	120	43.6	0.36	>0.9	0.80	1.83	10	<1.7	0°F, -18°C	F2-4
		277	43.2	0.16	>0.9	0.80	1.85	12	<1.7	0°F, -18°C	F2-4
	1	120	26.4	0.22	>0.9	0.94	3.56	10	<1.7	0°F, -18°C	F1-4
		277	27.0	0.10	>0.9	0.94	3.48	15	<1.7	0°F, -18°C	F1-4
F17T8	2	120	27.2	0.22	>0.9	0.80	2.94	10	<1.7	0°F, -18°C	F2-4
		277	27.5	0.11	>0.9	0.80	2.91	12	<1.7	0°F, -18°C	F2-4
	1	120	19.0	0.16	>0.9	1.05	5.53	12	<1.7	0°F, -18°C	F1-4
		277	19.4	0.08	>0.9	1.05	5.41	15	<1.7	0°F, -18°C	F1-4
F40T8	1	120	37.4	0.31	>0.9	0.90	2.41	10	<1.7	0°F, -18°C	F1-4
		277	37.0	0.14	>0.9	0.90	2.43	12	<1.7	0°F, -18°C	F1-4

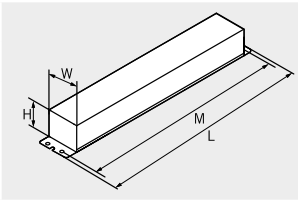
KTEB-232-UV-IS-L-P

T8 ELECTRONIC BALLAST

Version D1

PHYSICAL SPECIFICATIONS

CASE DIMENSIONS



LENGTH	9.50”
WIDTH	1.30”
HEIGHT	1.18”
MOUNTING	9.00”
CASE STYLE	L4

STANDARD LEAD LENGTH*

WHITE	25”
BLACK	25”
BLUE	31”
RED	45”

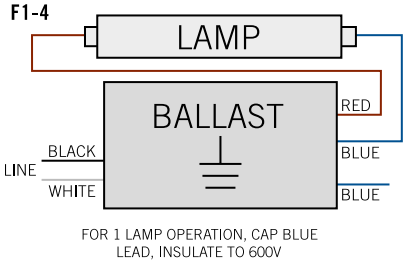
* Consult Keystone for special lead length requirements.

CASE MATERIAL: Steel

Lead wires are
18 AWG 105 C/600V,
solid copper.

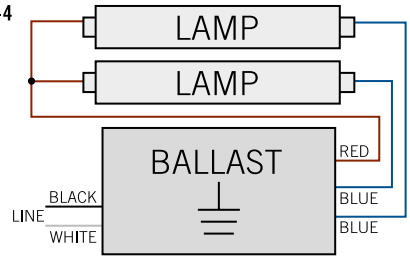
WIRING DIAGRAMS

F1-4



FOR 1 LAMP OPERATION, CAP BLUE LEAD, INSUTLATE TO 600V

F2-4



ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KTEB-232-UV-IS-L-P-CP	Carton Pack	10	Quick Ship
KTEB-232-UV-IS-L-P-DP	Distributor Pack		

NOTE: Version D1 (Manufacturing Revision). Prior versions of this ballast exist. Spec sheets for prior versions available upon request. Contact Keystone for details.

CATALOG NUMBER BREAKDOWN

KTEB-232-UV-IS-L-P-CP

KTEB	232	UV	IS	L	P	CP
Keystone Technologies Electronic Ballast	2 Lamps, 32 Watts	Universal Voltage	Instant Start	Low Ballast Factor	Premium Series	Packaging Style

Keystone Technologies • 208 Progress Drive, Montgomeryville, PA 18936 • Phone (800) 464-2680 • Fax (888) 966-0556 • **www.keystoneballast.com**

KTEB-232-UV-IS-N-P

T8 ELECTRONIC BALLAST

Version D1

DESCRIPTION

2 x F32T8 | 120-277 Multi-Voltage | HPF | Instant Start

STARTING METHOD: Instant Start
LAMP CONNECTION: Parallel
INPUT VOLTAGE: 120-277Vac ±10%
INPUT FREQUENCY: 50/60 Hz
POWER FACTOR: High
WARRANTY: 5 Years

- **2014 DOE Compliant**
- Sound Rated: A
- Maximum Case Temperature: 167°F, 75°C
- Meets FCC Part 18 (Class A) Non-Consumer Limits
- Meets ANSI Standard C82.11 and C62.41
- Max. Output Voltage: 600V
- Max. Voltage to Ground: 600V
- UL, cUL Listed Class P, Type 1 Outdoor
- Anti-Striation Circuitry
- Type HL

ELECTRICAL SPECIFICATIONS

LAMP TYPE	NO. OF LAMPS	INPUT VOLTS	INPUT WATTS	NOMINAL LINE AMPS	POWER FACTOR	BALLAST FACTOR	BALLAST EFFICACY FACTOR	MAX THD (%)	CREST FACTOR	MIN. START TEMP.	WIRING DIAGRAM
F32T8 (32W)	2	120V	54.4	0.48	>0.90	0.88	1.62	10	<1.70	0°F/-18°C	F2-4
		277V	53.5	0.21	>0.90	0.88	1.64	10	<1.70	0°F/-18°C	F2-4
	1	120V	35.2	0.29	>0.90	1.04	2.96	10	<1.70	0°F/-18°C	F1-4
		277V	35.3	0.13	>0.90	1.04	2.95	12	<1.70	0°F/-18°C	F1-4
F32T8 (30W)	2	120V	52.2	0.44	>0.90	0.88	1.69	10	<1.70	60°F/16°C	F2-4
		277V	51.7	0.20	>0.90	0.88	1.70	12	<1.70	60°F/16°C	F2-4
	1	120V	32.5	0.27	>0.90	1.04	3.20	10	<1.70	60°F/16°C	F1-4
		277V	32.4	0.12	>0.90	1.04	3.21	15	<1.70	60°F/16°C	F1-4
F32T8 (28W)	2	120V	50.2	0.43	>0.90	0.88	1.75	10	<1.70	60°F/16°C	F2-4
		277V	49.5	0.19	>0.90	0.88	1.78	12	<1.70	60°F/16°C	F2-4
	1	120V	31.0	0.26	>0.90	1.05	3.38	10	<1.70	60°F/16°C	F1-4
		277V	30.9	0.12	>0.90	1.05	3.40	15	<1.70	60°F/16°C	F1-4
F32T8 (25W)	2	120V	45.1	0.40	>0.90	0.89	1.97	10	<1.70	60°F/16°C	F2-4
		277V	44.7	0.17	>0.90	0.89	1.99	12	<1.70	60°F/16°C	F2-4
	1	120V	30.0	0.26	>0.90	1.05	3.50	10	<1.70	60°F/16°C	F1-4
		277V	30.0	0.12	>0.90	1.05	3.50	15	<1.70	60°F/16°C	F1-4
F25T8	2	120V	43.5	0.36	>0.90	0.89	2.05	10	<1.70	0°F/-18°C	F2-4
		277V	43.1	0.16	>0.90	0.89	2.06	12	<1.70	0°F/-18°C	F2-4
	1	120V	28.2	0.25	>0.90	1.05	3.72	10	<1.70	0°F/-18°C	F1-4
		277V	28.0	0.12	>0.90	1.05	3.75	15	<1.70	0°F/-18°C	F1-4
F17T8	2	120V	30.7	0.26	>0.90	0.91	2.96	10	<1.70	0°F/-18°C	F2-4
		277V	30.9	0.12	>0.90	0.91	2.94	12	<1.70	0°F/-18°C	F2-4
	1	120V	22.0	0.19	>0.90	1.07	4.86	12	<1.70	0°F/-18°C	F1-4
		277V	22.0	0.09	>0.90	1.07	4.86	15	<1.70	0°F/-18°C	F1-4
F15T8	2	120V	27.0	0.23	>0.90	0.66	2.44	10	<1.70	0°F/-18°C	F2-4
		277V	27.0	0.10	>0.90	0.66	2.44	15	<1.70	0°F/-18°C	F2-4
	1	120V	18.3	0.15	>0.90	0.82	4.48	12	<1.70	0°F/-18°C	F1-4
		277V	18.7	0.07	>0.90	0.82	4.38	18	<1.70	0°F/-18°C	F1-4
F40T8	1	120V	42.7	0.36	>0.90	1.00	2.34	10	<1.70	0°F/-18°C	F1-4
		277V	42.3	0.16	>0.90	1.00	2.36	15	<1.70	0°F/-18°C	F1-4
PLL 25W	2	120V	48.5	0.41	>0.90	0.90	1.86	10	<1.70	0°F/-18°C	P2-3
		277V	48.0	0.18	>0.90	0.90	1.88	12	<1.70	0°F/-18°C	P2-3
	1	120V	30.9	0.26	>0.90	1.02	3.30	10	<1.70	0°F/-18°C	P2-3
		277V	30.9	0.12	>0.90	1.02	3.30	15	<1.70	0°F/-18°C	P2-3

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KTEB-232-UV-IS-N-P

T8 ELECTRONIC BALLAST

Version D1

ELECTRICAL SPECIFICATIONS

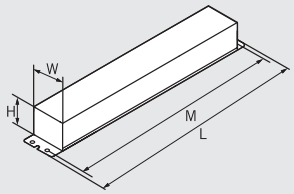
CONTINUED FROM PAGE 1

LAMP TYPE	NO. OF LAMPS	INPUT VOLTS	INPUT WATTS	NOMINAL LINE AMPS	POWER FACTOR	BALLAST FACTOR	BALLAST EFFICACY FACTOR	MAX THD (%)	CREST FACTOR	MIN. START TEMP.	WIRING DIAGRAM
PLL 28W	2	120V	56.2	0.47	>0.90	0.93	1.65	10	<1.70	0°F/-18°C	P2-3
		277V	56.0	0.21	>0.90	0.93	1.66	12	<1.70	0°F/-18°C	P2-3
	1	120V	35.9	0.31	>0.90	1.09	3.04	10	<1.70	0°F/-18°C	P2-3
		277V	35.9	0.13	>0.90	1.09	3.04	15	<1.70	0°F/-18°C	P2-3
PLL 40W	1	120V	38.5	0.33	>0.90	0.83	2.16	10	<1.70	0°F/-18°C	P2-3
		277V	38.2	0.14	>0.90	0.83	2.17	15	<1.70	0°F/-18°C	P2-3

Will also operate equivalent U-bend lamps.

PHYSICAL SPECIFICATIONS

CASE DIMENSIONS



LENGTH	9.50”
WIDTH	1.30”
HEIGHT	1.18”
MOUNTING	9.00”
CASE STYLE	L4

STANDARD LEAD LENGTHS*

BLACK	25”
WHITE	25”
BLUE	31”
RED	45”

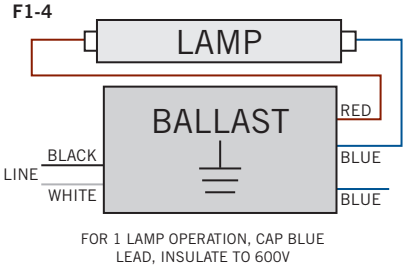
*Consult Keystone for special lead length requirements.

Lead wires are 18 AWG 105°C/600V, solid copper.

CASE MATERIAL: Steel

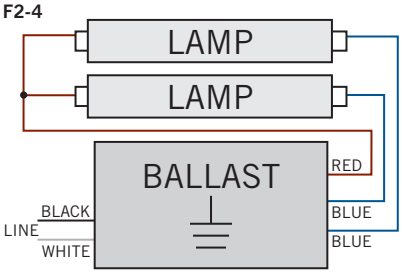
WIRING DIAGRAMS

F1-4

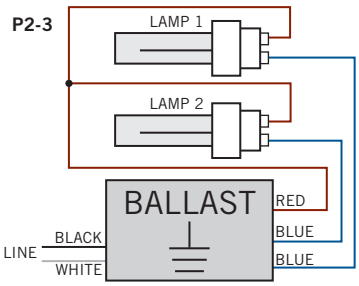


FOR 1 LAMP OPERATION, CAP BLUE LEAD, INSULATE TO 600V

F2-4



P2-3



CAP OFF BLUE LEAD FOR 1 LAMP APPLICATION

Instant start T8 ballasts require the use of either shunted sockets or a sockets with a manual wire shunt (or “bridge”).

ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KTEB-232-UV-IS-N-P-DP	Distributor Pack	10	Quick Ship
KTEB-232-UV-IS-N-P-CP	Carton Pack	10	Active

NOTE: Version D1 (Manufacturing Revision). Prior versions of this ballast exist. Spec sheets for prior versions available upon request. Contact Keystone for details.

CATALOG NUMBER BREAKDOWN

KTEB-232-UV-IS-N-P-DP

KTEB	232		UV	IS	N	P	DP
Keystone Technologies Electronic Ballast	2 Lamp	Wattage	Universal Voltage	Instant Start	Normal Ballast Factor	Premium Series	Packaging Style

KTEB-332-UV-IS-L-P

T8 ELECTRONIC BALLAST

Version D1

DESCRIPTION

3×F32T8 | 120-277 Multi-Voltage | HPF | Instant Start

STARTING METHOD: Instant
LAMP CONNECTION: Parallel
INPUT VOLTAGE: 120-277VAC ±10%
INPUT FREQUENCY: 50/60 Hz
POWER FACTOR: High
WARRANTY: 5 Years

PRODUCT FEATURES

- **2014 DOE Compliant**
- Sound Rated: A
- Maximum Ambient Temperature: 105ºF, 40ºC
- Maximum Case Temperature: 167ºF, 75ºC
- Meets FCC Part 18 (Class A) Non-Consumer Limits
- Meets ANSI Standard C82.11 and C62.41
- UL, cUL Listed Class P, Type 1 Outdoor
- Anti-Striation Circuitry
- Type HL

ELECTRICAL SPECIFICATIONS

LAMP TYPE	NO. OF LAMPS	INPUT VOLTS	INPUT WATTS	INPUT CURRENT (AMPS)	POWER FACTOR	BALLAST FACTOR	BALLAST EFFICACY FACTOR	MAX THD%	CREST FACTOR	MIN START TEMP	WIRING DIAGRAM
F32T8 (32W)	3	120	73.5	0.63	>0.9	0.78	1.06	10	<1.7	0°F, -18°C	F3-2
		277	72.1	0.27	>0.9	0.78	1.08	10	<1.7	0°F, -18°C	F3-2
	2	120	55.7	0.47	>0.9	0.90	1.62	10	<1.7	0°F, -18°C	F2-5
		277	55.1	0.20	>0.9	0.90	1.63	12	<1.7	0°F, -18°C	F2-5
F32T8 (30W)	3	120	67.0	0.57	>0.9	0.78	1.16	10	<1.7	60°F, 16°C	F3-2
		277	66.0	0.25	>0.9	0.78	1.18	12	<1.7	60°F, 16°C	F3-2
	2	120	50.1	0.42	>0.9	0.90	1.80	10	<1.7	60°F, 16°C	F2-5
		277	49.8	0.19	>0.9	0.90	1.81	12	<1.7	60°F, 16°C	F2-5
F32T8 (28W)	3	120	66.2	0.56	>0.9	0.78	1.18	10	<1.7	60°F, 16°C	F3-2
		277	65.2	0.24	>0.9	0.78	1.20	12	<1.7	60°F, 16°C	F3-2
	2	120	47.7	0.42	>0.9	0.90	1.89	10	<1.7	60°F, 16°C	F2-5
		277	48.7	0.19	>0.9	0.90	1.85	12	<1.7	60°F, 16°C	F2-5
F32T8 (25W)	3	120	57.7	0.50	>0.9	0.78	1.35	10	<1.7	60°F, 16°C	F3-2
		277	57.3	0.22	>0.9	0.78	1.36	12	<1.7	60°F, 16°C	F3-2
	2	120	46.6	0.39	>0.9	0.90	1.93	10	<1.7	60°F, 16°C	F2-5
		277	46.4	0.17	>0.9	0.90	1.94	12	<1.7	60°F, 16°C	F2-5
F25T8	3	120	57.7	0.48	>0.9	0.78	1.35	10	<1.7	0°F, -18°C	F3-2
		277	57.3	0.21	>0.9	0.78	1.36	12	<1.7	0°F, -18°C	F3-2
	2	120	42.9	0.36	>0.9	0.90	2.10	10	<1.7	0°F, -18°C	F2-5
		277	42.8	0.16	>0.9	0.90	2.10	12	<1.7	0°F, -18°C	F2-5
F17T8	3	120	40.6	0.33	>0.9	0.80	1.97	10	<1.7	0°F, -18°C	F3-2
		277	40.7	0.15	>0.9	0.80	1.97	12	<1.7	0°F, -18°C	F3-2
	2	120	31.1	0.26	>0.9	0.92	2.96	10	<1.7	0°F, -18°C	F2-5
		277	31.3	0.12	>0.9	0.92	2.94	12	<1.7	0°F, -18°C	F2-5
F40T8	2	120	66.4	0.57	>0.9	0.84	1.27	10	<1.7	0°F, -18°C	F2-5
		277	65.4	0.24	>0.9	0.84	1.28	12	<1.7	0°F, -18°C	F2-5

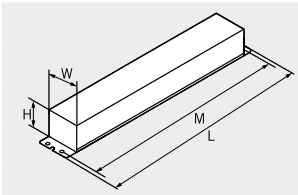
KTEB-332-UV-IS-L-P

T8 ELECTRONIC BALLAST

Version D1

PHYSICAL SPECIFICATIONS

CASE DIMENSIONS



LENGTH	9.50”
WIDTH	1.30”
HEIGHT	1.18”
MOUNTING	9.00”
CASE STYLE	L4

STANDARD LEAD LENGTH*

WHITE	25”
BLACK	25”
BLUE	31”
RED	37”

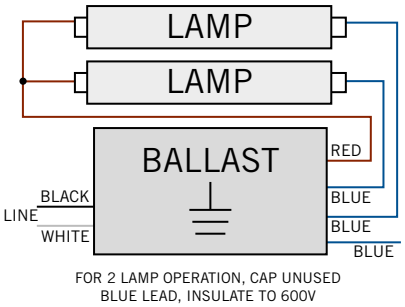
* Consult Keystone for special lead length requirements.

CASE MATERIAL: Steel

Lead wires are
18 AWG 105 C/600V,
solid copper.

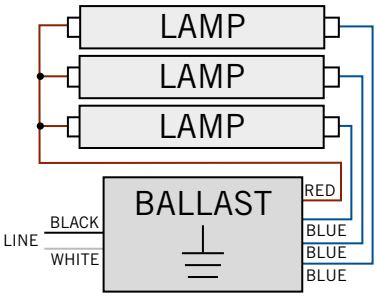
WIRING DIAGRAMS

F2-5



FOR 2 LAMP OPERATION, CAP UNUSED
BLUE LEAD, INSULATE TO 600V

F3-2



ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KTEB-332-UV-IS-L-P-CP	Carton Pack	10	Quick Ship
KTEB-332-UV-IS-L-P-DP	Distributor Pack		

NOTE: Version D1 (Manufacturing Revision). Prior versions of this ballast exist. Spec sheets for prior versions available upon request. Contact Keystone for details.

CATALOG NUMBER BREAKDOWN

KTEB-332-UV-IS-L-P-CP

KTEB	332		UV	IS	L	P	CP
Keystone Technologies Electronic Ballast	3 Lamps	32 Watts	Universal Voltage	Instant Start	Low Ballast Factor	Premium Series	Packaging Style

KEYSTONE
SINCE 1945
ENGINEERED LIGHTING SOLUTIONS

KTEB-332-UV-IS-N-P

T8 ELECTRONIC BALLAST

Version D1

c UL us | RoHS Compliant | 5 YEAR WARRANTY

DESCRIPTION

3 x F32T8 | 120-277 Multi-Voltage | High Power Factor | Instant Start

STARTING METHOD: Instant Start
LAMP CONNECTION: Parallel
INPUT VOLTAGE: 120-277Vac ±10%
INPUT FREQUENCY: 50/60 Hz
POWER FACTOR: High
WARRANTY: 5 Years

- **2014 DOE Compliant**
- Sound Rated: A
- Maximum Case Temperature: 167ºF, 75ºC
- Meets FCC Part 18 (Class A) Non-Consumer Limits
- Meets ANSI Standard C82.11 and C62.41
- Max. Output Voltage: 600V
- Max. Voltage to Ground: 600V
- UL, cUL Listed Class P, Type 1 Outdoor
- Anti-Striation Circuitry
- Type HL

ELECTRICAL SPECIFICATIONS

LAMP TYPE	NO. OF LAMPS	INPUT VOLTS	INPUT WATTS	NOMINAL LINE AMPS	POWER FACTOR	BALLAST FACTOR	BALLAST EFFICACY FACTOR	MAX THD (%)	CREST FACTOR	MIN. START TEMP.	WIRING DIAGRAM
F32T8 (32W)	3	120V	83.6	0.73	>0.90	0.88	1.05	10	<1.70	0ºF/-18ºC	F3-2
		277V	82.6	0.30	>0.90	0.88	1.07	10	<1.70	0ºF/-18ºC	F3-2
	2	120V	62.5	0.53	>0.90	1.03	1.65	10	<1.70	0ºF/-18ºC	F2-5
		277V	61.6	0.23	>0.90	1.03	1.67	10	<1.70	0ºF/-18ºC	F2-5
F32T8 (30W)	3	120V	76.6	0.64	>0.90	0.88	1.15	10	<1.70	60ºF/16ºC	F3-2
		277V	76.1	0.28	>0.90	0.88	1.16	12	<1.70	60ºF/16ºC	F3-2
	2	120V	58.9	0.50	>0.90	1.03	1.75	10	<1.70	60ºF/16ºC	F2-5
		277V	58.2	0.22	>0.90	1.03	1.77	12	<1.70	60ºF/16ºC	F2-5
F32T8 (28W)	3	120V	74.9	0.60	>0.90	0.88	1.17	10	<1.70	60ºF/16ºC	F3-2
		277V	73.5	0.26	>0.90	0.88	1.20	10	<1.70	60ºF/16ºC	F3-2
	2	120V	57.0	0.48	>0.90	1.03	1.81	10	<1.70	60ºF/16ºC	F2-5
		277V	56.4	0.21	>0.90	1.03	1.83	10	<1.70	60ºF/16ºC	F2-5
F32T8 (25W)	3	120V	63.7	0.57	>0.90	0.88	1.38	10	<1.70	60ºF/16ºC	F3-2
		277V	62.8	0.25	>0.90	0.88	1.40	12	<1.70	60ºF/16ºC	F3-2
	2	120V	52.6	0.44	>0.90	1.04	1.98	10	<1.70	60ºF/16ºC	F2-5
		277V	52.4	0.20	>0.90	1.04	1.98	12	<1.70	60ºF/16ºC	F2-5
F25T8	3	120V	63.7	0.55	>0.90	0.89	1.40	10	<1.70	0ºF/-18ºC	F3-2
		277V	62.8	0.23	>0.90	0.89	1.42	12	<1.70	0ºF/-18ºC	F3-2
	2	120V	48.2	0.40	>0.90	1.05	2.18	10	<1.70	0ºF/-18ºC	F2-5
		277V	47.8	0.18	>0.90	1.05	2.20	12	<1.70	0ºF/-18ºC	F2-5
F17T8	3	120V	45.6	0.38	>0.90	0.91	2.00	10	<1.70	0ºF/-18ºC	F3-2
		277V	45.4	0.17	>0.90	0.91	2.00	12	<1.70	0ºF/-18ºC	F3-2
	2	120V	34.8	0.29	>0.90	1.07	3.07	10	<1.70	0ºF/-18ºC	F2-5
		277V	35.0	0.14	>0.90	1.07	3.06	12	<1.70	0ºF/-18ºC	F2-5
F40T8	2	120V	77.3	0.66	>0.90	0.97	1.33	10	<1.70	0ºF/-18ºC	F2-5
		277V	76.6	0.28	>0.90	0.97	1.27	12	<1.70	0ºF/-18ºC	F2-5
PLL 25W	3	120V	72.5	0.61	>0.90	0.86	1.19	10	<1.70	0ºF/-18ºC	P3-1
		277V	71.9	0.26	>0.90	0.86	1.20	12	<1.70	0ºF/-18ºC	P3-1
	2	120V	54.7	0.46	>0.90	1.01	1.85	10	<1.70	0ºF/-18ºC	P3-1
		277V	54.1	0.20	>0.90	1.01	1.87	12	<1.70	0ºF/-18ºC	P3-1
PLL 28W	3	120V	82.4	0.70	>0.90	0.92	1.11	10	<1.70	0ºF/-18ºC	P3-1
		277V	80.5	0.29	>0.90	0.92	1.14	12	<1.70	0ºF/-18ºC	P3-1
	2	120V	64.3	0.54	>0.90	1.05	1.63	10	<1.70	0ºF/-18ºC	P3-1
		277V	63.3	0.23	>0.90	1.05	1.66	12	<1.70	0ºF/-18ºC	P3-1
PLL 40W	2	120V	68.1	0.57	>0.90	0.74	1.09	10	<1.70	0ºF/-18ºC	P3-1
		277V	67.4	0.24	>0.90	0.74	1.10	12	<1.70	0ºF/-18ºC	P3-1

Will also operate equivalent U-bend lamps.

Keystone Technologies • 208 Progress Drive, Montgomeryville, PA 18936 • Phone (800) 464-2680 • Fax (888) 966-0556 • **www.keystoneballast.com**

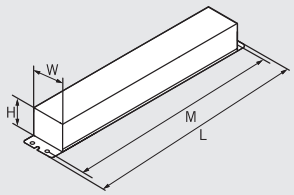
KEYSTONE
SINCE 1945
ENGINEERED LIGHTING SOLUTIONS

KTEB-332-UV-IS-N-P
T8 ELECTRONIC BALLAST

Version D1

PHYSICAL SPECIFICATIONS

CASE DIMENSIONS



LENGTH	9.50”
WIDTH	1.30”
HEIGHT	1.18”
MOUNTING	9.00”
CASE STYLE	L4

STANDARD LEAD LENGTHS*

BLACK	25”
WHITE	25”
BLUE	31”
RED	37”

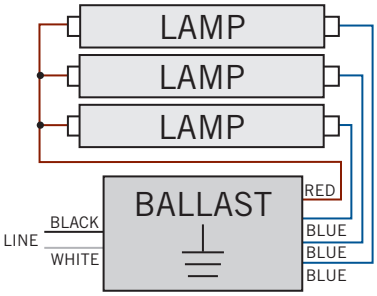
*Consult Keystone for special lead length requirements.

Lead wires are 18 AWG 105ºC/600V, solid copper.

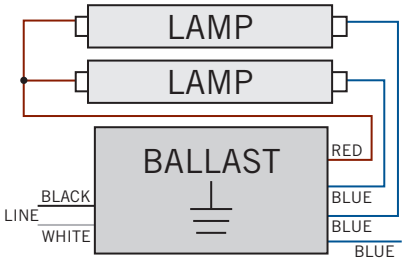
CASE MATERIAL: Steel

WIRING DIAGRAMS

F3-2

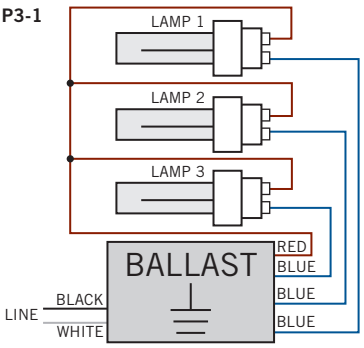


F2-5



FOR 2 LAMP OPERATION, CAP UNUSED BLUE LEAD, INSULATE TO 600V

P3-1



CAP OFF ANY BLUE LEAD FOR 2 LAMP APPLICATION

Instant start T8 ballasts require the use of either shunted sockets or a sockets with a manual wire shunt (or “bridge”).

ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KTEB-332-UV-IS-N-P-DP	Distributor Pack	10	Quick Ship
KTEB-332-UV-IS-N-P-CP	Carton Pack	10	Active

NOTE: Version D1 (Manufacturing Revision). Prior versions of this ballast exist. Spec sheets for prior versions available upon request. Contact Keystone for details.

CATALOG NUMBER BREAKDOWN

KTEB-332-UV-IS-N-P-DP

KTEB	3	32	UV	IS	N	P	DP
Keystone Technologies Electronic Ballast	3 Lamp	Wattage	Universal Voltage	Instant Start	Normal Ballast Factor	Premium Series	Packaging Style

KTEB-432-UV-IS-L-P

T8 ELECTRONIC FLUORESCENT

NEMA Premium | RoHS Compliant | c UL us

PRODUCT FEATURES

STARTING METHOD: Instant	**INPUT VOLTAGE:** 120-277VAC ±10%	**WARRANTY:** 5 Years
LAMP CONNECTION: Parallel	**INPUT FREQUENCY:** 50/60 Hz	**POWER FACTOR:** High

- Sound Rated: A
- Minimum Starting Temperature: 0ºF, -18ºC
- Maximum Case Temperature: 167ºF, 75ºC
- Meets FCC Part 18 (Class A) Non-Consumer Limits
- Transient Protection Meets ANSI/IEEEC62.41 Cat. A
- Ballast frequency for all listed lamps: > 40kHz

ELECTRICAL SPECIFICATIONS

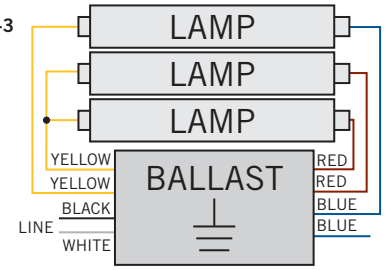
LAMP TYPE	NO. OF LAMPS	INPUT VOLTS	INPUT WATTS	INPUT CURRENT (AMPS)	POWER FACTOR	CREST FACTOR	BALLAST FACTOR	BALLAST EFFICACY FACTOR	MAX THD%	WIRING DIAGRAM
F32T8 32W	4	120	98.0	0.82	0.99	<1.70	0.78	0.80	10	F4-1
		277	96.0	0.35	0.98	<1.70	0.77	0.80	10	F4-1
	3	120	81.0	0.68	0.99	<1.70	0.87	1.07	10	F3-3
		277	78.0	0.28	0.97	<1.70	0.86	1.10	12	F3-3
F32T8 30W	4	120	92.0	0.77	0.99	<1.70	0.76	0.83	10	F4-1
		277	92.0	0.33	0.98	<1.70	0.75	0.82	10	F4-1
	3	120	75.0	0.63	0.99	<1.70	0.82	1.09	10	F3-3
		277	75.0	0.27	0.97	<1.70	0.81	1.08	12	F3-3
F32T8 28W	4	120	89.0	0.74	0.99	<1.70	0.78	0.88	10	F4-1
		277	89.0	0.32	0.98	<1.70	0.77	0.87	10	F4-1
	3	120	68.0	0.57	0.99	<1.70	0.79	1.16	10	F3-3
		277	74.0	0.27	0.97	<1.70	0.78	1.05	12	F3-3
F32T8 25W	4	120	81.0	0.68	0.99	<1.70	0.80	0.99	10	F4-1
		277	83.0	0.30	0.98	<1.70	0.81	0.98	10	F4-1
	3	120	67.0	0.56	0.99	<1.70	0.88	1.31	10	F3-3
		277	69.0	0.25	0.97	<1.70	0.90	1.30	12	F3-3
F25T8 25W	4	120	76.0	0.63	0.99	<1.70	0.75	0.99	10	F4-1
		277	77.0	0.28	0.98	<1.70	0.76	0.99	10	F4-1
	3	120	63.0	0.53	0.99	<1.70	0.82	1.30	10	F3-3
		277	63.0	0.23	0.97	<1.70	0.84	1.33	12	F3-3
F17T8 17W	4	120	56.0	0.47	0.99	<1.70	0.81	1.45	10	F4-1
		277	56.0	0.20	0.96	<1.70	0.81	1.45	12	F4-1
	3	120	47.0	0.39	0.99	<1.70	0.90	1.91	10	F3-3
		277	47.0	0.17	0.95	<1.70	0.90	1.91	15	F3-3
F40T8 40W	3	120	97.0	0.81	0.99	<1.70	0.79	0.81	10	F3-3
		277	98.0	0.35	0.98	<1.70	0.80	0.82	10	F3-3

KTEB-432-UV-IS-L-P

T8 ELECTRONIC FLUORESCENT

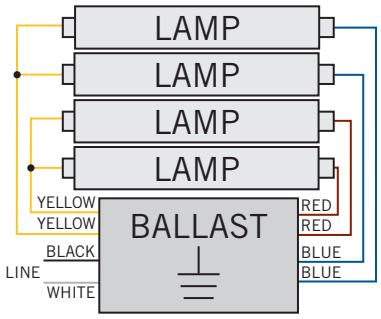
WIRING DIAGRAMS

F3-3



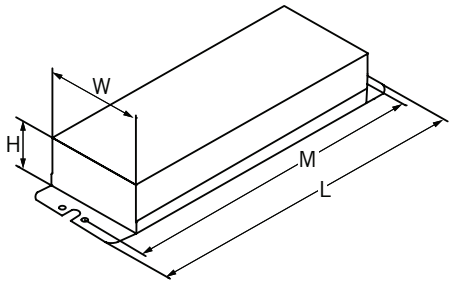
FOR 3 LAMP OPERATION, CAP UNUSED BLUE LEAD, INSULATE TO 600V

F4-1



Instant Start T8 ballasts require the use of Shunted lampholders/ sockets.

CASE STYLE/DIMENSIONS



CASE DIMENSIONS

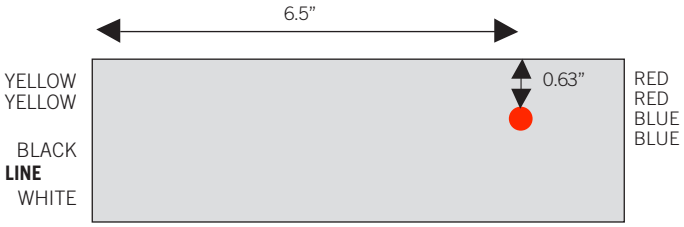
LENGTH: 9.50”
WIDTH: 1.38”
HEIGHT: 1.18”
MOUNTING: 8.90”
UNIT WEIGHT: 1.23 lbs

STANDARD LEAD LENGTHS*

BLACK: 25.00”
WHITE: 25.00”
BLUE: 31.00” X 31.00”
RED: 31.00” X 31.00”
YELLOW: 45.00” X 45.00”

*Consult Keystone for special lead length requirements.

HOT SPOT LOCATION



ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KTEB-432-UV-IS-L-P-CP	Carton	40	Quick Ship
KTEB-432-UV-IS-L-P-DP	Carton	10	Quick Ship

CATALOG NUMBER BREAKDOWN

KTEB-432-UV-IS-L-P

KTEB	4	32	UV	IS	L	P
Keystone Technologies Electronic Ballast	4 Lamps	32 Watts	Universal Voltage Input (120-277V)	Instant Start	Low Ballast Factor	NEMA Premium Series

Keystone Technologies, LLC • P.O. Box 246, Ambler PA 19002 • Phone (800) 464-2680 • Fax (215) 628-4412 • www.keystoneballast.com

SINCE 1945
KEYSTONE
ENGINEERED LIGHTING SOLUTIONS

KTEB-432-UV-IS-N-P

T8 ELECTRONIC FLUORESCENT

Version A1

4 x F32T8 | 120-277V Input | High Power Factor | Instant Start

STARTING METHOD: Instant Start
LAMP CONNECTION: Parallel
INPUT VOLTAGE: 120-277VAC ±10%
INPUT FREQUENCY: 50/60 Hz
POWER FACTOR: High
WARRANTY: 5 Years

PRODUCT FEATURES

- **2014 DOE Compliant**
- Sound Rated: A
- Maximum Case Temperature: 167ºF, 75ºC
- Meets FCC Part 18 (Class A) Non-Consumer Limits
- Meets ANSI Standard C82.11-2002 and C62.41-2002
- UL, cUL Listed, Class P, Type 1 Outdoor
- OCV: 600V
- Anti-Striation Circuitry
- Type HL

ELECTRICAL SPECIFICATIONS

LAMP TYPE	NO. OF LAMPS	INPUT VOLTS	INPUT WATTS	INPUT CURRENT (AMPS)	POWER FACTOR	CREST FACTOR	BALLAST FACTOR	BALLAST EFFICACY FACTOR	MAX THD (%)	MIN. START TEMP (ºF/ºC)	WIRING DIAGRAM
F32T8 (32W)	4	120	112	0.93	≥0.98	≤1.70	0.88	0.80	10	0/-18	F4-1
		277	108	0.40	≥0.98	≤1.70	0.88	0.81	10	0/-18	F4-1
	3	120	92	0.77	≥0.98	≤1.70	0.96	1.04	10	0/-18	F3-3
		277	89	0.34	≥0.98	≤1.70	0.96	1.07	10	0/-18	F3-3
F32T8 (30W)	4	120	101	0.85	≥0.98	≤1.70	0.88	0.87	10	0/-18	F4-1
		277	100	0.37	≥0.98	≤1.70	0.88	0.88	10	0/-18	F4-1
	3	120	84	0.71	≥0.98	≤1.70	0.96	1.14	10	0/-18	F3-3
		277	84	0.31	≥0.98	≤1.70	0.96	1.15	10	0/-18	F3-3
F32T8 (28W)	4	120	94	0.79	≥0.98	≤1.70	0.88	0.93	10	0/-18	F4-1
		277	94	0.35	≥0.98	≤1.70	0.88	0.93	10	0/-18	F4-1
	3	120	77	0.65	≥0.98	≤1.70	0.96	1.24	10	0/-18	F3-3
		277	77	0.29	≥0.98	≤1.70	0.96	1.25	10	0/-18	F3-3
F32T8 (25W)	4	120	88	0.74	≥0.98	≤1.70	0.88	1.00	10	0/-18	F4-1
		277	88	0.33	≥0.98	≤1.70	0.88	1.00	10	0/-18	F4-1
	3	120	74	0.62	≥0.98	≤1.70	0.96	1.29	10	0/-18	F3-3
		277	73	0.27	≥0.98	≤1.70	0.96	1.31	10	0/-18	F3-3
F25T8	4	120	87	0.72	≥0.98	≤1.70	0.89	1.02	10	0/-18	F4-1
		277	85	0.32	≥0.98	≤1.70	0.89	1.05	10	0/-18	F4-1
	3	120	72	0.60	≥0.98	≤1.70	0.96	1.33	10	0/-18	F3-3
		277	71	0.26	≥0.98	≤1.70	0.96	1.35	10	0/-18	F3-3
F17T8	4	120	59	0.49	≥0.98	≤1.70	0.93	1.57	10	0/-18	F4-1
		277	58	0.22	≥0.98	≤1.70	0.93	1.59	10	0/-18	F4-1
	3	120	50	0.41	≥0.98	≤1.70	0.92	1.86	10	0/-18	F3-3
		277	49	0.18	≥0.97	≤1.70	0.92	1.87	10	0/-18	F3-3
F40T8	3	120	114	0.95	≥0.98	≤1.70	0.96	0.84	10	32/0	F3-3
		277	109	0.41	≥0.98	≤1.70	0.96	0.88	10	32/0	F3-3

* Will also operate equivalent U-bend lamps.

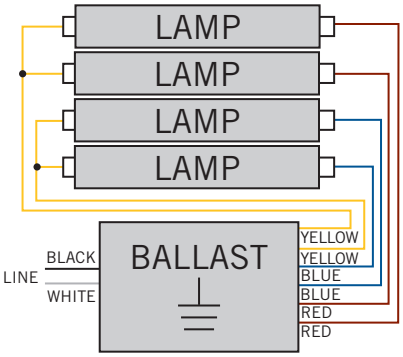
KTEB-432-UV-IS-N-P

T8 ELECTRONIC FLUORESCENT

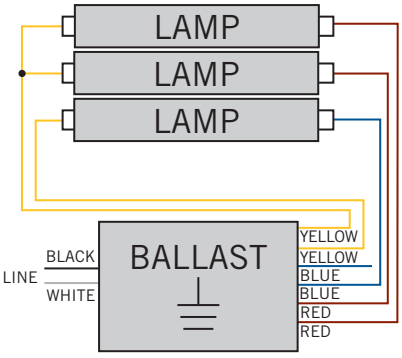
Version A1

WIRING DIAGRAM

F4-1

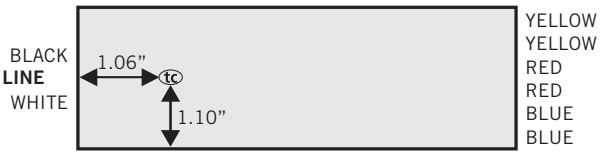


F3-3



FOR 3 LAMP OPERATION, CAP ANY BLUE LEAD, INSULATE TO 600V.

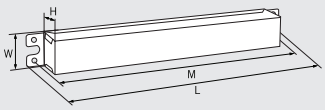
HOT SPOT LOCATION



Actual tc point is noted on each ballast label.

PHYSICAL SPECIFICATIONS

CASE DIMENSIONS



LENGTH	9.50"
WIDTH	1.30"
HEIGHT	1.10"
MOUNTING	8.90"
CASE STYLE	L11

STANDARD LEAD LENGTHS*

WHITE	25"
BLACK	25"
YELLOW	46"
RED	31"
BLUE	31"

*Consult Keystone for special lead length requirements.

Lead wires are 18 AWG 105ºC/600V, solid copper.

CASE MATERIAL: Metal

ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KTEB-432-UV-IS-N-P-DP	Distributor Pack	10	Quick Ship
KTEB-432-UV-IS-N-P-CP	Carton Pack	20	Active

NOTE: Version A1 (Manufacturing Revision). Prior versions of this ballast exist. Spec sheets for prior versions available upon request. Contact Keystone for details.

CATALOG NUMBER BREAKDOWN

KTEB-432-UV-IS-N-P-DP

KTEB	432	UV	IS	N	P	DP
Keystone Technologies Electronic Ballast	4 Lamp	Wattage	120-277V Universal Input	Instant Start	Normal Light Output	Premium Series	Packaging Style

LITHONIA LIGHTING®

FEATURES & SPECIFICATIONS

INTENDED USE — The BLT Best-in-Value Low Profile LED luminaire features a popular center basket design that offers a clean, versatile style and volumetric distribution. High efficacy LED light engines deliver energy savings and low maintenance compared to traditional sources. An extensive selection of configurations and options make the BLT the perfect choice for many lighting applications including schools, offices and other commercial spaces, retail, hospitals and healthcare facilities. The low profile BLT design (2-3/8") also makes it an excellent choice for renovation projects.

CONSTRUCTION — BLT enclosure components are die-formed for dimensional consistency and painted after fabrication with a polyester powder paint for improved performance and protection.

The reflector is finished with a high reflective matte white powder paint for improved aesthetics and increased light diffusion.

End plates contain easy-to-position integral T-bar clips for securely attaching the luminaire to the T-grid. For additional T-grid security, optional screw on T-bar clips are available.

Diffusers are extruded from impact modified acrylic for increased durability. Injection molded diffuser light traps add a finished look to the diffuser ends and help seal the diffuser to the housing end plates. Optional diffuser trim rings provide an attractive mounting for integral sensors as well as adding a decorative element to the luminaire aesthetics.

LED boards are accessible from below; driver is accessible from the plenum.

OPTICS — Volumetric illumination is achieved by creating an optimal mix of light to walls, partitions and vertical and horizontal work surfaces – rendering the interior space, objects and occupants in a more balanced, complimentary luminous environment. High performance extruded acrylic diffusers conceal LEDs and efficiently deliver light in a volumetric distribution. Four diffuser choices available - curved and square designs with linear prisms or a smooth frosted finish.

ELECTRICAL — Long-life LEDs, coupled with high-efficiency drivers, provide superior quantity and quality of illumination for extended service life. 90% LED lumen maintenance at 60,000 hours (L90/60,000).

Non-Configurable BLT: 0-10 volt dimming driver. Dims to 10%

Configurable BLT: available in High Efficiency (HE) versions for applications where a lower wattage (over the standard product) is required. The High Efficiency versions deliver >130 LPW and can be specified via the Lumen Package designations in the Ordering Information below.

eldoLED driver options deliver choice of dimming range, and choices for control, while assuring flicker-free, low-current inrush, 89% efficiency and low EMI.

Optional integrated nLight®controls make each luminaire addressable - allowing it to digitally communicate with other nLight enabled controls such as dimmers, switches, occupancy sensors and photocontrols. Simply connect all the nLight enabled control devices and the BLT luminaires using standard Cat-5 cabling. Unique plug-and-play convenience as devices and luminaires automatically discover each other and self-commission.

Lumen Management: Unique lumen management system (option N80) provides on board intelligence that actively manages the LED light source so that constant lumen output is maintained over the system life, preventing the energy waste created by the traditional practice of over-lighting.

Step-level dimming option allows system to be switched to 50% power for compliance with common energy codes while maintaining fixture appearance.

Driver disconnect provided where required to comply with US and Canadian codes.

SENSOR— Integrated sensor (individual control): Sensor Switch MSD7ADCX ((Passive infrared (PIR)) or MSDPDT7ADCX ((PIR/Microphonics Dual Tech (PDT)) integrated occupancy sensor/automatic dimming photocell allows the luminaire to power off when the space is unoccupied or enough ambient light is entering the space. See page 2 for more details on the integrated sensor.

Integrated Sensor (nLight Wired Networking): This sensor is nLight-enabled, meaning it has the ability to communicate over an nLight network. When wired, using CAT-5 cabling, with other nLight-enabled sensors, power packs, or WallPods, an nLight control zone is created. Once linked to a Gateway, directly or via a Bridge, the zone becomes capable of remote status monitoring and control via SensorView software. See page 2 for the nLight sensor options.

INSTALLATION — The BLT's low profile design of only 2-3/8" provides increased installation flexibility especially in restrictive plenum applications. The BLT fits into standard 15/16" and narrow 9/16" T-grid ceiling systems.

Suitable for damp location.

For recessed mounting in hard ceiling applications, Drywall Grid Adapters (DGA) are available as an accessory. See Accessories section.

LISTINGS — CSA Certified to meet U.S. and Canadian standards. IC rated.

DesignLights Consortium® (DLC) qualified product. Not all versions of this product may be DLC qualified. Please check the DLC Qualified Products List at www.designlights.org/QPL to confirm which versions are qualified.

WARRANTY — 5-year limited warranty. Complete warranty terms located at www.acuitybrands.com/CustomerResources/Terms_and_conditions.aspx

NOTE: Actual performance may differ as a result of end-user environment and application.

All values are design or typical values, measured under laboratory conditions at 25 °C.

Specifications subject to change without notice.

Catalog Number
Notes
Type

BLT Series LED

2BLT

2' x 2'
LED

eldoLED nLIGHT

Specifications

Length: 23-3/4 (60.3)

Width: 23-3/4 (60.3)

Depth: 2-3/8 (6.0)

All dimensions are inches (centimeters) unless otherwise specified.

Mulitple Diffuser Options

ADP
Curved Ribbed

ADSM
Curved Smooth

SDP
Square Ribbed

SDSM
Square Smooth

2BLT Volumetric Recessed Lighting 2'x2'

ORDERING INFORMATION Lead times will vary depending on options selected. Consult with your sales representative.

Example: 2BLT2 33L ADPT EZ1 LP835

2BLT2

Series	Air function	Lumens[1]		Diffuser	Voltage	Driver	Color temperature
2BLT2 2X2 BLT	(blank) Static	**Standard efficiency (>100 LPW)**	**High efficiency (>130 LPW)**	ADP Curved, Linear Prisms	(blank) MVOLT	EZ1 eldoLED dims to 1% (0-10 volt dimming)	LP830 82CRI, 3000 K
		20L 2000	33LHE 3300	ADSM Curved, Smooth	347 347[2]	SLD Step-level dimming[3]	LP835 82CRI, 3500 K
		33L 3300	40LHE 4000	SDP Square, Linear Prisms			LP840 82CRI, 4000 K
		40L 4000	48LHE 4800	SDSM Square, Smooth			LP850 82CRI, 5000 K
				Diffusers w/ trim rings			LP930 90CRI, 3000K
				ADPT Curved, Linear Prisms			LP935 90CRI, 3500K
				ADSMT Curved, Smooth			LP940 90CRI, 4000K
				SDPT Square, Linear Prisms			LP950 90CRI, 5000K
				SDSMT Square, Smooth			

Controls		Occupancy Control[5]			Options	
(blank)	No nLight®	(blank)	No sensor control	**Individual Control**	EL7L	700 lumen battery pack[8]
N80	nLight® with 80% lumen management		**nLight Wired Networking**	MSD7ADCX PIR integral occupancy sensor with automatic dimming control photocell[3,7]	EL14L	1400 lumen battery pack[8]
N80EMG	nLight® with 80% lumen management For use with generator supply EM power[4]	NES7	nLight™ nES 7 PIR integral occupancy sensor[6]	MSDPDT7ADCX PDT integral occupancy sensor with automatic dimming control photocell[3,7]	CP	Chicago plenum
N100	nLight® without lumen management	NESPDT7	nLight™ nES PDT 7 dual technology integral occupancy control[6]		BGTD	Bodine Generator Transfer Device
N100EMG	nLight® without lumen management For use with generator supply EM power[4]	NES7ADCX	nLight™ nES 7 ADCX PIR integral occupancy sensor with automatic dimming photocell[6]		PWS1836	6' pre-wire, 3/8" diameter, 18 gauge, 1 circuit
		NESPDT7ADCX	nLight™ nES PDT 7 dual technology integral occupancy sensor with automatic dimming photocell[6]		PWS1846	6' pre-wire, 3/8" diameter, 18 gauge, 2 circuit
					PWS1846 PWSLV	Two cables: one 6' pre-wire, 3/8" diameter, 18 gauge, 2 circuits; one 6' pre-wire, 3/8" diameter, 18 gauge, purple and gray
					PWS1856LV	6' pre-wire, 3/8" diameter, 18 gauge, 1 circuit w/low voltage purple and grey wires
					GLR	Fast-blowing fuse[9]
					GMF	Slow-blowing fuse[9]
					NPLT	Narrow pallet
					RRL_	RELOC®-ready luminaire[10]
					LATC	Earthquake clip
					DWAM	Anti-Microbial paint

Accessories next page

Non-Configurable BLT Configurations

Stock/MTO	Catalog Description *	UPC	Lumens	Wattage	LPW	Color Temperature	Voltage	Pallet Qty
Stock	2BLT2 33L ADP LP835	00889804471908	3241	30	108	3500K/82 CRI	120-277	52
	2BLT2 33L ADP LP840	00889804471939	3313	30	111	4000K/82CRI	120-277	52
MTO	2BLT2 33L ADP 347 LP835	00889804569384	3241	30	108	3500K/82 CRI	347	52
	2BLT2 33L ADP 347 LP840	00889804569407	3313	30	111	4000K/82CRI	347	52

*0-10V Dimming to 10%.

Notes

1 Approximate lumen output.
2 Not available with SLD,EL7L or EL14L battery packs.
3 Not available with N80, N80EMG, N100 N100EMG or occupancy control.
4 nLight EMG option requires a connection to existing nLight network. Power is provided from a separate N80 or N100 enabled fixture.
5 Must specify diffuser with trim rings. See sensor options on page 3.
6 Requires N80, N80EMG, N100, or N100EMG.
7 Only available with EZ1 driver option. 0-10v dimming wires not accessible via access plate.
8 When using pre-wire option, use PWS1846. or PWS1846 PWSLV.
9 Must specify voltage, 120 or 277.
10 For ordering logic consult: RRL_2013.

LITHONIA LIGHTING®
An AcuityBrands Company
LED: One Lithonia Way Conyers, GA 30012 Phone: 800-858-7763 Fax: 770-929-8789 www.lithonia.com

Rev. 03/15/16

Accessories: *Order as separate catalog number.*

DGA22	Drywall grid adapter for 2x2 recessed fixture

nLight® Control Accessories:
Order as separate catalog number. Visit www.acuitybrands.com/products/controls/nlight.

WallPod stations	**Model number**	**Occupancy sensors**	**Model number**
On/Off	nPODM [color]	Small motion 360°, ceiling (PIR / dual tech)	nCM 9 RJB / nCM PDT 9 RJB
On/Off & raise/lower	nPODM DX [color]	Large motion 360°, ceiling (PIR / dual tech)	nCM10 RJB / nCM PDT 10 RJB
Graphic touchscreen	nPOD GFX [color]	Wall switch with raise/lower	nWSX PDT LV DX [color]
Photocell controls	**Model number**	**Cat-5 cable (plenum rated)**	**Model number**
Full range dimming	nCM ADCX RJB	10' cable	CAT5 10FT J1
		30' cable	CAT5 30FT J1

Replacement Parts: *Order as separate catalog number.*

*237LJR	DBLT24 ADP LENS ASSEMBLY	2 ft. replacement lens (light traps included)
*237LKH	DBLT24 SDP LENS ASSEMBLY	2 ft. replacement lens (light traps included)
*237LKY	DBLT24 ADSM LENS ASSEMBLY	2 ft. replacement lens (light traps included)
*237LL7	DBLT24 SDSM LENS ASSEMBLY	2 ft. replacement lens (light traps included)
*237LT1	DBLT24 ADPT LENS ASSEMBLY	2 ft. replacement lens (trims included)
*237LT3	DBLT24 SDPT LENS ASSEMBLY	2 ft. replacement lens (trims included)
*237LT5	DBLT24 ADSMT LENS ASSEMBLY	2 ft. replacement lens (trims included)
*237LT7	DBLT24 SDSMT LENS ASSEMBLY	2 ft. replacement lens (trims included)
*237LT9	DBLT24 ADPT SENSOR LENS ASSEMBLY	2 ft. replacement lens (trims included)
*237M4Y	DBLT24 SDPT SENSOR LENS ASSEMBLY	2 ft. replacement lens (trims included)
*237M57	DBLT24 ADSMT SENSOR LENS ASSEMBLY	2 ft. replacement lens (trims included)
*237M5H	DBLT24 SDSMT SENSOR LENS ASSEMBLY	2 ft. replacement lens (trims included)

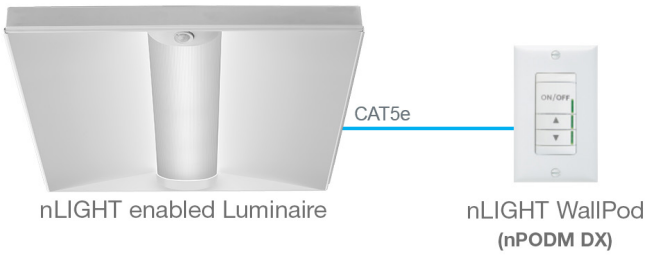
LITHONIA LIGHTING®
An AcuityBrands Company
LED: One Lithonia Way Conyers, GA 30012 Phone: 800-858-7763 Fax: 770-929-8789 www.lithonia.com

Rev. 03/15/16

2BLT Volumetric Recessed Lighting 2'x2'

Sensor Options				
Option	Automatic Dimming Photocell	Occupancy Sensing		nLight Wired Networking
		PIR	PDT	
MSD7ADCX	X	X		
MSDPDT7ADCX	X		X	
NES7		X		X
NES7ADCX	X	X		X
NESPDT7			X	X
NESPDT7ADCX	X		X	X

Basic nLight Zone



Integrated Sensor with Individual Control

The MSD7ADCX PIR occupancy sensor/automatic dimming photocell is ideal for areas without obstructions and where daylight harvesting may be desired. Suggested applications include, but not limited to, hallways, corridors, storage rooms, and breakrooms or other areas where people are typically moving.

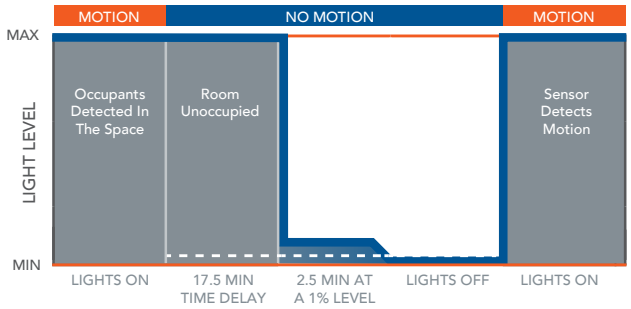
The MSDPDT7ADCX PIR/Microphonics Dual Tech occupancy sensor/automatic dimming photocell is ideal for areas with obstructions and where daylight harvesting is desired. Suggested applications include, but not limited to, open offices, private offices, classrooms, public restrooms, and conference rooms.

nLight Wired Networking

The nES 7 is ideal for small rooms without obstructions or areas with primarily walking motion. Ideal areas include hallways, corridors, storage rooms, and breakrooms. Additionally, the NES7ADCX includes an integrated photocell, which enables daylight harvesting controls.

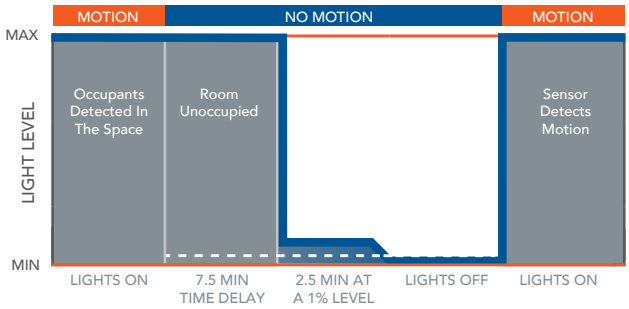
For areas like restrooms, private offices, open offices, conference rooms or any space with obstructions, the nES PDT 7 dual technology sensor is recommended. The nES PDT 7 utilizes both PIR (passive infrared) and Microphonics technologies to detect occupancy. Additionally, the NESPDT7ADCX includes an integrated photocell, which enables daylight harvesting controls which is ideal for areas where windows are present.

Sequence of Operation



*The presetting on the automatic dimming photocell is 5fc.

Sequence of Operation

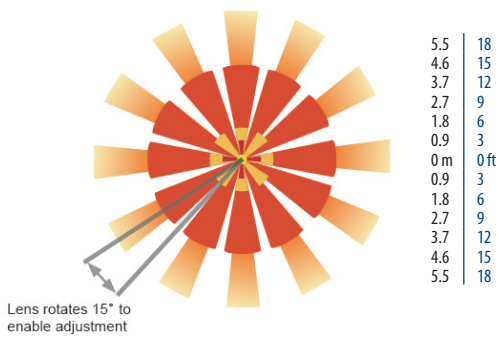


*The presetting on the automatic dimming photocell is 5fc.

Sensor Coverage Pattern
Mini 360° Lens

- Recommended for walking motion detection from mounting heights between 8 ft (2.44 m) and 20 ft (6.10 m)
- Initial detection of walking motion along sensor axes at distances of 2x the mounting height up to 15 ft (4.57 m) and
- 1.75x up to 20 ft (6.10 m).
- Provides 12 ft (3.66 m) radial detection of small motion when mounted at 9 ft (2.74 m)
- Initial detection will occur earlier when walking across sensor's field of view than when walking directly at sensor

9 FT Mounting



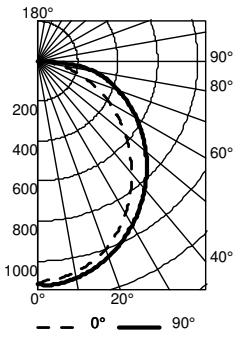
LED: One Lithonia Way Conyers, GA 30012 Phone: 800-858-7763 Fax: 770-929-8789 www.lithonia.com

Rev. 03/15/16

2BLT Volumetric Recessed Lighting 2'x2'

PHOTOMETRICS

2BLT2 33L ADP LP835, 3241 delivered lumens, test no. LTL28918P4, tested in accordance to IESNA LM-79



CP Summary

	0°	90
0°	1114	1114
5°	1092	1118
15°	1042	1075
25°	943	996
35°	808	891
45°	653	770
55°	492	638
65°	334	501
75°	177	359
85°	44	147
90	5	2

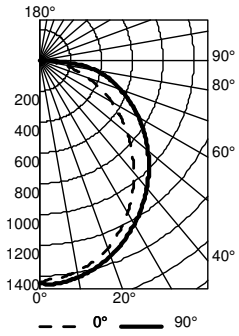
Coefficients of Utilization

RCR	pf 80% 70%	50% 30%	20% 10%	50% 30%	10%	50% 30%	10%
pc							
pw							
0	119	119	119	116	116	116	111	111	111
1	108	103	98	100	96	92	96	92	89
2	98	89	82	87	80	75	83	78	73
3	89	78	69	76	68	62	73	66	61
4	81	69	60	67	59	52	65	57	52
5	75	61	52	60	52	45	58	50	44
6	69	55	46	54	46	39	52	45	39
7	64	50	41	49	41	35	48	40	34
8	59	46	37	45	37	31	44	36	31
9	56	42	34	41	33	28	40	33	28
10	52	39	31	38	30	25	37	30	25

Zonal Lumen Summary

Zone	Lumens	% Lamp	% Fixture
0° - 30°	852	26.3	26.3
0° - 40°	1385	42.7	42.7
0° - 60°	2440	75.3	75.3
0° - 90°	3242	100.0	100.0
90° - 180°	0	0.0	0.0
0° - 180°	3242	100.0	100.0

2BLT2 40L ADP L835, 4210 delivered lumens, test no. LTL28918P5, tested in accordance to IESNA LM-79



CP Summary

	0°	90
0°	1447	1447
5°	1419	1452
15°	1354	1396
25°	1224	1294
35°	1050	1158
45°	849	1001
55°	640	829
65°	434	650
75°	230	466
85°	57	191
90	7	3

Coefficients of Utilization

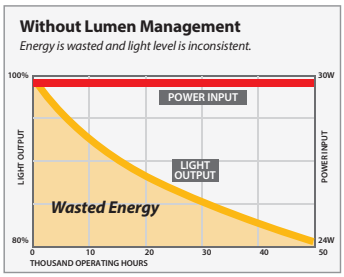
RCR	pf 80% 70%	50% 30%	20% 10%	50% 30%	10%	50% 30%	10%
pc							
pw							
0	119	119	119	116	116	116	111	111	111
1	108	103	98	100	96	92	96	92	89
2	98	89	82	87	80	75	83	78	73
3	89	78	69	76	68	62	73	66	61
4	81	69	60	67	59	52	65	57	52
5	75	61	52	60	52	45	58	50	44
6	69	55	46	54	46	39	52	45	39
7	64	50	41	49	41	35	48	40	34
8	59	46	37	45	37	31	44	36	31
9	56	42	34	41	33	28	40	33	28
10	52	39	31	38	30	25	37	30	25

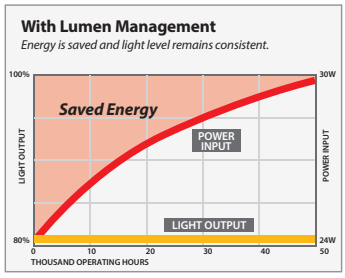
Zonal Lumen Summary

Zone	Lumens	% Lamp	% Fixture
0° - 30°	1107	26.3	26.3
0° - 40°	1799	42.7	42.7
0° - 60°	3169	75.3	75.3
0° - 90°	4211	100.0	100.0
90° - 180°	0	0.0	0.0
0° - 180°	4211	100.0	100.0

Constant Lumen Management

Enabled by the embedded nLight control, the BLT actively tracks its run-time and manages its light source such that constant lumen output is maintained over the system life. Referred to as lumen management, this feature eliminates the energy waste created by the traditional practice of over-lighting.





Performance Data

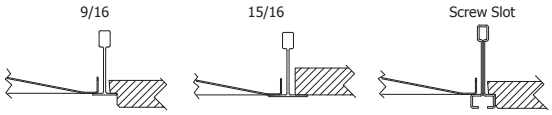
Lumen Package	Lumens	Input Watts	LPW
20L ADP LP830	2157	20	110
20L ADP LP835	2213	20	113
20L ADP LP840	2261	20	116
20L ADP LP850	2373	20	121
33L ADP LP830	3160	30	106
33L ADP LP835	3241	30	108
33L ADP LP840	3313	30	111
33L ADP LP850	3476	30	116
40L ADP LP830	4103	39	106
40L ADP LP835	4209	39	108
40L ADP LP840	4302	39	111
40L ADP LP850	4514	39	116

HE Performance Data

Lumen Package	Lumens	Input Watts	LPW
40LHE ADP LP830	4118	32	127
40LHE ADP LP835	4224	32	131
40LHE ADP LP840	4317	32	134
40LHE ADP LP850	4530	32	140
48LHE ADP LP830	4699	37	128
48LHE ADP LP835	4820	37	131
48LHE ADP LP840	4927	37	134
48LHE ADP LP850	5169	37	140

MOUNTING DATA

Ceiling Type	Appropriate Trim Type
Exposed grid tee (1' and 9/16")	G
Concealed grid tee	G
Plaster or plasterboard	G*



*DGA accessory available to provide ceiling trim flange and fixture support for plaster or plasterboard ceiling. Recommended rough-in dimensions for DGA installation is 24-3/4" x 24-3/4" (Tolerance is +1/8", -0").

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LITHONIA LIGHTING®

FEATURES & SPECIFICATIONS

INTENDED USE —The BLT Best-in-Value Low Profile LED luminaire features a popular center basket design that offers a clean, versatile style and volumetric distribution. High efficacy LED light engines deliver energy savings and low maintenance compared to traditional sources. An extensive selection of configurations and options make the BLT the perfect choice for many lighting applications including schools, offices and other commercial spaces, retail, hospitals and healthcare facilities. The low profile BLT design (2-3/8") also makes it an excellent choice for renovation projects.

CONSTRUCTION — BLT enclosure components are die-formed for dimensional consistency and painted after fabrication with a polyester powder paint for improved performance and protection.

The reflector is finished with a high reflective matte white powder paint for improved aesthetics and increased light diffusion.

End plates contain easy-to-position integral T-bar clips for securely attaching the luminaire to the T-grid. For additional T-grid security, optional screw on T-bar clips are available.

Diffusers are extruded from impact modified acrylic for increased durability. Injection molded diffuser light traps add a finished look to the diffuser ends and help seal the diffuser to the housing end plates. Optional diffuser trim rings provide an attractive mounting for integral sensors as well as adding a decorative element to the luminaire aesthetics.

LED boards are accessible from below; driver is accessible from the plenum.

OPTICS — Volumetric illumination is achieved by creating an optimal mix of light to walls, partitions and vertical and horizontal work surfaces – rendering the interior space, objects and occupants in a more balanced, complimentary luminous environment. High performance extruded acrylic diffusers conceal LEDs and efficiently deliver light in a volumetric distribution. Four diffuser choices available - curved and square designs with linear prisms or a smooth frosted finish.

ELECTRICAL — Long-life LEDs, coupled with high-efficiency drivers, provide superior quantity and quality of illumination for extended service life. 90% LED lumen maintenance at 60,000 hours (L90/60,000).

Non-Configurable BLT: 0-10 volt dimming driver. Dims to 10%

Configurable BLT: available in High Efficiency (HE) versions for applications where a lower wattage (over the standard product) is required. The High Efficiency versions deliver >130 LPW and can be specified via the Lumen Package designations in the Ordering Information below.

eldoLED driver options deliver choice of dimming range, and choices for control, while assuring flicker-free, low-current inrush, 89% efficiency and low EMI.

Optional integrated nLight®controls make each luminaire addressable - allowing it to digitally communicate with other nLight enabled controls such as dimmers, switches, occupancy sensors and photocontrols. Simply connect all the nLight enabled control devices and the BLT luminaires using standard Cat-5 cabling. Unique plug-and-play convenience as devices and luminaires automatically discover each other and self-commission.

Lumen Management: Unique lumen management system (option N80) provides on board intelligence that actively manages the LED light source so that constant lumen output is maintained over the system life, preventing the energy waste created by the traditional practice of over-lighting.

Step-level dimming option allows system to be switched to 50% power for compliance with common energy codes while maintaining fixture appearance.

Driver disconnect provided where required to comply with US and Canadian codes.

SENSOR— Integrated sensor (individual control): Sensor Switch MSD7ADCX ((Passive infrared (PIR)) or MSDPDT7ADCX ((PIR/Microphonics Dual Tech (PDT)) integrated occupancy sensor/automatic dimming photocell allows the luminaire to power off when the space is unoccupied or enough ambient light is entering the space. See page 2 for more details on the integrated sensor.

Integrated Sensor (nLight Wired Networking): This sensor is nLight-enabled, meaning it has the ability to communicate over an nLight network. When wired, using CAT-5 cabling, with other nLight-enabled sensors, power packs, or WallPods, an nLight control zone is created. Once linked to a Gateway, directly or via a Bridge, the zone becomes capable of remote status monitoring and control via SensorView software. See page 2 for the nLight sensor options.

INSTALLATION — The BLT's low profile design of only 2-3/8" provides increased installation flexibility especially in restrictive plenum applications. The BLT fits into standard 15/16" and narrow 9/16" T-grid ceiling systems.

Suitable for damp location.

For recessed mounting in hard ceiling applications, Drywall Grid Adapters (DGA) are available as an accessory. See Accessories section.

LISTINGS — CSA Certified to meet U.S. and Canadian standards. IC rated.
DesignLights Consortium® (DLC) qualified product. Not all versions of this product may be DLC qualified. Please check the DLC Qualified Products List at www.designlights.org/QPL to confirm which versions are qualified.

WARRANTY — 5-year limited warranty. Complete warranty terms located at www.acuitybrands.com/CustomerResources/Terms_and_conditions.aspx

NOTE: Actual performance may differ as a result of end-user environment and application.

All values are design or typical values, measured under laboratory conditions at 25 °C.

Specifications subject to change without notice.

Catalog Number
Notes
Type

BLT Series LED

2BLT

2' x 4' LED

eldoLED nLIGHT

Specifications

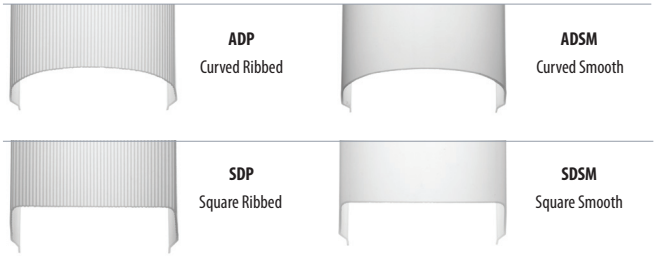
Length: 47-3/4 (121.2)

Width: 23-3/4 (60.3)

Depth: 2-3/8 (6.0)

All dimensions are inches (centimeters) unless otherwise specified.

Mulitple Diffuser Options



2BLT Volumetric Recessed Lighting 2'x4'

ORDERING INFORMATION Lead times will vary depending on options selected. Consult with your sales representative.

Example: 2BLT4 40L ADP SLD LP840

2BLT4

Series	Air function	Lumens[1]		Diffuser	Voltage	Driver	Color temperature
2BLT4 2x4 BLT	(blank) Static	**Standard efficiency (>100 LPW)**	**High efficiency (>130 LPW)**	ADP Curved, Linear Prisms	(blank) MVOLT	EZ1 eldoLED dims to 1% (0-10 volt dimming)	LP830 82CRI, 3000 K
		30L 3000	40LHE 4000	ADSM Curved, Smooth	347 347[2]	SLD Step-level dimming[3]	LP835 82CRI, 3500 K
		40L 4000	48LHE 4800	SDP Square, Linear Prisms			LP840 82CRI, 4000 K
		48L 4800	60LHE 6000	SDSM Square, Smooth			LP850 82CRI, 5000 K
		60L 6000	72LHE 7200	**Diffusers w/ trim rings**			LP930 90CRI, 3000K
		72L 7200	85LHE 8500	ADPT Curved, Linear Prisms			LP935 90CRI, 3500K
				ADSMT Curved, Smooth			LP940 90CRI, 4000K
				SDPT Square, Linear Prisms			LP950 90CRI, 5000K
				SDSMT Square, Smooth			

Controls	Occupancy Control[5]		Options	
(blank) No nLight®	(blank) No sensor control	**Individual Control**	EL7L	700 lumen battery pack[8]
N80 nLight® with 80% lumen management	**nLight Wired Networking**	MSD7ADCX PIR integral occupancy sensor with automatic dimming control photocell[3,7]	EL14L	1400 lumen battery pack[8]
N80EMG nLight® with 80% lumen management For use with generator supply EM power[4]	NES7 nLight™ nES 7 PIR integral occupancy sensor[6]	MSDPDT7ADCX PDT integral occupancy sensor with automatic dimming control photocell[3,7]	CP	Chicago plenum
N100 nLight® without lumen management	NESPDT7 nLight™ nES PDT 7 dual technology integral occupancy control[6]		BGTD	Bodine Generator Transfer Device
N100EMG nLight® without lumen management For use with generator supply EM power[4]	NES7ADCX nLight™ nES 7 ADCX PIR integral occupancy sensor with automatic dimming photocell[6]		PWS1836	6' pre-wire, 3/8" diameter, 18 gauge, 1 circuit
	NESPDT7ADCX nLight™ nES PDT 7 dual technology integral occupancy sensor with automatic dimming photocell[6]		PWS1846	6' pre-wire, 3/8" diameter, 18 gauge, 2 circuit
			PWS1846 PWSLV	Two cables: one 6' pre-wire, 3/8" diameter, 18 gauge, 2 circuits; one 6' pre-wire, 3/8" diameter, 18 gauge, purple and gray
			PWS1856LV	6' pre-wire, 3/8" diameter, 18 gauge, 1 circuit w/low voltage purple and grey wires
			GLR	Fast-blowing fuse[9]
			GMF	Slow-blowing fuse[9]
			NPLT	Narrow pallet
			RRL_	RELOC®-ready luminaire[10]
			LATC	Earthquake clip
			DWAM	Anti-Microbial paint

Accessories next page

Non-Configurable BLT Configurations

Stock/MTO	Catalog Description *	UPC	Lumens	Wattage	LPW	Color Temperature	Voltage	Pallet Qty
Stock	2BLT4 40L ADP LP835	00889804471953	3945	34	116	3500K/82 CRI	120-277	26
	2BLT4 40L ADP LP840	00889804488265	4032	34	118	4000K/82CRI	120-277	26
	2BLT4 46L ADP LP835	00889804541403	4520	38.34	118	3500K/82 CRI	120-277	26
	2BLT4 46L ADP LP840	00889804541533	4620	38.34	120	4000K/82CRI	120-277	26
MTO	2BLT4 40L ADP 347 LP835	00889804569452	3945	34	116	3500K/82 CRI	347	26
	2BLT4 40L ADP 347 LP840	00889804569469	4032	34	118	4000K/82CRI	347	26
	2BLT4 46L ADP 347 LP835	00889804569476	4520	38.34	118	3500K/82 CRI	347	26
	2BLT4 46L ADP 347 LP840	00889804569490	4620	38.34	120	4000K/82CRI	347	26

*0-10V Dimming to 10%.

Notes

1 Approximate lumen output.
2 Not available with SLD,EL7L or EL14L battery packs.
3 Not available with N80, N80EMG, N100, N100EMG or occupancy control.
4 nLight EMG option requires a connection to existing nLight network. Power is provided from a separate N80 or N100 enabled fixture.
5 Must specify diffuser with trims rings. See sensor options on page 3.
6 Requires N80, N80EMG, N100, or N100EMG.
7 Only available with EZ1 driver option. 0-10v dimming wires not accessible via access plate.
8 When using pre-wire option, use PWS1846 or PWS1846 PWSLV.
9 Must specify voltage, 120 or 277.
10 For ordering logic consult: RRL_2013.

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Accessories: *Order as separate catalog number.*

DGA24	Drywall grid adapter for 2x4 recessed fixture

nLight® Control Accessories:
Order as separate catalog number. Visit www.acuitybrands.com/products/controls/nlight.

WallPod stations	**Model number**	**Occupancy sensors**	**Model number**
On/Off	nPODM [color]	Small motion 360°, ceiling (PIR / dual tech)	nCM 9 RJB / nCM PDT 9 RJB
On/Off & raise/lower	nPODM DX [color]	Large motion 360°, ceiling (PIR / dual tech)	nCM10 RJB / nCM PDT 10 RJB
Graphic touchscreen	nPOD GFX [color]	Wall switch with raise/lower	nWSX PDT LV DX [color]
Photocell controls	**Model number**	**Cat-5 cable (plenum rated)**	**Model number**
Full range dimming	nCM ADCX RJB	10' cable	CAT5 10FT J1
		30' cable	CAT5 30FT J1

Replacement Parts: *Order as separate catalog number.*

*237LKE	DBLT48 ADP LENS ASSEMBLY	4 ft. replacement lens (light traps included)
*237LKL	DBLT48 SDP LENS ASSEMBLY	4 ft. replacement lens (light traps included)
*237LL2	DBLT48 ADSM LENS ASSEMBLY	4 ft. replacement lens (light traps included)
*237LLA	DBLT48 SDSM LENS ASSEMBLY	4 ft. replacement lens (light traps included)
*237LT2	DBLT48 ADPT LENS ASSEMBLY	4 ft. replacement lens (trims included)
*237LT4	DBLT48 SDPT LENS ASSEMBLY	4 ft. replacement lens (trims included)
*237LT6	DBLT48 ADSMT LENS ASSEMBLY	4 ft. replacement lens (trims included)
*237LT8	DBLT48 SDSMT LENS ASSEMBLY	4 ft. replacement lens (trims included)
*237LTA	DBLT48 ADPT SENSOR LENS ASSEMBLY	4 ft. replacement lens (trims included)
*237M52	DBLT48 SDPT SENSOR LENS ASSEMBLY	4 ft. replacement lens (trims included)
*237M5A	DBLT48 ADSMT SENSOR LENS ASSEMBLY	4 ft. replacement lens (trims included)
*237M5L	DBLT48 SDSMT SENSOR LENS ASSEMBLY	4 ft. replacement lens (trims included)

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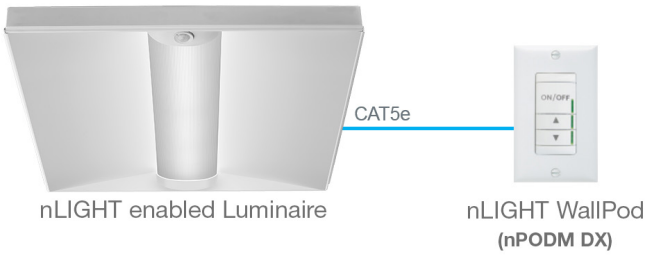
2BLT Volumetric Recessed Lighting 2'x4'

Sensor Options				
Option	Automatic Dimming Photocell	Occupancy Sensing		nLight Wired Networking
		PIR	PDT	
MSD7ADCX	X	X		
MSDPDT7ADCX	X		X	
NES7		X		X
NES7ADCX	X	X		X
NESPDT7			X	X
NESPDT7ADCX	X		X	X

Basic nLight Zone



Integrated Sensor with Individual Control

The MSD7ADCX PIR occupancy sensor/automatic dimming photocell is ideal for areas without obstructions and where daylight harvesting may be desired. Suggested applications include, but not limited to, hallways, corridors, storage rooms, and breakrooms or other areas where people are typically moving.

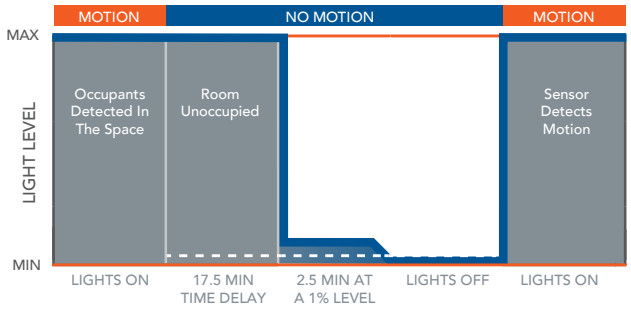
The MSDPDT7ADCX PIR/Microphonics Dual Tech occupancy sensor/automatic dimming photocell is ideal for areas with obstructions and where daylight harvesting is desired. Suggested applications include, but not limited to, open offices, private offices, classrooms, public restrooms, and conference rooms.

nLight Wired Networking

The nES 7 is ideal for small rooms without obstructions or areas with primarily walking motion. Ideal areas include hallways, corridors, storage rooms, and breakrooms. Additionally, the NES7ADCX includes an integrated photocell, which enables daylight harvesting controls.

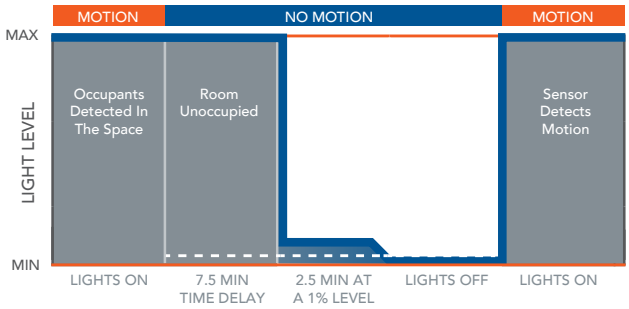
For areas like restrooms, private offices, open offices, conference rooms or any space with obstructions, the nES PDT 7 dual technology sensor is recommended. The nES PDT 7 utilizes both PIR (passive infrared) and Microphonics technologies to detect occupancy. Additionally, the NESPDT7ADCX includes an integrated photocell, which enables daylight harvesting controls which is ideal for areas where windows are present.

Sequence of Operation



*The presetting on the automatic dimming photocell is 5fc.

Sequence of Operation

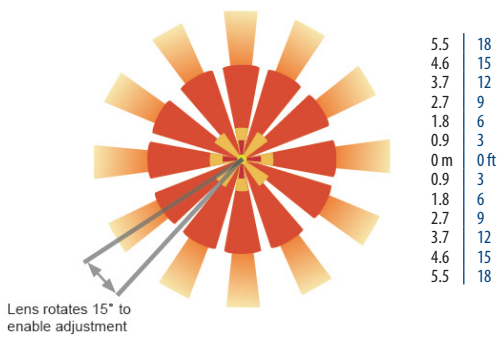


*The presetting on the automatic dimming photocell is 5fc.

Sensor Coverage Pattern
Mini 360° Lens

- Recommended for walking motion detection from mounting heights between 8 ft (2.44 m) and 20 ft (6.10 m)
- Initial detection of walking motion along sensor axes at distances of 2x the mounting height up to 15 ft (4.57 m) and
- 1.75x up to 20 ft (6.10 m).
- Provides 12 ft (3.66 m) radial detection of small motion when mounted at 9 ft (2.74 m)
- Initial detection will occur earlier when walking across sensor's field of view than when walking directly at sensor

9 FT Mounting



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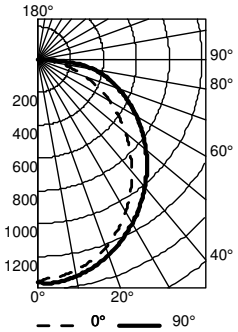
2BLT Volumetric Recessed Lighting 2'x4'

PHOTOMETRICS

2BLT4 40L ADP LP835, 3945 delivered lumens, test no. LTL28918P37, tested in accordance to IESNA LM-79



CP Summary

	0°	90
0°	1356	1356
5°	1330	1361
15°	1269	1309
25°	1147	1212
35°	984	1085
45°	795	938
55°	599	777
65°	407	609
75°	216	437
85°	54	179
90	6	2

Coefficients of Utilization

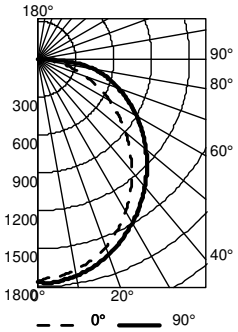
RCR	80% 70%	80% 50%	80% 30%	70% 50%	70% 30%	70% 10%	50% 50%	50% 30%	50% 10%
0	119	119	119	116	116	116	111	111	111
1	108	103	98	100	96	92	96	92	89
2	98	89	82	87	80	75	83	78	73
3	89	78	69	76	68	62	73	66	61
4	81	69	60	67	59	52	65	57	52
5	75	61	52	60	52	45	58	50	44
6	69	55	46	54	46	39	52	45	39
7	64	50	41	49	41	35	48	40	34
8	59	46	37	45	37	31	44	36	31
9	56	42	34	41	33	28	40	33	28
10	52	39	31	38	30	25	37	30	25

pf 20%
pc
pw

Zonal Lumen Summary

Zone	Lumens	% Lamp	% Fixture
0° - 30°	1037	26.3	26.3
0° - 40°	1686	42.7	42.7
0° - 60°	2970	75.3	75.3
0° - 90°	3947	100.0	100.0
90° - 180°	0	0.0	0.0
0° - 180°	3947	100.0	100.0

2BLT4 48L ADP L835, 5121 delivered lumens, test no. LTL28918P41, tested in accordance to IESNA LM-79



CP Summary

	0°	90
0°	1760	1760
5°	1726	1767
15°	1647	1699
25°	1490	1574
35°	1277	1409
45°	1033	1217
55°	778	1008
65°	528	791
75°	280	567
85°	70	232
90	8	3

Coefficients of Utilization

RCR	80% 70%	80% 50%	80% 30%	70% 50%	70% 30%	70% 10%	50% 50%	50% 30%	50% 10%
0	119	119	119	116	116	116	111	111	111
1	108	103	98	100	96	92	96	92	89
2	98	89	82	87	80	75	83	78	73
3	89	78	69	76	68	62	73	66	61
4	81	69	60	67	59	52	65	57	52
5	75	61	52	60	52	45	58	50	44
6	69	55	46	54	46	39	52	45	39
7	64	50	41	49	41	35	48	40	34
8	59	46	37	45	37	31	44	36	31
9	56	42	34	41	33	28	40	33	28
10	52	39	31	38	30	25	37	30	25

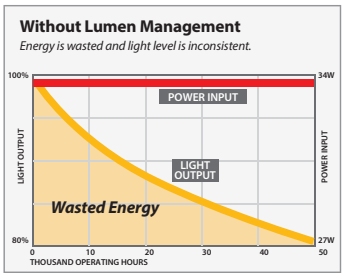
pf 20%
pc
pw

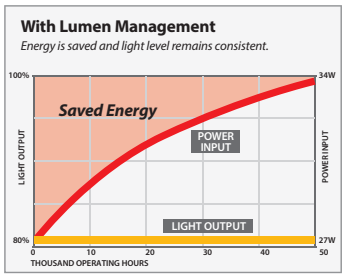
Zonal Lumen Summary

Zone	Lumens	% Lamp	% Fixture
0° - 30°	1346	26.3	26.3
0° - 40°	2188	42.7	42.7
0° - 60°	3856	75.3	75.3
0° - 90°	5123	100.0	100.0
90° - 180°	0	0.0	0.0
0° - 180°	5123	100.0	100.0

Constant Lumen Management

Enabled by the embedded nLight control, the BLT actively tracks its run-time and manages its light source such that constant lumen output is maintained over the system life. Referred to as lumen management, this feature eliminates the energy waste created by the traditional practice of over-lighting.





Performance Data

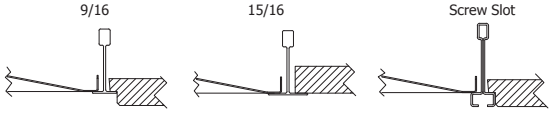
Lumen Package	Lumens	Input Watts	LPW
30L ADP LP830	3286	30	110
30L ADP LP835	3371	30	113
30L ADP LP840	3445	30	115
30L ADP LP850	3614	30	121
40L ADP LP830	3846	34	113
40L ADP LP835	3945	34	116
40L ADP LP840	4032	34	118
40L ADP LP850	4230	34	124
48L ADP LP830	4993	45	111
48L ADP LP835	5121	45	114
48L ADP LP840	5234	45	116
48L ADP LP850	5492	45	122
60L ADP LP830	6014	53	114
60L ADP LP835	6169	53	117
60L ADP LP840	6305	53	119
60L ADP LP850	6615	53	125
72L ADP LP830	7388	67	110
72L ADP LP835	7579	67	113
72L ADP LP840	7746	67	115
72L ADP LP850	8127	67	121

HE Performance Data

Lumen Package	Lumens	Input Watts	LPW
48LHE ADP LP830	4655	36	127
48LHE ADP LP835	4775	36	130
48LHE ADP LP840	4880	36	133
48LHE ADP LP850	5121	36	139
60LHE ADP LP830	5473	42	129
60LHE ADP LP835	5614	42	132
60LHE ADP LP840	5738	42	135
60LHE ADP LP850	6020	42	142
72LHE ADP LP830	6805	52	130
72LHE ADP LP835	6981	52	133
72LHE ADP LP840	7135	52	136
72LHE ADP LP850	7486	52	143
85LHE ADP LP830	8189	64	127.
85LHE ADP LP835	8400	64	131
85LHE ADP LP840	8585.	64	134
85LHE ADP LP850	9008	64	140

MOUNTING DATA

Ceiling Type	Appropriate Trim Type
Exposed grid tee (1' and 9/16")	G
Concealed grid tee	G
Plaster or plasterboard	G*



*DGA accessory available to provide ceiling trim flange and fixture support for plaster or plasterboard ceiling. Recommended rough-in dimensions for DGA installation is 24-3/4" x 48-3/4" (Tolerance is +1/8", -0").

LED: One Lithonia Way Conyers, GA 30012 Phone: 800-858-7763 Fax: 770-929-8789 www.lithonia.com

Rev. 03/15/16

LITHONIA LIGHTING®

Catalog Number	
Notes	
Type	

Decorative Indoor

LED Low Profile Round Flush Mount

HIGH-PERFORMANCE LED

FEATURES & SPECIFICATIONS

INTENDED USE

Provides general illumination in commercial and residential applications. Ideal for use in closets, foyers, hallways, corridors, bedrooms, offices, utility work areas, stairways and more.

CONSTRUCTION

Features a white acrylic diffuser and is available in 11″ and 14″ sizes. Hidden cam-latches provide easy diffuser removal for installation and maintenance.

OPTICS

11″ units produce 1100 lumens and 14″ units produce 1600 lumens, both at 50,000 hours life.

ELECTRICAL

Fixture operates at 120 volts, 60 Hz. 11″ Standard input = 16 watts, 69 lumens per watt.

14″ Standard input = 24 watts, 67 lumens per watt.

Works with most standard incandescent dimmers (see list of approved dimmers).

INSTALLATION

All mounting hardware included.

LISTINGS

UL Certified to US and Canadian standards and listed suitable for damp locations. ENERGY STAR® certified

WARRANTY

5-year limited warranty. Complete warranty terms located at www.acuitybrands.com/CustomerResources/Terms_and_conditions.aspx

NOTE: Actual performance may differ as a result of end-user environment and application.
All values are design or typical values, measured under laboratory conditions at 25°C.
Specifications subject to change without notice.

Specifications

Height: FMLRL 11 – 2-7/8 (7.3)
FMLRL 14 – 3-1/8 (7.9)

Width: FMLRL 11 – 11 (27.9)
FMLRL 14 – 13-11/16 (34.7)

All dimensions are inches (centimeters) unless otherwise indicated.

ORDERING INFORMATION For shortest lead times, configure product using **bolded options.**

Example: FMLRL 11 14840

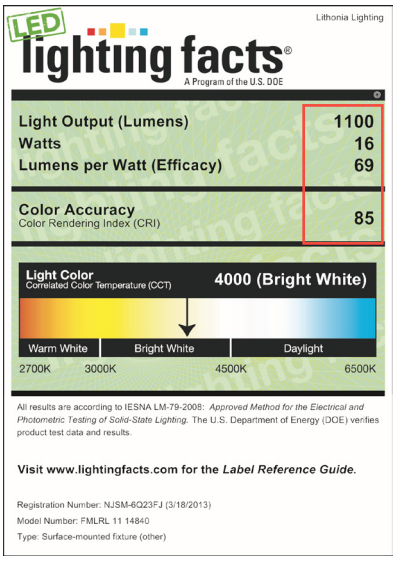
Series		Module/CRI		Color temperature	
FMLRL 11	11″ LED low profile round flush mount	**148**	>80	**40**	4000 K
FMLRL 14	14″ LED low profile round flush mount	**208**	>80	35	3500 K[1]
				30	3000 K
				27	2700 K[1]

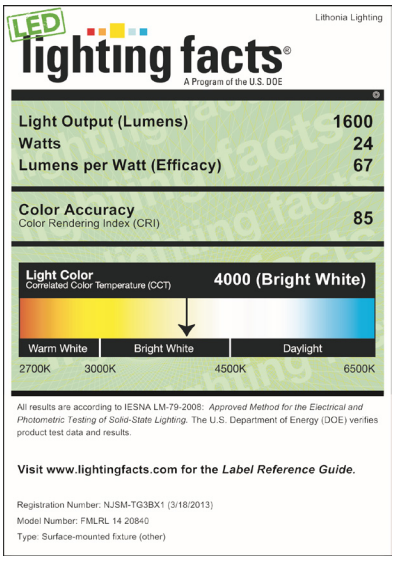
Accessories: *Order as separate catalog number.*	
DFMLRL11	11″ LED low profile round diffuser
DFMLRL14	14″ LED low profile round diffuser

Notes
1 Minimum 90-day lead time for non-standard color temperatures; minimum 50 order quantity.

LED Low Profile Round Flush Mount

LIGHTING FACTS





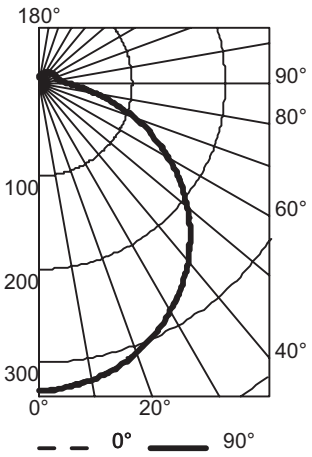
SUGGESTED DIMMERS

The FMLRL is designed to operate with most standard Triac Based (Forward Phase-Control or Leading Edge) dimmers and is not compatible with 0-10v dimming systems. The following is a list of dimmers tested and does not imply any guarantee or warranty of compatibility with a particular application. Unlisted dimmers do not imply non-compatibility.

Manufacturer	Part number(s)
Leviton	6633P
	IPL06
	6674P
	IPE04
	Trimatron 600W
Lutron	DVELV 300P
	Skylark 300P
	NTELV 300
	NLV 600
Synergy	ISD 600 I 120

PHOTOMETRICS

FMLRL 11 14840, test no. LTL23006, tested in accordance to IESNA LM-79.



CP Summary

	0°	90
0°	330	330
5°	327	328
15°	317	318
25°	296	296
35°	266	267
45°	230	230
55°	187	186
65°	137	135
75°	86	84
85°	44	42
90	31	30

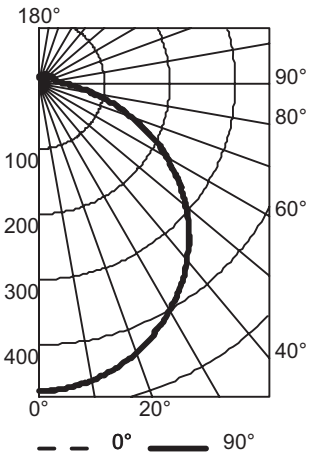
Coefficients of Utilization

	pf			20%					
	pc	80%			70%			50%	
RCR	pw	70%	50%	30%	50%	30%	10%	50%	30%	10%
	0	117	117	117	113	113	113	106	106	106
	1	105	100	95	97	92	88	90	87	84
	2	95	86	79	83	77	71	78	73	68
	3	86	75	67	73	65	59	68	62	56
	4	79	66	57	64	56	49	61	53	48
	5	72	59	50	57	49	42	54	47	41
	6	67	53	44	52	43	37	49	41	36
	7	62	48	39	47	38	32	44	37	31
	8	57	44	35	43	34	29	40	33	28
	9	54	40	32	39	31	26	37	30	25
	10	50	37	29	36	28	23	34	27	23

Zonal Lumen Summary

Zone	Lumens	% Lamp	% Fixture
0° - 30°	258	22.1	22.1
0° - 40°	425	36.5	36.5
0° - 60°	771	66.1	66.1
0° - 90°	1051	90.1	90.1
90° - 120°	72	6.2	6.2
90° - 130°	87	7.5	7.5
90° - 150°	107	9.2	9.2
90° - 180°	115	9.9	9.9
0° - 180°	1166	100.0	100.0

FMLRL 14 20840, test no. LTL23005, tested in accordance to IESNA LM-79.



CP Summary

	0°	90
0°	470	470
5°	467	468
15°	451	452
25°	421	420
35°	380	378
45°	327	324
55°	265	260
65°	195	188
75°	120	114
85°	58	56
90	39	38

Coefficients of Utilization

	pf			20%					
	pc	80%			70%			50%	
RCR	pw	70%	50%	30%	50%	30%	10%	50%	30%	10%
	0	117	117	117	113	113	113	106	106	106
	1	106	100	96	97	93	89	91	88	85
	2	96	87	79	84	77	72	79	74	69
	3	87	76	67	74	66	59	69	63	57
	4	79	67	58	65	57	50	61	54	48
	5	73	60	50	58	49	43	55	47	42
	6	67	53	44	52	43	37	49	42	36
	7	62	48	39	47	39	33	45	37	32
	8	58	44	35	43	35	29	41	34	28
	9	54	40	32	39	32	26	38	31	26
	10	50	37	29	36	29	24	35	28	23

Zonal Lumen Summary

Zone	Lumens	% Lamp	% Fixture
0° - 30°	366	22.8	22.8
0° - 40°	604	37.6	37.6
0° - 60°	1090	67.8	67.8
0° - 90°	1472	91.6	91.6
90° - 120°	86	5.3	5.3
90° - 130°	103	6.4	6.4
90° - 150°	125	7.8	7.8
90° - 180°	135	8.4	8.4
0° - 180°	1607	100.0	100.0

DECORATIVE INDOOR: One Lithonia Way, Conyers, GA 30012 Phone: 800-748-5070 Fax: 770-860-3903 www.lithonia.com

Project Name:	Type:
Part Number:	Date:

GREENCREATIVE

6” INNOFIT GEN 2 COMMERCIAL DOWNLIGHT

040921

SPECIFICATION FEATURES

- **Mechanical** - INNOFIT, with integrated driver, retrofits existing commercial housings and is field accessible from below the ceiling. Stainless steel spring action clips accommodate ½” to 2” ceiling thicknesses. Optional New Construction housing available.
- **Electrical** - Field select from three lumen outputs using SelectDrive technology. Universal 120-277V or 120V only, 50/60 Hz drivers available. Universal 0-10V drivers are dimmable to 5% with low end cutoff. 120V drivers are dimmable to 10% using forward or reverse phase dimmers.
- **Optical** - Self flanged, spun aluminum reflector with baffle trim for pleasant aesthetic in matte white finish. High resistance polycarbonate optical lens, with smooth diffusion. 105° beam angle. LED binned to 3-step SDCM to ensure color uniformity in 2700K, 3000K, 3500K, 4000K or 5000K CCT, with Minimum 80 CRI.
- **Thermal** - Fixture designed using passive thermal management to achieve a L70 rating of 50,000 hours.
  Fixture operating temperature: -13°F to 95°F (-25°C to 35°C).
- **Compliance and Warranty** - ETL Classified and Listed for wet locations. Certified air-tight per ASTM 283-04. IC Rated for direct contact with insulation. Complies with FCC 47CFR Part 15B consumer limits for EMI/RFI emissions. 5 year parts warranty for complete fixture. Optional 10 Year Extended Warranty available, subject to same terms, conditions and installation requirements as standard 5 Year Warranty.

ETL CLASSIFIED

BENEFITS

- Field select lumen output
- Quick and easy installation
- 0-10V or 120V dimmable
- Wet Location, IC and Airtight Rated
- Long life time, L70 Rated for 50,000 hours

APPLICATIONS

- New and retrofit construction
- Shallow plenum applications
- Commercial
- Retail & Office
- Education and Hospitality

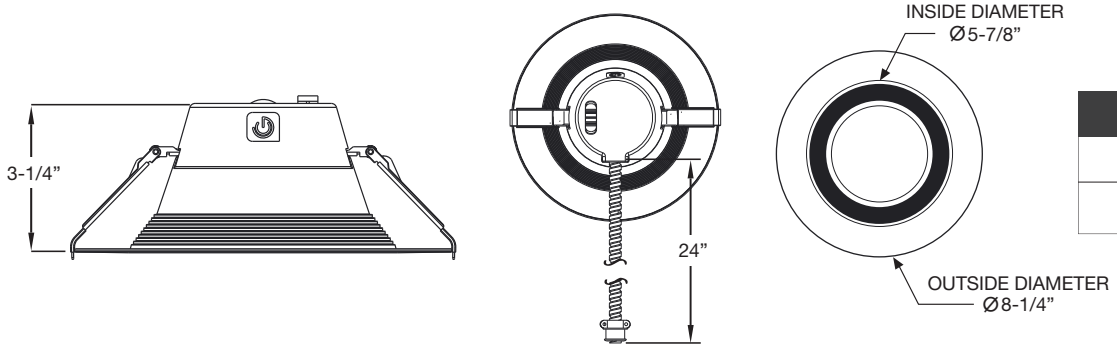
ORDERING INFORMATION

Series	Size	CRI	CCT	Dimming
☑ **INFT** INNOFIT	☑ **6** 6" 800 / 1,100 / 1,600 lumens	☑ **8** CRI 80	☐ **27** 2700K	☑ **DIM010UNV** 120-277V, 0-10V (Dimmable to 5%)
			☐ **30** 3000K	☐ **DIM120V** 120V forward or reverse-phase line voltage (Dimmable to 10%)
			☐ **35** 3500K	
			☑ **40** 4000K	
			☐ **50** 5000K	

GREENCREATIVE

6” INNOFIT GEN 2 COMMERCIAL DOWNLIGHT

LINE DRAWINGS



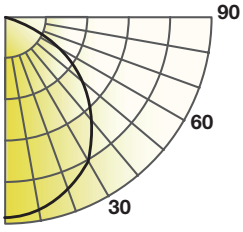
Ceiling Cutout	
Minimum	Maximum
Ø6”	Ø7-7/8”

TECHNICAL INFORMATION

Dimming	Input Voltage	Input Frequency	Input Current (Low / Med / High)	Input Power	THD Power	Power Factor
DIM120V	120V	50 / 60Hz	0.06 / 0.08 / 0.11A	6.5 / 9 / 13W	<20%	>0.9
DIM010VUNV	120V	50 / 60Hz	0.055 / 0.08 / 0.11A	6.5 / 9 / 13W	<20%	>0.9
	277V		0.032 / 0.04 / 0.052A			

PHOTOMETRY

INFT6/835/DIM010UNV (HIGH OUTPUT)



Lumens: 1,686 lm
CBCP: 673 cd
Power: 12.4 W
Efficacy: 136 lm/W
CRI: 80+
Spacing Criteria: 1.24
Beam Angle: 104.4°

Candlepower Distribution	
Angle (°)	Average (cd)
0	673
5	671
15	643
25	590
35	514
45	423
55	309
65	189
75	72
85	7
90	0

Initial Footcandles		
Height (ft)	Fc	Diameter (ft)
8	16	20.6
9	12	23.2
10	10	25.8
12	7	30.9
15	4	38.7

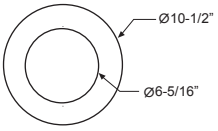
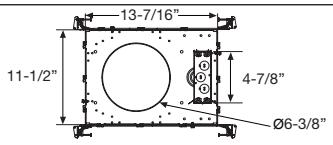
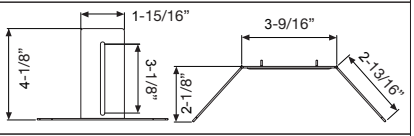
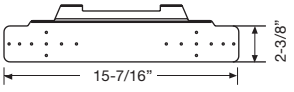
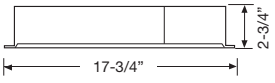
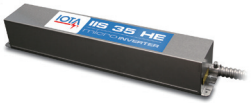
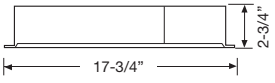
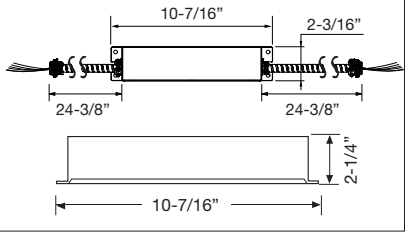
Zonal Lumen Summary		
Zone	Lumens	%Fixture
0-30	514	30%
0-40	833	49%
0-60	1,425	85%
0-90	1,686	100%

PERFORMANCE

CCT	2700K			3000K			3500K			4000K			5000K		
Output	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High
Lumens	745	1,035	1,495	765	1,060	1,535	780	1,080	1,560	800	1,105	1,600	800	1,105	1,600
LPW	115	115	115	118	118	118	120	120	120	123	123	123	123	123	123

6” INNOFIT GEN 2 COMMERCIAL DOWNLIGHT

ACCESSORY ORDERING INFORMATION

Product	Model	Description	Pictures	Dimensions
98568	GOOFRING6	Goof ring for extending from 8-1/4” to 10-1/2”		
35122	NCFJB6	6" Round New Construction Rough-in Frame with Jbox		
35126	NCFBFB	Field Installable Butterfly Brackets For New Construction Rough-in Frame		
35125	NCFEMB	Field Installable Emergency Bracket For New Construction Rough-in Frame		
58012	35EMINVERTER	35W Emergency Inverter (Field Installation)		
58013	35EMINVERTER/CEC	California Title 20 Compliant 35W Emergency Inverter (Field Installation)		
98003	23EMDRIVER	California Title 20 Compliant 23W Emergency LED Driver (Field Installation)		

6” INNOFIT GEN 2 COMMERCIAL DOWNLIGHT

ORDERING GUIDE

Product	Model
35066	INFT6/827/DIM010UNV
35067	INFT6/830/DIM010UNV
35068	INFT6/835/DIM010UNV
35069	INFT6/840/DIM010UNV
35070	INFT6/850/DIM010UNV
35106	INFT6/827/DIM120V
35107	INFT6/830/DIM120V
35108	INFT6/835/DIM120V
35109	INFT6/840/DIM120V
35110	INFT6/850/DIM120V

10 YEAR EXTENDED WARRANTY

Model	INFT6/10YEARWARRANTY

Project Name:	Type:
Part Number:	Date:

GREENCREATIVE

8” INNOFIT GEN 2 COMMERCIAL DOWNLIGHT

040921

SPECIFICATION FEATURES

- **Mechanical** - INNOFIT, with integrated driver, retrofits existing commercial housings and is field accessible from below the ceiling. Stainless steel spring action clips accommodate ½” to 2” ceiling thicknesses. Optional New Construction housing available.
- **Electrical** - Field select from three lumen outputs using SelectDrive technology. Universal 120-277V or 120V only, 50/60 Hz drivers available. Universal 0-10V drivers are dimmable to 5% with low end cutoff. 120V drivers are dimmable to 10% using forward or reverse phase dimmers.
- **Optical** - Self flanged, spun aluminum reflector with baffle trim for pleasant aesthetic in matte white finish. High resistance polycarbonate optical lens, with smooth diffusion. 110° beam angle. LED binned to 3-step SDCM to ensure color uniformity in 2700K, 3000K, 3500K, 4000K or 5000K CCT, with Minimum 80 CRI.
- **Thermal** - Fixture designed using passive thermal management to achieve a L70 rating of 50,000 hours.
  Fixture operating temperature: -13°F to 95°F (-25°C to 35°C).
- **Compliance and Warranty** - ETL Classified and Listed for wet locations. Certified air-tight per ASTM 283-04. IC Rated for direct contact with insulation. Complies with FCC 47CFR Part 15B consumer limits for EMI/RFI emissions. 5 year parts warranty for complete fixture. Optional 10 Year Extended Warranty available, subject to same terms, conditions and installation requirements as standard 5 Year Warranty.

ETL CLASSIFIED

BENEFITS

- Field select lumen output
- Quick and easy installation
- 0-10V or 120V dimmable
- Wet Location, IC and Airtight Rated
- Long life time, L70 Rated for 50,000 hours

APPLICATIONS

- New and retrofit construction
- Shallow plenum applications
- Commercial
- Retail & Office
- Education and Hospitality

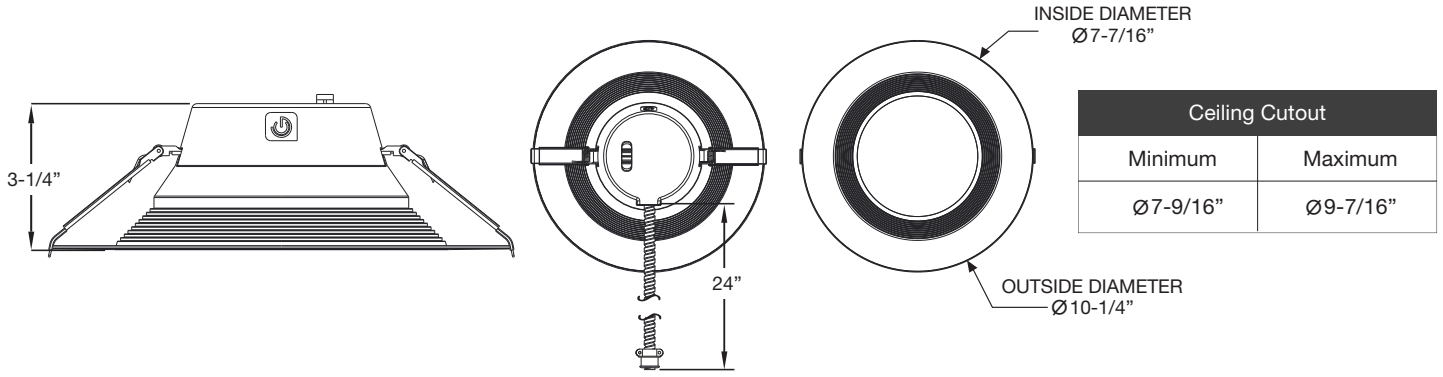
ORDERING INFORMATION

Series	Size	CRI	CCT	Dimming
☑ **INFT** INNOFIT	☑ **8** 8" 1,100 / 1,600 / 2,100 lumens	☑ **8** CRI 80	☐ **27** 2700K	☑ **DIM010UNV** 120-277V, 0-10V (Dimmable to 5%)
			☐ **30** 3000K	☐ **DIM120V** 120V forward or reverse-phase line voltage (Dimmable to 10%)
			☐ **35** 3500K	
			☑ **40** 4000K	
			☐ **50** 5000K	

GREENCREATIVE

8” INNOFIT GEN 2 COMMERCIAL DOWNLIGHT

LINE DRAWINGS



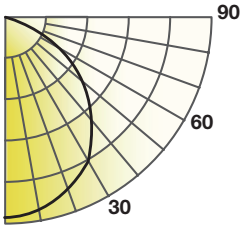
Ceiling Cutout	
Minimum	Maximum
Ø7-9/16”	Ø9-7/16”

TECHNICAL INFORMATION

Dimming	Input Voltage	Input Frequency	Input Current (Low / Med / High)	Input Power	THD Power	Power Factor
DIM120V	120V	50 / 60Hz	0.078 / 0.1 / 0.145A	8.5 / 12 / 17W	<20%	>0.9
DIM010VUNV	120V	50 / 60Hz	0.07 / 0.1 / 0.145A	8.5 / 12 / 17W	<20%	>0.9
	277V		0.045 / 0.06 / 0.078A			

PHOTOMETRY

INFT8/835/DIM010UNV (HIGH OUTPUT)



Lumens: 2,296 lm
CBCP: 898 cd
Power: 17.6 W
Efficacy: 130 lm/W
CRI: 80+
Spacing Criteria: 1.22
Beam Angle: 106.5°

Candlepower Distribution	
Angle (°)	Average (cd)
0	989
5	893
15	851
25	788
35	689
45	571
55	434
65	270
75	109
85	7
90	0

Initial Footcandles		
Height (ft)	Fc	Diameter (ft)
8	23	21.4
9	18	24.1
10	15	26.8
12	10	32.1
15	7	40.2

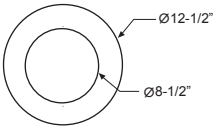
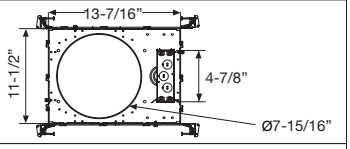
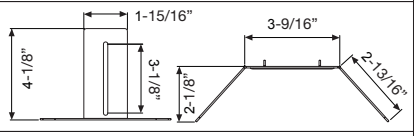
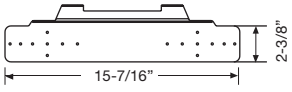
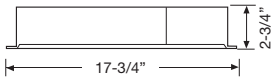
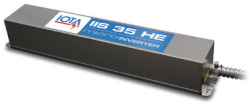
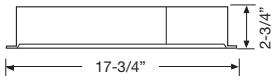
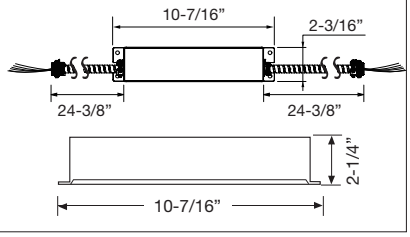
Zonal Lumen Summary		
Zone	Lumens	%Fixture
0-30	686	30%
0-40	1,112	48%
0-60	1,922	84%
0-90	2,296	100%

PERFORMANCE

CCT	2700K			3000K			3500K			4000K			5000K		
Output	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High
Lumens	1,000	1,415	2,000	1,030	1,450	2,060	1,045	1,475	2,090	1,060	1,500	2,125	1,060	1,500	2,125
LPW	118	118	118	121	121	121	123	123	123	125	125	125	125	125	125

8” INNOFIT GEN 2 COMMERCIAL DOWNLIGHT

ACCESSORY ORDERING INFORMATION

Product	Model	Description	Pictures	Dimensions
98567	GOOFRING8	8" Goof Ring - Outer Diameter 12-1/2"		
35123	NCFJB8	8" Round New Construction Rough-in Frame with Jbox		
35126	NCFBFB	Field Installable Butterfly Brackets For New Construction Rough-in Frame		
35125	NCFEMB	Field Installable Emergency Bracket For New Construction Rough-in Frame		
58012	35EMINVERTER	35W Emergency Inverter (Field Installation)		
58013	35EMINVERTER/CEC	California Title 20 Compliant 35W Emergency Inverter (Field Installation)		
98003	23EMDRIVER	California Title 20 Compliant 23W Emergency LED Driver (Field Installation)		

8” INNOFIT GEN 2 COMMERCIAL DOWNLIGHT

ORDERING GUIDE

Product	Model
35071	INFT8/827/DIM010UNV
35072	INFT8/830/DIM010UNV
35073	INFT8/835/DIM010UNV
35074	INFT8/840/DIM010UNV
35075	INFT8/850/DIM010UNV
35111	INFT8/827/DIM120V
35112	INFT8/830/DIM120V
35113	INFT8/835/DIM120V
35114	INFT8/840/DIM120V
35115	INFT8/850/DIM120V

10 YEAR EXTENDED WARRANTY

Model	INFT8/10YEARWARRANTY

SINCE 1945
KEYSTONE
LIGHT MADE EASY

XFIT | FLOOD LIGHT FIXTURES

KT-FLED35-R1A-UNV-8CSB-VDIM

COMPACT 35W GENERAL-PURPOSE LED FLOOD LIGHT

DESCRIPTION

Compact 35W General-Purpose LED Flood Light | 120–277V Input | 3000–5000K | Bronze Housing | Multiple Mounting Options

APPLICATION

Building Mount or Ground Mount for outdoor illumination (landscapes, display signage, loading docks, building façades, pathways, parking areas, and other general site lighting requirements)

PRODUCT FEATURES

- Uniform, wide flood design (NEMA 7h × 7w distribution pattern)
- Heavy-duty, die cast aluminum housing featuring built-in glare visor and tempered glass lens
- Powered by Keystone 0–10V dimming LED drivers
- Keystone Color Select Technology: Adjustable CCT (3000K, 4000K, or 5000K)
- Built-in dusk-to-dawn photocell behind translucent 3/4" threaded plug with anti-yellowing agent
- Heavy-duty 1/2" knuckle mount with 90° adjustment and yoke mount options included
- Ambient operating temperature: –30°C/–22°F to 45°C/113°F
- UL listed for wet locations, IP65
- 0–10V dimming, 10% min
- Power Factor: >0.95
- THD: <20%
- LED chip lifetime: L70 >100,000 hrs @ 25°C/77°F ambient fixture temp
- Meets FCC Part 15, Part B, Class A standards for conducted and radiated emissions
- 18" input cable, pre-stripped
- Fixture impact rating IK07

ELECTRICAL SPECIFICATIONS

Catalog Number	Wattage	Lumens	Dimming	CCT*	Efficacy	CRI	Housing Color	Mounting	Input Voltage	Rated Life	Legacy Equivalent
KT-FLED35-R1A-UNV-8CSB-VDIM	35W	4480 lm	0–10V	3000K	128 lm/W	>80	Bronze	Universal: 1/2" Knuckle or yoke	120–277V	50,000 hrs	150–175W MH
		5075 lm		4000K	145 lm/W						
		4900 lm		5000K	140 lm/W						

** Color Uniformity: CCT (Correlated Color Temperature) range as per guidelines outlined in ANSI C78.377-2017*

KEYSTONE SINCE 1945 LIGHT MADE EASY

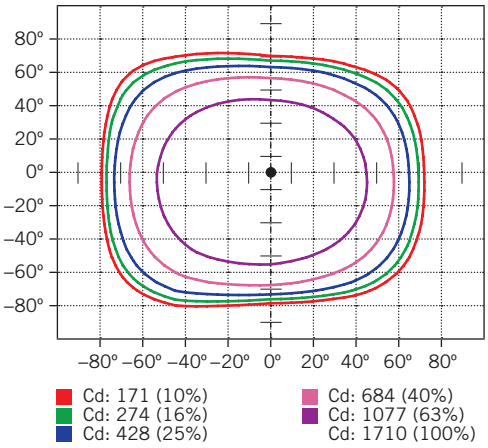
XFIT FLOOD LIGHT FIXTURES

KT-FLED35-R1A-UNV-8CSB-VDIM

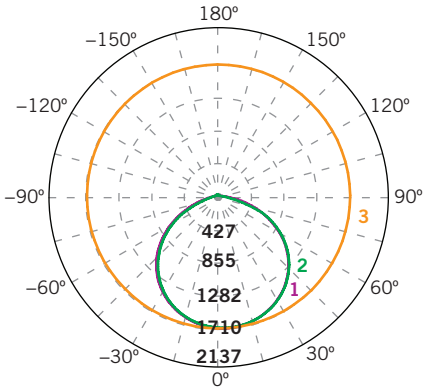
COMPACT 35W GENERAL-PURPOSE LED FLOOD LIGHT

PHOTOMETRIC SPECIFICATIONS

ISOCANDELA PLOT



LUMINOUS INTENSITY DISTRIBUTION



Average diffuse angle (50%): **114.3°**

1 **Violet** C0–C180

2 **Green** C90–C270

3 **Orange** G3

Unit: cd

FLUX DISTRIBUTION

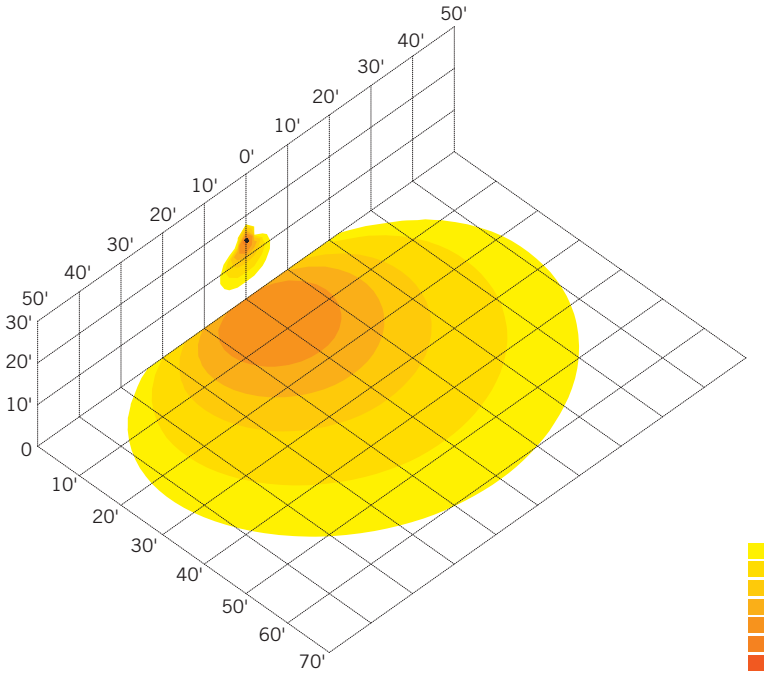
Zone	Lumens	% Luminaire
Forward Light	2,527 lm	53.2%
0°–30°	675 lm	14.2%
30°–60°	1,366 lm	28.8%
60°–80°	471 lm	9.9%
80°–90°	15 lm	0.3%
Back Light	2,181 lm	46.0%
0°–30°	656 lm	13.8%
30°–60°	1,223 lm	25.8%
60°–80°	297 lm	6.3%
80°–90°	5 lm	0.1%
Up Light	39 lm	0.8%
90°–100°	2 lm	0.0%
100°–180°	36 lm	0.8%

BUG* Rating	
Asymmetrical Luminare Types	
Type I, II, III, IV	B2 U2 G1
Quadrilateral Symmetrical Luminare Types	
Type V, Area Light	B2 U2 G1

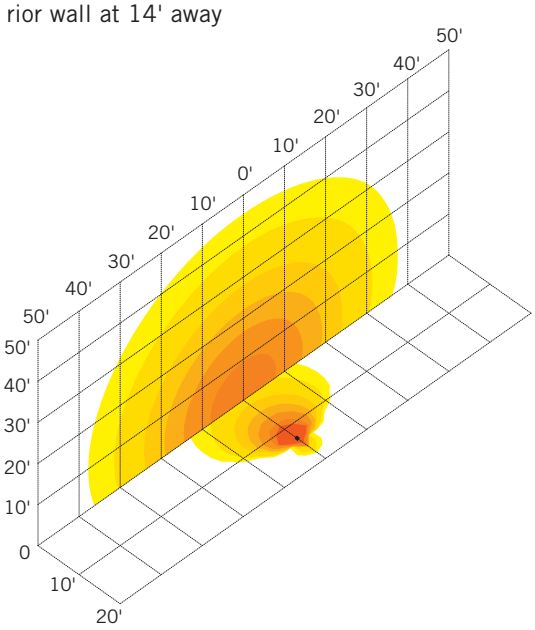
* ***B****acklight,* ***U****plight,* ***G****lare*

LIGHT DISTRIBUTION PATTERNS (Isometric view from above)

Building exterior mounted at
15', 30° below horizontal



Ground mounted at 6" above ground,
10° above horizontal, shining towards building exterior wall at 14' away



0.1 fc
0.2 fc
0.5 fc
1.0 fc
2.0 fc
5.0 fc
10.0 fc

SINCE 1945 KEYSTONE LIGHT MADE EASY

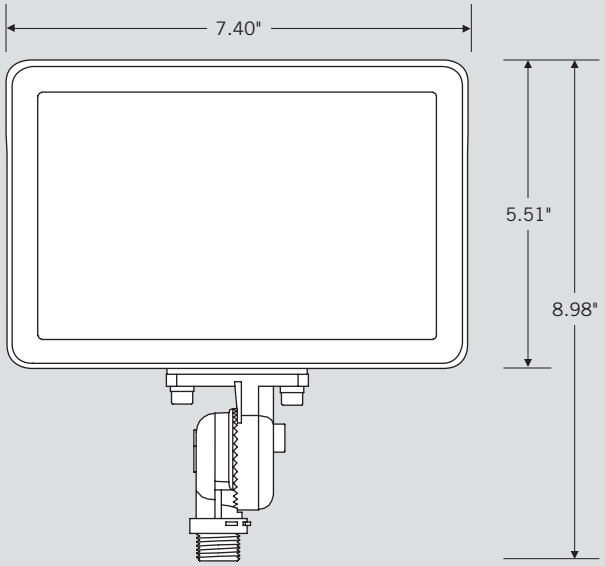
XFIT | FLOOD LIGHT FIXTURES

KT-FLED35-R1A-UNV-8CSB-VDIM

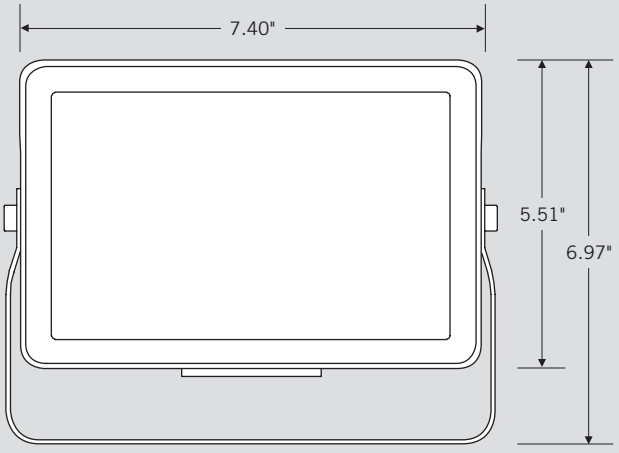
COMPACT 35W GENERAL-PURPOSE LED FLOOD LIGHT

PHYSICAL SPECIFICATIONS

KNUCKLE MOUNT



YOKE MOUNT



	EPA
Mounted Vertical	0.34 sq/ft
Mounted Horizontal	0.17 sq/ft
Mounted 45°	0.36 sq/ft

SINCE 1945 KEYSTONE LIGHT MADE EASY

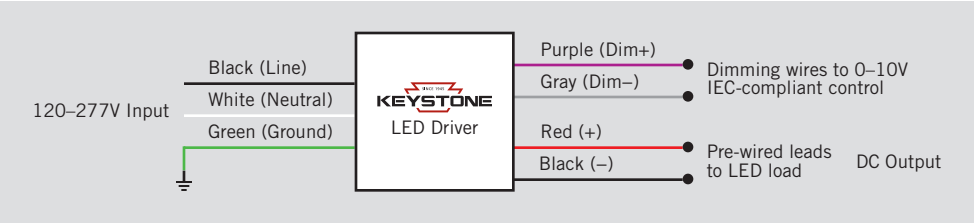
XFIT | FLOOD LIGHT FIXTURES

KT-FLED35-R1A-UNV-8CSB-VDIM

COMPACT 35W GENERAL-PURPOSE LED FLOOD LIGHT

GENERAL SETUP INSTRUCTIONS

GENERAL WIRING DIAGRAM



Caution: Before installing, make certain that AC power to the fixture is off.

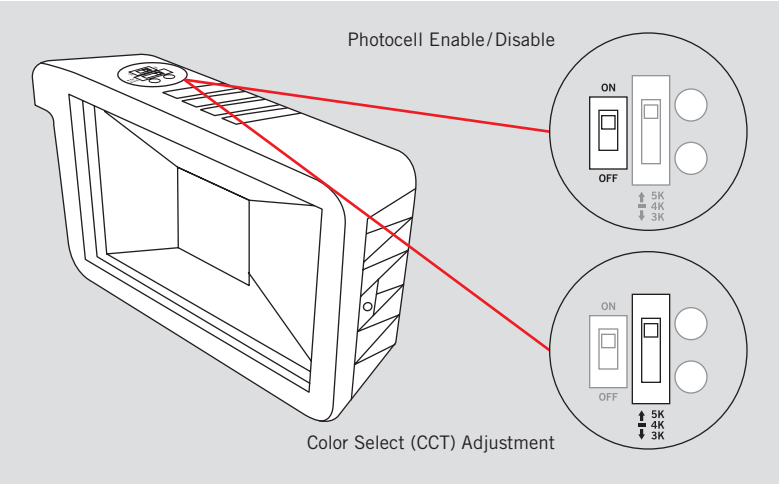
Caution: The electrical rating of this product is 120–277V. Installer must confirm that there is 120–277V at the fixture before installation.

PHOTOCELL ENABLE/DISABLE

This fixture is equipped with a dusk-to-dawn photocell behind the translucent knock-out (KO) cover. Adjust the dip switch to enable (ON) or disable (OFF) the photocell function (see illustrations to the right). Fixture comes preset with photocell enabled unless otherwise noted.

COLOR SELECT (CCT) ADJUSTMENT

This fixture is equipped with Color Select technology. There is an adjustable dip switch behind the translucent knock-out (KO) cover to change CCT between 5000K, 4000K, and 3000K (see illustrations to the right). Fixture comes preset at 5000K unless otherwise noted.



ACCESSORIES (SOLD SEPARATELY)

Catalog Number	Description
KT-FLED-SM-1-KIT	Flood Light Wall Mount Kit
KT-FLED-RC-4-W	4" Round Flood Light Junction Box Cover, White
KT-FLED-RC-4	4" Round Flood Light Junction Box Cover, Bronze

SINCE 1945
KEYSTONE
LIGHT MADE EASY

XFIT | FLOOD LIGHT FIXTURES

KT-FLED35-R1A-UNV-8CSB-VDIM

COMPACT 35W GENERAL-PURPOSE LED FLOOD LIGHT

ORDERING INFORMATION

CATALOG NUMBER	PACK QTY.	EASY CODE	UPC
KT-FLED35-R1A-UNV-8CSB-VDIM	1	DND-10	843654128962

CATALOG NUMBER BREAKDOWN

KT-FLED35-R1A-UNV-8CSB-VDIM

1 2 3 4 5 6 7 8 9 10 11 12 13

1 Keystone Technologies
2 Fixture Type
3 LED Lamp
4 Max Wattage
5 Shape
6 Style
7 Distribution
8 Mounting
9 CRI
10 Color
11 Color Select Designation
12 Dimming
13 Housing Color

2 Fixture Type

F	Flood
WP	Wallpack

5 Shape

R	Rectangular

6 Style

1	Non-Cutoff
2	Full-Cutoff

7 Distribution

A	Wide (7 × 7)
B	Narrow
C	Very Narrow

8 Mounting

UNV	Universal

9 CRI

8	>80
9	>90

10 Color

40	4000K
50	5000K
CS	Color Select

11 Color Select Designation

A	3500K, 4000K, 5000K
B	3000K, 4000K, 5000K
C	3000K, 3500K, 4000K, 5000K
D	TBD

12 Dimming

VDIM	0–10V

13 Housing Color

	Bronze
B	Black
W	White

SINCE 1945 KEYSTONE LIGHT MADE EASY | XFIT

KT-HBLED105PS-2FB-8CSD-VDIM-P

LED HIGH BAY FIXTURE

DESCRIPTION

2' LED High Bay Fixture | 120–277V Input | Frosted Lens | 0–10V Dimming | Premium Series

APPLICATION

Used for commercial and industrial high bay lighting applications

DLC PREMIUM | c UL us LISTED | 5 YEAR WARRANTY | POWER SELECT | COLOR SELECT | TRUSTED NLB WARRANTY

PRODUCT FEATURES

- Powered by Keystone 0–10V dimming LED drivers
- Smooth diffused lens for an even appearance
- 0–10V Dimming, Dim-to-off
- Compatible with Keystone SmartSafe emergency LED drivers
- Compatible with Keystone 480–277V step down transformers
- Built in port to accept Quick install Keystone sensor (KTS-MW3-12V-PKO & KTS-PIR3-12V-PKO.) NO wiring required
- Ambient operating temperature: –40ºC/–40ºF to 50ºC/122ºF
- UL Listed 1598: Suitable for damp locations
- THD: <20%
- Power factor >0.95
- L70 >50,000 hours
- DLC Premium Listed
- Architectural grade compact design
- Frosted lens eliminates glare
- V-hook and chain mounting accessories included
- Compatible with Keystone SmartSafe emergency LED drivers; KT-EMRG-LED-12C-1200-EN /DF and KT-EMRG-LED-20SD-2000-EN / DF are optimal for fixture level installation; mounting kit KT-HBLED-EM-BR-1B-KIT required (sold separately)

POWER AND COLOR TEMPERATURE SELECTABILITY

- Keystone Color Select Technology: Adjustable CCT (4000K/5000K)
- Keystone Power Select Technology: Adjustable Wattage (105W/90W/65W)

PRODUCT SPECIFICATIONS

Catalog Number	Input Voltage	Wattage	CCT	Lumen Output	Efficacy	CRI	Power Factor	Lifetime
KT-HBLED105PS-2FB-8CSD-VDIM-P	120–277V	105W	4000K	15,200	145 lm/W	> 80	> 0.90	50,000 hrs
			5000K	15,300	146 lm/W			
		90W	4000K	13,400	149 lm/W			
			5000K	13,500	150 lm/W			
		65W	4000K	10,100	155 lm/W			
			5000K	10,200	157 lm/W			

ONE CATALOG NUMBER WITH 6 DIFFERENT OPTIONS

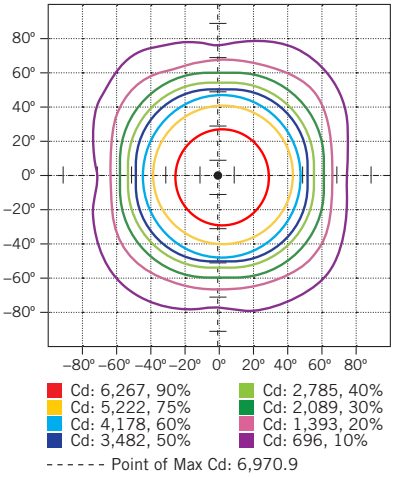
* Preset to highest lumen output (105W / 5000K)
* Color Uniformity: CCT (Correlated Color Temperature) range as per guidelines outlined in ANSI C78.377-2017.

KT-HBLED105PS-2FB-8CSD-VDIM-P

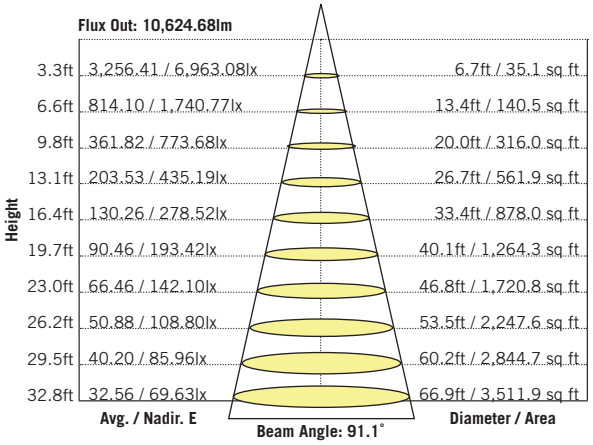
LED HIGH BAY FIXTURE

PHOTOMETRIC SPECIFICATIONS

ISOCANDELA PLOT



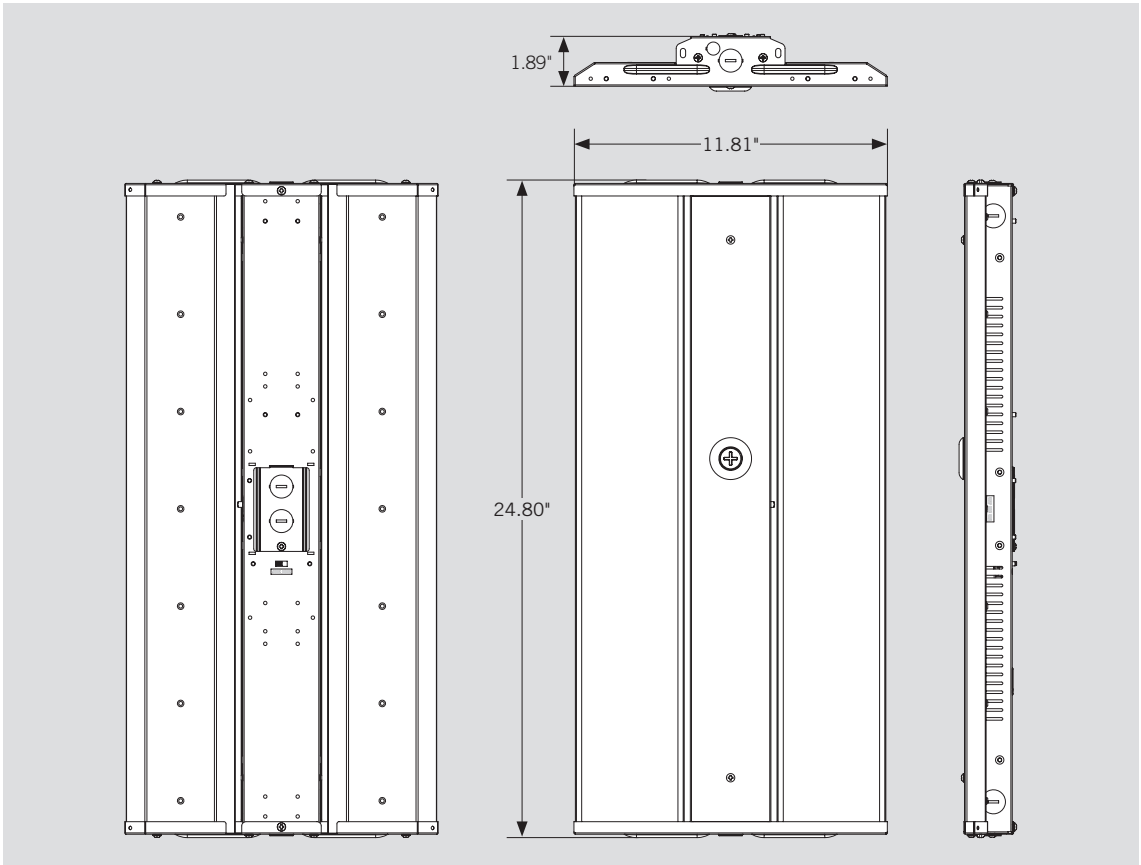
AVERAGE ILLUMINANCE



ZONAL LUMEN SUMMARY

Zone	Lumens	% Luminaire
0-30	5,456	35%
0-40	8,882	58%
0-60	13,618	88%
60-90	3,353	11%
70-100	765	5%
90-120	7	0%
0-90	15,406	99%
90-180	37	1%
0-180	15,440	100%

PHYSICAL SPECIFICATIONS



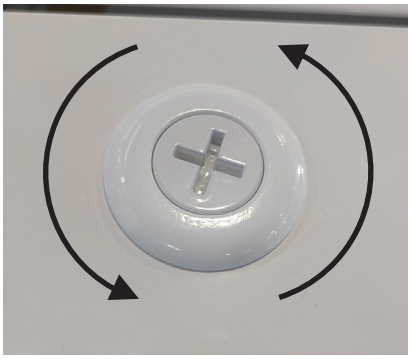
KT-HBLED105PS-2FB-8CSD-VDIM-P

LED HIGH BAY FIXTURE

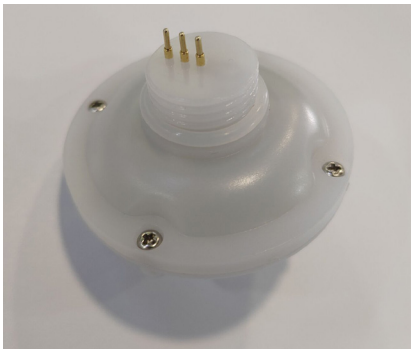
QUICK INSTALL ACCESSORIES (SOLD SEPARATELY)

Accessory	Catalog Number	Description
PIR Sensor	KTS-PIR3-12V-PKO /A	PIR sensor for 2FB LED Highbay fixtures, Preset for 1 min hold time, 3 min standby time at 30% dim, daylight disabled
	KTS-PIR3-12V-PKO /B	PIR sensor for 2FB LED Highbay fixtures, Preset for 5 min hold time, 10 min standby time at 10% dim, daylight disabled
Microwave Sensor	KTS-MW3-12V-PKO /A	Microwave sensor for 2FB LED Highbay fixtures, Preset for 1 min hold time, 3 min standby time at 30% dim, daylight disabled
	KTS-MW3-12V-PKO /B	Microwave sensor for 2FB LED Highbay fixtures, Preset for 5 min hold time, 10 min standby time at 10% dim, daylight disabled

1. UNSCREW FIXTURE CAP



2. TWIST IN SENSOR



3. DONE!

KT-HBLED105PS-2FB-8CSD-VDIM-P
LED HIGH BAY FIXTURE

ADDITIONAL ACCESSORIES (SOLD SEPARATELY)

Accessory	Catalog Number	Description
Surface Mount Kit	KT-HBLED-SM-1B-KIT	Surface Mount Kit for 2FB LED High Bay fixtures
Pendant Mount Kit	KT-HBLED-PM-1B-KIT	Pendant Mount Kit for 2FB LED High Bay fixtures
Wire Guard	KT-HBLED-WG-2B-KIT	Wire Guard Kit for 2FB LED Highbay fixtures
Cable Kit	KT-HBLED-CABLE-1B-KIT	Aircraft Cable Hanging Kit for 2FB LED Highbay fixtures
Emergency Backup Bracket	KT-HBLED-EM-BR-1B-KIT	Emergency LED Backup Mounting Kit for 2FB LED Highbay Fixtures
Smart Safe Battery Backup	KT-EMRG-LED-12C-1200-EN /DF	12W, 1200 lumen Smart Safe emergency battery backup with dual flex cables
	KT-EMRG-LED-20SD-2000-EN /DF	20W, 2000 lumen Smart Safe emergency battery backup with dual flex cables, Self diagnostic

ORDERING INFORMATION

Catalog Number	Pack Quantity	Easy Code	UPC
KT-HBLED105PS-2FB-8CSD-VDIM-P	TBD	WGG-22	843654134567

CATALOG NUMBER BREAKDOWN

KT-HBLED105PS-2FB-8CSD-VDIM-P

1 2 3 4 5 6 7 8 9 10 11

1 **Keystone Technologies**
2 **LED Stairwell Fixture**
3 **Wattage**
4 **Power Select**
5 **2' Nominal Length**
6 **Form Factor**
7 **800 Series**
8 **Color Select**
9 **Color Select Designation**
10 **0–10V Dimming**
11 **Premium Series**

8 Color Select Designation

A	3500K, 4000K, 5000K
B	3000K, 4000K, 5000K
C	3000K, 3500K, 4000K, 5000K
D	4000K, 5000K

SINCE 1945
KEYSTONE
LIGHT MADE EASY

XFIT | SMALL LOW PROFILE WALL PACK FIXTURES

KT-WPLED20-S1-8CSB-VDIM

SMALL 20W NON-CUTOFF LED WALL PACK

DESCRIPTION

Small 20W Non-Cutoff LED Wall Pack | 120–277V Input |
3000–5000K | Low Profile Bronze Housing | Impact Resistant Lens

APPLICATION

Building Mount for exterior illumination (entryways, pathways, stairwells, security, and other general site lighting requirements)

PRODUCT FEATURES

- Small non-cutoff design can be mounted virtually anywhere, offering uniform vertical and horizontal distribution pattern for general safety and security illumination needs
- Heavy-duty die-cast aluminum housing features modern aesthetics and includes (3) available 1/2" threaded conduit hubs, (1) on back and (1) on each side
- Powered by Keystone 0–10V dimming LED drivers
- Keystone Color Select Technology: Adjustable CCT (3000K, 4000K, or 5000K)
- Built-in dusk-to-dawn photocell behind translucent 1/2” threaded plug with anti-yellowing agent
- ADA Compliant with low-profile housing less than 4” deep
- Impact-resistant and highly diffused polycarbonate lens with anti-yellowing agent offers reduced glare for low mounting height applications
- Ambient operating temperature: –40ºC/–40ºF to 50ºC/122ºF
- UL listed for wet locations, IP65
- 0–10V dimming, 10% min
- Power Factor: >0.95
- THD: <20%
- LED chip lifetime: L70 >100,000 hrs @ 25Cº/77Fº ambient fixture temp
- Meets FCC Part 15, Part B, Class A standards for conducted and radiated emissions
- Fixture impact rating IK07

ELECTRICAL SPECIFICATIONS

Catalog Number	Wattage	Lumens	Lumens Below 90º	Dimming	CCT*	Efficacy	CRI	Housing Color	Input Voltage	Rated Life	Legacy Equivalent
KT-WPLED20-S1-8CSB-VDIM	20W	2600 lm	2340 lm	0–10V	3000K	130 lm/W	>80	Bronze	120–277V	50,000 hrs	50–70W MH
		2700 lm	2430 lm		4000K	135 lm/W					
		2500 lm	2330 lm		5000K	125 lm/W					

** Color Uniformity: CCT (Correlated Color Temperature) range as per guidelines outlined in ANSI C78.377-2017*

SINCE 1945
KEYSTONE
LIGHT MADE EASY

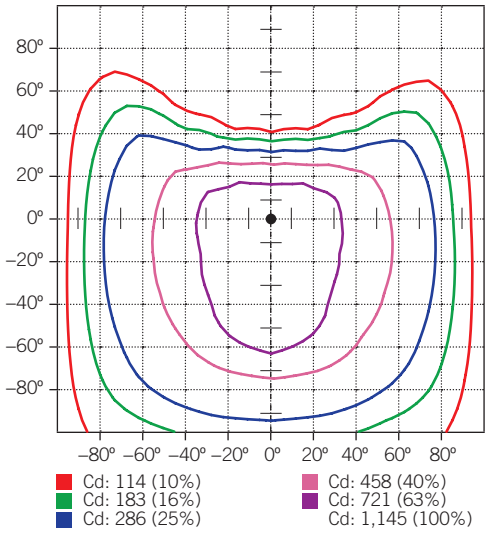
XFIT | SMALL LOW PROFILE WALL PACK FIXTURES

KT-WPLED20-S1-8CSB-VDIM

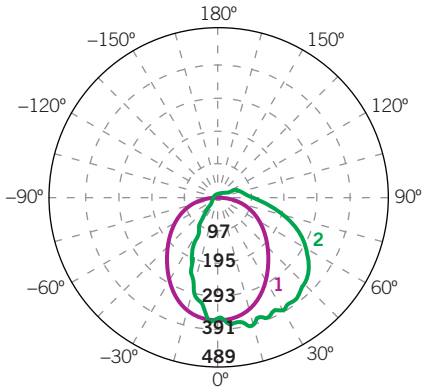
SMALL 20W NON-CUTOFF LED WALL PACK

PHOTOMETRIC SPECIFICATIONS

ISOCANDELA PLOT



LUMINOUS INTENSITY DISTRIBUTION



Average diffuse angle (50%): **100°**
1 Violet C0–C180
2 Green C90–C270
Unit: cd

FLUX DISTRIBUTION

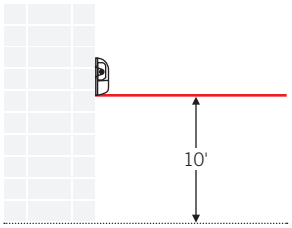
Zone	Lumens	% Luminaire
Forward Light	1,653 lm	64.0%
0°–30°	379 lm	14.7%
30°–60°	758 lm	29.4%
60°–80°	400 lm	15.5%
80°–90°	116 lm	4.5%
Back Light	667 lm	25.8%
0°–30°	264 lm	10.2%
30°–60°	283 lm	11.0%
60°–80°	97 lm	3.8%
80°–90°	23 lm	0.9%
Up Light	261 lm	10.1%
90°–100°	92 lm	3.5%
100°–180°	170 lm	6.6%

BUG* Rating	
Asymmetrical Luminare Types	
Type I, II, III, IV	B1 U3 G1
Quadrilateral Symmetrical Luminare Types	
Type V, Area Light	B1 U3 G1

* ***B****acklight,* ***U****plight,* ***G****lare*

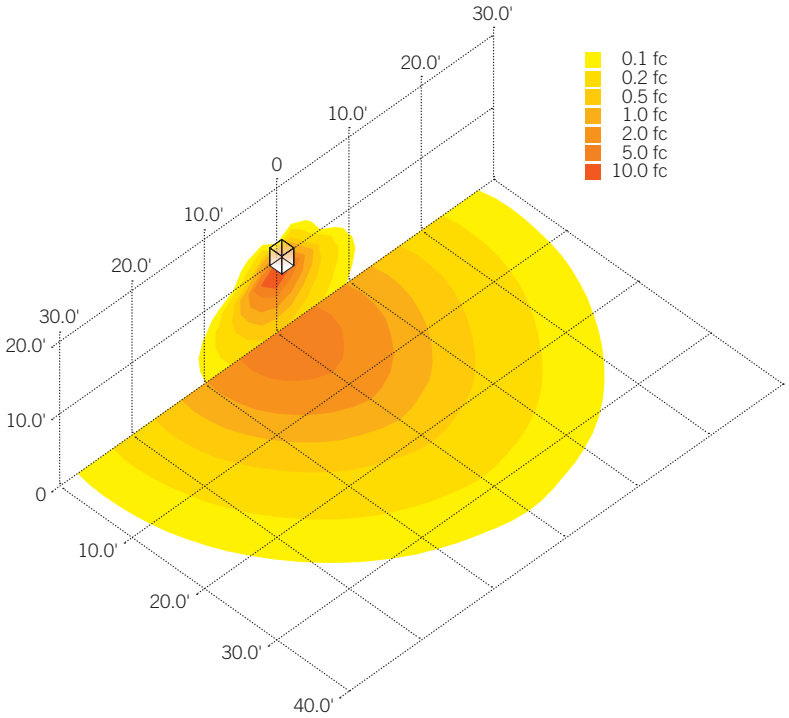
MOUNTING

Side view



LIGHT DISTRIBUTION PATTERN

Isometric view from above; Luminaire mounted at 10'



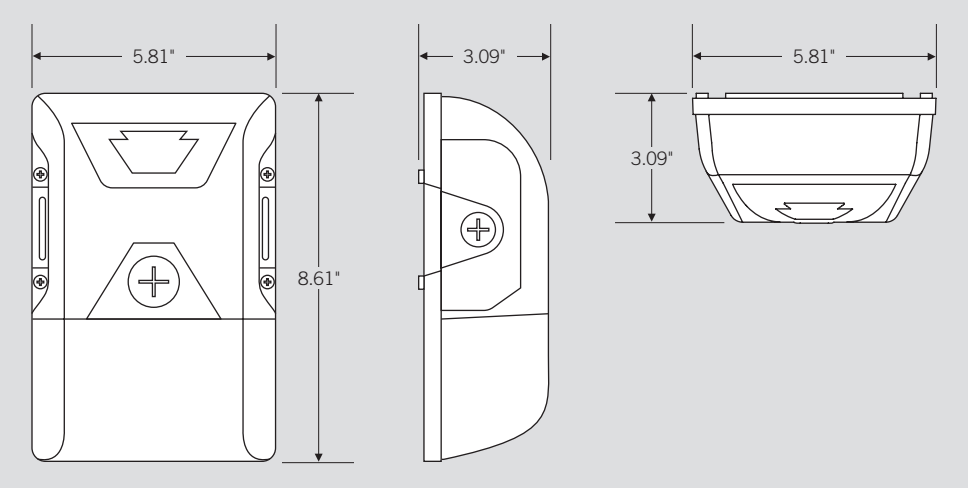
SINCE 1945
KEYSTONE
LIGHT MADE EASY

XFIT | SMALL LOW PROFILE WALL PACK FIXTURES

KT-WPLED20-S1-8CSB-VDIM

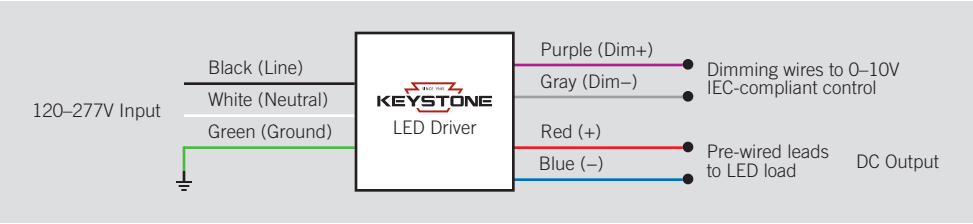
SMALL 20W NON-CUTOFF LED WALL PACK

PHYSICAL SPECIFICATIONS



GENERAL SETUP INSTRUCTIONS

GENERAL WIRING DIAGRAM



Caution: Before installing, make certain that AC power to the fixture is off.

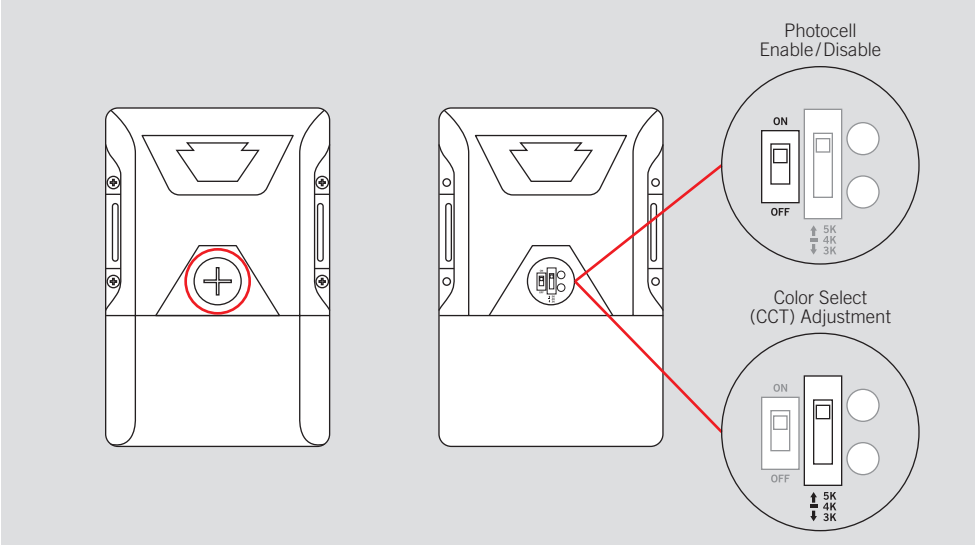
Caution: The electrical rating of this product is 120–277V. Installer must confirm that there is 120–277V at the fixture before installation.

PHOTOCELL ENABLE/DISABLE

This fixture is equipped with a dusk-to-dawn photocell behind the translucent knock-out (KO) cover. Adjust the dip switch to enable (ON) or disable (OFF) the photocell function (see illustrations to the right). Fixture comes preset with photocell enabled unless otherwise noted.

COLOR SELECT (CCT) ADJUSTMENT

Certain fixture models are equipped with Color Select technology. There is an adjustable dip switch behind the translucent knock-out (KO) cover to change CCT between 5000K, 4000K, and 3000K (see illustrations to the right). Fixture comes preset at 5000K unless otherwise noted.



SINCE 1945
KEYSTONE
LIGHT MADE EASY

XFIT | SMALL LOW PROFILE WALL PACK FIXTURES

KT-WPLED20-S1-8CSB-VDIM

SMALL 20W NON-CUTOFF LED WALL PACK

ACCESSORY (SOLD SEPARATELY)

Catalog Number	Description
KTSP-10KV-C	Wall Pack 10kV Surge Protector, Compact Design

ORDERING INFORMATION

CATALOG NUMBER	PACK QTY.	EASY CODE	UPC
KT-WPLED20-S1-8CSB-VDIM	1	XWA-37	843654129112

CATALOG NUMBER BREAKDOWN

KT-WPLED20-S1-8CSB-VDIM

1 2 3 4 5 6 7 8 9 10 11 12

1 Keystone Technologies
2 Fixture Type
3 LED Lamp
4 Max Wattage
5 Size
6 Style
7 CRI
8 Color
9 Color Select Designation
10 0–10V Dimming
11 Housing Color
12 Sensor Options

2 Fixture Type

F	Flood
WP	Wallpack

5 Size

S	Small
M	Medium
L	Large

6 Style

1	Non-Cutoff
2	Full-Cutoff

7 CRI

8	>80
9	>90

8 Color

40	4000K
50	5000K
CS	Color Select

9 Color Select Designation

A	3500K, 4000K, 5000K
B	3000K, 4000K, 5000K
C	3000K, 3500K, 4000K, 5000K
D	TBD

10 Dimming

VDIM	0–10V

11 Housing Color

	Bronze
B	Black
W	White

10 Sensor Options

	No option
/MW	Microwave occupancy Sensor Installed

SINCE 1945
KEYSTONE
LIGHT MADE EASY

XFIT | TRADITIONAL WALL PACK FIXTURES

KT-WPLED80-M1-8CSB-VDIM

TRADITIONAL 80W NON-CUTOFF LED WALL PACK

DESCRIPTION

Traditional 80W Non-Cutoff LED Wall Pack | 120–277V Input | 3000–5000K | Medium-Size Bronze Housing | Glass Lens

APPLICATION

Building Mount for exterior illumination (perimeters, pathways, loading docks, and other general security lighting requirements)

c UL us LISTED | DLC PREMIUM | 5 YEAR WARRANTY | COLOR SELECT | TRUSTED NLB WARRANTY

PRODUCT FEATURES

- Traditional design matches appearance and light distribution pattern of legacy HID, optimized for one-for-one replacements
- Heavy-duty, die-cast aluminum housing with (5) available 1/2" threaded conduit hubs: (1) on back and (1) on all four sides
- Powered by Keystone 0–10V dimming LED drivers
- Keystone Color Select Technology: Adjustable CCT (3000K, 4000K, or 5000K)
- Built-in dusk-to-dawn photocell behind translucent 3/4" threaded plug with anti-yellowing agent
- Borosilicate glass lens diffuses light source and provides uniform distribution
- Covers footprint of mid-size HID wallpacks
- Ambient operating temperature: –40ºC/–40ºF to 50ºC/122ºF
- UL listed for wet locations, IP65
- 0–10V dimming, 10% min
- Power Factor: >0.95
- THD: <20%
- LED chip lifetime: L70 >100,000 hrs @ 25ºC/77ºF ambient fixture temp
- Meets FCC Part 15, Part B, Class A standards for conducted and radiated emissions
- Fixture impact rating IK06
- Compatible with Keystone LED Emergency Backups

ELECTRICAL SPECIFICATIONS

Catalog Number	Wattage	Lumens	Lumens Below 90º	Dimming	CCT*	Efficacy	CRI	Housing Color	Input Voltage	Rated Life	Legacy Equivalent
KT-WPLED80-M1-8CSB-VDIM	80W	10955 lm	9860 lm	0–10V	3000K	137 lm/W	>80	Bronze	120–277V	50,000 hrs	250–320W MH
		11925 lm	10730 lm		4000K	149 lm/W					
		11360 lm	10225 lm		5000K	142 lm/W					

** Color Uniformity: CCT (Correlated Color Temperature) range as per guidelines outlined in ANSI C78.377-2017*

SINCE 1945
KEYSTONE
LIGHT MADE EASY

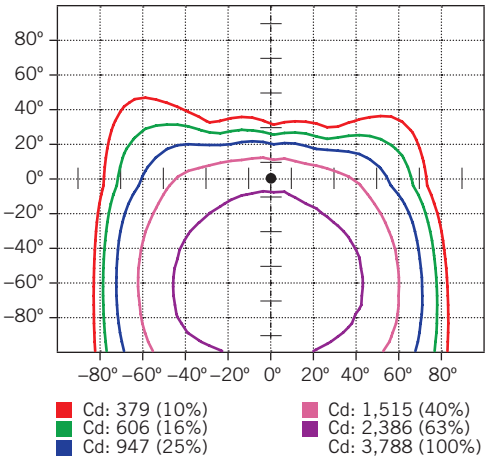
XFIT | TRADITIONAL WALL PACK FIXTURES

KT-WPLED80-M1-8CSB-VDIM

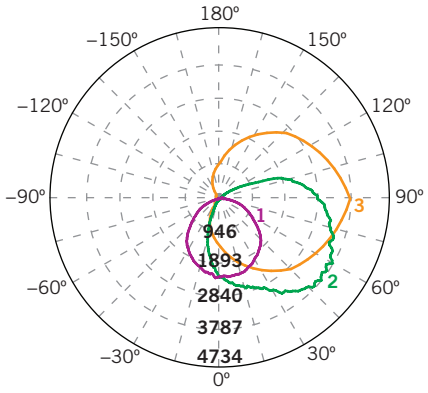
TRADITIONAL 80W NON-CUTOFF LED WALL PACK

PHOTOMETRIC SPECIFICATIONS

ISOCANDELA PLOT



LUMINOUS INTENSITY DISTRIBUTION



Average diffuse angle (50%): **111.4°**
1 Violet C0–C180
2 Green C90–C270
3 Orange G51
Unit: cd

FLUX DISTRIBUTION

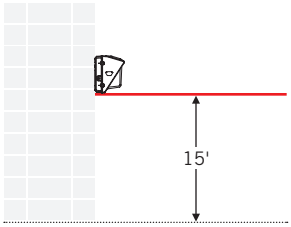
Zone	Lumens	% Luminaire
Forward Light	8,671 lm	79.6%
0°–30°	1,281 lm	11.8%
30°–60°	3,696 lm	33.9%
60°–80°	2,660 lm	24.4%
80°–90°	1,035 lm	9.5%
Back Light	1,029 lm	9.5%
0°–30°	409 lm	3.8%
30°–60°	471 lm	4.3%
60°–80°	126 lm	1.2%
80°–90°	23 lm	0.2%
Up Light	1,195 lm	11.0%
90°–100°	551 lm	5.1%
100°–180°	644 lm	5.9%

BUG* Rating	
Asymmetrical Luminare Types	
Type I, II, III, IV	B1 U4 G5
Quadrilateral Symmetrical Luminare Types	
Type V, Area Light	B1 U4 G5

* ***B****acklight,* ***U****plight,* ***G****lare*

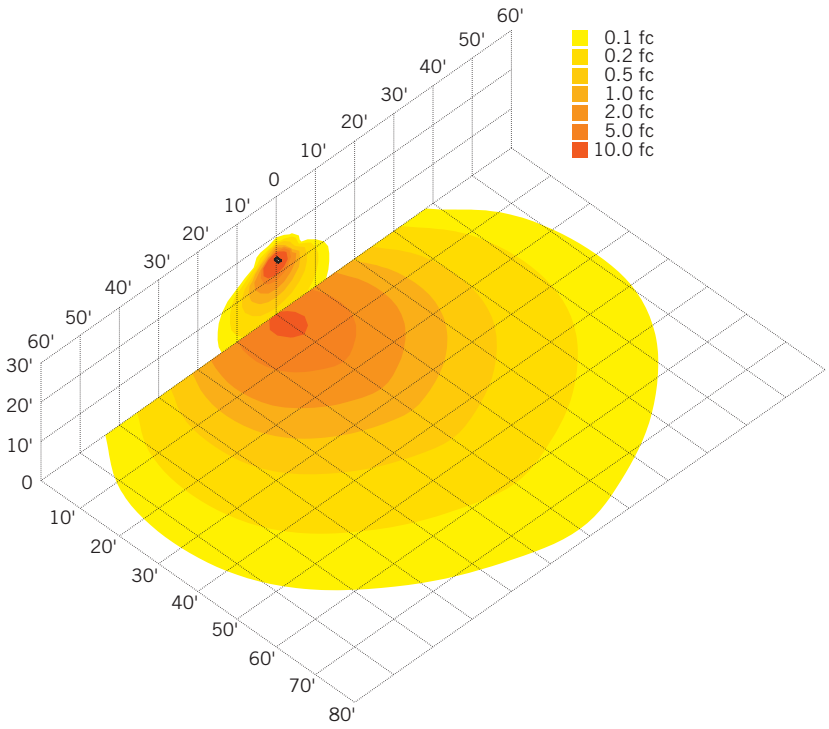
MOUNTING

Side view



LIGHT DISTRIBUTION PATTERN

Isometric view from above; Luminaire mounted at 15'



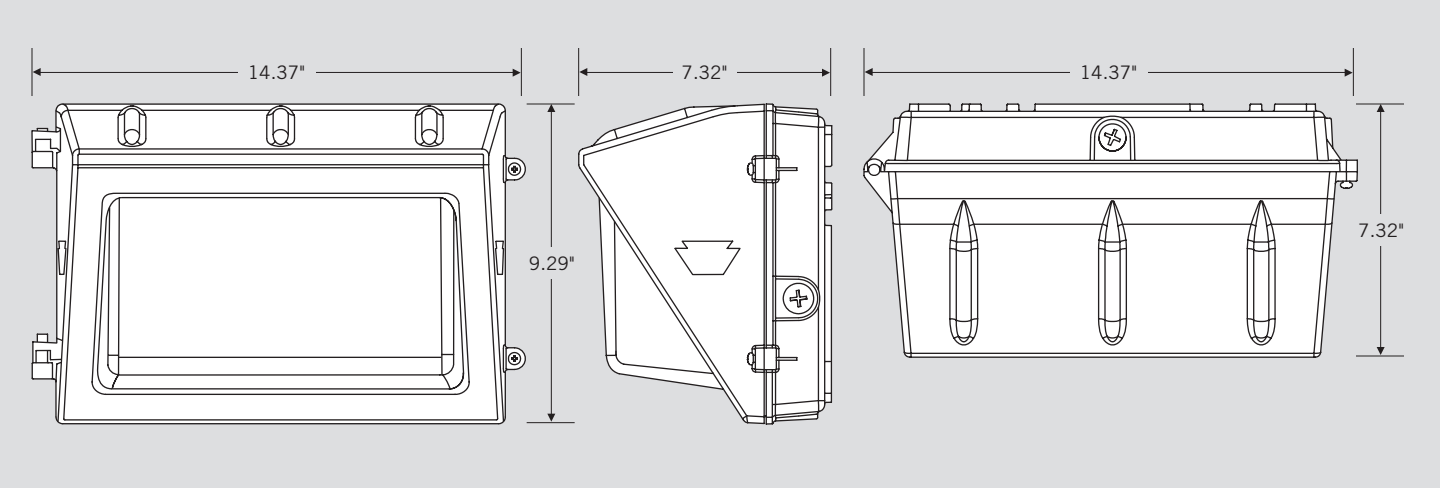
SINCE 1945 KEYSTONE LIGHT MADE EASY

XFIT | TRADITIONAL WALL PACK FIXTURES

KT-WPLED80-M1-8CSB-VDIM

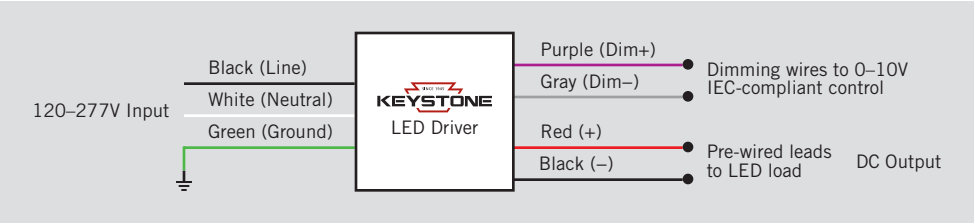
TRADITIONAL 80W NON-CUTOFF LED WALL PACK

PHYSICAL SPECIFICATIONS



GENERAL SETUP INSTRUCTIONS

GENERAL WIRING DIAGRAM



Caution: Before installing, make certain that AC power to the fixture is off.

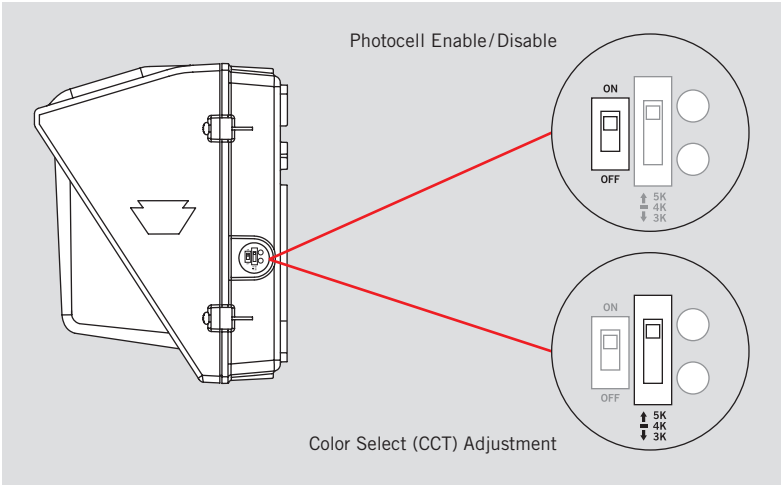
Caution: The electrical rating of this product is 120–277V. Installer must confirm that there is 120–277V at the fixture before installation.

PHOTOCELL ENABLE/DISABLE

This fixture is equipped with a dusk-to-dawn photocell behind the translucent knock-out (KO) cover. Adjust the dip switch to enable (ON) or disable (OFF) the photocell function (see illustrations to the right). Fixture comes preset with photocell enabled unless otherwise noted.

COLOR SELECT (CCT) ADJUSTMENT

This fixture is equipped with Color Select technology. There is an adjustable dip switch behind the translucent knock-out (KO) cover to change CCT between 5000K, 4000K, and 3000K (see illustrations to the right). Fixture comes preset at 5000K unless otherwise noted.



SINCE 1945
KEYSTONE
LIGHT MADE EASY

XFIT | TRADITIONAL WALL PACK FIXTURES

KT-WPLED80-M1-8CSB-VDIM

TRADITIONAL 80W NON-CUTOFF LED WALL PACK

ACCESSORY (SOLD SEPARATELY)

Catalog Number	Description
KTSP-10KV-C	Wallpack 10kV Surge Protector, Compact Design

ORDERING INFORMATION

CATALOG NUMBER	PACK QTY.	EASY CODE	UPC
KT-WPLED80-M1-8CSB-VDIM	1	XNA-33	843654129037

CATALOG NUMBER BREAKDOWN

KT-WPLED80-M1-8CSB-VDIM

1 2 3 4 5 6 7 8 9 10 11

1 Keystone Technologies
2 Fixture Type
3 LED Lamp
4 Max Wattage
5 Size
6 Style
7 CRI
8 Color
9 Color Select Designation
10 Dimming
11 Additional Options

2 Fixture Type

F	Flood
WP	Wallpack

5 Size

S	Small
M	Medium
L	Large

6 Style

1	Non-Cutoff
2	Full-Cutoff

7 CRI

8	>80
9	>90

8 Color

40	4000K
50	5000K
CS	Color Select

9 Color Select Designation

A	3500K, 4000K, 5000K
B	3000K, 4000K, 5000K
C	3000K, 3500K, 4000K, 5000K
D	TBD

10 Dimming

VDIM	0–10V

11 Additional Options

	No option
/MW	Microwave occupancy Sensor Installed
/EMRG-12	12W Emergency Battery Backup Installed

SINCE 1945
KEYSTONE
LIGHT MADE EASY

XFIT | TRADITIONAL WALL PACK FIXTURES

KT-WPLED120-L1-8CSB-VDIM

TRADITIONAL 120W NON-CUTOFF LED WALL PACK

DESCRIPTION

Traditional 120W Non-Cutoff LED Wall Pack | 120–277V Input | 3000–5000K | Large-Size Bronze Housing | Glass Lens

APPLICATION

Building Mount for exterior illumination (perimeters, pathways, loading docks, and other general security lighting requirements)

c UL us LISTED | DLC PREMIUM | 5 YEAR WARRANTY | COLOR SELECT | TRUSTED NLB WARRANTY

PRODUCT FEATURES

- Traditional design matches appearance and light distribution pattern of legacy HID, optimized for one-for-one replacements
- Heavy-duty, die-cast aluminum housing with (5) available 1/2" threaded conduit hubs: (1) on back and (1) on all four sides
- Powered by Keystone 0–10V dimming LED drivers
- Keystone Color Select Technology: Adjustable CCT (3000K, 4000K, or 5000K)
- Built-in dusk-to-dawn photocell behind translucent 3/4" threaded plug with anti-yellowing agent
- Borosilicate glass lens diffuses light source and provides uniform distribution
- Covers footprint of large HID wallpacks
- Ambient operating temperature: –40ºC/–40ºF to 50ºC/122ºF
- UL listed for wet locations, IP65
- 0–10V dimming, 10% min
- Power Factor: >0.95
- THD: <20%
- LED chip lifetime: L70 >100,000 hrs @ 25ºC/77ºF ambient fixture temp
- Meets FCC Part 15, Part B, Class A standards for conducted and radiated emissions
- Fixture impact rating IK06
- Compatible with Keystone LED Emergency Backups

ELECTRICAL SPECIFICATIONS

Catalog Number	Wattage	Lumens	Lumens Below 90º	Dimming	CCT*	Efficacy	CRI	Housing Color	Input Voltage	Rated Life	Legacy Equivalent
KT-WPLED120-L1-8CSB-VDIM	120W	16410 lm	14770 lm	0–10V	3000K	137 lm/W	>80	Bronze	120–277V	50,000 hrs	400W MH
		17865 lm	16075 lm		4000K	149 lm/W					
		16900 lm	15210 lm		5000K	141 lm/W					

** Color Uniformity: CCT (Correlated Color Temperature) range as per guidelines outlined in ANSI C78.377-2017*

SINCE 1945 KEYSTONE LIGHT MADE EASY

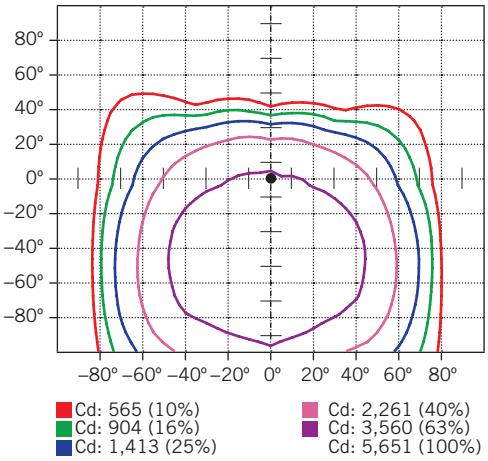
XFIT | TRADITIONAL WALL PACK FIXTURES

KT-WPLED120-L1-8CSB-VDIM

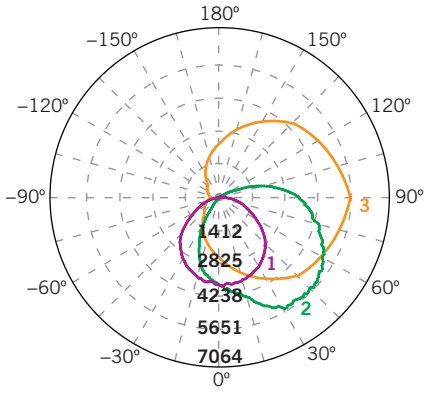
TRADITIONAL 120W NON-CUTOFF LED WALL PACK

PHOTOMETRIC SPECIFICATIONS

ISOCANDELA PLOT



LUMINOUS INTENSITY DISTRIBUTION



Average diffuse angle (50%): **112.3°**

1 **Violet** C0–C180

2 **Green** C90–C270

3 **Orange** G46

Unit: cd

FLUX DISTRIBUTION

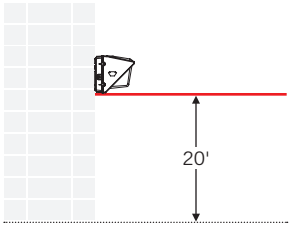
Zone	Lumens	% Luminaire
Forward Light	11,932 lm	71.6%
0°–30°	1,998 lm	12.0%
30°–60°	5,312 lm	31.9%
60°–80°	3,365 lm	20.2%
80°–90°	1,257 lm	7.5%
Back Light	2,803 lm	17.0%
0°–30°	1,280 lm	7.7%
30°–60°	1,273 lm	7.6%
60°–80°	250 lm	1.5%
80°–90°	39 lm	0.2%
Up Light	1,877 lm	11.3%
90°–100°	899 lm	5.4%
100°–180°	979 lm	5.9%

BUG* Rating	
Asymmetrical Luminare Types	
Type I, II, III, IV	B3 U4 G5
Quadrilateral Symmetrical Luminare Types	
Type V, Area Light	B3 U4 G5

* ***B****acklight,* ***U****plight,* ***G****lare*

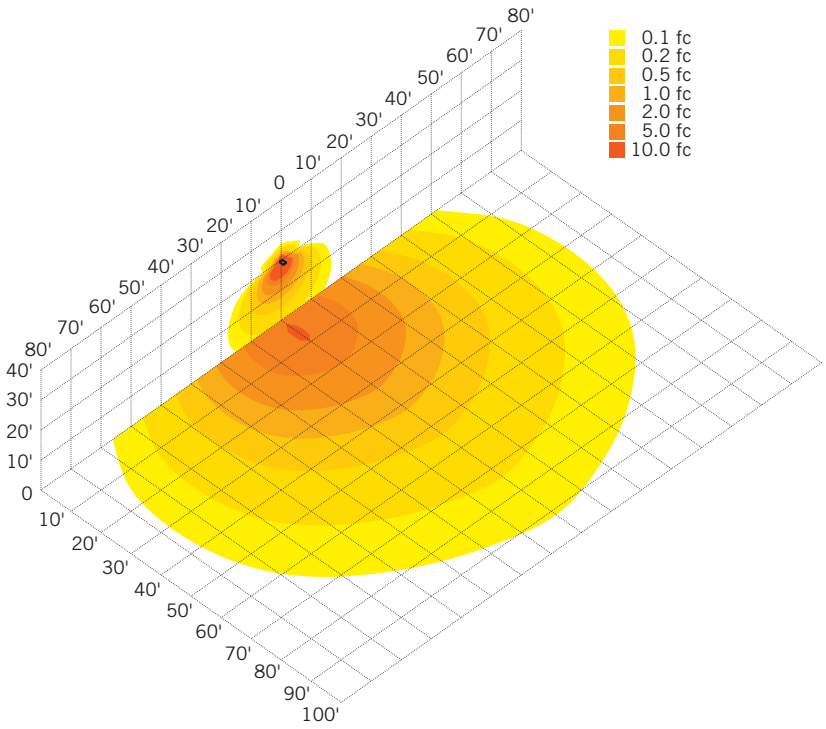
MOUNTING

Side view



LIGHT DISTRIBUTION PATTERN

Isometric view from above; Luminaire mounted at 20'



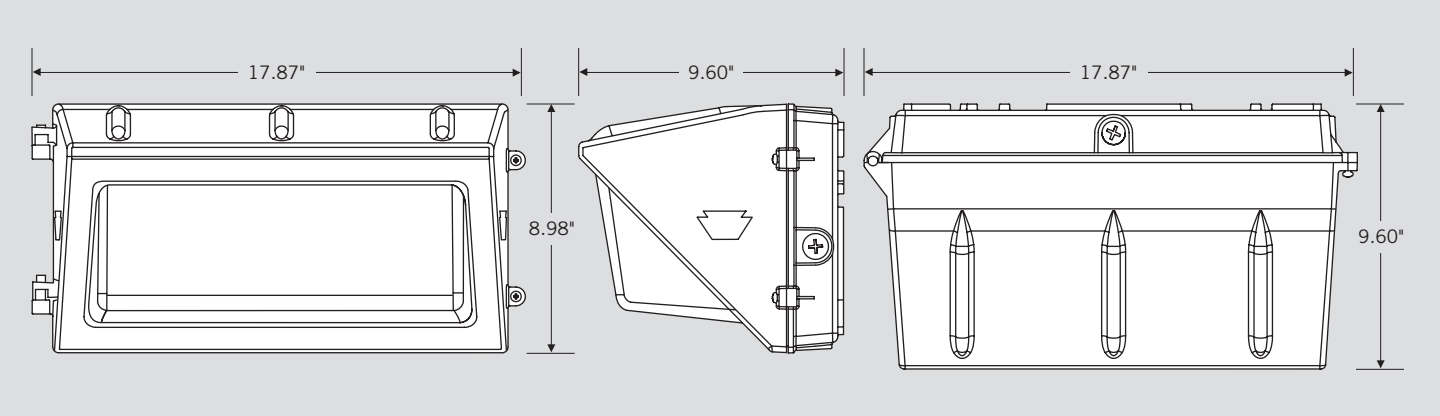
SINCE 1945
KEYSTONE
LIGHT MADE EASY

XFIT | TRADITIONAL WALL PACK FIXTURES

KT-WPLED120-L1-8CSB-VDIM

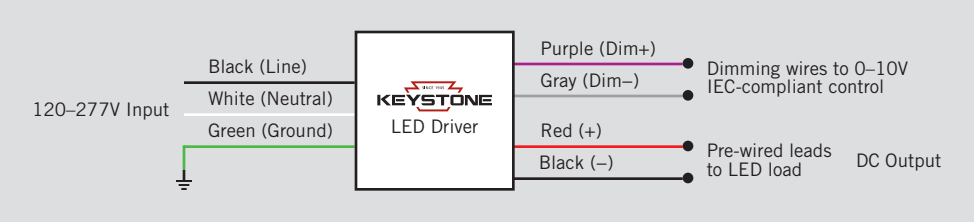
TRADITIONAL 120W NON-CUTOFF LED WALL PACK

PHYSICAL SPECIFICATIONS



GENERAL SETUP INSTRUCTIONS

GENERAL WIRING DIAGRAM



Caution: Before installing, make certain that AC power to the fixture is off.

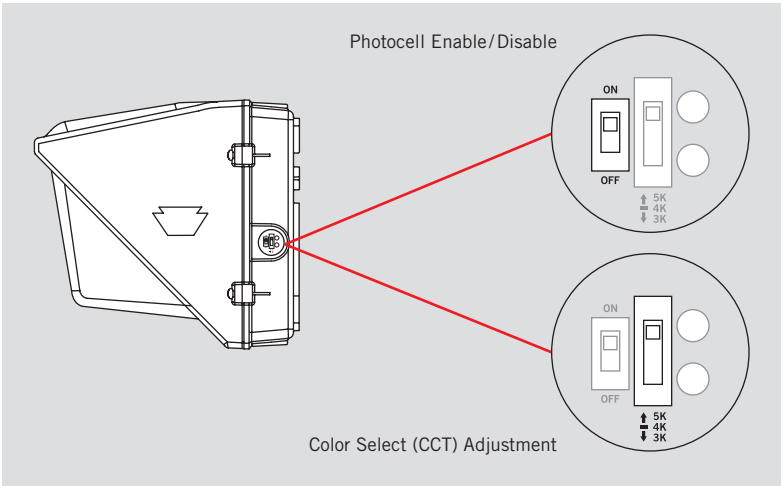
Caution: The electrical rating of this product is 120–277V. Installer must confirm that there is 120–277V at the fixture before installation.

PHOTOCELL ENABLE/DISABLE

This fixture is equipped with a dusk-to-dawn photocell behind the translucent knock-out (KO) cover. Adjust the dip switch to enable (ON) or disable (OFF) the photocell function (see illustrations to the right). Fixture comes preset with photocell enabled unless otherwise noted.

COLOR SELECT (CCT) ADJUSTMENT

This fixture is equipped with Color Select technology. There is an adjustable dip switch behind the translucent knock-out (KO) cover to change CCT between 5000K, 4000K, and 3000K (see illustrations to the right). Fixture comes preset at 5000K unless otherwise noted.



SINCE 1945
KEYSTONE
LIGHT MADE EASY

XFIT | TRADITIONAL WALL PACK FIXTURES

KT-WPLED120-L1-8CSB-VDIM

TRADITIONAL 120W NON-CUTOFF LED WALL PACK

ACCESSORY (SOLD SEPARATELY)

Catalog Number	Description
KTSP-10KV-C	Wallpack 10kV Surge Protector, Compact Design

ORDERING INFORMATION

CATALOG NUMBER	PACK QTY.	EASY CODE	UPC
KT-WPLED120-M1-8CSB-VDIM	1	EVM-25	843654129044

CATALOG NUMBER BREAKDOWN

KT-WPLED120-L1-8CSB-VDIM

1 2 3 4 5 6 7 8 9 10 11

1 Keystone Technologies
2 Fixture Type
3 LED Lamp
4 Max Wattage
5 Size
6 Style
7 CRI
8 Color
9 Color Select Designation
10 Dimming
11 Additional Options

2 Fixture Type

F	Flood
WP	Wallpack

5 Size

S	Small
M	Medium
L	Large

6 Style

1	Non-Cutoff
2	Full-Cutoff

7 CRI

8	>80
9	>90

8 Color

40	4000K
50	5000K
CS	Color Select

9 Color Select Designation

A	3500K, 4000K, 5000K
B	3000K, 4000K, 5000K
C	3000K, 3500K, 4000K, 5000K
D	TBD

10 Dimming

VDIM	0–10V

11 Additional Options

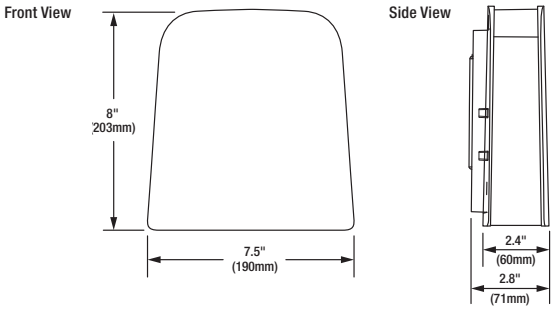
	No option
/MW	Microwave occupancy Sensor Installed
/EMRG-12	12W Emergency Battery Backup Installed

SYLVANIA Luminaires

Slim Wall Pack

Catalog #	Type
Project	
Notes	
Date	
Prepared by	

Dimensions



Product Features

The Wall Pack luminaires are environmentally preferable LED alternatives to traditional HID or Incandescent luminaires, offering up to 87% in energy savings. Ideal in place of traditional luminaires, or as new installations, the Wall Pack series is offered in four wattages/lumen packages for illuminating building exteriors, outdoor corridors, walkways, and stairwells.

The slim design of these luminaires is aesthetically pleasing and they are available with optional photo control. SYLVANIA luminaires assure optimum light engine performance for extended service and rated life (≥125,000 hours L_{70}).

Wattage Comparison Chart

Slim Wall Pack

Traditional Source	Traditional System Wattage	LED System Wattage	Energy Savings
23 W CFL	23	13	43%
100 W Inc	100	13	87%
150 W Inc	150	30	80%
50 W HPS	62	30	52%
70 W HPS	91	30	67%
70 W HPS	91	30	67%
70 W HPS	91	40	56%
100 W HPS	120	40	67%
100 W MH	130	40	69%
150 W HPS	170	60	65%
150 W MH	188	60	68%
175 W MH	210	60	71%

Specifications

Weight: UNV: 5.9 lbs (2.7 kg) 347V: 65 lbs (2.9 kg)

Construction: Two-piece cast aluminum alloy housing with powder coat paint finish and a glass lens. The standard color is bronze.

LED System: LED system with a life rating of ≥125,000 hours at L_{70} @25°C. Luminaire efficacy up to 121 LPW.

Electrical: Offered in 13, 30, 40, and 60 Watts, the luminaire is designed to operate through the 120-277 VAC universal voltage range (30 and 40 Watts in 347VAC). The LED driver has a 4kV inherent surge suppression and is a constant current device, meeting UL1310 and UL48 Class 2 with built-in over temperature protection. The fixture power factor is ≥90% and THD is ≤20%.

Color Characteristics: CRI>70; CCT of 4000K or 5000K.

Optics: Cutoff distribution with a flat tempered glass lens.

Options Available: Photocontrol (120V Only).

Installation: Luminaire mounts to exterior wall (knuckle and trunnion mount accessories available). Level included in back plate and luminaire can be mounted in any orientation.

Operating Temperature: -40°F to +104°F (-40°C to +40°C).

Listings: cULus listed to UL1598 standards for wet locations.

Warranty: Standard 5-year luminaire warranty (LEDLUM001).

Note: Specifications subject to change without notice. IES files available online.

c UL us LISTED · RoHS compliant · FC · DLC · DLC PREMIUM*

*See page 2 for DLC listings.

Ordering Guide

Item Number:

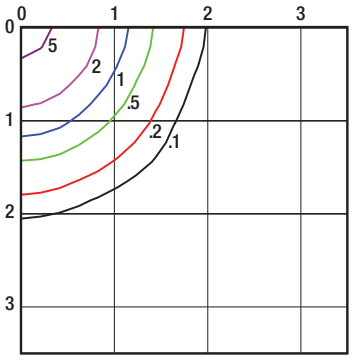
SLMWPK	XX	/	XXX	XXX	7	XX	/	CO	/	BZ	/	X
Product Name	Generation		Wattage (UNV)	Voltage	CRI	Color Temp (CCT)		Optics		Color/Finish		Options
SLMWPK	1A		013 = 13 Watts	UNV = 120-277V	7≥70	40 = 4000K		CO = Cutoff Distribution		BZ = Bronze		Blank = No Option
	2A		030 = 30 Watts	120 = 120V		50 = 5000K						P = Photocontrol (120V only)
			040 = 40 Watts	347 = 347V								
			060 = 60 Watts									
			Wattage (347V)									
			030 = 30 Watts									
			040 = 40 Watts									

SYLVANIA

Photometric Data

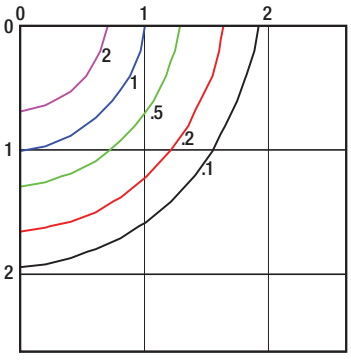
SLMWPK2A/030UNV750/CO

Isofootcandle Lines at 15' Mounting Height



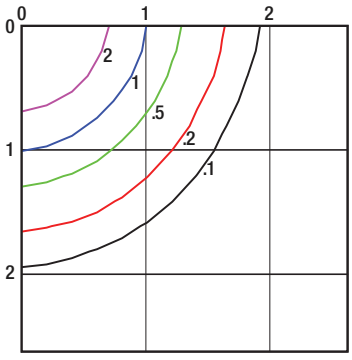
SLMWPK1A/040UNV750/CO (UNV/347V)

Isofootcandle Lines at 18' Mounting Height



SLMWPK2A/060UNV750/CO

Isofootcandle Lines at 20' Mounting Height



For other mounting heights apply the following multipliers:

Mounting Height	12'	15'	18'	20'	22'
Multiplier	1.56	1.00	0.69	0.56	0.46

Mounting Height	15'	18'	20'	22'	25'
Multiplier	1.44	1.00	0.81	0.67	0.52

Mounting Height	15'	18'	20'	22'	25'
Multiplier	1.78	1.23	1.00	0.83	0.64

Ordering Information

Item Number	Ordering Abbreviation	Power (W)	Input Voltage	CRI	Color Temp (CCT)	Distribution	Total Fixture Lumens	LPW*	DLC**	BUG Rating	Options	MTO***
74340	SLMWPK1A/013UNV740/CO/BZ	13	120-277V	>70	4000K	Cutoff	1400	113	Std	B1-U0-G1	–	
74341	SLMWPK1A/013UNV750/CO/BZ	13	120-277V	>70	5000K	Cutoff	1400	113	Std	B1-U0-G1	–	
74192	SLMWPK1A/030UNV740/CO/BZ	30	120-277V	>70	4000K	Cutoff	2800	92	Std	B1-U0-G1	–	
74195	SLMWPK1A/030UNV750/CO/BZ	30	120-277V	>70	5000K	Cutoff	2800	84	–	B1-U0-G1	–	
74193	SLMWPK1A/040UNV740/CO/BZ	40	120-277V	>70	4000K	Cutoff	4100	99	Std	B2-U0-G1	–	
74196	SLMWPK1A/040UNV750/CO/BZ	40	120-277V	>70	5000K	Cutoff	3900	98	Std	B2-U0-G1	–	
74194	SLMWPK1A/060UNV740/CO/BZ	60	120-277V	>70	4000K	Cutoff	5500	94	Std	B2-U0-G1	–	
74197	SLMWPK1A/060UNV750/CO/BZ	60	120-277V	>70	5000K	Cutoff	5100	83	–	B2-U0-G1	–	
74342	SLMWPK1A/013120740/CO/BZ/P	13	120V	>70	4000K	Cutoff	1400	113	Std	B1-U0-G1	Photocontrol	
74343	SLMWPK1A/013120750/CO/BZ/P	13	120V	>70	5000K	Cutoff	1400	113	Std	B1-U0-G1	Photocontrol	MTO
74204	SLMWPK1A/030120740/CO/BZ/P	30	120V	>70	4000K	Cutoff	2800	92	Std	B1-U0-G1	Photocontrol	MTO
74208	SLMWPK1A/040120750/CO/BZ/P	40	120V	>70	5000K	Cutoff	3900	98	Std	B2-U0-G1	Photocontrol	
74206	SLMWPK1A/060120740/CO/BZ/P	60	120V	>70	4000K	Cutoff	5500	94	Std	B2-U0-G1	Photocontrol	
74209	SLMWPK1A/060120750/CO/BZ/P	60	120V	>70	5000K	Cutoff	5100	83	–	B2-U0-G1	Photocontrol	
72966	SLMWPK1A/030347750/CO/BZ	30	347V	>70	5000K	Cutoff	3400	109	Std	B1-U0-G1	–	
72992	SLMWPK1A/040347750/CO/BZ	40	347V	>70	5000K	Cutoff	4300	104	Std	B2-U0-G1	–	
74381	SLMWPK2A/030UNV750/CO/BZ	30	120-277V	>70	5000K	Cutoff	3300	112	Prm	B1-U0-G1	–	
74380	SLMWPK2A/060UNV740/CO/BZ	60	120-277V	>70	4000K	Cutoff	7000	117	Prm	B2-U0-G1	–	
74382	SLMWPK2A/060UNV750/CO/BZ	60	120-277V	>70	5000K	Cutoff	7200	121	Prm	B2-U0-G1	–	
74384	SLMWPK2A/030120750/CO/BZ/P	30	120V	>70	5000K	Cutoff	3300	112	Prm	B1-U0-G1	Photocontrol	MTO
74383	SLMWPK2A/060120740/CO/BZ/P	60	120V	>70	4000K	Cutoff	7000	117	Prm	B2-U0-G1	Photocontrol	
74385	SLMWPK2A/060120750/CO/BZ/P	60	120V	>70	5000K	Cutoff	7200	121	Prm	B2-U0-G1	Photocontrol	MTO

*LPW per LM79 report.
**Prm for DLC Premium; Std for DLC Standard
***Made To Order
For further information and to learn more about utility rebates, contact your local SYLVANIA sales representative.

Accessories and Replacement Parts

Item Number	Ordering Abbreviation	Item Description
74392	SLMWPK1A/JBOX/BZ	Junction Box, Bronze Finish
74393	SLMWPK1A/TRUNNION/BZ	Junction Box Trunnion Mount, Bronze Finish
74394	SLMWPK1A/KNUCKLE/BZ	Junction Box Knuckle Mount, Bronze Finish

LEDVANCE LLC
200 Ballardvale Street
Wilmington, MA 01887 USA
Phone 1-800-LIGHTBULB (1-800-544-4828)
www.sylvania.com

VANLED40N/PCS

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
208V:	N/A	Color Accuracy:	78 CRI
240V:	N/A	L70 Lifespan:	100000
277V:	N/A	Lumens:	5177
Input Watts:	39W	Efficacy:	132 LPW
Efficiency:	N/A		

Technical Specifications

Listings

UL Listing:

Suitable for wet locations.

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: P3TDZ3HM

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.

Electrical

Driver:

Class 2, Constant Current, 100-277V, 50-60Hz, 1050mA

THD:

6.1% at 120V, 10.1% at 277V

Photocell:

120V Swivel Photocell Included. Photocell is only compatible with 120V.

Construction

Maximum Ambient Temperature:

SuitableFor use in 40°C (104°F) ambient temperatures

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, and contain 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.

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 C78.377-2015.

Replacement:

Replaces up to 100W Metal Halide.

Other

Warranty:

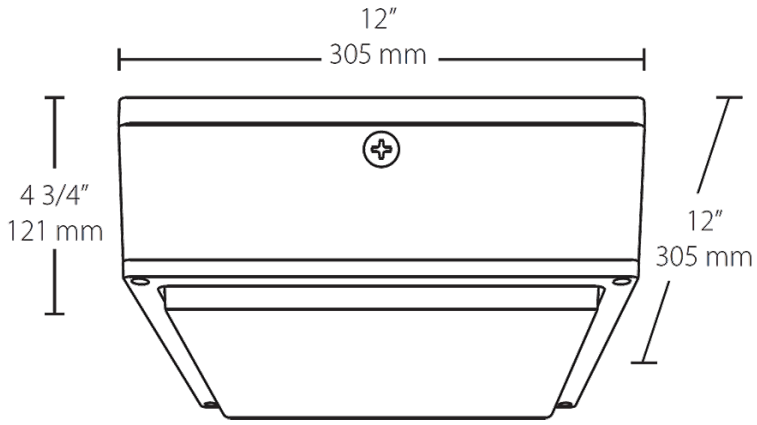
RAB warrants that our LED products will be free from defects in materials and workmanship for a period of five (5) years from the date of delivery to the end user, including coverage of light output, color stability, driver performance and fixture finish. See our full warranty

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.

VANLED40N/PCS

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	Watts	Color Temp	Lens	Motion Sensor & Finish	Driver Options	Photocell Options
VANLED						
	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 (not available w/ D10 models) **MSW** = White w/ SMS500 mini-sensor (not available w/ D10 models)	**Blank** = On/Off driver **/D10** = 0-10V Dimming (not available for 10w) **/480** = 480V (not available for 10W or 20W) **/480/D10** = 480V w/ 0-10V dimming (not available for 10W or 20W)	**/PCS** = 120V Swivel **/PCS2** = 277V Swivel **/PCS4** = 480V Swivel

A19-6-E26-927-DIM

RAB | Residential

Project:	Type:	Prepared By:	Date:

UPC: 019813748153

Features and Benefits

- Produces rich and vibrant colors >90CRI
- Energy efficient replacement for incandescent and halogen lamps
- Constructed from durable plastic which lowers risk of breakage
- Rated for use in enclosed and open fixtures in dry or damp locations
- Frosted lens produces smooth diffuse light
- Longer lifespan compared to legacy equivalents minimizes replacement and maintenance costs
- ENERGY STAR Compliant, Title 20 Compliant
- Dimmable with common dimmer types (check compatibility list)

Technical Specifications

Performance

Product Type:
A-Line

Input Wattage:
6W

Typical Lumen Output:
450

Efficacy:
75 lm/W

Color Temperature:
2700K Soft White

CRI:
90

L70 Lifespan:
25,000 Hours

Dimmable:
Yes, down to 10%

Construction

Bulb Shape:
A19

Base Type:
E26

Beam Angle:
230°

For Use Outdoors in Open Fixtures:
No

Other

Equivalency:
40W Incandescent

Warranty (Years):
RAB warrants that our LED products will be free from defects in materials and workmanship for a period of four (4) 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 rablighting.com/warranty.

Electrical

Power Factor:
0.9

Operating Temperature:
-20°C - 45°C

Input Voltage:
120V

Technical Specifications (continued)

Electrical

Operating Frequency:

60 Hz

Electrical Characteristics

Flicker:

<30%

Compliance

UL Listed:

Yes

ENERGY STAR V2.0:

This product is ENERGY STAR® Version 2.0 Certified

Energy Star ID:

2330066

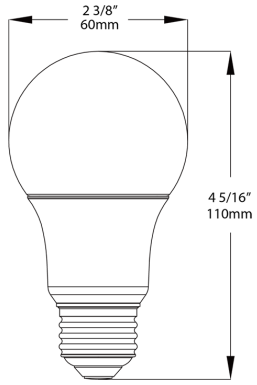
CEC Status:

Lawful for sale in California

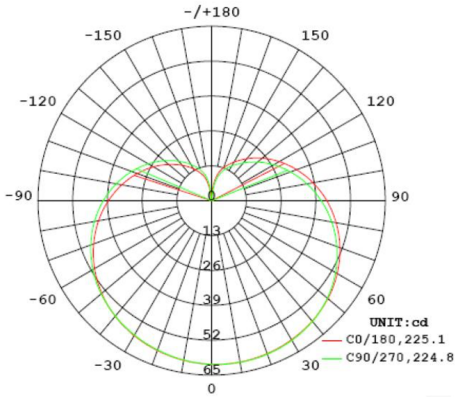
Case and Pallet Dimensions

	QTY	LENGTH (in)	WIDTH (in)	HEIGHT (in)
CASE	12	10	7.6	5.1
PALLET	3456	45.4	40	46.1

Dimension



Light Distribution



A19-9-E26-927-DIM

RAB | Residential

Project:	Type:	Prepared By:	Date:

UPC: 019813748054

Features and Benefits

- Produces rich and vibrant colors >90CRI
- Energy efficient replacement for incandescent and halogen lamps
- Constructed from durable plastic which lowers risk of breakage
- Rated for use in enclosed and open fixtures in dry or damp locations
- Frosted lens produces smooth diffuse light
- Longer lifespan compared to legacy equivalents minimizes replacement and maintenance costs
- ENERGY STAR Compliant, Title 20 Compliant
- Dimmable with common dimmer types (check compatibility list)

Technical Specifications

Performance

Product Type:
A-Line

Input Wattage:
9W

Typical Lumen Output:
800

Efficacy:
84 lm/W

Color Temperature:
2700K Soft White

CRI:
90

L70 Lifespan:
25,000 Hours

Dimmable:
Yes, down to 10%

Construction

Bulb Shape:
A19

Base Type:
E26

Beam Angle:
230°

For Use Outdoors in Open Fixtures:
No

Other

Equivalency:
60W Incandescent

Warranty (Years):
RAB warrants that our LED products will be free from defects in materials and workmanship for a period of four (4) 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 rablighting.com/warranty.

Electrical

Power Factor:
0.9

Operating Temperature:
-20°C - 45°C

Input Voltage:
120V

Technical Specifications (continued)

Electrical

Operating Frequency:

60 Hz

Electrical Characteristics

Flicker:

<30%

Compliance

UL Listed:

Yes

ENERGY STAR V2.0:

This product is ENERGY STAR® Version 2.0 Certified

Energy Star ID:

2330069

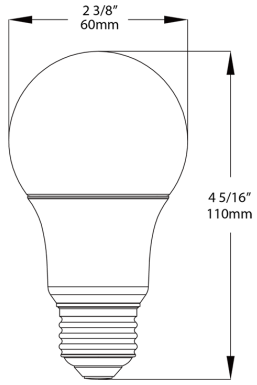
CEC Status:

Lawful for sale in California

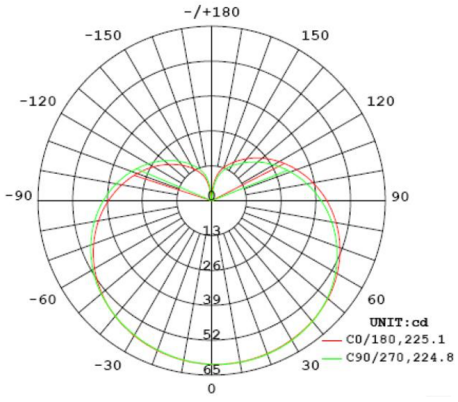
Case and Pallet Dimensions

	QTY	LENGTH (in)	WIDTH (in)	HEIGHT (in)
CASE	12	10	7.6	5.2
PALLET	3456	45.4	40	47.1

Dimension



Light Distribution



A19-13-E26-827-DIM

RAB | Residential

Project:	Type:	Prepared By:	Date:

UPC: 019813834023

Features and Benefits

Energy efficient replacement for incandescent and halogen lamps

Constructed from durable plastic which lowers risk of breakage

Rated for use in enclosed and open fixtures in dry or damp locations (>15W A19 is Open fixture rated)

Frosted lens produces smooth diffuse light

Longer lifespan compared to legacy equivalents minimizes replacement and maintenance costs

ENERGY STAR Compliant

Dimmable with common dimmer types (check compatibility list)

Technical Specifications

Performance

Product Type:
A-Line

Input Wattage:
13.5W

Typical Lumen Output:
1100

Efficacy:
82 lm/W

Color Temperature:
2700K Soft White

CRI:
80

L70 Lifespan:
15,000 Hours

Dimmable:
Yes, down to 10%

Construction

Bulb Shape:
A19

Base Type:
E26

Beam Angle:
230°

For Use Outdoors in Open Fixtures:
No

Other

Equivalency:
75W Incandescent

Warranty (Years):
RAB warrants that our LED products will be free from defects in materials and workmanship for a period of three (3) 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 rablighting.com/warranty.

Electrical

Power Factor:
0.7

Operating Temperature:
-20°C - 45°C

Input Voltage:
120V

Technical Specifications (continued)

Electrical

Operating Frequency:

60 Hz

Electrical Characteristics

Input Current @ 120V:

183mA

Compliance

UL Listed:

Yes

ENERGY STAR V2.0:

This product is ENERGY STAR® Version 2.0 Certified

Energy Star Model Number:

A10011

Energy Star ID:

2357498

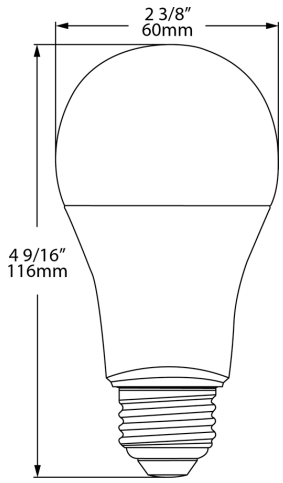
CEC Status:

Not lawful for sale in California

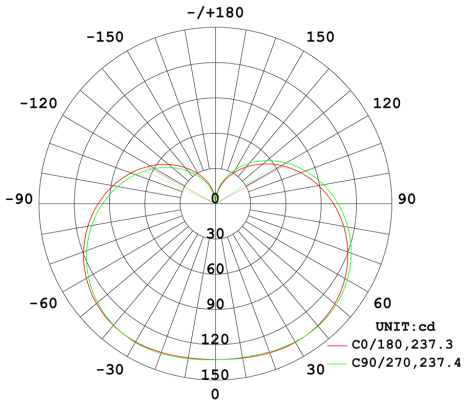
Case and Pallet Dimensions

	QTY	LENGTH (in)	WIDTH (in)	HEIGHT (in)
CASE	12	5.2	5.5	15.4
PALLET	2016	48.1	46.9	39.8

Dimension



Light Distribution



SINCE 1945 KEYSTONE | SMARTDRIVE LED PLUG & PLAY WITH BALLAST

KT-LED8T8-24GC-840-S

T8 LED LAMP

DESCRIPTION

8W T8 LED | 4000K | >80 CRI | High Efficiency | Ballast Compatible

RoHS Compliant | 5 YEAR WARRANTY

LAMP TYPE: Linear
BULB TYPE: T8 LED
BASE TYPE: G13 (Medium Bi-Pin)
WATTAGE: 8W
COLOR TEMPERATURE: 4000K
COLOR RENDERING INDEX (CRI): >80
WARRANTY: 5 Years

PRODUCT FEATURES

- **Compatible with Most Instant and Program Start Electronic T8 Ballasts, Contact Keystone for Ballast Compatibility List**
- Direct Replacement for F17T8 Fluorescent Lamps
- UL Listed; Listed on DLC QPL
- 50,000+ Hour Lifetime
- Environmentally Friendly: No Mercury Used
- Instant Startup
- Frosted Lens Eliminates Pixelation
- Operating Temperature: -20ºC/-4ºF to 45ºC/113ºF
- 100+ Lumens per Watt (Bare Lamp Efficacy)
- Suitable for Dry and Damp Locations
- Improved Lamp Durability with Shatterproof Coated Glass
- NSF Listed: NSF/ANSI Standard 2 - Food Equipment

OPERATING SPECIFICATIONS

ELECTRICAL AND PERFORMANCE CHARACTERISTICS

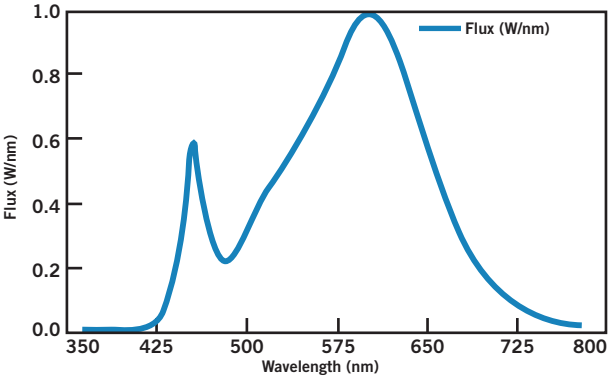
Input Voltage	CRI	Bare Lamp Wattage	Nominal Lamp Lumens	System Wattage*			Initial Lumens*			Beam Angle	Nominal Bare Lamp Efficacy	Power Factor	Max. THD
				0.78BF	0.88BF	1.18BF	0.78BF	0.88BF	1.18BF				
Ballast Dependent	>80	8W	1150 lm	9.3W	10.4W	14.3W	1110 lm	1235 lm	1610 lm	220º	127.0	>0.9	20%

** Nominal values. Actual values may vary depending on electronic ballast used.*

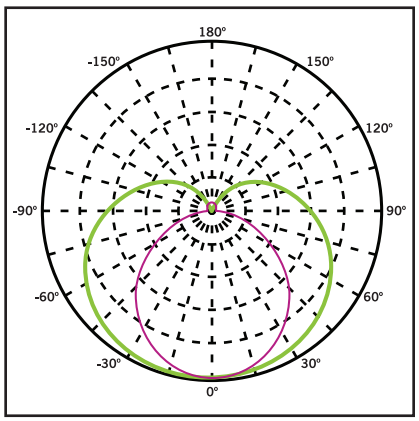
RATED LIFE

L70 (Hours)	50,000

SPECTRAL DISTRIBUTION



POLAR CANDELA DISTRIBUTION



Maximum Candela = 1248.55
Located at Horizontal Angle = 0, Vertical Angle 0

1. **Violet** Vertical Plane through Horizontal Angles (90-270)
2. **Green** Vertical Plane through Horizontal Angles (0-180)

Beam Angle: 220º

Visible Light Area: 325º

Keystone Technologies • 1390 Welsh Road, North Wales, PA 19454 • Phone (800) 464-2680 • Fax (888) 966-0556 • **www.keystonetech.com**

SINCE 1945 KEYSTONE | SMARTDRIVE LED PLUG & PLAY WITH BALLAST

KT-LED8T8-24GC-840-S

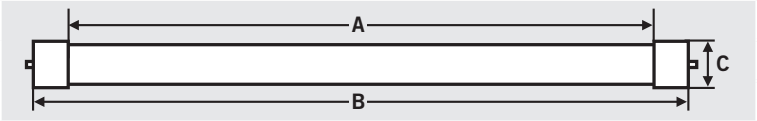
T8 LED LAMP

WIRING

Plug and Play: Simply replace the existing fluorescent lamp with Keystone Smart Drive LED lamp. No changes to the existing fluorescent ballast wiring needed. For ballast compability questions, please contact Keystone.

PHYSICAL CHARACTERISTICS

LAMP DIMENSIONS



A (Illuminated Length)	20.68"
B (Body Length)	23.19"
C (Diameter)	1.00"

NOMINAL LENGTH: 24" **BASE TYPE:** G13 (Medium Bi-Pin)

ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KT-LED8T8-24GC-840-S-CP	Carton Pack (Egg Crate Packaging)	25	Quick Ship
KT-LED8T8-24GC-840-S-DP	Distributor Pack (Individual Cartons)	20	Quick Ship

CATALOG NUMBER BREAKDOWN

KT-LED8T8-24GC-840-S-CP

KT	LED	8	T8	24	GC	840	S	CP
Keystone Technologies	LED Lamp	Wattage	Lamp Type	Nominal Length (Inches)	Shatterproof Coated Glass	800 Series	Color Temp.	Smart Drive Series	Packaging Style

SINCE 1945 KEYSTONE | SMARTDRIVE LED PLUG & PLAY WITH BALLAST

KT-LED15T8-48GC-840-S

T8 LED LAMP

DESCRIPTION

15W T8 LED | 4000K | >80 CRI | High Efficiency | Ballast Compatible

DLC | NSF | cULus LISTED | RoHS Compliant | 5 YEAR WARRANTY

LAMP TYPE: Linear
BULB TYPE: T8 LED
BASE TYPE: G13 (Medium Bi-Pin)
WATTAGE: 15W
COLOR TEMPERATURE: 4000K
COLOR RENDERING INDEX (CRI): >80
WARRANTY: 5 Years

PRODUCT FEATURES

- **Compatible with Most Instant and Program Start Electronic T8 Ballasts, Contact Keystone for Ballast Compatibility List**
- Direct Replacement for the Following Fluorescent Lamps: F32T8/32W, F32T8/30W, F32T8/28W, F32T8/25W
- UL Listed; Listed on DLC Qualified Product List
- 50,000+ Hour Lifetime
- Environmentally Friendly: No Mercury Used
- Instant Startup
- Frosted Lens Eliminates Pixelation
- Operating Temperature: -20ºC/-4ºF to 45ºC/113ºF
- 110+ Lumens per Watt (Bare Lamp Efficacy)
- Suitable for Dry and Damp Locations
- Improved Lamp Durability with Shatterproof Coated Glass
- NSF Listed: NSF/ANSI Standard 2 - Food Equipment

OPERATING SPECIFICATIONS

ELECTRICAL AND PERFORMANCE CHARACTERISTICS

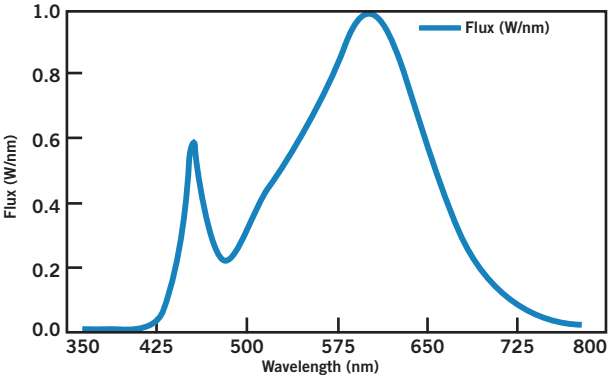
Input Voltage	CRI	Bare Lamp Wattage	Nominal Lamp Lumens	System Wattage*			Initial Lumens*			Visisble Light Area	Nominal Bare Lamp Efficacy	Power Factor	Max. THD
				0.78BF	0.88BF	1.18BF	0.78BF	0.88BF	1.18BF				
Ballast Dependent	>80	15W	2200 lm	15.8W	17.5W	24.1W	1965 lm	2185 lm	2825 lm	325º	147	>0.9	20%

** Nominal values. Actual values may vary depending on electronic ballast used.*

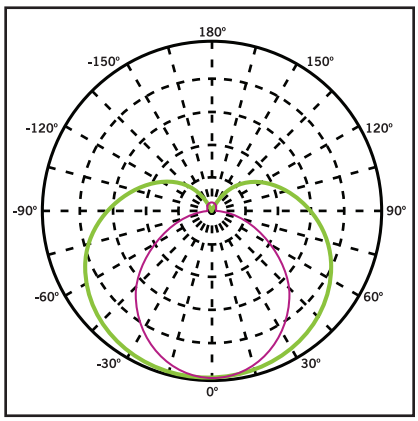
RATED LIFE

L70 (Hours)	50,000

SPECTRAL DISTRIBUTION



POLAR CANDELA DISTRIBUTION



Maximum Candela = 1248.55
Located at Horizontal Angle = 0, Vertical Angle 0

1. **Violet** Vertical Plane through Horizontal Angles (90-270)
2. **Green** Vertical Plane through Horizontal Angles (0-180)

Beam Angle: 220º

Visible Light Area: 325º

Keystone Technologies • 1390 Welsh Road, North Wales, PA 19454 • Phone (800) 464-2680 • Fax (888) 966-0556 • **www.keystonetech.com**

SINCE 1945 KEYSTONE | SMARTDRIVE LED PLUG & PLAY WITH BALLAST

KT-LED15T8-48GC-840-S

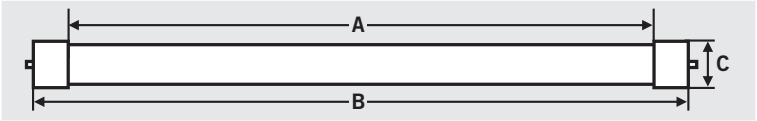
T8 LED LAMP

WIRING

Plug and Play: Simply replace the existing fluorescent lamp with Keystone Smart Drive LED lamp. No changes to the existing fluorescent ballast wiring needed. For ballast compability questions, please contact Keystone.

PHYSICAL CHARACTERISTICS

LAMP DIMENSIONS



A (Illuminated Length)	44.70”
B (Body Length)	47.15”
C (Diameter)	1.00”

NOMINAL LENGTH: 48” **BASE TYPE:** G13 (Medium Bi-Pin)

ORDERING INFORMATION

ORDER CODE	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KT-LED15T8-48GC-840-S-CP	Carton Pack (Egg Crate Packaging)	25	Quick Ship
KT-LED15T8-48GC-840-S-DP	Distributor Pack (Individual Cartons)	20	Quick Ship

CATALOG NUMBER BREAKDOWN

KT-LED15T8-48GC-840-S-CP

KT	LED15T8	48	GC	840	S	CP
Keystone Technologies	LED Lamp	Wattage	Lamp Type	Nominal Length (Inches)	Shatterproof Coated Glass	800 Series	Color Temp.	Smart Drive Series	Packaging Style

Lay-In and Troffer Support Clip, Straight/Upturned Lip – 515A

- Provides a positive method for securing troffers, lay-ins, and air diffusers
- Four clips per fixture required by code

Part Number	515A
Material	Spring Steel
Finish	GEOMET® 321
Complies With	NEC® Article 410.36
Certifications	UL
Standard Packaging Quantity	100 pc
UPC	78285668540

No load rating, for positioning only.

SINCE 1945
KEYSTONE
LIGHT MADE EASY

KT-EMRG-LED-12-1200-K1
CONSTANT WATTAGE LED EMERGENCY BACK-UP

DESCRIPTION

LED Emergency Back-Up Driver Kit | 12W Output | 120-277V Input

- **DRIVER TYPE:** Constant Wattage LED Emergency
- **MAX. OUTPUT POWER:** 12W
- **INPUT VOLTAGE:** 120-277Vac ±10%
- **OUTPUT VOLTAGE:** 12~41 Vdc
- **OUTPUT CURRENT:** 1000mA-200mA
- **WARRANTY:** 5 Years

PRODUCT FEATURES

- Drives Dedicated LED Load (Included) at 12W for a Minimum of 90 Minutes
- Meets FCC Part 15 (Class B) Consumer Limits
- Short Circuit Overload and Open Load Protection
- Type 1 Outdoor, Suitable for Dry and Damp Locations
- Evaluated to UL 924 Standards
- Operating Temperature: 32ºF/0ºC to 122ºF/50ºC
- Input Frequency: 50/60 Hz
- Test Switch/Charging Indicator Light
- Battery Pack with Quick Connect; NiCd
- Battery Capacity: 3000mAh

SPECIFICATIONS

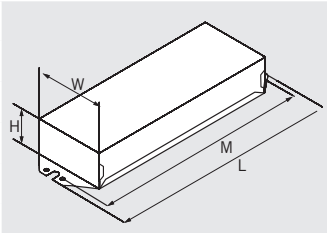
ELECTRICAL SPECIFICATIONS

	INPUT CHARACTERISTICS			OUTPUT CHARACTERISTICS		
Family	**Input Voltage**	**Power Factor**	**Max. Current**	**Max. Output Power**	**Rated Output Current**	**Output Voltage**
12W	120-277Vac	≥0.5	0.07A @ 120V	12W	1000mA-200mA	12~41Vdc

Emergency pack designed to deliver 12W to a constant current LED load. Approximate output is 1200 lumens assuming a nominal minimum efficacy of 100lm/W.

MECHANICAL SPECIFICATIONS

CASE DIMENSIONS



LENGTH	6.46”
WIDTH	1.37”
HEIGHT	1.00”
MOUNTING	6.00”
CASE STYLE	L7
CASE MATERIAL	METAL

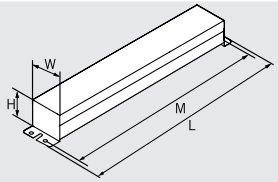
STANDARD LEAD LENGTHS*

WHITE	12”
BLACK	12”
WHITE/BLACK	12”
RED	24”
BLUE	24”
BROWN	24”

*Consult Keystone for special lead length requirements.

Lead wires are 18 AWG 105ºC/600V.

BATTERY SIZE



LENGTH	9.45”
WIDTH	2.23”
HEIGHT	1.02”
MOUNTING	8.91”

MODULE SPECIFICATIONS

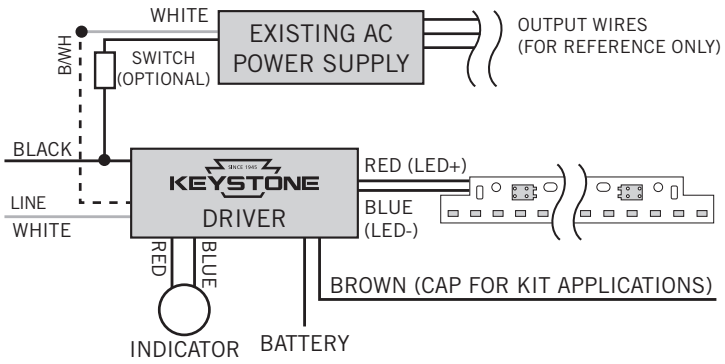
LENGTH	8.00”	**No. of LEDs**	24
WIDTH	0.70”	**Color Temperature**	5000K

SINCE 1945
KEYSTONE
LIGHT MADE EASY

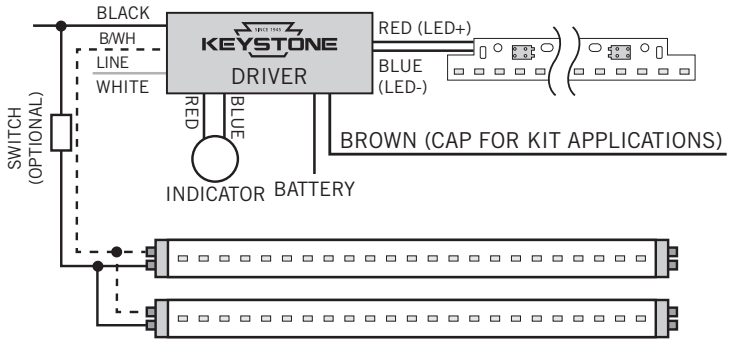
KT-EMRG-LED-12-1200-K1
CONSTANT WATTAGE LED EMERGENCY BACK-UP

WIRING DIAGRAMS

1. KIT WIRING DIAGRAM WITH EXISTING POWER SUPPLY



2. KIT WIRING DIAGRAM WITH DIRECT DRIVE LED TUBE FIXTURE



ORDERING INFORMATION

ORDER CODE	DESCRIPTION	PACKAGING STYLE	PACK QTY.	ITEM STATUS
KT-EMRG-LED-12-1200-K1-IP	LED Emergency Driver Kit with Battery and 0.7" x 8" 1200 lumen LED Module	Individually Packaged	1	Active

CATALOG NUMBER BREAKDOWN

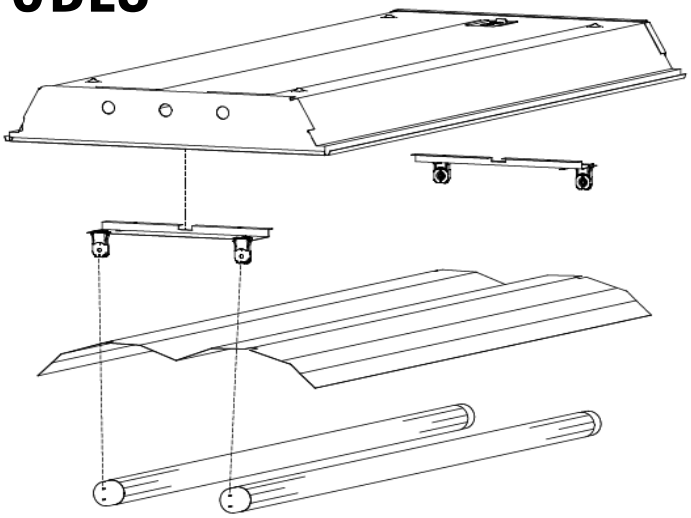
KT-EMRG-LED-12-1200-K1

Keystone Technologies	Emergency Back-Up Driver	LED Driver	Wattage Family	Nominal Lumen Output	Kit

TECHBRITE
SAVING ENERGY IN THE BEST POSSIBLE LIGHT

PROJECT NAME:
NOTES:
PART NUMBER:
DATE:

RETRO TROFFER—LED TUBES



PRODUCT DESCRIPTION:

Over 1 million kits sold! The LED Tube Retro Troffer is the easiest to install retro kit in the industry. The TechBrite LED Tube Retro Kit includes all of the items needed convert an existing troffer fixture to a UL approved retrofitted fixture. The kit contains sockets rated for direct wire voltage, ensuring a proper, safe installation with direct voltage TLEDs or ballast driven TLEDs. The aluminum reflector provides increased lumen output and covers the line/ load electrical connection. The TechBrite LED Tube Retro Troffer Kit is a fast, easy, and economical solution to upgrading existing troffer fixtures.

FEATURES:

- Fits most prismatic lens troffers (2x2 or 2x4)
- Available in 2x2 & 2x4
- Pinch fit reflector for quick installation
- Kit includes: reflector, sockets, mounting brackets, mounting screws, and LED tubes (optional)
- Limited warranty: 5 years on luminaire

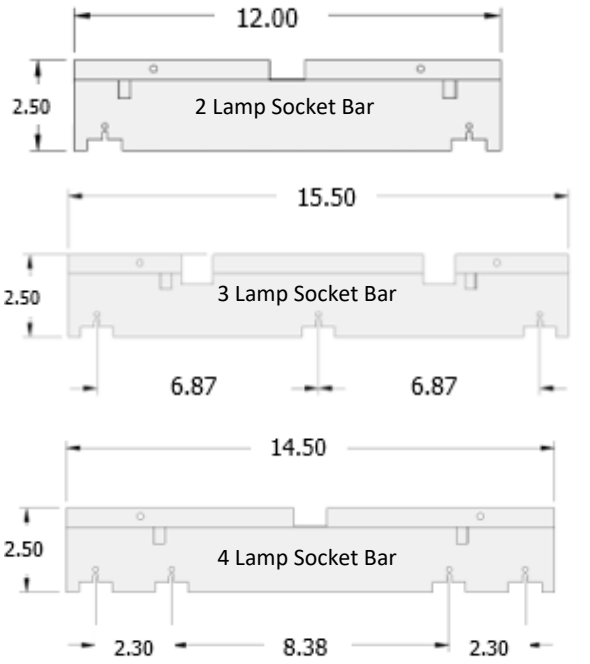
PERFORMANCE SPECIFICATION:

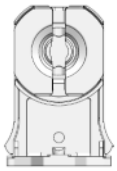
Lumens	6 Lamp Max—2x4 & 2x2
Watts	2x4=132w Max / 2x2=54w Max
LPW	See TLED Specification
Color	See TLED Specification
CRI	See TLED Specification
L70	See TLED Specification
L85	See TLED Specification
Max Ambient Temp	See TLED Specification
Min Ambient Temp	See TLED Specification
Dimming	See TLED Specification
Driver Voltage	See TLED Specification
Chip	See TLED Specification
Driver	See TLED Specification

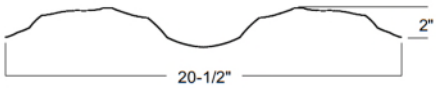
Retro Troffer—LED Tubes

Commercial/Industrial

DIMENSIONS:







Reflector Profile

Socket Bar Profile

ORDERING CHART:

Series		Length		Width		# of Tubes		Type		Socket Type		Reflector		Wiring*	
R	Retro	**2**	2 Foot	**21**	2X2	**2**	2 lamp	**SS**	LED Tubes	**X**	Shunted	**WXX**	White	**00P0**	Prewired
		4	4 Foot	**21**	2X4	**3**	3 lamp			**U**	Unshunted	**MXX**	Miro 4	**0000**	No Wiring
						4	4 lamp								
						6	6 lamp								

* Prewired includes: wire & disconnect
* No wiring includes: disconnect & no wires

ADDER:

Lamp Type	
BLANK	Wired single end with unshunted sockets
WOE	Wired opposing ends with shunted sockets

Retro Troffer—LED Tubes

Commercial/Industrial

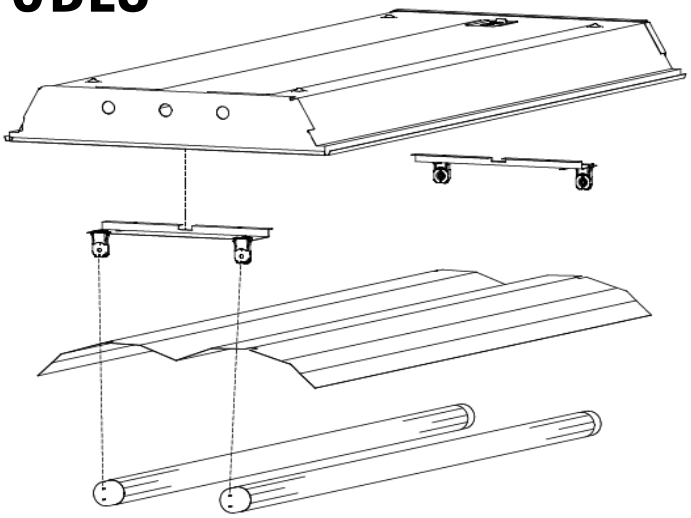
FREQUENTLY ORDERED PART NUMBERS:

Part Number	Description	Dimensions	Weight
R2212SSUWXX00P0	2' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	1.31 (lbs)
R2213SSUWXX00P0	2' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	1.44 (lbs)
R2214SSUWXX00P0	2' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	1.44 (lbs)
R2212SSUMXX00P0	2' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	1.31 (lbs)
R2213SSUMXX00P0	2' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	1.44 (lbs)
R2214SSUMXX00P0	2' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	1.44 (lbs)
R4212SSUWXX00P0	4' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	2.18 (lbs)
R4213SSUWXX00P0	4' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	2.30 (lbs)
R4214SSUWXX00P0	4' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	2.30 (lbs)
R4212SSUMXX00P0	4' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	2.18 (lbs)
R4213SSUMXX00P0	4' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	2.30 (lbs)
R4214SSUMXX00P0	4' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	2.30 (lbs)

TECHBRITE
SAVING ENERGY IN THE BEST POSSIBLE LIGHT

PROJECT NAME:
NOTES:
PART NUMBER:
DATE:

RETRO TROFFER—LED TUBES



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FEATURES:

- Fits most prismatic lens troffers (2x2 or 2x4)
- Available in 2x2 & 2x4
- Pinch fit reflector for quick installation
- Kit includes: reflector, sockets, mounting brackets, mounting screws, and LED tubes (optional)
- Limited warranty: 5 years on luminaire

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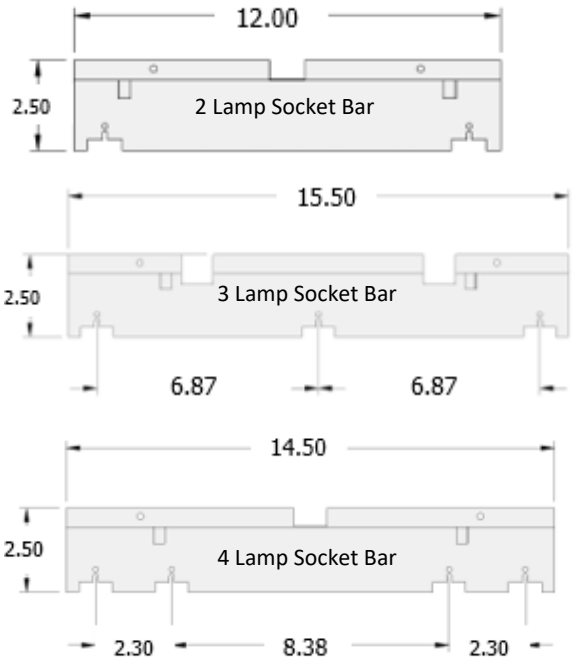
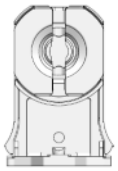
LPW	See TLED Specification
Color	See TLED Specification
CRI	See TLED Specification
L70	See TLED Specification
L85	See TLED Specification
Max Ambient Temp	See TLED Specification
Min Ambient Temp	See TLED Specification
Dimming	See TLED Specification
Driver Voltage	See TLED Specification
Chip	See TLED Specification
Driver	See TLED Specification

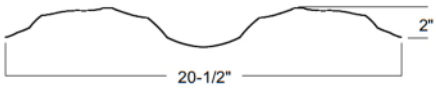
Retro Troffer—LED Tubes

Commercial/Industrial

DIMENSIONS:







Reflector Profile

Socket Bar Profile

ORDERING CHART:

Series		Length		Width		# of Tubes		Type		Socket Type		Reflector		Wiring*	
R	Retro	**2**	2 Foot	**21**	2X2	**2**	2 lamp	**SS**	LED Tubes	**X**	Shunted	**WXX**	White	**00P0**	Prewired
		4	4 Foot	**21**	2X4	**3**	3 lamp			**U**	Unshunted	**MXX**	Miro 4	**0000**	No Wiring
						4	4 lamp								
						6	6 lamp								

* Prewired includes: wire & disconnect
* No wiring includes: disconnect & no wires

ADDER:

Lamp Type	
BLANK	Wired single end with unshunted sockets
WOE	Wired opposing ends with shunted sockets

Retro Troffer—LED Tubes

Commercial/Industrial

FREQUENTLY ORDERED PART NUMBERS:

Part Number	Description	Dimensions	Weight
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R2213SSUMXX00P0	2' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	1.44 (lbs)
R2214SSUMXX00P0	2' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	1.44 (lbs)
R4212SSUWXX00P0	4' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	2.18 (lbs)
R4213SSUWXX00P0	4' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	2.30 (lbs)
R4214SSUWXX00P0	4' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	2.30 (lbs)
R4212SSUMXX00P0	4' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	2.18 (lbs)
R4213SSUMXX00P0	4' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	2.30 (lbs)
R4214SSUMXX00P0	4' Retro Troffer - LED Tubes	See Drawing on Page 2 (inches)	2.30 (lbs)

APPENDIX D
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 E
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.