



Legal Department

American Electric Power
1 Riverside Plaza
Columbus, OH 43215-2373
AEP.com

March 19, 2014

Chairman Todd Snitchler
Ohio Power Siting Board
Public Utilities Commission of Ohio
180 East Broad Street
Columbus, OH 43215-3793

Yazen Alami
Regulatory Services
(614) 716-2920 (P)
(614) 716-2950 (F)
yalami@aep.com

Re: **In the Matter of the Application of**)
E I Dupont De Nemour)
and Ohio Power Company) **Case No. 14-0396-EL-EEC**
for Approval of a Special Arrangement)
Agreement with a Mercantile Customer)

Dear Chairman Snitchler,

Attached please find the Joint Application of Ohio Power Company (OPCo) and mercantile customer E I Dupont De Nemour for approval of a Special Arrangement of the commitment of energy efficiency/peak demand reduction (EE/PDR) resources toward compliance with the statutory benchmarks for 2014.

Amended Substitute Senate Bill 221 sets forth in R.C. 4928.66 EE/PDR benchmarks that electric distribution utilities shall be required to meet or exceed. The statute allows utilities to include EE/PDR resources committed by mercantile customers for integration into the utilities programs to be counted toward compliance with a utility's EE/PDR benchmarks. The statute also enables the Commission to approve special arrangements for mercantile customers that commit EE/PDR resources to be counted toward compliance with EE/PDR benchmarks.

The Commission's Order in Case No. 10-834-EL-EEC, established a streamlined process to expedite review of these special arrangements by developing a sample application process for parties to follow for consideration of such programs implemented during the prior three calendar years. Attached is OPCo's version of that application and accompanying affidavit. Any confidential information referenced in the Joint Application has been provided to the Commission Staff for filing in Commission Docket 10-1799-EL-EEC, under a request for protective treatment. OPCo respectfully requests that the Commission treat the two cases as associated dockets.

Cordially,

/s/ Yazen Alami
Yazen Alami

Attachments



Case No.: 14-0396-EL-EEC

Mercantile Customer: E I DUPONT DE NEMOUR

Electric Utility: Ohio Power

Program Title or Description: AEP Ohio Business Incentives for Energy Efficiency: Self Direct Program

Rule 4901:1-39-05(F), Ohio Administrative Code (O.A.C.), permits a mercantile customer to file, either individually or jointly with an electric utility, an application to commit the customer's existing demand reduction, demand response, and energy efficiency programs for integration with the electric utility's programs. The following application form is to be used by mercantile customers, either individually or jointly with their electric utility, to apply for commitment of such programs in accordance with the Commission's pilot program established in Case No. [10-834-EL-POR](#)

Completed applications requesting the cash rebate reasonable arrangement option (Option 1) in lieu of an exemption from the electric utility's energy efficiency and demand reduction (EEDR) rider will be automatically approved on the sixty-first calendar day after filing, unless the Commission, or an attorney examiner, suspends or denies the application prior to that time. Completed applications requesting the exemption from the EEDR rider (Option 2) will also qualify for the 60-day automatic approval so long as the exemption period does not exceed 24 months. Rider exemptions for periods of more than 24 months will be reviewed by the Commission Staff and are only approved up the issuance of a Commission order.

Complete a separate application for each customer program. Projects undertaken by a customer as a single program at a single location or at various locations within the same service territory should be submitted together as a single program filing, when possible. Check all boxes that are applicable to your program. For each box checked, be sure to complete all subparts of the question, and provide all requested additional information. Submittal of incomplete applications may result in a suspension of the automatic approval process or denial of the application.

Any confidential or trade secret information may be submitted to Staff on disc or via email at ee-pdr@puc.state.oh.us.

Section 1: Company Information

Name: E I DUPONT DE NEMOUR

Principal address: 800 Dupont Road, Circleville, OH 43113

Address of facility for which this energy efficiency program applies: 500 Dupont Dr, Circleville, Oh 43113-1159

Name and telephone number for responses to questions:

Jonathan Yee, E I Dupont De Nemour, (740) 474-0576

Electricity use by the customer (check the box(es) that apply):

- ☒ The customer uses more than seven hundred thousand kilowatt hours per year at our facility. (Please attach documentation.)

See Confidential and Proprietary Attachment 4 – Calculation of Rider Exemption and UCT which provides the facility consumption for the last three years, benchmark kWh, and the last 12 months usage.

- ☐ The customer is part of a national account involving multiple facilities in one or more states. (Please attach documentation.) When checked, see Attachment 6 – Supporting Documentation for a listing of the customer's name and service addresses of other accounts in the AEP Ohio service territory.

Section 2: Application Information

A) The customer is filing this application (choose which applies):

- ☐ Individually, on our own.
- ☒ Jointly with our electric utility.

B) Our electric utility is: Ohio Power Company

The application to participate in the electric utility energy efficiency program is "Confidential and Proprietary Attachment 3 – Self Direct Program Project Completed Application."

C) The customer is offering to commit (choose which applies):

- ☐ Energy savings from our energy efficiency program. (Complete Sections 3, 5, 6, and 7.)
- ☐ Capacity savings from the customer's response/demand reduction program. (Complete Sections 4, 5, 6, and 7.)
- ☒ Both the energy savings and the demand reduction from the customer's energy efficiency program. (Complete all sections of the Application.)

Section 3: Energy Efficiency Programs

A) The customer's energy efficiency program involves (choose whichever applies):

- ☐ Early replacement of fully functioning equipment with new equipment. (Provide the date on which the customer replaced fully functioning equipment, and the date on which the customer would have replaced such equipment if it had not been replaced early. Please include a brief explanation for how the customer determined this future replacement date (or, if not known, please explain why this is not known)).
- ☒ Installation of new equipment to replace equipment that needed to be replaced. The customer installed new equipment on the following date(s): 12/31/2012
- ☐ Installation of new equipment for new construction or facility expansion. The customer installed new equipment on the following date(s):
- ☐ Behavioral or operational improvement.

B) Energy savings achieved/to be achieved by your energy efficiency program:

- 1) If you checked the box indicating that your project involves the early replacement of fully functioning equipment replaced with new equipment, then calculate the annual savings [(kWh used by the original equipment) - (kWh used by new equipment) = (kWh per year saved)]. Please attach your calculations and record the results below:

Annual savings: kWh

- 2) If you checked the box indicating that you installed new equipment to replace equipment that needed to be replaced, then calculate the annual savings [(kWh used by less efficient new equipment) - (kWh used by the higher efficiency new equipment) = (kWh per year saved)]. Please attach your calculations and record the results below:

Unit Quantity (watts) = Existing (watts x units) - Installed (watts x units)

kWh Reduction (Annual Savings) = Unit Quantity x (Deemed kWh/Unit)

Annual savings: 209,390 kWh

See Confidential and Proprietary Attachment 5 - Self Direct Program Project Calculation for annual energy savings calculations and 10-1599-EL-

EEC for the work papers that provide all methodologies, protocols, and practices used in this application for prescriptive measures, as needed.

Please describe the less efficient new equipment that you rejected in favor of the more efficient new equipment.

See 10-1599-EL-EEC for the work papers that provide all methodologies, protocols, and practices used in this application for prescriptive measures, as needed.

- 3) If you checked the box indicating that your project involves equipment for new construction or facility expansion, then calculate the annual savings [(kWh used by less efficient new equipment) – (kWh used by higher efficiency new equipment) = (kWh per year saved)]. Please attach your calculations and record the results below:

Annual savings: kWh

Please describe the less efficient new equipment that you rejected in favor of the more efficient new equipment.

- 4) If you checked the box indicating that the project involves behavioral or operational improvements, provide a description of how the annual savings were determined.

Section 4: Demand Reduction/Demand Response Programs

A) The customer's program involves (check the one that applies):

- ☒ Coincident peak-demand savings from the customer's energy efficiency program.
- ☐ Actual peak-demand reduction. (Attach a description and documentation of the peak-demand reduction.)
- ☐ Potential peak-demand reduction (check the one that applies):

➤ Choose one or more of the following that applies:

- ☐ The customer's peak-demand reduction program meets the requirements to be counted as a capacity resource under a tariff of a regional transmission organization (RTO) approved by the Federal Energy Regulatory Commission.
- ☐ The customer's peak-demand reduction program meets the requirements to be counted as a capacity resource under a program that is equivalent to an RTO program, which has been approved by the Public Utilities Commission of Ohio.

B) On what date did the customer initiate its demand reduction program?

The coincident peak-demand savings are permanent installations that reduce demand through energy efficiency and were installed on the date specified in Section 3 A above.

C) What is the peak demand reduction achieved or capable of being achieved (show calculations through which this was determined):

$$\text{Unit Quantity (watts)} = \text{Existing (watts x units)} - \text{Installed (watts x units)}$$

$$\text{KW Demand Reduction} = \text{Unit Quantity (watts)} \times (\text{Deemed KW/Unit (watts)})$$

27.0 kW

See Confidential and Proprietary Attachment 5 - Self Direct Program Project Calculation for peak demand reduction calculation, and 10-1599-EL-EEC for the work papers that provide all methodologies, protocols, and practices used in this application for prescriptive measures, as needed.

Section 5: Request for Cash Rebate Reasonable Arrangement (Option 1) or Exemption from Rider (Option 2)

Under this section, check the box that applies and fill in all blanks relating to that choice.

Note: If Option 2 is selected, the application will not qualify for the 60-day automatic approval. All applications, however, will be considered on a timely basis by the Commission.

A) The customer is applying for:

☒ Option 1: A cash rebate reasonable arrangement.

OR

☐ Option 2: An exemption from the cost recovery mechanism implemented by the electric utility.

OR

☐ Commitment payment

B) The value of the option that we are seeking is:

Option 1: A cash rebate reasonable arrangement, which is the lesser of (show both amounts):

☒ A cash rebate of \$ 11,607.30. (Rebate shall not exceed 50% project cost. Attach documentation showing the methodology used to determine the cash rebate value and calculations showing how this payment amount was determined.)

See Confidential and Proprietary Attachment 5 – Self Direct Program Project Calculation for incentive calculations for this mercantile program.

Option 2: An exemption from payment of the electric utility's energy efficiency/peak demand reduction rider.

☐ An exemption from payment of the electric utility's energy efficiency/peak demand reduction rider for ____ months (not to exceed 24 months). (Attach calculations showing how this time period was determined.)

OR

- ☐ A commitment payment valued at no more than \$_____. (Attach documentation and calculations showing how this payment amount was determined.)

OR

- ☐ Ongoing exemption from payment of the electric utility's energy efficiency/peak demand reduction rider for an initial period of 24 months because this program is part of an ongoing efficiency program that is practiced by our organization. (Attach documentation that establishes your organization's ongoing efficiency program. In order to continue the exemption beyond the initial 24 month period your organization will need to provide a future application establishing additional energy savings and the continuance of the organization's energy efficiency program.)

Section 6: Cost Effectiveness

The program is cost effective because it has a benefit/cost ratio greater than 1 using the (choose which applies):

- ☐ Total Resource Cost (TRC) Test. The calculated TRC value is: _____
(Continue to Subsection 1, then skip Subsection 2)
- ☒ Utility Cost Test (UCT) . The calculated UCT value is: 5.6 (Skip to Subsection 2.)

Subsection 1: TRC Test Used (please fill in all blanks).

The TRC value of the program is calculated by dividing the value of our avoided supply costs (generation capacity, energy, and any transmission or distribution) by the sum of our program overhead and installation costs and any incremental measure costs paid by either the customer or the electric utility.

The electric utility's avoided supply costs were _____.

Our program costs were _____.

The utility's incremental measure costs were _____.

Subsection 2: UCT Used (please fill in all blanks).

We calculated the UCT value of our program by dividing the value of our avoided supply costs (capacity and energy) by the costs to our electric utility (including administrative costs and incentives paid or rider exemption costs) to obtain our commitment.

Our avoided supply costs were \$ 71,650.39

The utility's program costs were \$ 1,256.34

The utility's incentive costs/rebate costs were \$ 11,607.30.

Section 7: Additional Information

Please attach the following supporting documentation to this application:

- Narrative description of your program including, but not limited to, make, model, and year of any installed and replaced equipment.

See Attachment 1 - Self Direct Project Overview and Commitment for a description of the project. See Attachment 6 - Supporting Documentation, for the specifications of the replacement equipment 10-1599-EL-EEC for the work papers that provide all methodologies, protocols, and practices used in this application for prescriptive measures, as needed. Due to the length of time since the equipment replacement, the make, model and year of the replaced equipment is not available.

- A copy of the formal declaration or agreement that commits your program to the electric utility, including:

- 1) any confidentiality requirements associated with the agreement;

See Attachment 2 - Self Direct Program Project Blank Application including Rules and Requirements. All confidentiality requirements are pursuant to the Retrospective Projects/Rules and Requirements that are part of the signed application which is provided as Confidential and Proprietary Attachment 3 - Self Direct Program Project Completed Application.)

- 2) a description of any consequences of noncompliance with the terms of the commitment;

See Attachment 2 - Self Direct Program Project Blank Application including Rules and Requirements. All consequences of noncompliance are pursuant to the Retrospective Projects/Rules and Requirements that are part of the signed application which is provided as Confidential and Proprietary Attachment 3 - Self Direct Program Project Completed Application.

- 3) a description of coordination requirements between the customer and the electric utility with regard to peak demand reduction;

None required because the resources committed are permanent installations that reduce demand through increased efficiency during the Company's peak summer demand period generally defined as May through September and do not require specific coordination and communication to provide demand reduction capabilities to the Company.

- 4) permission by the customer to the electric utility and Commission staff and consultants to measure and verify energy savings and/or peak-demand reductions resulting from your program; and,

See Attachment 2 - Self Direct Program Blank Application including Rules and Requirements granting such permission pursuant to the Retrospective Projects/Rules and Requirements that are part of the signed application which is provided as Confidential and Proprietary Attachment 3 - Self Direct Program Project Completed Application.

- 5) a commitment by you to provide an annual report on your energy savings and electric utility peak-demand reductions achieved.

See Attachment 1 - Self Direct Project Overview and Commitment for the commitment to comply with any information and compliance reporting requirements imposed by rule or as part of the approval of this arrangement by the Public Utilities Commission of Ohio.

- A description of all methodologies, protocols, and practices used or proposed to be used in measuring and verifying program results. Additionally, identify and explain all deviations from any program measurement and verification guidelines that may be published by the Commission.

The Company applies the same methodologies, protocols, and practices to Self Direct Program retrospective projects that are screened and submitted for approval as it does to prospective projects submitted through its Prescriptive and Custom Programs. The Commission has not published a technical reference manual for use by the Company so deviations can not be identified. The project submitted is a prescriptive project and energy savings are determined as described in Confidential and Proprietary Attachment 5 - Self Direct Program Project Calculation, and 10-1599-EL-EEC for the work papers that provide all methodologies, protocols, and practices used in this application for prescriptive measures, as needed.



Public Utilities Commission

Application to Commit
Energy Efficiency/Peak Demand
Reduction Programs
(Mercantile Customers Only)

Case No.: 14-0396-EL-EEC

State of OHIO :

MELANIE BOWSER Affiant, being duly sworn according to law, deposes and says that:

1. I am the duly authorized representative of:

KEMA Services, Inc agent of Ohio Power
2. I have personally examined all the information contained in the foregoing application, including any exhibits and attachments. Based upon my examination and inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete.


Signature of Affiant & Title

Energy Engineer

Sworn and subscribed before me this 14th day of March, 2014 Month/Year


Signature of official administering oath

Brenda Walke, Notary
Print Name and Title

My commission expires on 01-16-2018



Brenda Walke
Notary Public, State of Ohio
My Commission Expires 01-16-2018



Self Direct Project Overview & Commitment

The Public Utility Commission of Ohio (PUCO) will soon review your application for participation in AEP Ohio's Energy Efficiency/Peak Demand Response program. Based on your submitted project, please select by initialing one of the two options below, sign and fax to 877-607-0740.

Customer Name	E I DUPONT DE NEMOUR	
Project Number	AEP-13-11937	
Customer Premise Address	500 DUPONT DR, CIRCLEVILLE, OH 43113-1159	
Customer Mailing Address	800 DuPont Road, Circleville, OH 43113	
Date Received	11/14/2013	
Project Installation Date	12/31/2012	
Annual kWh Reduction	209,390	
Total Project Cost	\$96,442.96	
Unadjusted Energy Efficiency Credit (EEC) Calculation	\$15,476.40	
Simple Payback (yrs)	9.0	
Utility Cost Test (UCT) for EEC	5.57	
Utility Cost Test (UCT) for Exemption	0.06	
<i>Please Choose One Option Below and Initial</i>		
Self Direct EEC: 75%	\$11,607.30	<input checked="" type="checkbox"/> Initial: <u>JAY</u>
EE/PDR Rider Exemption	2 Months (After PUCO Approval)	<input type="checkbox"/> Initial: _____

Note: This is a one time selection. By selecting EEC, the customer will receive payment in the amount stated above. Selection of EE/PDR rider exemption, will result in the customer not being eligible to participate in any other energy efficiency programs offered by AEP Ohio during the period of exemption. In addition, the term of EE/PDR rider exemption is subject to ongoing review for compliance and could be changed by the PUCO.

If EEC has been selected, will the Energy Efficiency Funds selected help you move forward with other energy efficiency projects?

YES ☐ NO ☒

Note: Exemptions for periods beyond 24 months are subject to look-back or true-up adjustments every year to ensure that the exemption accurately reflects the EEDR savings. Applicants must file for renewal for any exemption beyond 12 months.

Project Overview:

The Self Direct (Prescriptive) project that the above has completed and applied is as follows.

Installed VFD on (3) 1 HP process fan and pump motors
 Installed VFD on (4) 2 HP process fan and pump motors
 Installed VFD on (1) 3 HP process fan and pump motor
 Installed VFD on (3) 5 HP HVAC motors
 Installed VFD on (2) 7.5 HP process fan and pump motors
 Installed VFD on (1) 15 HP HVAC motor
 Installed VFD on (1) 20 HP process fan and pump motor
 Installed VFD on (2) 40 HP process fan and pump motors
 Installed VFD on (1) 75 HP process fan and pump motor
 Replaced (3) 2L-8'-T12 with (3) 2L-8'-T8
 Replaced (73) 2L-4'-T12 with (73) 2L-4'-T8
 Replaced (3) 3L-4'-T12 with (3) 3L-4'-T8
 Replaced (12) 4L-4'-T12 with (12) 4L-4'-T8
 Replaced (13) 2L-4'-T12 with (13) 2L-4'-T8
 Replaced (51) 4L-4'-T12 with (51) 4L-4'-T8

The documentation that was included with the application proved that the energy measures applied for were purchased and installed.

By signing this document, the Mercantile customer affirms its intention to commit and integrate the above listed energy efficiency resources into the utility's peak demand reduction, demand response, and energy efficiency programs. By signing, the Mercantile customer also agrees to serve as a joint applicant in any filings necessary to secure approval of this arrangement by the Public Utilities Commission of Ohio, and comply with any information and compliance reporting requirements imposed by rule or as part of that approval.

Ohio Power Company

E I DUPONT DE NEMOUR

By: _____

By: _____

Title: Manager

Title: DPS EXPERT

Date: 2/26/2014

Date: 2/26/14

Self-Direct Program Application

ENERGY IS PRECIOUS. LET'S NOT WASTE IT.



STEPS FOR SUBMITTING YOUR APPLICATION

Step 1: Verify Project, Equipment and Customer Eligibility

- ✓ Project must be a facility improvement that produces a permanent reduction in electrical energy usage (kWh).
- ✓ Facilities must be AEP electric customers that are considered "mercantile" under the definition of the Public Utilities Commission of Ohio (PUCO).
- ✓ Projects must operate at least 2,245 hours per year to qualify for credits. Projects with annual energy (kWh) savings greater than the facility's annual energy (kWh) consumption are not eligible.
- ✓ All installed equipment must meet or exceed the specifications outlined in the application.
- ✓ Equipment must be installed in facilities served by AEP Ohio.
- ✓ Customer must have a valid AEP Ohio account number on an eligible AEP Ohio non-residential account or approved agricultural account.

Step 2: Submit Application

- ✓ Complete the Checklist page.
- ✓ Read the Terms and Conditions.
- ✓ Attach the documentation listed:
 - Completed Applicant Information form
 - Completed and signed Customer Agreement form
 - Measure worksheet(s)
 - Scope of work (type, quantity, and wattage of old and new equipment)
 - Dated and itemized invoices for the purchase and installation of all equipment installed
 - Specifications for all equipment installed showing that it meets program specifications
- ✓ Submit a completed application via email, fax or mail prior to November 15, 2013, for any projects completed on or after January 1, 2010. Any applications received after the deadline may not be submitted to the Public Utilities Commission of Ohio (PUCO) by December 31, 2013, which may jeopardize approval.

Step 3: Project Review

- ✓ The program team will review your application. The review of some projects will require an inspection; the team will contact applicants requiring an inspection for scheduling.
- ✓ After approval by AEP Ohio, the customer will receive an Overview and Commitment form to sign and return. The project will then be submitted to the PUCO for consideration. The PUCO will assign a case number and review the project details prepared by AEP Ohio. The PUCO may request additional information, or approve or reject the energy efficiency credits.

Step 4: Receive Energy Efficiency Credits

- ✓ The program team will issue energy efficiency credits four to six weeks after the PUCO approves a project.
- ✓ In lieu of a one-time energy efficiency credit, you may elect to seek an exemption from the Energy Efficiency/Peak Demand Reduction (EE/PDR) rider for the associated electric account(s) for a defined period of time as stated in this application. For this exemption, the energy efficiency credit amount (Option 1) is compared to the estimated value of the EE/PDR obligation (Option 2), as calculated by AEP Ohio. The value of Option 2 will be approximately equal to the value of Option 1. If exemption is elected, the affected account is not eligible for other programs offered by AEP Ohio during the exemption period. Unless additional resources are committed, you will, after the specified number of months exempted, again be subject to the EE/PDR rider. New construction projects are not eligible to elect Option 2. Major renovation projects that do not have a representative billing history for three years prior to the project installation also are not eligible to elect Option 2.
- ✓ If the energy efficiency credit is elected, you remain in the EE/PDR rider for the period of time that an exemption would have been in effect and may also participate in AEP Ohio programs. However, during that period of time, you are not allowed to elect the Option 2 exemption for any additional self-direct projects for the same account number.
- ✓ You are allowed and encouraged to consider using all or a portion of the energy credits, as received from AEP Ohio under this program, to help fund other energy efficiency and demand-reduction projects you choose to initiate in the future. Future projects also can qualify for credits under the prescriptive or custom programs.

AEP Ohio Business Incentives Program

2740 Airport Drive, Suite 160

Columbus, OH 43219

Phone: (877) 607-0739

Fax: (877) 607-0740

aepohioincentives@dnvkema.com

Visit our website at aepohio.com/incentives.

Self-Direct Program Application

ENERGY IS PRECIOUS. LET'S NOT WASTE IT.



CHECKLIST

FINAL APPLICATION

Required Attachments

- ☐ Completed and signed Applicant Information form
- ☐ Completed Final Payment Agreement form including Energy Efficiency Credits Requested section
- ☐ Itemized invoices
- ☐ Equipment specifications
- ☐ Scope of work
- ☐ W-9 (LLC, individual, partnership, property management companies)

Credit Worksheets¹

- ☐ Lighting
- ☐ HVAC
- ☐ Motors & Drives
- ☐ Compressed Air
- ☐ Refrigeration/Food Service
- ☐ Agriculture & Miscellaneous
- ☐ Transformer
- ☐ UPS
- ☐ Custom
- ☐ New Construction Lighting

Application date _____

Estimated project cost _____

Expected completion date _____

¹Incomplete applications will delay processing and receipt of energy efficiency credits.

Revised Submittal

Please complete below if this is a revised submittal.

Submittal date _____ AEP Project Number (if known) AEP - 1 ____ - ____ - ____ - ____

AEP Ohio Business Incentives Program

2740 Airport Drive, Suite 160

Columbus, OH 43219

Phone: (877) 607-0739

Fax: (877) 607-0740

aepohioincentives@dnvkema.com

Visit our website at aepohio.com/incentives.

TERMS AND CONDITIONS

AEP Ohio offers prescriptive and custom credits under the AEP Ohio Business Incentives Program to facilitate the implementation of past cost-effective energy efficiency improvements for non-residential customers. AEP Ohio provides energy efficiency credits (EEC) for the purchase and installation of qualifying cost-effective equipment in the customer's facility under the Terms and Conditions provided in this application and subject to regulatory approvals. EEC will only be provided in the form of a check or an Energy Efficiency/Peak Demand Reduction (EE/PDR) rider exemption under this program.

Please note that funds are limited and subject to availability.

Program Effective Dates

AEP Ohio Business Incentives Program offers credits until approved funds are exhausted or November 15, 2013, whichever comes first. The effective dates of the current AEP Ohio Business Incentives Program and application submittal requirements are as follows:

- Self-direct projects are projects completed since January 1, 2010. Self-direct projects are eligible to apply for EEC with this application. Current or future projects should apply using a prescriptive or custom application.
- All 2013 AEP Ohio Business Incentives Program applications should be received no later than November 15, 2013. Any applications received after the deadline may not be submitted to the Public Utility Commission of Ohio (PUCO) by December 31, 2013, which may jeopardize approval. AEP Ohio reserves the right to extend or shorten this timeline.

Program and Project Eligibility

The AEP Ohio Business Incentives Program offers both prescriptive credits for some of the more-common energy efficiency measures and custom credits for other eligible improvements not included on the list of prescriptive measures. Credits available under the AEP Ohio Business Incentives Program include non-residential accounts or approved agricultural accounts served on AEP Ohio's regulated retail rates.

Qualifying projects must be installed in a facility in AEP Ohio's electric service territory in Ohio. Credits are available to all non-residential accounts or approved agricultural accounts that pay into the EE/PDR rider and receive their electricity over AEP Ohio wires, regardless from which retail electric supplier the customer has chosen to purchase power. A customer may neither apply for nor receive credits for the same product, equipment or service from more than one utility.

Custom projects must involve measures that result in a reduction in electric energy usage due to an improvement in system efficiency. Projects that result in reduced energy consumption without an improvement in system efficiency are not eligible for a custom credit. The project simple payback prior to the credit payment generally should fall between 1 to 7 years, or pass cost-effectiveness test(s) determined by AEP Ohio to qualify for a credit.

Projects involving measures covered by the prescriptive credit portion of the program are not eligible for a custom credit. However, the applicant has the option to apply for a custom credit for whole building integrated projects or systems, even if they include prescriptive measures. Prescriptive elements may be capped at the deemed savings and/or credit level.

The self-direct program applies to customer facilities served by AEP Ohio's retail electric rates that are defined as "mercantile" and meet the minimum energy usage requirements of 700,000 kWh per year, or that are part of a national account involving multiple facilities in one or more states.

Facilities must be eligible under the definition of "mercantile" as designated by the PUCO. All applications are subject to review and approval by AEP Ohio, its contractor(s)/agent(s) and the PUCO prior to any EEC payments or exemptions from the EE/PDR rider in this program.

Project requirements under the AEP Ohio Business Incentives Program include the following:

- Projects must involve a new facility improvement with capital improvements that results in a permanent reduction in electrical energy usage (kWh). Existing/old equipment must be functional and in operation.
- Any measures installed at a facility must produce verifiable and persistent energy reduction and must be sustainable and provide 100% of the energy benefits as stated in the application for a period of at least five (5) years or for the life of the product, whichever is less. If the customer ceases to be a delivery service customer of AEP Ohio or removes the equipment or systems at any time during the 5-year period or the life of the product, the customer may be required to return a prorated amount of credit funds to AEP Ohio.
- All equipment must be new.
- All installed equipment must meet state, federal and local codes and requirements.
- Projects must be installed on the AEP Ohio electric account in Ohio served by an eligible electric rate.
- Equipment must be purchased, installed and operating (or capable of operating in the case of seasonal uses) prior to submitting an application for a credit.

Self-Direct Program Application

ENERGY IS PRECIOUS. LET'S NOT WASTE IT.



TERMS AND CONDITIONS

- AEP Ohio will issue credit payments in the form of checks, not utility bill credits.
- The credit is paid as a one-time, one-program offer and cannot be combined with incentive payments from other AEP Ohio programs. The customer may be eligible to participate in other programs offered by AEP Ohio, as long as no project receives more than one credit or incentive.

Confidential information contained in any documents associated with this application will be protected from public filings. However, this information may be disclosed to the PUCO for further review and approval.

Projects that are NOT eligible for a credit include the following:

- Fuel switching (e.g., electric to gas or gas to electric)
- Changes in operational and/or maintenance practices or simple control modifications not involving capital costs (Please visit aepohio.com/incentives for Retro-Commissioning Program or Continuous Improvement Program)
- Removal or termination of existing processes, facilities and/or operations
- On-site electricity generation
- Projects involving gas-driven equipment in place of or to replace electric equipment (such as a chiller)
- Projects focused primarily on power factor improvement
- Projects that involve peak-shifting (and not kWh savings)
- Used or rebuilt equipment
- Costs associated with internal labor
- Renewables (Please visit aepohio.com/save for Renewables Program)
- Projects required by state or federal law, building or other codes, or projects that are standard industry practice
- Projects easily reverted/removed or projects installed entirely for reasons other than improving energy efficiency
- Other conditions to be determined by AEP Ohio

Energy Efficiency Credit Limits

For both prescriptive and custom measures in this application, **total EEC shall be 75% the lesser of:** 1) The calculated credit as approved by AEP Ohio or 2) 50% of total project cost (not including internal labor). In calculating the savings and EEC for custom measures, please contact the AEP Ohio Business Incentives Program office to determine an appropriate baseline for savings. In addition to the above project cost limit, credit payment rates vary when a customer's calculated credit exceeds the tiers listed below:

PROGRAM ENERGY EFFICIENCY CREDITS	
Energy efficiency credit levels for one-year energy savings	See tables for prescriptive credits. Custom credits: \$0.08/kWh x 75%.
Minimum/maximum simple payback before energy efficiency credit applied	Must pass cost effectiveness test(s) determined by AEP Ohio; generally between one and seven years
Maximum payout	75% of 50% of the total cost (additional measure caps may apply)
Energy efficiency credit levels for projects completed since 1/1/2010	Calculated amount on the prescriptive or custom worksheets attached and subject to funding limits
Credit limit	See Credit Limits and Tiering section
Credit calculation order	Measure credit caps are applied first. Project-cost credit limits are applied second. Credit tiering is applied third. Lastly, 75% factor is applied to credit.

Energy Efficiency Credit Tiering

The total credit paid for any self-direct application cannot exceed 50% of the total project cost (not including internal labor). In addition to the above project cost limit, credit payment rates vary when a customer's calculated credit exceeds the tiers listed below:

- Tier 1 \$0 - \$100,000 = 100% of eligible calculated credit value
- Tier 2 \$100,001 - \$300,000 = 50% of eligible calculated credit value
- Tier 3 \$300,001 - \$500,000 = 25% of eligible calculated credit value
- Tier 4 \$500,001 - beyond = 10% of eligible calculated credit value

Application Review Process

Applications are not a guarantee of program acceptance and energy efficiency credits. AEP Ohio will review applications for eligibility and completeness. Completed applications will be reviewed in the order received. Funds are reserved for the project when AEP Ohio receives a completed application and determines that the project meets the program eligibility requirements. Upon review of the application, the program will notify applicants who submit incomplete applications of deficiencies; applicants may lose their place in the review process until receipt of all requested information. Applications must be completed and all information received by the deadlines defined above to begin processing. Applicants are encouraged to call the program hotline with any questions about documentation requirements.

TERMS AND CONDITIONS

Application

Projects completed on or after Jan 1, 2010, must submit an application and all required supporting documentation by November 15, 2013, to be applicable for the 2013 program year. Any applications received after the deadline may not be submitted to the PUCO by December 31, 2013, and could jeopardize approval.

A signed application with supporting project documentation verifying project installation and capital improvements must be submitted to AEP Ohio prior to application approval. Project documentation, such as (but not limited to) copies of dated invoices for the purchase and installation of the measures, equipment specification sheets, energy-savings analysis, complete application and W-9 forms (LLC, individual, partnership, property management companies), is required. The invoice should provide sufficient detail to separate the project cost from the costs of other services not related to the energy efficiency project and other repairs. The location or business name on the invoice must be consistent with the application information.

AEP Ohio reserves the right to request additional supporting documentation as deemed necessary to ensure measure eligibility and verify that the expected energy savings will occur. Confidential information contained in any documents associated with this application will be protected from public filings. However, this information may be disclosed to the PUCO and the evaluators. Requested information could include equipment purchase dates, installation dates, proof that the equipment is operational, manufacturer specifications, savings calculation documentation, monitoring data, warranty information and proof of customer co-payment.

Inspections

The AEP Ohio Business Incentives Program reserves the right to inspect all projects to verify compliance with the program rules and verify the accuracy of project documentation. This may include installation inspections, verification of detailed lighting layout descriptions, metering, data collection, interviews and utility bill or monitoring data analysis. Customers are required to allow access to project documents and the facility where the measures were installed for a period of five years after receipt of credit payment by AEP Ohio. In the event a building(s) are turned over to a new account holder/owner before AEP Ohio officially measures and verifies incentivized equipment, AEP Ohio reserves the right to do so under new ownership. Customer understands and agrees that program installations may also be subject to inspections by the PUCO or its designee, and photographs of installation may be required.

Requirements for Custom Project Electricity Savings Calculation

The annual electricity savings must be calculated for custom projects using industry-accepted engineering algorithms or simulation models. The applicant may estimate the annual electricity usage of both the existing and proposed equipment based on the current operation of the facility. A listing of the pre-existing information requirements is provided at the end of the custom application section. If equipment is replaced prior to the end of its rated service life in order to achieve energy savings, the existing equipment performance may be used as the baseline in the energy-savings calculations. Documentation of early replacement decision and/or actual equipment energy usage will be required. If equipment is replaced due to failure or for other reasons (such as obsolescence or a need for more capacity), the baseline performance used in the savings calculation should be either the minimum performance that would be required by code for that equipment type and application (where a code applies) or the performance of the equipment that would have been selected as the customer's standard practice when a code does not apply.

If the previous equipment was at the end of its useful life, the applicant must use, as the baseline, the equipment that would meet the applicable federal and local energy codes unless an "as found" baseline is being used by the applicant. If the applicant is using an "as found" baseline, additional specific information on the pre-existing information must be provided.

The applicant must be able to clearly describe the method used to calculate the savings. The applicant must provide all assumptions used in the calculations and document the sources for these assumptions. If no savings analysis is provided by the customer/contractors, AEP Ohio reserves the right to utilize its approved methodology and analysis to determine energy savings.

The method and assumptions used by the applicant to calculate the annual savings will be reviewed by AEP Ohio. AEP Ohio is solely responsible for the final determination of the annual energy savings and peak-demand reduction used in calculating the credit amount. AEP Ohio also reserves the right to require specific measurement and verification activities, including monitoring the retrofit to determining the credit. Verification of the pre-existing consumption may also be required.

For custom and "as found" projects, the applicant is required to provide information in order to allow AEP Ohio to verify the baseline usage of the pre-existing equipment. AEP Ohio may need to conduct inspections of projects to verify equipment and operating conditions.

TERMS AND CONDITIONS

Customers are encouraged to submit projects that warrant special treatment (i.e., non-typical projects) to be considered on a case-by-case basis by AEP Ohio.

Tax Liability

Credits are taxable and, if more than \$600, will be reported to the IRS unless the customer is exempt. AEP Ohio is not responsible for any taxes that may be imposed on your business as a result of your receipt of credit. A W-9 (for LLC, individual, partnership, property management companies) must be provided with all applications.

Disclaimer

Any and all energy savings and coincident demand generated by the project described in this application are hereby committed to AEP Ohio. That retained demand can be used to count against AEP Ohio's benchmark requirements in S.B. 221, regardless; any retained demand provided to PJM generation auctions must be done so by AEP Ohio only.

Peak-demand reduction is defined as the reduction in average load over the performance hours as a result of replacing existing electrical equipment with more-efficient electrical equipment. Peak performance hours are defined as the time between June 1 and August 31 on weekdays and non-holidays, between the hours 3:00 p.m. and 6:00 p.m. Eastern Standard Time. PJM Peak Hours are defined as the time between June 1 and August 31 on weekdays and non-holidays, between the hours 2:00 p.m. and 6:00 p.m. Eastern Standard Time.

AEP Ohio does not guarantee the energy savings and does not make any warranties associated with the measures eligible for credits under this program. AEP Ohio has no obligations regarding and does not endorse or guarantee any claims, promises, work or equipment made, performed or furnished by any contractors or equipment vendors that sell or install any energy efficiency measures. AEP Ohio is not responsible for the proper disposal/recycling of any waste generated as a result of this project. AEP Ohio is not liable for any damage caused by the operation or malfunction of the installed equipment.

Self-Direct Program Application

ENERGY IS PRECIOUS. LET'S NOT WASTE IT.



APPLICANT INFORMATION

Important: Please read the Terms and Conditions before signing and submitting this application. Complete all information and provide required documentation to avoid processing delays.

Project Information

Business Type

(Select One) _____

W-9 Tax Status

(Select One) _____

How Did You Hear About the Program?

(Select One) _____

Shift

(Select One) _____

Affected Area Square Footage

Dodge Report Number

Building Operating Hours

Equipment Operating Hours

Name of Applicant's Business _____

Project Name (if applicable) _____ Name as It Appears on Utility Bill _____

AEP Ohio Account Number Where Measure Installed _____ Taxpayer ID (SSN/FEIN) _____

Mailing Address _____ City _____ State ^{OH} Zip _____

☐ Check if mailing address and installation address are the same.

Installation Address _____ City _____ State ^{OH} Zip _____

Customer Contact

Please provide all contacts we may need to process this project. List the project decision-maker, the technical contact, etc. as the contractor contact.

Name of Contact (preferred contact for documentation) _____

Title of Contact _____ Phone # _____ Ext. _____

Contact Fax # _____ Contact Email _____

Solution Provider/Contractor Information¹

Name of Contracting Company _____

Name of Contact Person _____ Title of Contact _____

Mailing Address _____ City _____ State ^{OH} Zip _____

Phone # _____ Ext. _____ Contact Fax # _____ Contact Email _____

If there are questions about the application who should we contact? ☐ Customer ☐ Contractor

¹Solution provider/contractor is the party involved in the application submittal (i.e., specs, scope of work, etc.).

FINAL PAYMENT AGREEMENT

Final Payment Agreement

I understand that the application and all required documentation should be received by the AEP Ohio Business Incentives Program by November 15, 2013, for any projects completed on or after January 1, 2010. Any applications received after the deadline may not be submitted to the PUCO by December 31, 2013, and could jeopardize approval of any credit by the PUCO. All equipment must be purchased, installed and fully operational prior to submitting the application.

I understand that AEP Ohio or its representatives have the right to ask for additional information at any time. AEP Ohio Business Incentives Program will make the final determination of credit levels for this project.

I understand that this project must involve a facility improvement that results in improved energy efficiency.

As an eligible AEP Ohio account holder, I certify that decisions to acquire and install the indicated energy efficiency measures, which will be demonstrated with supporting documentation required by AEP Ohio, were made after January 1, 2010, and that work was completed on this project on or after January 1, 2010. The energy efficiency measures are for use in my business facility and not for resale.

I understand that the location and business name on the project documentation must be consistent with the application information. Project documentation, product specification sheets and details of measure installation are included. Documentation indicating contract dates prior to November 16, 2012, may render this application ineligible. I understand that all submissions become the property of AEP Ohio. It is recommended to keep a copy for your records.

I agree that if: (1) I did not install the related product(s) identified in my application or (2) I remove the related product(s) identified in my application before a period of five (5) years or the end of the product life, whichever is less, I shall refund a prorated amount of energy efficiency credits to AEP Ohio based on the actual period of time the related product(s) were installed and operating. This is necessary to assure that the project's related energy benefits will be achieved. (3) AEP Ohio will pay 75% of the lesser of: 1) The calculated credit as approved by AEP Ohio, subject to funding limits or 2) 50% of the project cost (subject to application caps). I understand that AEP Ohio or its representatives have the right to ask for additional information at any time. AEP Ohio Business Incentives Program will make the final determination of energy efficiency credit levels for this project.

I agree to be responsible to comply with any applicable codes

or ordinances. I also understand that all materials removed, including lamps and PCB ballasts, must be permanently taken out of service and disposed of in accordance with local codes and ordinances. I understand it is my responsibility to be aware of any applicable codes or ordinances. Information about hazardous waste disposal can be found at epa.gov/epawaste/hazard/index.htm.

I agree to verification by the utility or its representatives of both sales transactions and equipment installation. I understand that these credits are available to all non-residential accounts or approved agricultural accounts that pay into the Energy Efficiency and Demand Response (EE/PDR) rider and receive their electricity over AEP Ohio wires, regardless from which retail electric supplier the customer has chosen to purchase power.

I understand that AEP Ohio reserves the right to refuse payment and participation if the customer or contractor violates program rules and requirements. AEP Ohio is not liable for energy efficiency credits promised to customers as a result of misrepresentation of the program.

I understand that AEP Ohio does not guarantee the energy savings and does not make any warranties associated with the measure eligible for energy efficiency credits under this program. Furthermore, AEP Ohio has no obligations regarding any claims, promises, work or equipment made, performed or furnished by any contractors or equipment vendors that sell or install any energy efficiency measures and does not endorse or guarantee same.

Energy efficiency credits will be based upon the Final Application and program terms and conditions, as well as the availability of funds.

I understand that the program has a limited budget. Applications will be processed until allocated funds are reserved or spent. Final Applications should be received by November 15, 2013, to be eligible for funding under the current program period.

I certify that the information on this application is true and correct, and that the taxpayer ID number, tax status and W-9 are the applicant's. I understand that credits exceeding \$600 will be reported to the IRS, unless the applicant is exempt. I understand that credits assume related energy benefits over a period of five (5) years or for the life of the product, whichever is less.

I understand that the program may be modified or terminated without prior notice.

I understand and agree that all other terms and conditions as specified in the application, including all attachments and exhibits

FINAL PAYMENT AGREEMENT

attached to this application, will serve as a contract for the customer's commitment of energy and demand resources to AEP Ohio and shall apply.

Any and all energy savings and coincident demand generated by the project described in this application are hereby committed to AEP Ohio. That retained demand can be used to count against AEP Ohio's benchmark requirements in S.B. 221, regardless; any retained demand provided to PJM generation auctions must be done so by AEP Ohio only.

Self-Direct Program Application

ENERGY IS PRECIOUS. LET'S NOT WASTE IT.



CUSTOMER AGREEMENT

- ☐ I have read and understand the program requirements, measure specifications, and Terms and Conditions set forth in this application and agree to abide by those requirements. Furthermore, I concur that I must meet all eligibility criteria in order to be paid under this program.

All equipment must be installed and operational. A customer signature is required for payment. Signed applications received by email or fax will be treated the same as original applications received by mail.

All submissions become the property of AEP Ohio. Keep a copy for your records.

Digital Signature Instructions

1. Click in the signature box.
2. Follow the digital signature directions displayed in the "Add Digital ID" pop-up box.
3. Establish a digital ID and password.
4. In the "Sign Document" pop-up box, you can select to change the signature appearance from typed font to an imported graphic.
5. Follow directions to save signed application; signature and verification information will appear in the signature box.

Total Project Cost

Customer Signature (AEP Ohio Customer)

Date

03/08/13

Total Credits Requested¹

Print Name

Project Completion Date

SUBMIT VIA EMAIL

PRINT APPLICATION

¹AEP Ohio will pay the lesser of 1) the calculated credit as approved by AEP Ohio or 2) 50% of the total project cost.



The right combination

Philips Advance's instant start, low-profile Centium® T8 ballasts for standard and energy saving lamps

Reliable and energy-efficient, Philips Advance's broad line of Centium high frequency electronic ballasts for T8 fluorescent lamps offers all of the energy-saving properties of our standard electronic line plus the added benefits of lamp striation reduction technology making these ballasts compatible with all energy saving T8 lamps. This provides your customers with a more sustainable lighting solution over standard T8 or T12 fixtures.

Our 1 and 2 lamp models have been designed in a new more compact ballast measuring just 9.5"L x 1.3"W x 1.0"H while weighing just 0.678 lbs. making it even more ideal for today's low profile designer fixtures. The 3 and 4 lamp models are featured in our industry standard small housing 9.5"L x 1.7"W x 1.18"H.

Our Centium ballasts are an optimal choice for a broad range of new construction and retrofit applications within the commercial sector including general office lighting, conference, meeting, and board room applications, indirect and decorative lighting, and new fixture designs requiring smaller ballasts.

Lamp Striation Reduction Technology

- Allows for additional energy saving opportunities by being compatible with all energy saving T8 lamps

IntelliVolt® Technology

- Enhances accuracy and ease of ordering while reducing stocking/SKU requirements

0°F Starting Capability*

- Suitable for cold temperature applications

NEMA Premium® Designated Ballasts**

- Meets the energy-efficiency standards set by NEMA for T8 ballasts

* When operating standard (non-Energy Saving) lamps

** As a licensee in the NEMA Premium Ballast Program, Philips Lighting Electronics has determined that these products meet the NEMA Premium specification for premium energy efficiency.

PHILIPS
ADVANCE

ALL CEE LISTED

No. of Lamps	Input Volts	Lamp Starting Method	Ballast Family	Catalog Number	Input Power ANSI (Watts)	Ballast Factor	Max. THD %	Line Current (Amps)	Min. Starting Temp. (°F /°C)	Dim.	Wiring Diag.*
F17T8, FB016T8 (17W)											
1	120-277	IS	Centium	ICN-1P32-N	18	0.93	10	0.15 - 0.07	0/-18	D	63
				ICN-2P32-N	21	1.08	10	0.17 - 0.05		D	64
2	120-277	IS	Centium	ICN-2P32-N	32	0.90	10	0.26 - 0.11	0/-18	D	64
				ICN-3P32-SC	38	1.07	15	0.32 - 0.14		B	65
3	120-277	IS	Centium	ICN-3P32-SC	48	0.92	15	0.39 - 0.17	0/-18	B	65
				ICN-4P32-SC	53	1.04	15	0.45 - 0.20			66
4	120-277	IS	Centium	ICN-4P32-SC	64	0.93	10	0.54 - 0.23	0/-18	B	66
F25T8, FB024T8 (25W - 36")											
1	120-277	IS	Centium	ICN-1P32-N	18	0.93	10	0.15 - 0.07	0/-18	D	63
				ICN-2P32-N	21	1.08	10	0.17 - 0.05		D	64
2	120-277	IS	Centium	ICN-2P32-N	32	0.90	10	0.26 - 0.11	0/-18	D	64
				ICN-3P32-SC	38	1.07	15	0.32 - 0.14		B	65
3	120-277	IS	Centium	ICN-3P32-SC	48	0.92	15	0.39 - 0.17	0/-18	B	65
				ICN-4P32-SC	53	1.04	15	0.45 - 0.20			66
4	120-277	IS	Centium	ICN-4P32-SC	64	0.93	10	0.54 - 0.23	0/-18	B	66
F25T8/ES (25W - 48")											
1	120-277	IS	Centium	ICN-1P32-N	25	0.90	10	0.11 - 0.10	60/16	D	63
2	120-277	IS	Centium	ICN-2P32-N	46 - 45	0.88	10	0.38 - 0.16	60/16	D	64
				ICN-3P32-SC	51 - 50	1.00	10	0.42 - 0.18		B	65
3	120-277	IS	Centium	ICN-3P32-SC	68 - 67	0.88	10	0.56 - 0.24	60/16	B	65
				ICN-4P32-SC	76 - 75	1.00	10	0.64 - 0.27			66A
4	120-277	IS	Centium	ICN-4P32-SC	92 - 91	0.88	10	0.77 - 0.33	60/16	B	66
F28T8/ES (28W - 48")											
1	120-277	IS	Centium	ICN-1P32-N	27	0.92	10	0.22 - 0.10	60/16	D	63
2	120-277	IS	Centium	ICN-2P32-N	49 - 48	0.88	10	0.41 - 0.17	60/16	D	64
				ICN-3P32-SC	55 - 54	1.00	10	0.46 - 0.20		B	65
3	120-277	IS	Centium	ICN-3P32-SC	73 - 72	0.88	10	0.61 - 0.29	60/16	B	65
				ICN-4P32-SC	82 - 81	1.00	10	0.69 - 0.29			66
4	120-277	IS	Centium	ICN-4P32-SC	100 - 98	0.88	10	0.84 - 0.35	60/16	B	66

* Insulate unused blue lead tp 600V

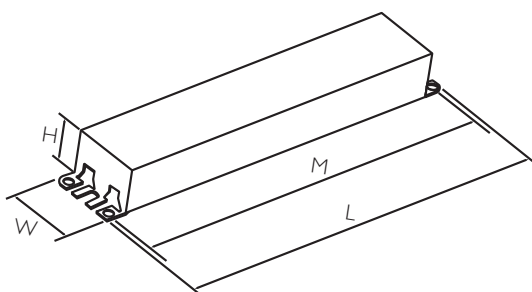


Fig. B
9.5"(L) x 1.7"(W) x 1.18"(H) x 8.9"(M)

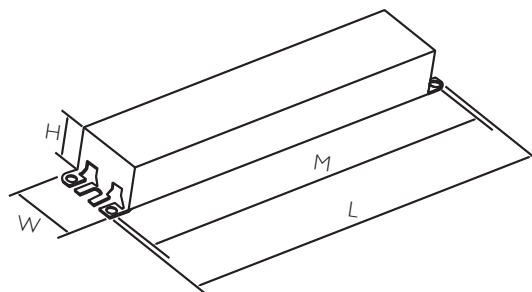
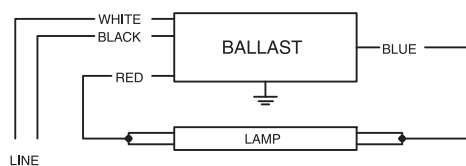


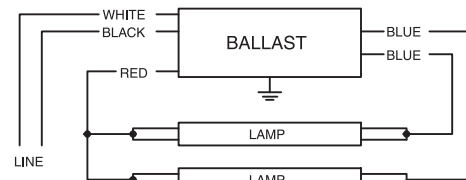
Fig. D
9.5"(L) x 1.3"(W) x 1.0"(H) x 8.9"(M)

No. of Lamps	Input Volts	Lamp Starting Method	Ballast Family	Catalog Number	Input Power ANSI (Watts)	Ballast Factor	Max. THD %	Line Current (Amps)	Min. Starting Temp. (°F /°C)	Dim.	Wiring Diag.
F32T8/ES (30W - 48")											
1	120-277	IS	Centium	ICN-1P32-N	26	0.92	10	0.22 - 0.10	60/16	B	63
				ICN-2P32-N	37 - 36	1.05	10	0.31 - 0.13			64
2	120-277	IS	Centium	ICN-2P32-N	59 -58	0.89	10	0.49 - 0.22	60/16	B	64
				ICN-3P32-SC	61	1.01	10	0.51 - 0.22			65
3	120-277	IS	Centium	ICN-3P32-SC	79	0.88	10	0.66 - 0.29	60/16	B	65
				ICN-4P32-SC	87	1.00	10	0.73 - 0.32			66
4	120-277	IS	Centium	ICN-4P32-SC	105	0.88	10	0.88 - 0.38	60/16	B	66
F32T8, FB031T8, F32T8/U6 (32W)											
1	120-277	IS	Centium	ICN-1P32-N	31	0.90	10	0.26 - 0.12	0/-18	B	63
				ICN-2P32-N	36	1.03	15	0.30 - 0.14			64
2	120-277	IS	Centium	ICN-2P32-N	59	0.88	10	0.49 - 0.22	0/-18	B	64
				ICN-3P32-SC	65	1.01	10	0.54 - 0.24			65
3	120-277	IS	Centium	ICN-3P32-SC	85	0.88	10	0.71 - 0.31	0/-18	B	65
				ICN-4P32-SC	93	1.00	10	0.78 - 0.33			66
4	120-277	IS	Centium	ICN-4P32-SC	112	0.88	10	0.94 - 0.41	0/-18	B	66
F40T8 (40W)											
1	120-277	IS	Centium	ICN-2P32-SC	42	1.00	10	0.35 - 0.15	32/0	B	64
2	120-277	IS	Centium	ICN-3P32-SC	77	1.00	10	0.65 - 0.28	32/0	B	65
3	120-277	IS	Centium	ICN-4P32-SC	112	0.97	10	0.94 - 0.40	32/0	B	66

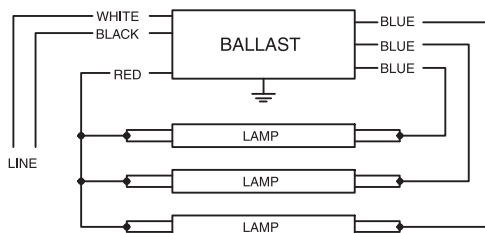
* Insulate unused blue lead tp 600V



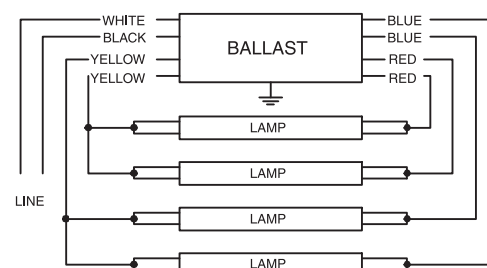
Diag. 63



Diag. 64



Diag. 65



Diag. 66

Ballast Specification

Section I - Physical Characteristics

- 1.1 Ballast shall be physically interchangeable with standard electromagnetic or standard electronic ballasts, where applicable.
- 1.2 Ballast shall be provided with integral leads color-coded per ANSI C82.11.

Section II - Performance Requirements

- 2.1 Ballast shall be Instant Start.
- 2.2 Ballast shall provide Independent Lamp Operation (ILO) for Instant Start ballasts allowing remaining lamp(s) to maintain full light output when one or more lamps fail.
- 2.3 Ballast shall contain auto restart circuitry in order to restart lamps without resetting power.
- 2.4 Ballast shall operate from 50/60 Hz input source of 120V through 277V with sustained variations of +/- 10% (voltage and frequency) with no damage to the ballast.
- 2.5 Ballast shall be high frequency electronic type and operate lamps at a frequency between 42 kHz and 52kHz to avoid interference with infrared devices, eliminate visible flicker and avoid Article Surveillance Systems, such as anti-theft devices.
- 2.6 Ballast shall have a Power Factor greater than 0.98 for primary lamp.
- 2.7 Ballast shall have a minimum ballast factor for primary lamp application as follows: 0.75 for Low Watt, 0.85 for Normal Light Output, and 1.20 for High Light.
- 2.8 Ballast shall provide for a Lamp Current Crest Factor of 1.7 or less in accordance with lamp manufacturer recommendations.
- 2.9 Ballast input current shall have Total Harmonic Distortion (THD) of less than 10% when operated at normal line voltage with primary lamp.
- 2.10 Ballast shall have a Class A sound rating.
- 2.11 Ballast shall have a minimum starting temperature of -18° C (0° F) for standard T8 lamps and 16° C (60° F) energy saving T8 lamps.
- 2.12 Ballast shall tolerate sustained open circuit and short circuit output conditions without damage.
- 2.13 Ballast shall contain an anti-striation circuit to reduce striation on energy-saving T8 lamps.

Section III - Regulatory Requirements

- 3.1 Ballast shall not contain any Polychlorinated Biphenyl (PCB).
- 3.2 Ballast shall be Underwriters Laboratories (UL) listed, Class P and Type I Outdoor; and Canadian Standards Association (CSA) certified where applicable.
- 3.3 Ballast shall comply with ANSI C62.41 Category A for Transient protection.
- 3.4 Ballast shall comply with ANSI C82.11 where applicable.
- 3.5 Ballast shall comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 18, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).

Section IV - Other

- 4.1 Ballast shall be manufactured in a factory certified to ISO 9002 Quality System Standards.
- 4.2 Ballast shall carry a _____ limited warranty from date of manufacture against defects in material or workmanship for operation at a maximum case temperature of _____ (Go to our web site for up-to-date warranty information: www.philips.com/advancewarranty).
- 4.3 Manufacturer shall have a twenty-year history of producing electronic ballasts for the North American market.
- 4.4 Ballast shall be Philips Advance part # _____ or approved equal.





IOPA-4P32-SC@120V

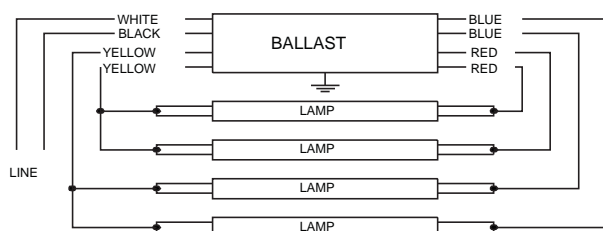
Brand Name	OPTANIUM
Ballast Type	Electronic
Starting Method	Instant Start
Lamp Connection	Parallel
Input Voltage	120-277
Input Frequency	50/60 HZ
Status	Active

Electrical Specifications

CEE LISTED

Lamp Type	Num. of Lamps	Rated Lamp Watts	Min. Start Temp (°F/C)	Input Current (Amps)	Input Power (ANSI Watts)	Ballast Factor	MAX THD %	Power Factor	MAX Lamp Current Crest Factor	B.E.F .
F32T8	3	32	-20/-29	0.75	90	0.97	10	0.99	1.6	1.08
* F32T8	4	32	-20/-29	0.92	109	0.87	10	0.99	1.6	0.80

Wiring Diagram



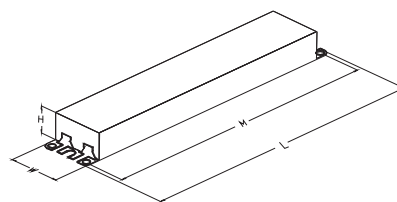
Diag. 66

The wiring diagram that appears above is for the lamp type denoted by the asterisk (*)

Standard Lead Length (inches)

	in.	cm.		in.	cm.
Black	25	63.5	Yellow/Blue		0
White	25	63.5	Blue/White		0
Blue	31	78.7	Brown		0
Red	31	78.7	Orange		0
Yellow	39	99.1	Orange/Black		0
Gray		0	Black/White		0
Violet		0	Red/White		0

Enclosure



Enclosure Dimensions

OverAll (L)	Width (W)	Height (H)	Mounting (M)
9.50 "	1.7 "	1.18 "	8.90 "
9 1/2	1 7/10	1 9/50	8 9/10
24.1 cm	4.3 cm	3 cm	22.6 cm

Revised 03/02/2010



Data is based upon tests performed by Philips Lighting Electronics N.A. in a controlled environment and is representative of relative performance. Actual performance can vary depending on operating conditions. Specifications are subject to change without notice. All specifications are nominal unless otherwise noted.

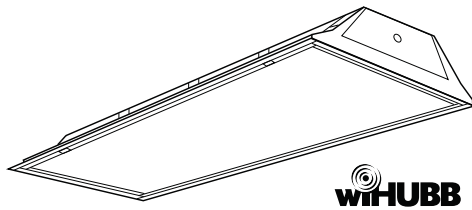
PHILIPS LIGHTING ELECTRONICS N.A.

10275 WEST HIGGINS ROAD · ROSEMONT, IL 60018
Tel: 800-322-2086 · Fax: 888-423-1882 · www.philips.com/advance
Customer Support/Technical Service: 800-372-3331 · OEM Support: 866-915-5886

Columbia LIGHTING

ST814

1' x 4' Shallow Specification Troffer / 2-Lamp T5, T5HO, 2 or 3-Lamp T8



FEATURES

- Optical performance designed for T8 and T5 lamp technology
- Mechanical light seal
- Mitered corners on door present a clean uninterrupted appearance
- Spring loaded latches optional
- Rolled fixture edges reduce risk of injury during fixture handling and installation
- Integral T-Bar clips quickly secure fixture to grid system without the need for time consuming loose parts
- Snap-on ballast covers can be removed with lamps installed
- Corner hinging for easy insertion and removal of door frame from either side
- Optional flush or regressed aluminum shielding frames available with positive action or spring loaded latches
- Housing ends secured by unique corner interlock and screws
- Available with exclusive wiHUBB technology preinstalled
 - Peer to peer, self-healing wireless mesh network
 - Integrated control system for 0-10VDC or step dimming, or On/Off

PROJECT INFORMATION

Project Name _____

Catalog No. _____

Type _____

Date _____

FLANGED FEATURES

Four adjustable Uni-Lugs for quick easy installation. Optional plaster frames available for individual or row mounting. Fixture end flanges are removable for row mounting. Joiner cables are included.

HOUSING

Heavy gauge steel. Die formed for extra rigidity. Designed for installation in standard inverted tee grid ceilings.

BALLASTS

Energy efficient, thermally protected, automatic resetting, Class P, high power factor, sound rated A, unless otherwise specified. CEE NEMA Premium compliant.

ELECTRICAL

Standard class "P," thermally protected, autoresetting HPF ballast, sound rated A. CEE NEMA Premium compliant. All ballast leads extend a minimum of 6" through access location. NEC/CEC-compliant ballast disconnect is standard.

FINISH

All metal parts are processed with a five phase phosphate bonding treatment. Grid units are pre-painted with high polyester baked white enamel, 86% reflective. Flanged units are painted after fabrication with a polyester powder coat, reflectance of 90%.

SHIELDING

100% acrylic prismatic, extruded and roll-embossed, diagonally oriented female prisms, unless otherwise specified.

CERTIFICATION

All luminaires are built to UL 1598 standards and bear appropriate UL and cUL or CSA labels. Damp location labeling is standard. Emergency-equipped fixtures labeled UL 924.

ORDERING INFORMATION

EXAMPLE ST814-232G-FSA12-EU-F0735-C488

ST8	14	-	-	-	-	-
MODEL	NO. OF LAMPS	CEILING TYPE	SHIELDING	VOLTAGE	OPTIONS	
ST8 Shallow Specification Troffer	1 One 2 Two 3 Three (T8 only)	G Inverted T-Bar (Std.) F Overlap Flange (4½" overall fixture height)	A12 Pattern 12 Acrylic 0.100" Nominal (Standard) A12.125 Pattern 12 Acrylic 0.125" Nominal A19 Pattern 19 Acrylic 0.15" Male Prism	U 120V-277V 347 347V	F0730 T8, 70CRI, 3000K Lamps, Furn/Inst. F0735 T8, 70CRI, 3500K Lamps, Furn/Inst. F0741 T8, 70CRI, 4100K Lamps, Furn/Inst. F0835 35K 80CRI T8 Lamps Installed	
SIZE	LAMP TYPE	DOOR STYLE	BALLAST			
14 1' x 4'	28 4', T5: 28 Watt (2-Lamp only) 32 4', T8: 32, 30, 28 or 25 Watt 54 4', T5HO: 54 or 51 Watt (2-Lamp Only)	FS Flush Steel FA Flush Aluminum RA Regressed Aluminum PS Premium Steel	PC1 Silver Parabolic Louver ½" x ½" x ½" PC2 Silver Parabolic Louver 1½" x 1½" x 1" For more shielding see options and accessories section.	E Electronic T8, Instant Start 3E 3-Lamp Electronic T8, Instant Start EP Electronic T5 or T8, Programmed Start 3EP 3-Lamp Electronic T8, Programmed Start For specific ballast vendor, show as option.	GLR Fast Blow Fuse EL Emergency Battery Pack PAF Paint After Fabrication SLL Spring Loaded Latches MS9 Master/Satellite Pair w/9' Harness C388 ¾" Flex with 3 No. 18 Wires C488 ¾" Flex with 4 No. 18 Wires NYC NYC Compliant NYCU NYC Compliant, Union Label WIH wiHUBB Enabled ¹	

¹ Not available with Surface Mount Ceiling Types.

Columbia
LIGHTING**1' x 4' Shallow Specification Troffer / 2-Lamp T5, T5HO, 2 or 3-Lamp T8****ST814****PHOTOMETRIC DATA**

Test 13767 Test Date 12/27/04

LUMINAIRE DATA

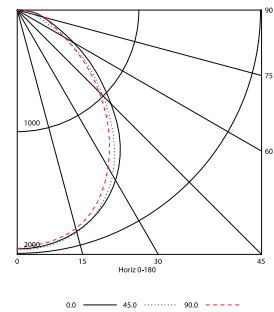
Luminaire	ST814-232G-FSA12 ST8 Lensed Troffer 1' x 4' 2-Lamp with A12 Prismatic Acrylic Lens
Ballast	REL-2P32-SC
Ballast Factor	0.88
Lamp	F32T8
Lumens per Lamp	2900
Total Input Watts	59
Mounting	Recessed
Reflectance	PCW 95.2
Shielding Angle	0° = 90 90° = 90
Spacing Criterion	0° = 1.23 90° = 1.16

AVG. LUMINANCE (Candela/Sq. M.)

	0.0	22.5	45.0	67.5	90.0
Average Luminance Angle	0	6843	6843	6843	6843
	30	6504	6472	6311	6094
	40	5896	5782	5446	5222
	45	5381	5263	4918	4716
	50	4840	4667	4417	4194
	55	4324	3977	3813	3588
	60	3732	3300	3083	3027
	65	3243	2814	2459	2732
	70	2968	2580	2101	2682
	75	2924	2601	2224	2763
	80	3194	2732	2651	3033
	85	3402	3082	2801	3562

COEFFICIENTS OF UTILIZATION (%)

RC	80	70	50	0
RW	70	50	30	10
1	82	79	76	73
2	76	70	65	61
3	70	62	57	52
4	64	56	50	45
5	59	50	44	40
6	55	46	40	35
7	51	42	36	31
8	48	38	32	28
9	45	35	30	26
10	42	33	27	23

INDOOR CANDELA PLOT

RCR = Room Cavity Ratio

RC = Effective Ceiling Cavity Reflectance RW = Wall Reflectance

ENERGY DATA

Total Luminaire Efficiency	74.9%
Luminaire Efficacy Rating (LER)	65
IESNA RP-1-1993 Compliance	Noncompliant
Comparative Yearly Lighting Energy Cost per 1000 Lumens	\$3.69 based on 3000 hrs. and \$0.08 per KWH

LUMINAIRE DATA

Luminaire	ST814-332G-FSA12 ST8 Lensed Troffer 1' x 4' 3-Lamp with A12 Pattern Acrylic Prism Lens
Ballast	REL3P32SC
Ballast Factor	0.88
Lamp	F32T8
Lumens per Lamp	2900
Total Input Watts	85
Shielding Angle	N/A
Spacing Criterion	0° = 1.25 90° = 1.28

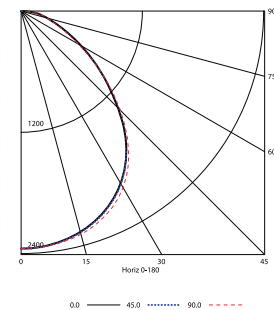
AVG. LUMINANCE (Candela/Sq. M.)

	0.0	22.5	45.0	67.5	90.0
Average Luminance Angle	0	8240	8240	8240	8240
	30	7964	7984	7992	8154
	40	7333	7333	7333	7465
	45	6729	6749	6764	6858
	50	6071	6093	6104	6115
	55	5434	5428	5422	5288
	60	4797	4741	4712	4488
	65	4215	4115	4082	3883
	70	3783	3691	3660	3578
	75	3604	3549	3549	3658
	80	3857	3736	3736	3998
	85	4104	3983	4104	4586

COEFFICIENTS OF UTILIZATION (%)

RC	80	70	50	0
RW	70	50	30	10
1	72	69	66	64
2	66	61	57	53
3	60	54	49	45
4	56	48	43	39
5	51	43	38	34
6	48	39	34	30
7	44	36	30	26
8	41	33	27	24
9	39	30	25	22
10	36	28	23	20

Test 13385 Test Date 4/14/03

INDOOR CANDELA PLOT

RCR = Room Cavity Ratio

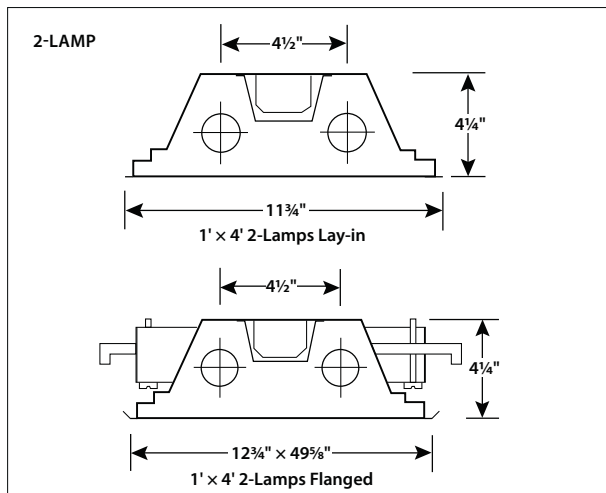
RC = Effective Ceiling Cavity Reflectance RW = Wall Reflectance

ENERGY DATA

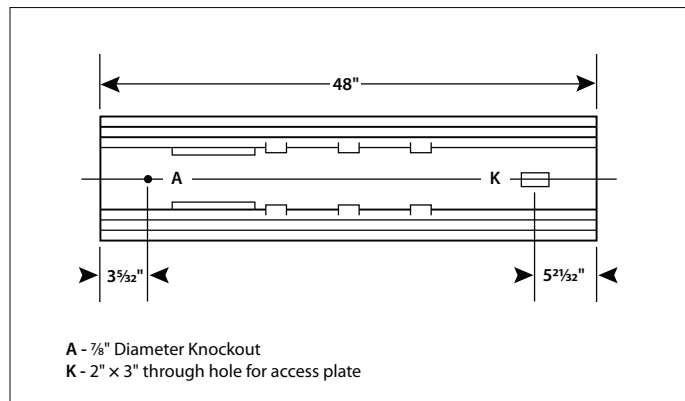
Total Luminaire Efficiency	65.6%
Luminaire Efficacy Rating (LER)	59
IESNA RP-1-1993 Compliance	Noncompliant
Comparative Yearly Lighting Energy Cost per 1000 Lumens	\$4.07 based on 3000 hrs. and \$0.08 per KWH

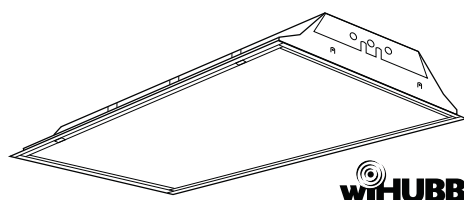
ZONAL LUMEN SUMMARY

Zone	Lumens	% Lamp	% Fixt.
0-30	1838	21.1	32.2
0-40	2974	34.2	52.1
0-60	4821	55.4	84.5
0-90	5706	65.6	100.0
0-180	5706	65.6	100.0

DIMENSIONAL DATA

Flanged cut out dimensions for single unit only: 12" x 48"

**NOTE:** All dimensions are in inches; dimensions and specifications are subject to change without notice. Please consult factory or check sample for verification.

Columbia
LIGHTING**ST824-4****2' x 4' Shallow Specification Troffer / 4-Lamp T5, T5HO, T8****PROJECT INFORMATION**

Project Name _____

Type _____

Catalog No. _____

Date _____

FEATURES

- Optical performance designed for T8 and T5 lamp technology
- 2½" minimum spacing from bottom of lamp to bottom of lens
- Mechanical light seal
- Mitered corners on door present a clean uninterrupted appearance
- Spring loaded latches optional
- Rolled fixture edges reduce risk of injury during fixture handling and installation
- Integral T-Bar clips quickly to secure fixture to grid system without the need for time-consuming loose parts
- Snap-in ballast covers can be removed with lamps installed
- Corner hinging for easy insertion and removal of door frame from either side
- Optional flush or regressed aluminum shielding frames available with positive action or spring loaded latches
- Housing ends secured by unique corner interlock and screws
- Available with exclusive wiHUBB technology preinstalled
 - Peer to peer, self-healing wireless mesh network
 - Integrated control system for 0-10VDC or step dimming, or On/Off

HOUSING

Heavy gauge steel. Die formed for extra rigidity. Grid housings are designed for installation in standard 1½" T-Bar ceilings. Integral T-Bar clips are located at the end of the housing. Flanged housings for hard ceilings feature overlap flange trim and wing hangers.

BALLASTS

Energy efficient, thermally protected, automatic resetting, Class P, high power factor, sound rated A, magnetic or electronic ballasts. CEE NEMA Premium compliant.

ELECTRICAL

Standard class "P," thermally protected, autoresetting HPF ballast, sound rated A. CEE NEMA Premium compliant. All ballast leads extend a minimum of 6" through access location. NEC/CEC-compliant ballast disconnect is standard.

FINISH

All parts pre-painted with high gloss baked white enamel, minimum reflectance 86%, applied over iron phosphate pretreatment for maximum adhesion and rust resistance.

SHIELDING

100% clear prismatic acrylic, extruded and roll-embossed, diagonally oriented female prisms, unless otherwise specified.

CERTIFICATION

All luminaires are built to UL 1598 standards and bear appropriate UL and cUL or CSA labels. Damp location labeling is standard. Emergency-equipped fixtures labeled UL 924.

ORDERING INFORMATION**EXAMPLE ST824-432G-FSA12-4EU-F0741-C388**

ST8	24	-	-	-	-	-
MODEL	NO. OF LAMPS	CEILING TYPE	DOOR STYLE	VOLTAGE	OPTIONS	
ST8 Shallow Specification Troffer	4 Four 6 Six	G Inverted T-Bar F Overlap Flange	FS Flush Steel FA Flush Aluminum RA Regressed Aluminum PS Premium Steel	U 120V-277V 347 347V	F0730 T8, 70CRI, 3000K Lamps, Furn/Inst. F0735 T8, 70CRI, 3500K Lamps, Furn/Inst. F0741 T8, 70CRI, 4100K Lamps, Furn/Inst.	GLR Fast Blow Fuse EL Emergency Battery Pack PAF Paint After Fabrication SLL Spring Loaded Latches C388 ¾" Flex with 3 No. 18 Wires C384 ¾" Flex with 3 No. 14 Wires C488 ¾" Flex with 4 No. 18 Wires C424 ½" Flex with 4 No. 14 Wires M4R Miro®-4 Aluminum Reflector SAR Low Iridescent Specular Alum Reflector NYC NYC Compliant NYCU NYC Compliant, Union Label WIH wiHUBB Enabled ¹
SIZE	LAMP TYPE	SHIELDING	BALLAST			
24 2' x 4'	28 4', T5: 28 Watt 32 4', T8: 32, 30, 28 or 25 Watt 54 4', T5HO: 54 or 51 Watt	A12 Pattern 12 Acrylic 0.100" Nominal (Std.) A12.125 Pattern 12 Acrylic 0.125" Nominal A19 Pattern 19 Acrylic 0.15" Male Prism PC1 Silver Parabolic Louver ½" x ½" x ½" PC2 Silver Parabolic Louver 1½" x 1½" x 1" For complete list of lenses and louvers, see Options and Accessories.	E Electronic T8, Instant Start ELW 2-Lamp Electronic T8, 0.77 Ballast Factor, Low Wattage, Instant Start 4E 4-Lamp Electronic T8, Instant Start 4ELW 4-Lamp Electronic T8, 0.77 Ballast Factor, Low Wattage, Instant Start EP Electronic T5 or T8, Programmed Start 4EP 4-Lamp Electronic T5HO (N/A 347V) or T8, Programmed Start For specific ballast vendor, show as option.			

¹ Not available with Surface Mount Ceiling Types.

Columbia
LIGHTING**ST824-4**
2' x 4' Shallow Specification Troffer / 4-Lamp T5, T5HO, T8**PHOTOMETRIC DATA**

Test 12582 Test Date 1/08/03

LUMINAIRE DATA

Luminaire	ST824-432G-FSA12-4E-PAF ST8 Lensed Troffer 2' x 4' 4-Lamp with A12 Lens
Ballast	B4321120RH
Ballast Factor	0.88
Lamp	F32T8
Lumens per Lamp	2900
Total Input Watts	110
Shielding Angle	N/A
Spacing Criterion	0° = 1.22 90° = 1.30

ZONAL LUMEN SUMMARY

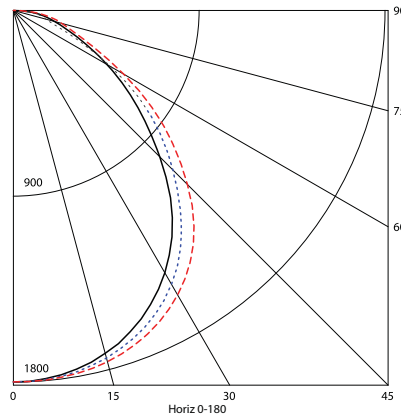
Zone	Lumens	%Lamp	%Fixt.
0-30	3127	27.0	32.4
0-40	5071	43.7	52.5
0-60	8253	71.1	85.4
0-90	9663	83.3	100.0
0-180	9663	83.3	100.0

ENERGY DATA

Total Luminaire Efficiency	83.3%
Luminaire Efficacy Rating (LER)	77
IESNA RP-1-1993 Compliance	Noncompliant
Comparative Yearly Lighting Energy Cost per 1000 Lumens	\$3.12 based on 3000 hrs. and \$0.08 per KWH

COEFFICIENTS OF UTILIZATION (%)

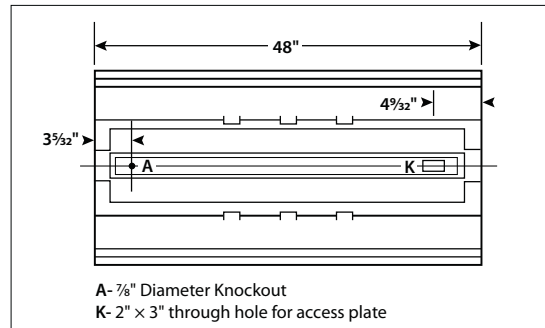
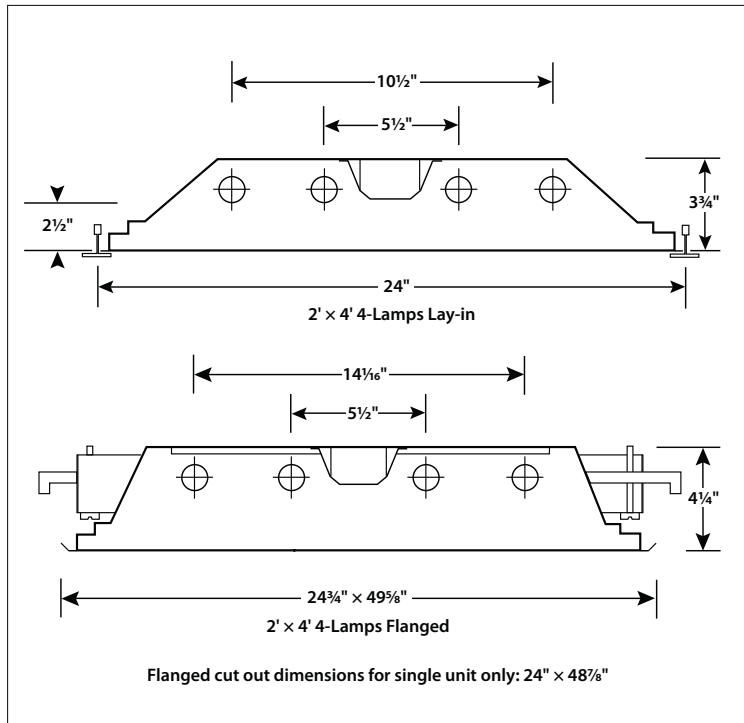
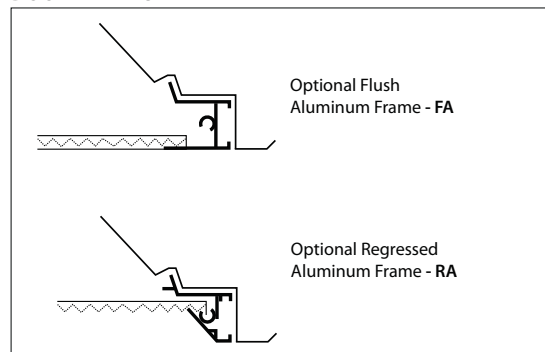
RCR	RC 80				RC 70				RC 50				RC 0			
	RW	70	50	30	10	70	50	30	10	70	50	30	10	70	50	30
1	91	88	84	81	89	86	83	80	82	80	78	71	61	52	46	41
2	84	77	72	68	82	76	71	67	73	69	66	61	52	46	41	36
3	77	69	63	58	75	68	62	57	65	60	56	52	46	41	36	31
4	71	62	55	49	69	60	54	49	58	53	48	46	41	36	31	26
5	66	55	48	43	64	55	48	43	53	47	42	40	35	30	25	20
6	61	50	43	38	59	49	43	38	48	42	38	35	30	25	20	15
7	56	46	39	34	55	45	38	34	44	38	34	31	26	21	16	11
8	53	42	35	30	51	41	35	30	40	34	30	28	23	18	13	8
9	49	39	32	27	48	38	32	27	37	31	27	24	19	14	9	4
10	46	36	29	25	45	35	29	25	34	29	25	23	18	13	8	3

INDOOR CANDELA PLOT**AVG. LUMINANCE (Candela/Sq. M.)**

	0.0	22.5	45.0	67.5	90.0
0	6124	6124	6124	6124	6124
30	5815	5920	6095	6239	6276
40	5237	5360	5547	5767	5832
45	4761	4953	5176	5372	5379
50	4351	4502	4747	4867	4884
55	3949	3979	4124	4221	4340
60	3462	3348	3292	3459	3697
65	3018	2755	2481	2813	3168
70	2871	2465	2023	2515	2944
75	3025	2470	2231	2536	3049
80	3104	2695	2561	2677	3246
85	3278	3012	2640	2924	3296

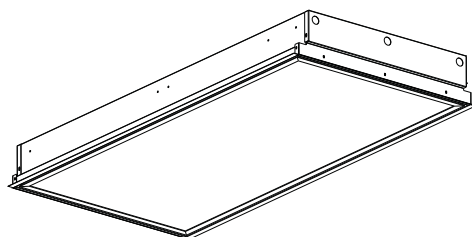
RCR = Room Cavity Ratio

RC = Effective Ceiling Cavity Reflectance RW = Wall Reflectance

DIMENSIONAL DATA**DOOR FRAMES****NOTE:** All dimensions are in inches; dimensions and specifications are subject to change without notice. Please consult factory or check sample for verification.

Columbia
LIGHTING**CRS-4**

1' x 4', 2' x 4' Cleanroom, Class 1 / 2, 3, 4, or 6-Lamp T5, T5HO, T8

**FEATURES**

- Class 1 Cleanroom certified for any application
- 1½" T-Bar standard, 1" or 2" optional
- Anodized extruded aluminum door frame
- One-piece, 18 gauge stainless or carbon steel doors available
- Meets Federal Standard No. 209E for Class 1 cleanrooms and ISO 14644-1 Class 6 cleanrooms

PROJECT INFORMATION

Project Name _____

Type _____

Catalog No. _____

Date _____

CONSTRUCTION

Heavy duty channel is constructed of die-formed code gauge steel. All holes in housing are completely closed with silicone sealant. Both housing and door frame are sealed with gasketing. Full length steel ballast cover and socket plates completely enclose all wiring. Fixture is designed for installation into either 1½" wide face T-Bar used in clean rooms as standard with 1" or 2" T-Bar as option.

BALLASTS

Energy efficient, thermally protected, automatic resetting, Class P, high power factor, sound rated A, unless otherwise specified. CEE NEMA Premium compliant.

ELECTRICAL

Standard class "P," thermally protected, auto-resetting HPF ballast, sound rated A. CEE NEMA Premium compliant. All ballast leads extend a minimum of 6" through access location. NEC/CEC-compliant ballast disconnect is standard.

FINISH

All painted parts are processed with a multi-stage phosphate bonding treatment and finished with a high temperature baked white enamel after fabrication. Internal reflecting parts will have a reflectance of 90%.

SHIELDING

Lens is constructed of acrylic material with many pattern and thicknesses available. The door frame is of anodized extruded aluminum material. Also, a one piece 18 gauge stainless steel or carbon steel door is available.

CERTIFICATION

Meets Federal Standard No. 209E for Class 1 cleanrooms and ISO 14644-1 Class 6 cleanrooms. All luminaires are built to UL 1598 standards and bear appropriate UL and cUL or CSA labels. Damp location labeling is standard and Wet Location labeling is an option. Emergency-equipped fixtures labeled UL 924.

ORDERING INFORMATION**EXAMPLE CRS24-332G-FCSA12125-3EU**

CRS							
MODEL	NO. OF LAMPS IN CROSS SECTION	CEILING TYPE	DOORS	VOLTAGE	OPTIONS	SIZE	LAMP TYPE
CRS Cleanroom, Class 1	2 Two 3 Three 4 Four (2 × 4 only) 6 Six (2 × 4 only)	G Lay-in Inverted 1½" Grid F Flange with Wing Hangers S Surface Mount	FA Flush Aluminum FCS Flush One-Piece Carbon Steel Door¹ FSS Flush One-Piece Stainless Steel Door¹	U 120V-277V 347 347V	1T 1" T-Bar 2T 2" T-Bar GLR Fast Blow Fuse RIF Radio Interference Filter³ ⁴ EL Emergency Battery Pack WL Wet Location⁵ NYC NYC Compliant NYCU NYC Compliant, Union Label	14 1' × 4' 24 2' × 4'	28 4', T5: 28 Watt 32 4', T8: 32, 30, 28 or 25 Watt 54 4', T5HO; 54 or 51 Watt (not available in 1' × 4' 3-Lamp)

Columbia LIGHTING

1' x 4', 2' x 4' Cleanroom, Class 1 / 2, 3, 4, or 6-Lamp T5, T5HO, T8

CRS-4

PHOTOMETRIC DATA

Test Lpi62521 Test Date 1/26/05

LUMINAIRE DATA

Luminaire	CRS24-432F-FAA12.125-EB8 CRS Cleanroom 2 x 4 4-Lamp with 0.125" A-12 Pattern Acrylic Prismed Lens
Ballast	B432I120RH
Ballast Factor	0.88
Lamp	F32T8
Lumens per Lamp	2850
Watts	111
Shielding Angle	0° = 90 90° = 90
Spacing Criterion	0° = 0.96 90° = 0.93
Luminous Opening in Feet	Length: 3.79 Width: 1.80 Height: 0.00

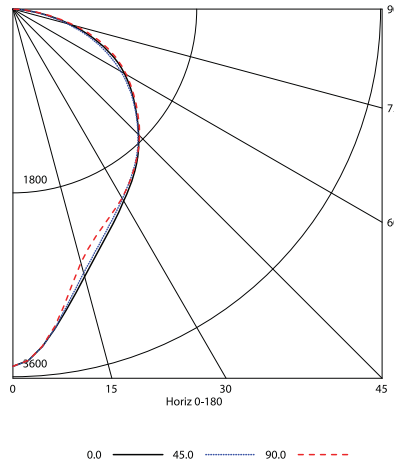
ZONAL LUMEN SUMMARY

Zone	Lumens	%Lamp	%Fixt.
0-30	2117	18.6	27.1
0-40	3384	29.7	43.4
0-60	6006	52.7	77.0
0-90	7799	68.4	100.0
0-180	7799	68.4	100.0

ENERGY DATA

Total Luminaire Efficiency	68.4%
Luminaire Efficacy Rating (LER)	62
IESNA RP-1-1993 Compliance	Noncompliant
Comparative Yearly Lighting Energy Cost per 1000 Lumens	\$3.87 based on 3000 hrs. and \$0.08 per KWH

INDOOR CANDELA PLOT



AVG. LUMINANCE (Candela/Sq. M.)

	0.0	22.5	45.0	67.5	90.0
Average Luminance Angle					
0	5518	5518	5518	5518	5518
30	3950	3955	3903	3875	3893
40	3911	3911	3878	3889	3895
45	3885	3892	3867	3916	3912
50	3871	3896	3856	3947	3920
55	3909	3912	3859	3989	3961
60	3976	3919	3850	4008	4049
65	3999	3872	3808	3984	4137
70	3889	3718	3672	3847	4129
75	3572	3390	3359	3554	3908
80	2989	2835	2808	3035	3326
85	2046	1991	1991	2245	2426

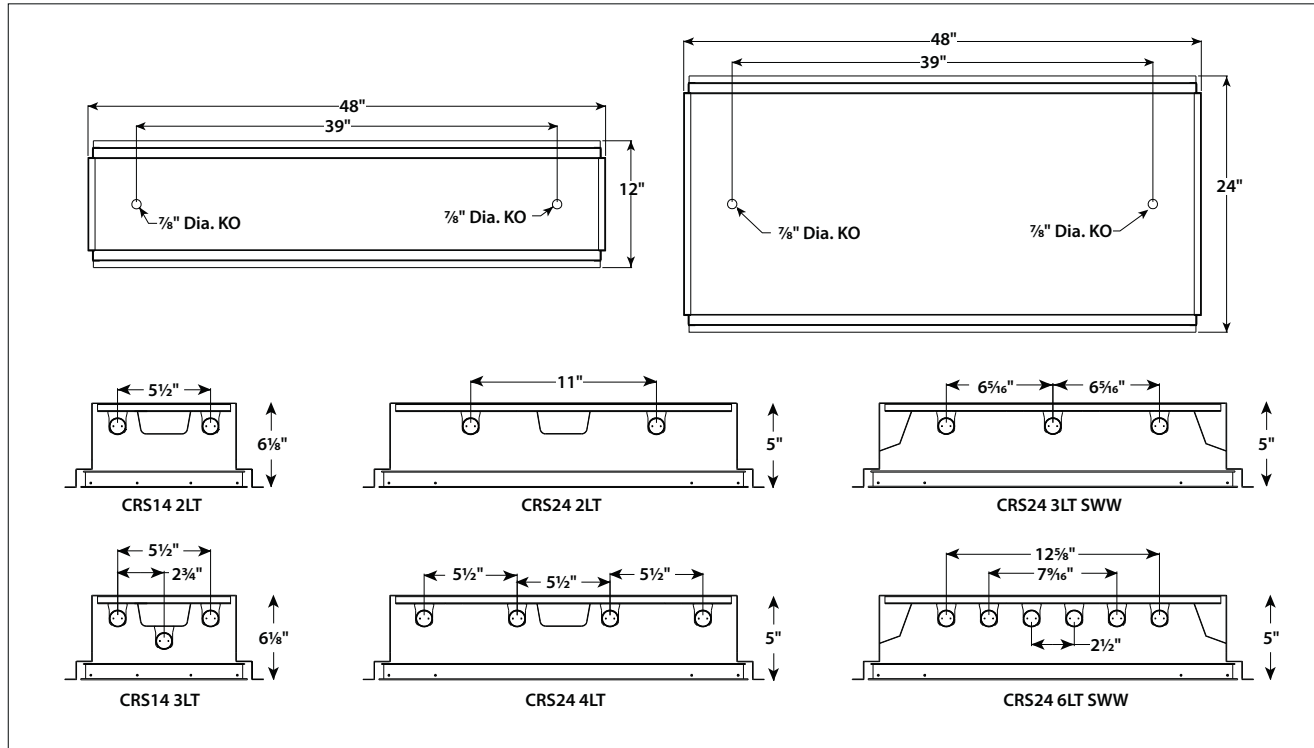
COEFFICIENTS OF UTILIZATION (%)

RCR	RC 80				RC 70				RC 50				RC 0			
	RW	70	50	30	10	70	50	30	10	50	30	10	0	70	50	30
1	74	71	68	65	72	69	64	66	64	62	57	57	57	57	57	57
2	67	62	57	53	65	60	56	52	58	54	51	47	47	47	47	47
3	61	54	48	44	60	53	48	43	51	46	42	39	39	39	39	39
4	56	48	42	37	54	47	41	37	45	40	36	34	34	34	34	34
5	52	43	36	32	50	42	36	32	40	35	31	29	29	29	29	29
6	48	38	32	28	46	38	32	28	36	31	27	25	25	25	25	25
7	44	35	29	24	43	34	28	24	33	28	24	22	22	22	22	22
8	41	32	26	22	40	31	26	22	30	25	22	20	20	20	20	20
9	38	29	24	20	37	29	23	20	28	23	20	18	18	18	18	18
10	36	27	22	18	35	27	21	18	26	21	18	16	16	16	16	16

RCR = Room Cavity Ratio

RC = Effective Ceiling Cavity Reflectance RW = Wall Reflectance

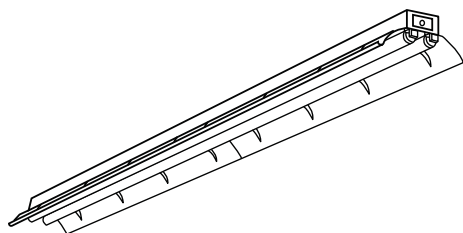
DIMENSIONAL DATA

**NOTE:** All dimensions are in inches; dimensions and specifications are subject to change without notice. Please consult factory or check sample for verification.

Columbia
LIGHTING

CSR4, CSR8 HIGH OUTPUT

4' or 8' Industrial / 1 or 2-Lamp T8HO, T12HO



FEATURES

- Available in 4' and 8' lengths
- 5% uplight distribution reflectors
- Telescopic spring loaded lampholders
- 2½" lamp spacing
- For individual or continuous row mounting
- Channel ends double as joiners
- Two 4' reflectors with reflector aligners supplied on 8' fixtures

PROJECT INFORMATION

Project Name

Type

Catalog No.

Date

HOUSING

Die formed steel with knockouts for stems or chain hangers.

REFLECTOR

Die embossed with transverse ribs for maximum rigidity. Available with apertures for uplight.

BALLASTS

Energy efficient, thermally protected, automatic resetting, Class P, high power factor, sound rated A, unless otherwise specified.

FINISH

White painted parts are treated with a five stage phosphate bonding process and finished after fabrication with a minimum 90% reflective gloss baked enamel. LSR and M4R reflectors specular room side, Mill finish aluminum top surface.

CERTIFICATION

All luminaires are built to UL 1598 standards and bear appropriate UL and cUL or CSA labels. Damp location labeling is standard. Emergency-equipped fixtures labeled UL 924.

ORDERING INFORMATION

EXAMPLE CSR8-296HO-U-EPU-GLR

CSR		-		-		EP		-	
MODEL		SIZE	NO. OF LAMPS IN CROSS SECTION	LAMP TYPE	REFLECTOR TYPE	BALLAST	VOLTAGE	OPTIONS	
CSR Industrial	4 4'	1 One 2 Two	48HO	4', T12: High Output	U	Apertured Reflector for 5% Uplight (Std.)	EP Electronic T12 or T8 Rapid Start For a specific ballast vendor, show as option.	U	120V-277V
	8 8'		96HO	8', T12: High Output	ST	Solid Reflector, No Uplight		347	347V
			96T8HO	96", T8: High Output	LSRU	Apertured Alum Reflector with Specular Silver Finish			
<div>ACCESSORIES (ORDER SEPARATELY)</div>									
CSZTF	Zip Tee Hanger - flush mounting on T-Bar ceiling								
CSZT	Zip Tee Hanger - 1½" spacer on tee bar ceiling								
CSHT	Slide Clamp Tong Hanger								
S18	18" Stem, canopy and 8° aligner								
SS18	18", 45° Swivel Stem & Canopy								
ITB4	Close Mounting on T-Bar ceiling								
CHSC	14" Chain Hanging Assembly								
CSRWG4	4' Wire Guard (two required for 8' fixture)								
OS1K	Occupancy Sensor Kit, 120/277/347V, One Relay¹								
					LSR	Solid Top Alum Reflector with Specular Silver Finish			
					M4RU	Apertured Alum Reflector with 95% Reflective Specular Silver Finish			
					M4R	Solid Top Alum Reflector with 95% Reflection Specular Silver Finish			
								GLR	Fast Blow Fuse
								GMF	Slow Blow Fuse
								EL	Emergency Battery Pack
								BC	Branch Circuit Plug-on Wiring System (See options section for details.)
								PAF	Paint After Fabrication
								NYC	NYC Compliant
								NYCU	NYC Compliant, Union Label

ACCESSORIES (ORDER SEPARATELY)

- CSZTF** Zip Tee Hanger - flush mounting on T-Bar ceiling
- CSZT** Zip Tee Hanger - 1½" spacer on tee bar ceiling
- CSH** Slide Clamp Tong Hanger
- S18** 18" Stem, canopy and 8° aligner
- SS18** 18", 45° Swivel Stem & Canopy
- ITB4** Close Mounting on T-Bar ceiling
- CHC** 14" Chain Hanging Assembly
- CSRWG4** 4' Wire Guard (two required for 8' fixture)
- OS1K** Occupancy Sensor Kit, 120/277/347V, One Relay¹

¹ Use programmed start ballast. Not recommended for use with an instant start.
For more occupancy/daylight harvesting sensor accessories see Technical section.

Columbia
LIGHTING**CSR4, CSR8 HIGH OUTPUT**
4' or 8' Industrial / 1 or 2-Lamp T8HO, T12HO**PHOTOMETRIC DATA**

Test 10124 Test Date 1/8/03

LUMINAIRE DATA

Luminaire	CSR8-296HO-U-LE
	CSR Industrial
	96" X 11" Industrial with Baked
	White Apertured Reflector
Ballast	R-2S110-TP
Ballast Factor	0.95
Lamp	F96T12/CW/HO
Lumens per Lamp	9000
Watts	237
Shielding Angle	N/A
Spacing Criterion	0° = 1.27 90° = 1.45
Luminous Opening in Feet	Length: 8.00
	Width: 0.92
	Height: 0.00

ZONAL LUMEN SUMMARY

Zone	Lumens	Lamp	Fixt.
0-30	3371	18.7	22.2
0-40	5669	31.5	37.3
0-60	10770	59.8	70.9
0-90	14595	81.1	96.1
90-120	388	2.2	2.6
90-130	507	2.8	3.3
90-150	582	3.2	3.8
90-180	597	3.3	3.9
0-180	15192	84.4	100.0

ENERGY DATA

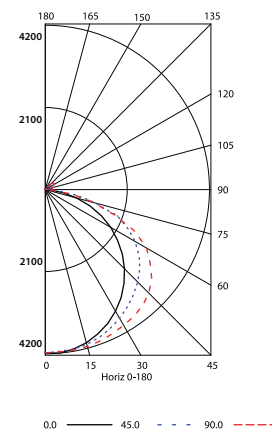
Total Luminaire Efficiency	84.4%
Luminaire Efficacy Rating (LER)	61
IESNA RP-1-1993 Compliance	Non-Compliant
Comparative Yearly Lighting Energy Cost per 1000 Lumens	\$3.93 based on 3000 hrs. and \$0.08 per KWH

AVG. LUMINANCE (Candela/Sq. M.)

	0.0	22.5	45.0	67.5	90.0
Average Luminance Angle					
0	6099	6099	6099	6099	6099
30	6061	6184	6410	6667	6768
40	5972	6182	6693	7203	7388
45	5917	6184	6908	7518	7737
50	5847	6205	7169	7881	8070
55	5755	6260	7471	8129	8340
60	5672	6388	7748	8488	8746
65	5475	6617	8018	8672	8734
70	5183	6833	8373	8157	8009
75	4724	6990	7538	7295	7222
80	3925	6932	6536	6089	5929
85	2635	6142	5135	4246	3641

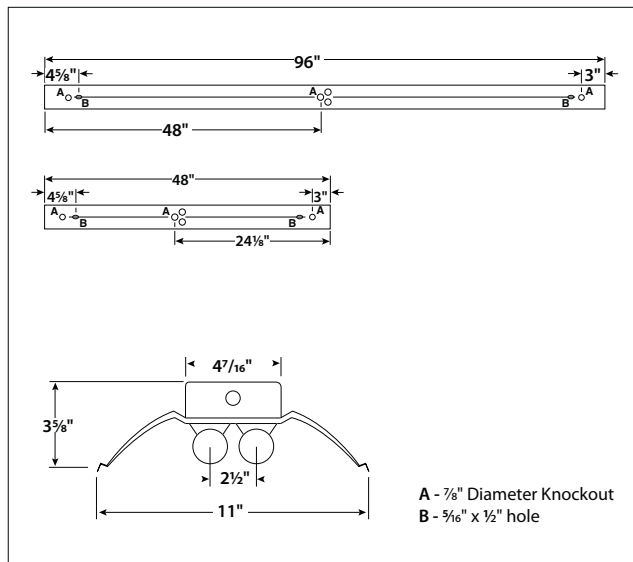
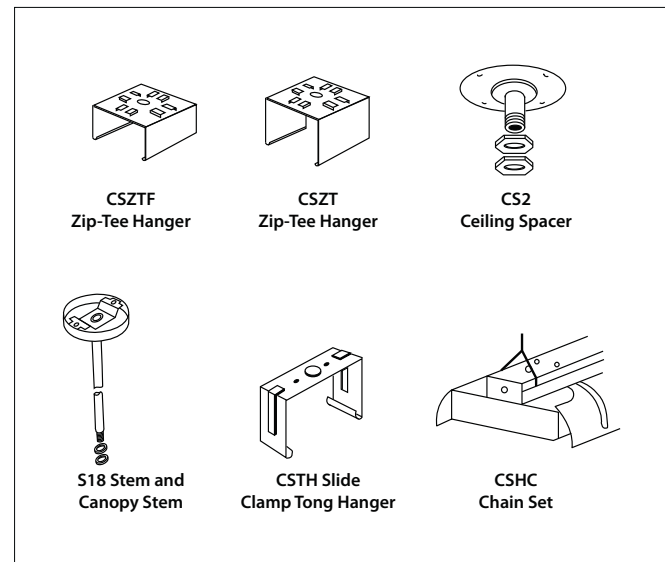
COEFFICIENTS OF UTILIZATION (%)

RCR	80				70				50				0
	RW	70	50	30	10	70	50	30	10	70	50	30	10
1	90	86	82	78	88	84	80	77	79	77	74	74	66
2	81	74	68	63	79	72	66	62	68	64	60	60	54
3	74	64	57	51	71	63	56	50	60	54	49	49	45
4	67	56	49	43	65	55	48	42	53	46	41	41	37
5	61	50	42	36	59	49	41	36	47	40	35	35	32
6	57	45	37	31	55	44	36	31	42	35	30	30	28
7	52	40	33	27	51	40	32	27	38	31	27	27	24
8	49	37	29	24	47	36	29	24	35	28	24	24	21
9	45	34	26	22	44	33	26	21	32	26	21	21	19
10	42	31	24	19	41	30	24	19	29	23	19	19	17

INDOOR CANDELA PLOT

RCR = Room Cavity Ratio

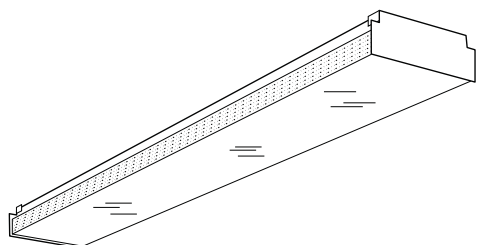
RC = Effective Ceiling Cavity Reflectance RW = Wall Reflectance

DIMENSIONAL DATA**MOUNTING ACCESSORIES****NOTE:** All dimensions are in inches; dimensions and specifications are subject to change without notice. Please consult factory or check sample for verification.

Columbia
LIGHTING

AWN

8⁵/₁₆" Wide Low Profile Wraparound / 2-Lamp T5, T5HO, T8



FEATURES

- Clear acrylic prismatic diffuser, flat bottom with vertical sides
- Two, three, or four-lamp cross sections
- Hinges from either side
- White steel end plates with flush knockouts for continuous row mounting
- Heavy gauge steel housing die embossed for maximum rigidity
- Heat sink embossments and levelling projections allow direct mounting of HPF fixtures on combustible low density cellulose fiberboard ceilings
- All metal parts are treated with a five stage phosphate bonding process and finished with a baked white enamel

PROJECT INFORMATION

Project Name _____

Type _____

Catalog No. _____

Date _____

BALLASTS

Energy efficient, thermally protected, automatic resetting, Class P, high power factor, sound rated A, unless otherwise specified. CEE NEMA Premium compliant.

ELECTRICAL

Standard class "P", thermally protected, auto-resetting HPF ballast, sound rated A. CEE NEMA Premium compliant. All ballast leads extend a minimum of 6" through access location. NEC/CEC-compliant ballast disconnect is standard.

FINISH

All parts pre-painted with high gloss baked white enamel, minimum reflectance 86%, applied over iron phosphate pre-treatment for maximum adhesion and rust resistance.

SHIELDING

100% clear prismatic acrylic.

CERTIFICATION

All luminaires are built to UL 1598 standards and bear appropriate UL and cUL or CSA labels. Damp location labeling is standard. Emergency-equipped fixtures labeled UL 924.

ORDERING INFORMATION

EXAMPLE AWN4-232-EU

AWN		2					
MODEL	LENGTH	NO. OF LAMPS IN CROSS SECTION	LAMP TYPE	BALLAST	VOLTAGE	OPTIONS	
AWN 8 ⁵ / ₁₆ " Wide Low Profile Wraparound	2 2'	2 Two	17 2', T8: 17 Watt	E Electronic T8, Instant Start	U 120V-277V	GLR Fast Blow Fuse	
	4 4'		28 4', T5: 28 Watt	4E 4-Lamp Electronic T8, Instant Start	347 347V	EL Emergency Battery Pack	
	8 8'		32 4', T8: 32, 30, 28 or 25 Watt	EP Electronic T5 or T8, Programmed Start		PAF Paint After Fabrication	
			54 4', T5HO: 54 or 51 Watt	4EP 4-Lamp Electronic T5HO or T8, Programmed Start		NYC NYC Compliant	
				For a specific ballast vendor, show as option.			
						ACCESSORIES (ORDER SEPARATELY)	
						S18 18" Stem, Canopy	
						SS18 18" Swivel Stem - 45° Swivel	

Columbia LIGHTING

AWN

8 $\frac{5}{16}$ " Wide Low Profile Wraparound / 2-Lamp T5, T5HO, T8

PHOTOMETRIC DATA

Test 12409 Test Date 7/23/03

LUMINAIRE DATA

Luminaire	AWN4-232 AWN/AWW Wraparound 8" x 48" 2-Lamp with Wraparound Acrylic Prismatic Lens
Ballast	B232I120RH
Ballast Factor	0.88
Lamp	F32T8
Lumens per Lamp	2900
Watts	54
Shielding Angle	N/A
Spacing Criterion	0° = 1.28 90° = 1.36
Luminous Opening in Feet	Length: 3.99 Width: 0.68 Height: 0.12

ZONAL LUMEN SUMMARY

Zone	Lumens	% Lamp	% Fixt.
0-30	1089	18.8	26.2
0-40	1800	31.0	43.3
0-60	2948	50.8	70.9
0-90	3665	63.2	88.1
90-120	385	6.6	9.3
90-130	428	7.4	10.3
90-150	476	8.2	11.4
90-180	493	8.5	11.9
0-180	4158	71.7	100.0

ENERGY DATA

Total Luminaire Efficiency	71.7%
Luminaire Efficacy Rating (LER)	68
IESNA RP-1-1993 Compliance	Noncompliant
Comparative Yearly Lighting Energy Cost per 1000 Lumens	\$3.53 based on 3000 hrs. and \$0.08 per KWH

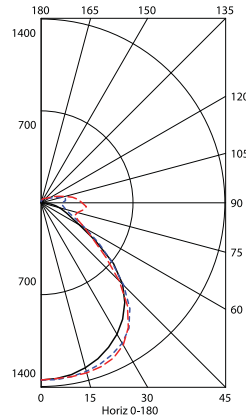
COEFFICIENTS OF UTILIZATION (%)

RCR	RC	80				70				50				0
		RW	70	50	30	10	70	50	30	10	50	30	10	0
1	76	72	69	66	66	73	70	67	64	65	63	61	52	
2	69	63	58	54	66	61	57	53	57	54	51	44		
3	63	56	50	46	61	54	49	45	51	47	43	38		
4	58	50	44	39	56	48	43	38	46	41	37	32		
5	54	45	39	34	52	43	38	33	41	36	32	28		
6	50	40	34	30	48	39	34	29	37	32	28	25		
7	46	37	31	26	44	36	30	26	34	29	25	22		
8	43	34	28	24	41	33	27	23	31	26	23	20		
9	40	31	25	21	39	30	25	21	29	24	20	18		
10	38	28	23	19	36	28	23	19	26	22	19	16		

RCR = Room Cavity Ratio

RC = Effective Ceiling Cavity Reflectance RW = Wall Reflectance

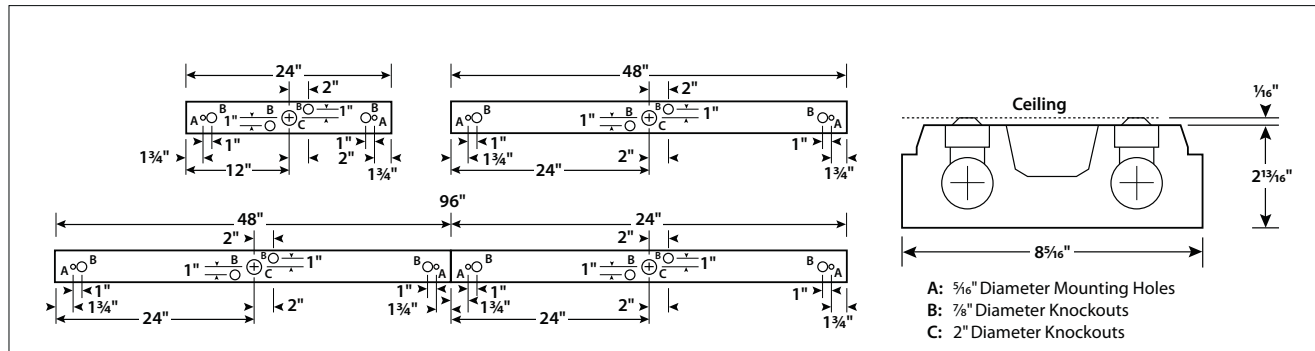
INDOOR CANDELA PLOT



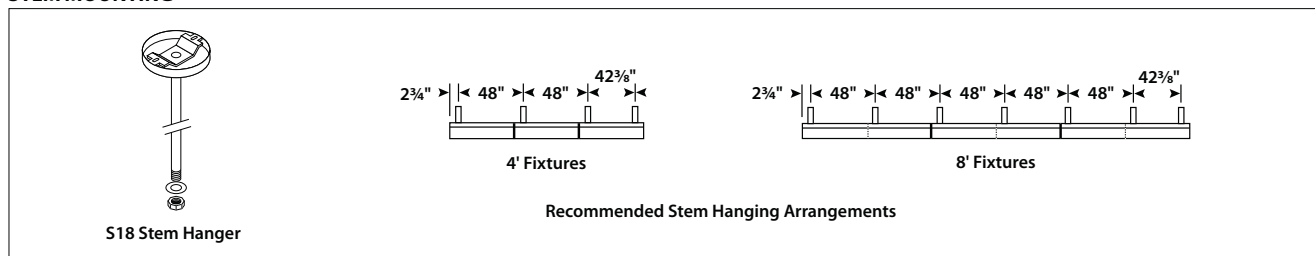
AVG. LUMINANCE (Candela/Sq. M.)

	0.0	22.5	45.0	67.5	90.0
Average Luminance Angle					
0	5356	5356	5356	5356	5356
30	5205	5124	5218	5214	5201
40	5006	4920	4849	4675	4615
45	4782	4605	4357	4089	4006
50	4290	4068	3706	3331	3279
55	3362	3476	3073	2630	2679
60	2526	2840	2489	2266	2340
65	2143	2221	2073	2111	2098
70	2025	1848	1879	2117	2148
75	1971	1707	1925	2404	2652
80	1932	1720	2174	3169	3677
85	1762	1917	2711	4499	5220

DIMENSIONAL DATA



STEM MOUNTING

**NOTE:** All dimensions are in inches; dimensions and specifications are subject to change without notice. Please consult factory or check sample for verification.

Equipment List

Item	Product
1	22A-D4P0N104 PowerFlex4 AC Drive, 480VAC, 3PH, 4 Amps, 1.5 kW, 2 HP,Frame Size A, IP20 (Open), LED Display, Fixed Digital Keypad, No CE Compliant Filter, RS485
2	20BD011A0AYNAND0 PowerFlex700 AC Drive, 480 VAC, 3 PH, 11 Amps, 7.5 HP Normal Duty, 5 HP Heavy Duty, IP20 / Type 1, with conformal coating, No HIM (Blank Plate), Brake IGBT Installed, Without Drive Mounted Brake Resistor, Second Environment Filter per CE EMC directive (89/336/EEC), No Communication Module, Vector Control with 120V I/O, No Feedback
3	22A-D4P0N104 PowerFlex4 AC Drive, 480VAC, 3PH, 4 Amps, 1.5 kW, 2 HP,Frame Size A, IP20 (Open), LED Display, Fixed Digital Keypad, No CE Compliant Filter, RS485
4	22A-D4P0N104 PowerFlex4 AC Drive, 480VAC, 3PH, 4 Amps, 1.5 kW, 2 HP,Frame Size A, IP20 (Open), LED Display, Fixed Digital Keypad, No CE Compliant Filter, RS485
5	22C-D010N103 PowerFlex 400 , Fan & Pump Drive. 480 VAC, 3 PH. 10 Amps. 5 HP,Frame Size C, IP20 (Open). Fixed Keypad. RS485 (without Brake IGBT)
6	22C-D010N103 PowerFlex 400 , Fan & Pump Drive. 480 VAC, 3 PH. 10 Amps. 5 HP,Frame Size C, IP20 (Open). Fixed Keypad. RS485 (without Brake IGBT)
7	22C-D017N103 PowerFlex 400 , Fan & Pump Drive. 480 VAC, 3 PH. 17 Amps. 10 HP,Frame Size C, IP20 (Open). Fixed Keypad. RS485 (without Brake IGBT)
8	20BD5P0A0AYNAND0 PowerFlex700 AC Drive, 480 VAC, 3 PH, 5 Amps, 3 HP Normal Duty, 2 HP Heavy Duty, IP20 / Type 1, with conformal coating, No HIM (Blank Plate), Brake IGBT Installed, Without Drive Mounted Brake Resistor, Second Environment Filter per CE EMC directive (89/336/EEC), No Communication Module, Vector Control with 120V I/O, No Feedback
9	20BD5P0A0AYNAND0 PowerFlex700 AC Drive, 480 VAC, 3 PH, 5 Amps, 3 HP Normal Duty, 2 HP Heavy Duty, IP20 / Type 1, with conformal coating, No HIM (Blank Plate), Brake IGBT Installed, Without Drive Mounted Brake Resistor, Second Environment Filter per CE EMC directive (89/336/EEC), No Communication Module, Vector Control with 120V I/O, No Feedback
10	20BD011A0AYNAND0 PowerFlex700 AC Drive, 480 VAC, 3 PH, 11 Amps, 7.5 HP Normal Duty, 5 HP Heavy Duty, IP20 / Type 1, with conformal coating, No HIM (Blank Plate), Brake IGBT Installed, Without Drive Mounted Brake Resistor, Second Environment Filter per CE EMC directive (89/336/EEC), No Communication Module, Vector Control with 120V I/O, No Feedback
11	20BD027A0AYNAND0 PowerFlex700 AC Drive, 480 VAC, 3 PH, 27 Amps, 20 HP Normal Duty, 15 HP Heavy Duty, IP20 / Type 1, with conformal coating, No HIM (Blank Plate), Brake IGBT Installed, Without Drive Mounted Brake Resistor, Second Environment Filter per CE EMC directive (89/336/EEC), No Communication Module, Vector Control with 120V I/O, No Feedback
12	20BD027A0AYNAND0 PowerFlex700 AC Drive, 480 VAC, 3 PH, 27 Amps, 20 HP Normal Duty, 15 HP Heavy Duty, IP20 / Type 1, with conformal coating, No HIM (Blank Plate), Brake IGBT Installed, Without Drive Mounted Brake Resistor, Second Environment Filter per CE EMC directive (89/336/EEC), No Communication Module, Vector Control with 120V I/O, No Feedback
13	22C-D022N103 PowerFlex 400 , Fan & Pump Drive. 480 VAC, 3 PH. 22 Amps. 15 HP,Frame Size C, IP20 (Open). Fixed Keypad. RS485 (without Brake IGBT)
14	22C-D060A103 PowerFlex 400 , Fan & Pump Drive. 480 VAC, 3 PH. 60 Amps. 40 HP,Frame Size D, IP30 (NEMA 1 / UL Type 1). Fixed Keypad. RS485 (without Brake IGBT)
15	20F11ND052AA0NNNNN PowerFlex 753 AC Drive, with Embedded I/O, Air Cooled, AC Input with DC Terminals, Open Type, 52 Amps, 40HP ND, 30HP HD, 480 VAC, 3 PH, Frame 4, Filtered, CM Jumper Removed, DB Transistor, Blank (No HIM)

Equipment List

Item	Product
1	20BD065A0AYNANDO PowerFlex700 AC Drive, 480 VAC, 3 PH, 65 Amps, 50 HP Normal Duty, 40 HP Heavy Duty, IP20 / Type 1, with conformal coating, No HIM (Blank Plate), Brake IGBT Installed, Without Drive Mounted Brake Resistor, Second Environment Filter per CE EMC directive (89/336/EEC), No Communication Module, Vector Control with 120V I/O, No Feedback
2	20BD011A0AYNANDO PowerFlex700 AC Drive, 480 VAC, 3 PH, 11 Amps, 7.5 HP Normal Duty, 5 HP Heavy Duty, IP20 / Type 1, with conformal coating, No HIM (Blank Plate), Brake IGBT Installed, Without Drive Mounted Brake Resistor, Second Environment Filter per CE EMC directive (89/336/EEC), No Communication Module, Vector Control with 120V I/O, No Feedback
3	20F11ND027AA0NNNNN PowerFlex 753 AC Drive, with Embedded I/O, Air Cooled, AC Input with DC Terminals, Open Type, 27 Amps, 20HP ND, 15HP HD, 480 VAC, 3 PH, Frame 3, Filtered, CM Jumper Removed, DB Transistor, Blank (No HIM)
4	23C-D6P0E103NNAANN-E5-LR PowerFlex 400 , Fan & Pump Drive. 480 VAC, 3 PH. 4.8 Amps. 3 HP. Type 4. Fixed Keypad. RS485. Main Input Fused Disconnect

12/9/13

AB Support : PowerFlex 700 : Drive Specifications



DRIVES SERVICE & SUPPORT

> Powerflex 700 > Specifications


Drives Service & Support

- Drives Support Home
- Drives Products Home
- + AC Drives
- + DC Drives
- + Communications
- + Peripherals
- + Support Options
- + Get Literature
- + Contact Drives Support

General Resources


- A to Z Product Directory
- Configuration and Selection Tools
- Knowledgebase
- Events Listing
- + Locate Us
- Newsletters & Magazines
- Product Certification
- + Publications Library
- Technical Support

Click for [Dimensions](#).

Category	Specification					
Protection	PowerFlex 700 Drive	200-208V Drive	240V Drive	380/400 Drive	480V Drive	600V Drive
	AC Input Overvoltage Trip	247V AC	285V AC	475V AC	570V AC	690V AC
	AC Input Undervoltage Trip	120V AC	138V AC	233V AC	280V AC	345V AC
	Bus Overvoltage Trip	350V DC	405V AC	675V AC	810V AC	1013V DC
	Bus Undervoltage Trip	Adjustable				
	Nominal Bus Voltage	281V DC	324V AC	540V AC	648V AC	810V DC
	Heat Sink Thermistor	Monitored by microprocessor overtemp trip				
	Drive Overcurrent Trip	Software Current Limit: 20-160% of rated current				
		Hardware Current Limit: 200% of rated current (typical)				
		Instantaneous Current Limit: 220-300% of rated current (dependent on drive rating)				
	Line transients	up to 6000 volts peak per IEEE C62.41-1991				
	Control Logic Noise Immunity	Showering arc transients up to 1500V peak				
	Power Ride-Thru	15 millisecond at full load				
	Logic Control Ride-Thru	0.5 seconds minimum, 2 seconds typical				
	Ground Fault Trip	Phase-to-ground on drive output				
	Short Circuit Trip	Phase-to-phase on drive output				
		The drive is designed to meet the following specifications: NFPA 70 - US National Electrical Code NEMA ICS 3.1 - Safety standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems. NEMA 250 - Enclosures for Electrical Equipment IEC 146 - International Electrical Code.				
		 UL and cUL Listed to UL508C and CAN/CSA-C2.2 No. 14-M91				

12/9/13

AB Support : PowerFlex 700 : Drive Specifications

Agency Certification	 <p>Marked for all applicable European Directives (1) EMC Directive (89/336/EEC) Emissions EN 61800-3 Adjustable Speed electrical power drive systems Part 3 Immunity EN 61800-3 Second Environment, Restricted Distribution Low Voltage Directive (73/23/EEC) EN 60204-1 Safety of Machinery -Electrical Equipment of Machines EN 50178 Electronic Equipment for use in Power Installations</p>	
	PowerFlex 700 AC drives 160...500 kW / 250...700 Hp are now available with CE and C-Tick Certification	
Environment	Altitude:	1000 m (3300 ft) max. without derating
	Ambient Operating Temperature without derating	Open Type: 0°C to 50°C (32°F to 122°F) IP20: 0°C to 50°C (32°F to 122°F) NEMA Type 1: 0°C to 40°C (32°F to 104°F) IP56, NEMA Type 4X: 0°C to 40°C (32°F to 104°F)
	Storage Temperature (all const.)	-40°C to 70°C (-40°F to 158°F)
	Relative Humidity	5 to 95% non-condensing
	Shock	15G peak for 11ms duration (1.0 ms)
	Vibration	0.152 mm (0.006 in.) displacement, 1G peak
Electrical	Voltage Tolerance	-10% of minimum, +10% of maximum.
	Frequency Tolerance	47-63 Hz.
	Input Phase	Three-phase input provides full rating for all drives. Single-phase operation provides 50% of rated current.
	Displacement Power Factor	TBD
	Efficiency	97.5% at rated amps, nominal line volts.
	Max. Short Circuit Current Rating: Using Recommended Fuse or Circuit Breaker Type	Maximum short circuit current rating to match specified fuse/circuit breaker capability.
	Method	Sine coded PWM with programmable carrier frequency. Ratings apply to all drives (refer to the Derating Guidelines on page 1-3 of reference manual). The drive can be supplied as 6 pulse or 12 pulse in a configured package.
	Carrier	PF700 - 0-3 Frames:

12/9/13

AB Support : PowerFlex 700 : Drive Specifications

Control	Frequency	2-10 kHz. Drive rating based on 4 kHz
	Output Voltage Range	0 to rated motor voltage
	Output Frequency Range	0 to 400 Hz.
	Frequency Accuracy	Digital Input: Within $\pm 0.01\%$ of set output frequency. Analog Input : Within $\pm 0.4\%$ of maximum output frequency.
	Selectable Motor Control	Sensorless Vector with full tuning. Standard V/Hz with full custom capability. PF700 adds flux vector.
	Stop Modes	Multiple programmable stop modes including - Ramp, Coast, DC-Brake, Ramp-to-Hold and S-curve.
	Accel/Decel	Two independently programmable accel and decel times. Each time may be programmed from 0 - 3600 seconds in 0.1 second increments
	Intermittent Overload	110% Overload capability for up to 1 minute 150% Overload capability for up to 3 seconds
	Current Limit Capability	Proactive Current Limit programmable from 20 to 160% of rated output current. Independently programmable proportional and integral gain.
	Electronic Motor Overload Protection	Class 10 protection with speed sensitive response. Investigated by U.L. to comply with N.E.C. Article 430. U.L. File E59272, volume 12.

(1) Applied noise impulses may be counted in addition to the standard pulse train causing erroneously high [Pulse Freq] readings.

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Adjustable Speed Drives & Drive Systems - PowerFlex 525



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PowerFlex 525

Introduction Cat. No. Explanation Product Selection Accessories **Specifications** Approximate Dimensions



For details, refer to the PowerFlex 520-Series Technical Data.

Certifications

ACS 156	Tested by Trentec to be compliant with AC156 Acceptance Criteria for Seismic Qualification Testing of Nonstructural Components and 2003 International Building Code for worst-case seismic level for USA excluding site class F.
ATEX	Certified to ATEX directive 94/9/EC Group II Category (2) GD Applications with ATEX Approved Motors
C-Tick	Australian Communications and Media Authority In conformity with the following: Radiocommunications Act: 1992 Radiocommunications Standard: 2008 Radiocommunications Labelling Notice: 2008 Standards applied: EN 61800-3:2004
c-UL-us	Listed to UL508C and CAN/CSA-C22.2 No. 14-05.
CE	In conformity with the following European Directives: EMC Directive (2004/108/EC) Low Voltage Directive (2006/95/EC) Standards applied: EN 61800-3:2004 EN 61800-5-1:2007
EPRI/SEMI F47	Electric Power Research Institute Certified compliant with the following standards: SEMI F47 IEC 61000-4-34
GOST-R	Russian GOST-R Certificate no. POCC US.ME92.H00040
KCC	Korean Registration of Broadcasting and Communications Equipment Compliant with the following standards: Article 58-2 of Radio Waves Act, Clause 3
Lloyd's Register	Lloyd's Register Type Approval Certificate 12/10068(E1)
RoHS	Compliant with the European "Restriction of Hazardous Substances" Directive
TÜV	TÜV Rheinland Standards applied: EN ISO 13849-1:2008 EN ISO 13849-2:2008 EN 61800-5-2:2007 EN 61508 PARTS 1-7:2010 EN 62061:2005 EN 60204-1:2009 Certified to ISO 13849-1 SIL2/PLd with embedded Safe-Torque-Off function. Meets Functional Safety (FS) when used with embedded Safe-Torque-Off function.
The drive is also designed to meet the appropriate portions of the following specifications: NFPA 70 - US National Electrical Code NEMA ICS 3.1 - Safety standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems.	

Environmental Specifications

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Category	Specification
Altitude Without derating: With derating:	1000 m (3300 ft) maximum Up to 4000 m (13,200 ft) maximum, with the exception of 600V drives at 2000 m (6600 ft) maximum.
Maximum Surrounding Air Temperature Without derating: With derating:	-20...50 °C (-4...122 °F) -20...60 °C (-4...140 °F) or -20...70 °C (-4...158 °F) with optional fan kit.
Storage Temperature Frame A...D: Frame E:	-40...85 °C (-40...185 °F) -40...70 °C (-40...158 °F)
Atmosphere:	Important: Drive must not be installed in an area where the ambient atmosphere contains volatile or corrosive gas, vapors or dust. If the drive is not going to be installed for a period of time, it must be stored in an area where it will not be exposed to a corrosive atmosphere.
Relative Humidity:	0 to 95% non-condensing
Shock:	Complies with IEC 60068-2-27
Vibration:	Complies with IEC 60068-2-6:1995
Conformal Coating:	Complies with IEC 60721-3-3 to level 3C2 (chemical gases only)
Surrounding Environment Pollution Degree Pollution Degree 1 & 2:	All enclosures are acceptable.

Technical Specifications

Category	Specification	
Protection	Electronic Motor Overload Protection:	Class 10 motor overload protection according to NEC article 430 and motor over-temperature protection according to NEC article 430.126 (A) (2). UL 508C File 29572.
	Overcurrent:	200% hardware limit, 300% instantaneous fault
	Bus Overvoltage Trip (AC Input) 100...120V: 200...240V: 380...480V: 525...600V:	405V DC bus (equivalent to 150V AC incoming line) 405V DC bus (equivalent to 290V AC incoming line) 810V DC bus (equivalent to 575V AC incoming line) 1005V DC bus (equivalent to 711V AC incoming line)
	Bus Undervoltage Trip (AC Input) 100...120V: 200...240V: 380...480V: 525...600V AC Input P038 = 3 "High Voltage": P038 = 2 "Low Voltage":	190V DC bus (equivalent to 75V AC incoming line) 190V DC bus (equivalent to 150V AC incoming line) 390V DC bus (equivalent to 275V AC incoming line) 487V DC bus (equivalent to 344V AC incoming line) 390V DC bus (equivalent to 275V AC incoming line)
	Power Ride-Thru:	100 ms
	Logic Control Ride-Thru:	Minimum is 0.5 seconds - 2 seconds, typical.
	Ground Fault Trip:	Phase-to-ground on drive output
	Short Circuit Trip:	Phase-to-phase on drive output
Electrical	Input Phases:	Three-phase input provides full rating. Single-phase input provides 35% rating on three-phase drives.
	Voltage Tolerance:	-15% / +10%
	Frequency Tolerance:	47...63 Hz
	Displacement Power Factor:	0.98 across entire speed range
	Maximum Short Circuit Rating:	100,000 Amps symmetrical
	Actual Short Circuit Rating:	Determined by AIC Rating of installed fuse/circuit breaker.
	Transistor Type:	Isolated Gate Bipolar Transistor (IGBT).
Control	Method:	Sinusoidal PWM, Volts/Hertz, Sensorless Vector Control, Economizer SVC motor control, and Closed Loop Velocity Vector Control.
	Carrier Frequency:	2...16 kHz, drive rating based on 4 kHz.

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	Frequency Accuracy Digital Input: Analog Input: Analog Output:	Within $\pm 0.05\%$ of set output frequency. Within 0.5% of maximum output frequency, 10-bit resolution. $\pm 2\%$ of full scale, 10-bit resolution.
	Speed Regulation Volts/Hertz: Sensorless Vector: Economizer SVC: Velocity Vector Control:	$\pm 1\%$ of base speed across a 60:1 speed range. $\pm 0.5\%$ of base speed across a 100:1 speed range. $\pm 0.5\%$ of base speed across a 100:1 speed range. $\pm 0.5\%$ of base speed across a 60:1 speed range.
	Speed Regulation with Encoder Sensorless Vector: Economizer SVC: Velocity Vector Control:	$\pm 0.1\%$ of base speed across a 100:1 speed range. $\pm 0.1\%$ of base speed across a 100:1 speed range. $\pm 0.1\%$ of base speed across a 1000:1 speed range.
	Output Voltage Range:	0V to rated motor voltage
	Output Frequency:	0...500 Hz (programmable)
	Efficiency:	97.5% (typical)
	Stop Modes:	Multiple programmable stop modes including; Ramp, Coast, DC Brake, and Ramp-to-Stop.
	Accel/Decel:	Four independently programmable accel and decel times. Each time may be programmed from 0...600 seconds in 0.01 second increments.
	Intermittent Overload Normal Duty: Heavy Duty:	110% Overload capability for up to 60 seconds, 150% for up to 3 seconds. 150% Overload capability for up to 60 seconds, 180% for up to 3 seconds (200% programmable).
Control I/O	Digital Control Inputs Bandwidth: Quantity: Current: SRC (Source) Mode: SNK (Sink) Mode:	10 Rad/s for open and closed loop 1 dedicated for stop, 6 programmable 6 mA On = 18...24V, Off = 0...6V On = 0...6V, Off = 18...24V
	Analog Control Inputs Quantity: Resolution: 0...10V DC: 4...20 mA: External Pot:	2 isolated, -10V to 10V and 4-20mA 10-bit 100k ohm input impedance 250 ohm input impedance 1...10k ohms, 2 Watt minimum
	Relay Control Outputs Quantity: Resistive Rating: Inductive Rating:	1 programmable Form A and 1 programmable Form B 3.0 A at 30V DC, 3.0 A at 125 and 240V AC 0.5 A at 30V DC, 0.5 A at 125 and 240V AC
	Opto Control Outputs Quantity: Specification:	2 programmable 30V DC, 50 mA non-inductive
	Analog Control Outputs Quantity: Resolution: 0-10V DC: 4-20 mA:	1 non-isolated 0-10V or 4-20 mA 10-bit 1 k ohm minimum 525 ohm maximum
Encoder	Type: Supply: Quadrature: Duty Cycle: Requirements:	Incremental, dual channel 12V, 250 mA. 90 °, ± 27 ° at 25 °C. 50%, +10% Encoders must be line driver type, quadrature (dual channel) or pulse (single channel), 3.5...26V DC output, single-ended or differential and capable of supplying a minimum of 10 mA per channel. Allowable input is DC up to a maximum frequency of 250 kHz. The encoder I/O automatically scales to allow 5V, 12V and 24V DC nominal voltages.

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Adjustable Speed Drives & Drive Systems - PowerFlex 753



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PowerFlex 753

Introduction Cat. No. Explanation Product Selection Accessories **Specifications** Approximate Dimensions



For details, refer to the PowerFlex 750-Series Technical Data.

Certifications

ABS (Frames 2...7, 400/480V AC)	American Bureau of Shipping Certificate 11-HS743429-PDA
C-Tick	Australian Communications and Media Authority In conformity with the following: Radiocommunications Act: 1992 Radiocommunications Standard: 2008 Radiocommunications Labelling Notice: 2008 Standards applied: EN 61800-3:2004
c-UL-us	Listed to UL508C and CAN/CSA-C22.2 No. 14-05.
CE	In conformity with the following European Directives: EMC Directive (2004/108/EC) Low Voltage Directive (2006/95/EC) Standards applied: EN 61800-3:2004 EN 61800-5-1:2007
EPRI/SEMI F47	Electric Power Research Institute Certified compliant with the following standards: SEMI F47 IEC 61000-4-34
GOST-R (Frames 2...7, 400/480V AC)	Russian GOST-R Certificate no. POCC US.ME92.H00040
Lloyds Register (Frames 2...7, 400/480V AC)	Lloyd's Register Type Approval Certificate 11/60008
RINA (Frames 2...7, 400/480V AC)	RINA Certificate ELE349811CS
TÜV	TÜV Rheinland Certification applies to 20-750-S and 20-750-S1 Safety Options when installed in drive. Standards applied: EN 61800-3:2004 EN 61800-5-1:2007 EN ISO 13849-1:2008 EN ISO 13849-2:2003 EN 61800-5-2:2007 EN 61508 PARTS 1-7:2000 EN 62061:2005 EN 60204-1:2006

Environmental Specifications

Category	Specification				
Altitude: Based on Load: Based on Voltage:	Refer to the PowerFlex 750-Series Technical Data (publication 750-TD001) for Derating Guidelines.				
	System & Ground Configuration Center Grounded (Y Neutral) w/Solid Ground	Overvoltage Category (1) II (2) III (3)	Altitude Limit at 400/480V AC (2) (5) 9000 m above sea level (3) 4800 m above sea level	Altitude Limit at 600V AC (2) (5) 7500 m above sea level (3) 4800 m above sea level	Altitude Limit at 690V AC (2) (5) 7500 m above sea level (3) 4800 m above sea level
	Ungrounded, Impedance Grounded, or Corner	II (2) III (3)	4800 m above sea level		4800 m above

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	Grounded		level 2000 m above sea level	7500 m above sea level (3) 4800 m above sea level	sea level 2000 m above sea level
<p>Notes: Based on EN61800-5-1 (Electro-thermal Safety Standard for drives)</p> <p>(1) Overvoltage Categories: Category II (Isolation Transformer Level) - Typically two levels of isolation or protection from outdoor power lines. Category III (Most Common) Distribution Level Inside a Building - Typically one level of isolation or protection from outdoor power lines.</p> <p>(2) Excluding failure from cosmic radiation. Cosmic radiation will increase rate of IGBT malfunction at altitudes greater than 3000 m above sea level. Concrete walls and ceilings or concrete walls and large bottles of water overhead are examples of ways to shield against cosmic radiation.</p> <p>(3) Drive is limited to a maximum of 4800 m thermally. Refer to the PowerFlex 750-Series Technical Data (publication 750-TD001) for Derating Guidelines.</p> <p>(4) In CE installations, Frame 1 does not support ungrounded or corner grounded configurations.</p> <p>(5) Frame 1 drives are limited to a maximum of 2000 m thermally. Refer to the PowerFlex 750-Series Technical Data (publication 750-TD001) for Derating Guidelines.</p>					
Maximum Surrounding Air Temperature	IP20, NEMA/UL Open Type: IP00, NEMA/UL Open Type: IP20, NEMA/UL Type 1 (w/Hood): IP20, NEMA/UL Type 1 (w/Label):	Frame 1...5, All Ratings: Frame 6...7, All Ratings: Frame 1...5, All Ratings: Frame 6...7, All Ratings:	0...50 °C (32...122 °F) 0...50 °C (32...122 °F) 0...40 °C (32...104 °F) 0...40 °C (32...104 °F)		
Flange Mount, Front			0...50 °C (32...122 °F) 0...50 °C (32...122 °F)		
Flange Mount, Back/Heat Sink			0...40 °C (32...104 °F)		
Stand-alone/Wall Mount	IP66, NEMA/UL Type 4X: IP54, NEMA/UL Type 12:	Frame 2...5, All Ratings: Frame 6...7, All Ratings: Frame 2...7, All Ratings: Frame 2...7, All Ratings:	0...40 °C (32...104 °F)		
Storage Temperature (All Const.):	-40...70 °C (-40...158 °F)				
Atmosphere:	Important: Drive must not be installed in an area where the ambient atmosphere contains volatile or corrosive gas, vapors or dust. If the drive is not going to be installed for a period of time, it must be stored in an area where it will not be exposed to a corrosive atmosphere.				
UV Radiation	The HIM and IP54, NEMA/UL Type 12 drive plastics are not UV rated.				
Relative Humidity:	5 to 95% non-condensing				
Shock:	Operating Frame 1...6: Frame 7:	15 g peak for 11 ms duration (±1.0 ms) 10 g peak for 11 ms duration (±1.0 ms)			
	Packaged for Shipment Frame 1...2: Frame 3...4: Frame 5: Frame 6...7:	381 mm (15 in.) drop height 330 mm (13 in.) drop height 305 mm (12 in.) drop height Meets International Safe Transit Association (ISTA) test procedure 2B			
Vibration:	Operating Frame 1...2: Frame 3...5: Frame 6...7:	1.000 mm (0.040 in.) displacement, 2 g peak 1.000 mm (0.040 in.) displacement, 1.5 g peak 1.000 mm (0.040 in.) displacement, 1 g peak			
	Packaged for Shipment - Sinusoidal Loose Load Frame 1...5: Frame 6...7:	20.0 mm (0.8 in.) peak to peak, 2...5.186 Hz; 1.1 g peak from 5.186...20 Hz Meets ISTA 2B packaging standards			
	Random Secured Frame 1...5: Frame 6...7:	Frequency (Hz)/PSD (g ² /Hz) 1/0.00005 4/0.01 16/0.01 40/0.001 80/0.001 200/0.00001 Meets International Safe Transit Association (ISTA) test procedure 2B			

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Required Airflow:	Frame 1...2: Frame 3: Frame 4: Frame 5: Frame 6: Frame 7:	Total Fan Air Flow 0.024 CMS (50 CFM) 0.038 CMS (80 CFM) 0.151 CMS (320 CFM) 0.245 CMS (520 CFM) 0.238 CMS (504CFM) 0.357 CMS (756 CFM)
Sound:	Frame 1...2: Frame 3: Frame 4: Frame 5: Frame 6: Frame 7:	Sound Level 63 dB 64 dB 72 dB 77 dB 73 dB 74 dB (Sound pressure is measured at 2 m)
Surrounding Environment Pollution Degree Pollution Degree 1 & 2: Pollution Degree 3 & 4:	All enclosures acceptable. Enclosure that meets or exceeds IP54, NEMA/UL Type 12 required.	

Technical Specifications

Category	Specification	Motor Voltage			
		380...400V	480V	600V	690V
Protection	AC Input Overvoltage Trip:	576V AC	576V AC	825V AC	825V AC
	AC Input Undervoltage Trip:	250V AC	300V AC	400V AC	400V AC
	Bus Overvoltage Trip:	815V DC	815V DC	1167V DC	1167V DC
	Bus Undervoltage Shutoff:	200V DC	200V DC	200V DC (Frames 3...7)	200V DC (Frames 6...7)
	Nominal Bus Voltage:	540V DC	648V DC	810V DC	932V DC
	Drive Overcurrent Trip Software Overcurrent Limit: Instantaneous Current Limit: Hardware Overcurrent Limit:	200% of drive rated 100% of 3 sec. rating (158...210%) 143% of 3 sec. rating (215...287%)			
	Line transients:	up to 6000 volts peak per IEEE C62.41-1991			
	Control Logic Noise Immunity:	Showering arc transients up to 1500V peak			
	Power Ride-Thru:	15 milliseconds at full load			
	Logic Control Ride-Thru:	0.5 seconds minimum, 2 seconds typical			
	Ground Fault Trip:	Phase-to-ground on drive output			
	Short Circuit Trip:	Phase-to-phase on drive output			
Electrical	AC Input Voltage Tolerance:	Refer to the PowerFlex 750-Series Technical Data (publication 750-TD001)			
	Frequency Tolerance:	47...63 Hz			
	Input Phases:	Three-phase input provides full rating for all drives. Single-phase operation on Frames 1...7 provides up to 50% of rated current at 25 °C (77 °F) surrounding temperature.			
	DC Input Voltage Tolerance:	±10% of Nominal Bus Voltage (above)			
	Displacement Power Factor:	0.98 across entire speed range			
	DC Link Impedance:	Greater than or equal to 5%			
	Efficiency:	97.5% at rated amps, nominal line volts			
	Maximum Short Circuit Rating:	200,000 Amps RMS symmetrical (20F & 20G drives only)			
	Actual Short Circuit Rating:	Determined by AIC rating of installed fuse/circuit breaker			
	Drive to Motor Power Ratio Minimum: Maximum:	Recommended not less than 1:2 ratio Recommended not greater than 2:1 ratio			
	Brake IGBT Rating:	100% of motor rated torque			
	Control POD Current Draw:	5A			

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	Digital Inputs Nominal: Maximum: High State: Low State:	DC 24V DC 30V DC 20...24V DC 0...5V DC	AC 120V AC 132V AC 100...132V AC 0...30V AC
	Battery:	User installed CR1220 lithium coin cell battery provides power to the real time clock (optional, not supplied). Preserves the clock setting in the event power to the drive is lost or cycled. Approximate life is 4.5 years with drive unpowered, or lifetime if drive is powered.	
Control	Method:	Sine coded PWM with programmable carrier frequency. Ratings apply to all drives.	
	Carrier Frequency Default Settings:	Frame 1...4: 4 kHz Frame 5...7: 2 kHz	
	Settings:	Frame 1...6: 2, 4, 8, 12 kHz Frame 7: 2, 4, 8 kHz	
	Output Voltage Range:	0 to rated motor voltage	
	Output Frequency Range:	0...325 Hz at 2 kHz carrier, 0...650 Hz at 4 kHz carrier	
	Frequency Accuracy Digital Input: Analog Input:	Within ±0.01% of set output frequency Within ±0.4% of maximum output frequency	
	Frequency Control:	Speed regulation - with Slip Compensation (V/Hz & Sensorless Vector modes) 0.5% of base speed across 40:1 speed range, 40:1 operating range	
	Speed Control:	Without feedback (Flux Vector mode), 0.1% of base speed across 100:1 speed range, 120:1 operating range, 50 rad/sec bandwidth	
		With feedback (Flux Vector mode), 0.001% of base speed across 100:1 speed range, 1000:1 operating range, 190 rad/sec bandwidth	
	Torque Regulation:	Without feedback (Flux Vector mode), ±5%, 600 rad/sec bandwidth	
		With feedback (Flux Vector mode), ±2%, 2500 rad/sec bandwidth	
	Selectable Motor Control:	<ul style="list-style-type: none"> - Standard V/Hz with full custom capability - Sensorless Vector with full tuning - Flux Vector with and without a feedback device - Induction motor control - Surface mount permanent magnet motor control with encoder feedback (Frames 1...7) - Surface mount permanent magnet motor control without encoder feedback (Frames 1...7) - Internal permanent magnet motor control with encoder feedback (Frames 1...7) 	
	Stop Modes:	Multiple programmable stop modes including - Ramp, Coast, DC-Brake, Ramp-to-Hold, Fast Braking, and Current Limit Stop.	
	Accel/Decel:	Two independently programmable accel and decel times. Each time may be programmed from 0 to 3600 seconds in 0.1 second increments (0 to motor nameplate speed).	
	S Curve Time:	Adjustable from 0 to 100% of ramp time (normal duty rating).	
	Intermittent Overload: Normal Duty Heavy Duty	110% Overload capability for up to 1 minute out of 10 minutes 150% Overload capability for up to 3 seconds out of 60 seconds 150% Overload capability for up to 1 minute out of 10 minutes 180% Overload capability for up to 3 seconds out of 60 seconds	
	Current Limit Capability:	Proactive Current Limit programmable from 20 to 160% of rated output current. Independently programmable proportional and integral gain.	
	Electronic Motor Overload Protection:	Class 10 motor overload protection according to NEC article 430.126 (A)(2). UL 508C File E59272.	

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DRIVES SERVICE & SUPPORT

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Category	Specifications	
Environment	Altitude	1000 m (3300 ft) max. without derating
	Ambient Operating Temperature	IP20: -10 to 50 degrees C (14 to 122 degrees F) NEMA 1: -10 to 40 degrees C (14 to 104 degrees F)
	Cooling Method	Convection: 0.2 kW (0.25 HP) drive ratings, Catalog Numbers 22A-V1P5N104, 22A-A1P5N114, 22A-A1P5104 and 22A-B1P5N104 Fan: All other drive ratings.
	Storage Temperature:	-40 to 85 degrees C (-40 to 185 degrees F)
	Atmosphere:	Important: Drive must not be installed in an area where the ambient atmosphere contains volatile or corrosive gas, vapors or dust. If the drive is not going to be installed for a period of time, it must be stored in an area where it will not be exposed to a corrosive atmosphere.
	Relative Humidity:	0 to 95% non-condensing
	Shock (operating):	15G peak for 11ms duration (±1.0ms)
	Vibration (operating):	1G peak, 5 to 2000 Hz
Control	Method	Sine coded PWM with programmable carrier frequency. The drive is supplied as a 6 pulse converter.
	Carrier Frequency	2-16 kHz. Drive rating based on 4 kHz.
	Frequency Accuracy	Digital Input: Within ±0.05% of set output frequency. Analog Input: Within 0.5% of maximum output frequency.
	Speed Regulation - Open Loop with Slip Compensation:	±2% of base speed across a 40:1 speed range.
	Stop Modes:	Multiple programmable stop modes including - Ramp, Coast, DC-Brake, Ramp-to-Hold and S Curve.
	Accel/Decel:	Two independently programmable accel and decel times. Each time may be programmed from 0 - 600 seconds in 0.1 second increments.
	Intermittent Overload:	150% Overload capability for up to 1 minute 200% Overload capability for up to 3 seconds
	Electronic Motor Overload Protection	Class 10 protection with speed sensitive response.

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Category	Specifications	
Environment	Altitude	1000 m (3300 ft) max. without derating
	Ambient Operating Temperature	IP20: -10 to 50 degrees C (14 to 122 degrees F) NEMA 1: -10 to 40 degrees C (14 to 113 degrees F)
	Cooling Method	All drive ratings: Fan
	Storage Temperature:	-40 to 85 degrees C (-40 to 185 degrees F)
	Atmosphere:	Important: Drive must not be installed in an area where the ambient atmosphere contains volatile or corrosive gas, vapors or dust. If the drive is not going to be installed for a period of time, it must be stored in an area where it will not be exposed to a corrosive atmosphere.
	Relative Humidity:	0 to 95% non-condensing
	Shock (operating):	15G peak for 11ms duration (±1.0ms)
	Vibration (operating):	1G peak, 5 to 2000 Hz
Control	Method	Sine coded PWM with programmable carrier frequency. The drive is supplied as a 6 pulse converter.
	Carrier Frequency	Frames C and D: 2-10 kHz Frame E: 2-8 kHz Both drive ratings based on 4 kHz.
	Frequency Accuracy	Digital Input: Within ±0.05% of set output frequency. Analog Input: Within 0.5% of maximum output frequency, 10-bit resolution ±2% of full scale Analog Output: 10-bit resolution
	Speed Regulation - Open Loop with Slip Compensation:	±1% of base speed across a 60:1 speed range.
	Stop Modes:	Multiple programmable stop modes including - Ramp, Coast, DC-Brake, Ramp-to-Hold and S Curve.
	Accel/Decel:	Two independently programmable accel and decel times. Each time may be programmed from 0 - 600 seconds in 0.1 second increments.
	Intermittent Overload:	110% Overload capability for up to 1 minute
	Electronic Motor Overload Protection	Class 10 protection with speed sensitive response.
>Input / Output Ratings	Output Frequency	0-320hz (Programmable)
	Efficiency	97.5% (Typical)
Approvals	   EMC Directive 89/336 LV: EN 50178, EN 60204 EMC: EN 61800-3, EN 50081-1, EN 50082-2	
Digital Control Inputs (Input Current=6mA)	SRC (Source) Mode	18-24V = ON 0-6V = OFF
	SNK (Sink) Mode	0-6V = ON 18-24V = OFF
Analog Control Inputs	4-20mA Analog	250 Ohm Input Impedance
	0-10V DC Analog	100k Ohm Input Impedance
	External Pot	1-10k ohms, 2 Watt Minimum
Control Output Programmable Output (form C relay)	Resistive Rating	3.0A at 30Vdc/125Vac/240Vac
	Inductive Rating	0.5A at 30Vdc/125Vac/240Vac
Output Outputs	30V DC, 50mA Non-inductive	

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Opto Outputs		0-5V DC, common emitter
Analog Outputs (10 bit)		0-10V, 1k ohm Min. : 4-20mA, 525 ohm Max.
Protective Features	Motor Protection	I ² T Overload Protection - 110% for 60 Seconds, 200% for 3 Seconds (Provides Class 10 Protection)
	Over Current	200% Hardware Limit 300% Instantaneous Fault
	Over Voltage	200-240Vac Input - Trip at 405Vdc Bus Voltage (Equivalent to 290Vac Incoming Line)
		380-480Vac Input - Trip at 810Vdc Bus Voltage (Equivalent to 575Vac Incoming Line)
	Under Voltage	200-240Vac Input - Trip at 210Vdc Bus Voltage (Equivalent to 150Vac Incoming Line)
		380-480Vac Input - Trip at 390Vdc Bus Voltage (Equivalent to 275Vac Incoming Line)
	Control Ride Through	Minimum Ride Through is 0.5 Seconds, Typical Value 2 Seconds
	Faultless Power Ride Through	100 milliseconds

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Catalog Number	Output Ratings		Input Ratings			Branch Circuit Protection			Power Dissipation
	kW (HP)	Amps	Voltage Range	kVA	Amps	Fuses	140M Motor Protectors	Contactors	IP20 Open Watts
100-115V AC 1-Phase Input, 0-230V 3-Phase Output									
22A-V1P5N104	0.2 (0.25)	1.5	90-126	0.75	6.0	10	140M-C2E-C10	100-C09	25
22A-V2P3N104	0.37 (0.5)	2.3	90-126	1.15	9.0	15	140M-C2E-C16	100-C12	30
22A-V4P5N104	0.75 (1.0)	4.5	90-126	2.25	18.0	30	140M-D8E-C20	100-C23	50
200 - 240V AC – 1-Phase ⁽¹⁾ Input, 0- 230V 3-Phase Output									
22A-A1P5N104	0.2 (0.25)	1.5	180-265	0.75	5.0	10	140M-C2E-B63	100-C009	25
22A-A2P3N104	0.37 (0.5)	2.3	180-265	1.15	6.0	10	140M-C2E-B63	100-C009	30
22A-A4P5N104	0.75 (1.0)	4.5	180-265	2.25	10.0	15	140M-C2E-C16	100-C12	50
22A-A8P0N104	1.5 (2.0)	8.0	180-265	4.0	18.0	30	140M-D8E-C20	100-C23	80
200 - 240V AC – 3-Phase Input, 0 - 230V 3-Phase Output									
22A-B1P5N104	0.2 (0.25)	1.5	180-265	0.75	1.8	3	140M-C2E-B25	100-C09	25
22A-B2P3N104	0.37 (0.5)	2.3	180-265	1.15	2.5	6	140M-C2E-B40	100-C09	30
22A-B4P5N104	0.75 (1.0)	4.5	180-265	2.25	5.2	10	140M-C2E-C10	100-C09	50
22A-B8P0N104	1.5 (2.0)	8.0	180-265	4.0	9.5	15	140M-C2E-C16	100-C12	80
22A-B012N104	2.2 (3.0)	12.0	180-265	5.5	15.5	25	140M-C2E-C16	100-C16	115
22A-B017N104	3.7 (5.0)	17.5	180-265	8.6	21.0	35	140M-F8E-C25	100-C23	165
380 - 480V AC – 3-Phase Input, 0 - 460V 3-Phase Output									
22A-D1P4N104	0.37 (0.5)	1.4	340-528	1.4	1.8	3	140M-C2E-B25	100-C09	30
22A-D2P3N104	0.75 (1.0)	2.3	340-528	2.3	3.2	6	140M-C2E-B40	100-C09	40
22A-D4P0N104	1.5 (2.0)	4.0	340-528	4.0	5.7	10	140M-C2E-B63	100-C09	60
22A-D6P0N104	2.2 (3.0)	6.0	340-528	5.9	7.5	15	140M-C2E-C10	100-C09	90
22A-D8P7N104	3.7 (5.0)	8.7	340-528	8.6	9.0	15	140M-C2E-C16	100-C16	145

⁽¹⁾ 200-240V AC - 1-Phase drives are also available with an integral EMC filter. Catalog suffix changes from N104 to N114.

Input / Output Ratings	Output Frequency	0-240hz (Programmable)
	Efficiency	97.5% (Typical)
Approvals		
Digital Control Inputs	SRC (Source) Mode	18-24V = ON 0-6V = OFF
	SNK (Sink) Mode	0-6V = ON 18-24V = OFF
Analog Control Inputs	4-20mA Analog	250 Ohm Input Impedance
	0-10V DC Analog	100k Ohm Input Impedance

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	External Pot	1-10k ohms, 2 Watt Minimum
Control Output Programmable Output (form C relay)	Resistive Rating	3.0A at 30Vdc/125Vac/240Vac
	Inductive Rating	0.5A at 30Vdc/125Vac/240Vac
Protective Features	Motor Protection	I ² T Overload Protection - 150% for 60 Seconds, 200% for 3 Seconds (Provides Class 10 Protection)
	Over Current	200% Hardware Limit 300% Instantaneous Fault
	Over Voltage	100-120Vac Input - Trip at 405Vdc Bus Voltage (Equivalent to 150Vac Incoming Line)
		200-240Vac Input - Trip at 405Vdc Bus Voltage (Equivalent to 290Vac Incoming Line)
		380-480Vac Input - Trip at 810Vdc Bus Voltage (Equivalent to 575Vac Incoming Line)
	Under Voltage	100-120Vac Input - Trip at 210Vdc Bus Voltage (Equivalent to 75Vac Incoming Line)
		200-240Vac Input - Trip at 210Vdc Bus Voltage (Equivalent to 150Vac Incoming Line)
		380-480Vac Input - Trip at 390Vdc Bus Voltage (Equivalent to 275Vac Incoming Line)
	Control Ride Through	Minimum Ride Through is 0.5 Seconds, Typical Value 2 Seconds
	Faultless Power Ride Through	100 milliseconds
Dynamic Braking	Internal brake IGBT included with all ratings (except no brake version)	

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Case No(s). 14-0396-EL-EEC

Summary: Application E I Dupont De Nemour and Ohio Power Company for approval of a special arrangement agreement with a mercantile customer