Weaver
CONSTRUCTION MANAGEMENT
3679 S Huron Street, Suite 404 Englewood, Colorado 80110
Phone: (303) 789-4111 FAX: (303) 789-4310

# SUBMITTAL TRANSMITAL

March 1, 2012

**Submittal No: 16289-002.A**

**(Includes: 16410, 16442, & 16461)**

PROJECT: **Harold Thompson Regional WRF**
Birdsall Rd.
Fountain, CO 80817
Job No. 2908

ENGINEER: **GMS, Inc.**
611 No. Weber St., #300
Colorado Springs, CO 80903
719-475-2935 Roger Sams

OWNER: **Lower Fountain Metropolitan Sewage Disposal District**
901 S. Santa Fe Ave.
Fountain, CO 80817
719-382-5303 James Heckman

CONTRACTOR: **McDade Woodcock, Inc.**
7222 Commerce Center Drive, #245
Colorado Springs, CO 80909
719-264-1236

SUBJECT: Resubmittal of Electrical Equipment for the Headworks Building Includes:

- 16289- Surge Protection Device
- 16410- Enclosed Switches
- 16442- Panel Boards
- 16461- Low Voltage (Dry-Type Transformers)

SPEC SECTION: 16289, 16410, 16442, 16461

PREVIOUS SUBMISSION DATES: 1/27/12

DEVIATIONS FROM SPEC: ___ YES _X_ NO

CONTRACTOR'S STAMP: This submittal has been reviewed by Weaver Construction Management and, unless indicated otherwise, has been found to be in conformance with the intent of the contract documents.

| Contractor's Stamp: | Engineer's Stamp: |
|---|---|
| Date: 3/1/12<br><br>Reviewed by: John Jacob<br>( X ) Reviewed Without Comments<br>( ) Reviewed With Comments | |

ENGINEER'S COMMENTS:_____

_____

# McDade-Woodcock, Inc.

**TRANSMITTAL**
**No. 00025**

7222 Commerce Center Dr. Suite 245
Colorado Springs, CO 80919

**Phone:** 719-264-1236
**Fax:** 719-264-1450

**PROJECT:** Harold D. Thompson WRF

**DATE:** 2/28/2012

**TO:** Weaver General Construction
,

**REF:** Electrical Re-Submittal
16289-001A, 16410-001A,
16442-001A,
16461-001A Electrical Equip.
HEADWORKS BLDG

**ATTN:** Wes Weaver

| WE ARE SENDING: | SUBMITTED FOR: | ACTION TAKEN: |
|---|---|---|
| ☑ Shop Drawings | ☑ Approval | ☐ Approved as Submitted |
| ☐ Letter | ☐ Your Use | ☐ Approved as Noted |
| ☐ Prints | ☐ As Requested | ☐ Returned After Loan |
| ☐ Change Order | ☑ Review and Comment | ☑ Resubmit |
| ☐ Plans | | ☐ Submit |
| ☐ Samples | **SENT VIA:** | ☐ Returned |
| ☐ Specifications | ☑ Attached | ☐ Returned for Corrections |
| ☐ Other | ☐ Separate Cover Via | ☑ Due Date: 3/16/2012 |

| ITEM | PACKAGE | SUBMITTAL | DRAWING | REV. | ITEM NO. | COPIES | DATE | DESCRIPTION | STATUS |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 001 | 1 | 2/28/2012 | Electrical Re-Submittal<br>16289-001A - Surge Protection Device<br>16410-001A - Enclosed Switches<br>16442-001A - Panelboards<br>16461-001A - LV (Dry-Type) Transformers<br>ELECTRICAL EQUIPMENT - HEADWORKS BLDG. | RES |

**Remarks:** Electrical Re-Submittal for Review and Approval
Via Email Only

**CC:**

**Signed:**
Janelle L Smith

McDADE-WOODCOCK, INC.

# HAROLD D. THOMPSON RWRF HEADWORKS BUILDING

## McDADE-WOODCOCK INC.
## PROJECT NUMBER - 1402

## ELECTRICAL RE-SUBMITTAL

## ELECTRICAL EQUIPMENT

## 16289-001A (Surge Protection Device)
## 16410-001A (Enclosed Switches)
## 16442-001A (Panel Boards)
## 16461-001A (LV Transformers)

**Owner:** Lower Fountain Metropolitan Sewage District
901 S. Santa Fe Avenue
Fountain, CO 80817

**General Contractor:** Weaver General Construction Co.
3679 S. Huron St. – Suite 404
Englewood, CO 80110

**Electrical Contractor:** McDade-Woodcock, Inc.
7222 Commerce Center Dr.
#245
Colorado Springs, CO 80919

**Engineer:** GMS Inc.
611 N. Weber St., Suite 300
Colorado Springs, CO 80903


**CORPORATE**
2404 Claremont Ave. NE
Albuquerque, NM 87107
Mailing Address
P.O. Box 11592
Albuquerque, NM 87192
Ph 505-884-0155
Fax 505-884-6073

**DENVER**
10700 E. Geddes Avenue
Suite 170
Englewood CO 80112
Ph 303-803-1809
Fax 303-803-1818

**COLORADO SPRINGS**
7222 Commerce Center Drive
Suite 245
Colorado Springs, CO 80919
Mailing Address
P.O. Box 7349
Colorado Springs, CO 80933
Ph 719-264-1236
Fax 719-264-1450

MWIEIC.com

McDADE-WOODCOCK, INC.

# HAROLD D. THOMPSON RWRF EQUIPMENT MAINTENANCE BLDG.

**McDADE-WOODCOCK INC.**
**PROJECT NUMBER - 1402**

## ELECTRICAL RE-SUBMITTAL

## ELECTRICAL EQUIPMENT

**16289-001A (Surge Protection Device)**
**16410-001A (Enclosed Switches)**
**16442-001A (Panelboards)**
**16461-001A (LV Dry-Type Transformers)**

## TABLE OF CONTENTS




**CORPORATE**
2404 Claremont Ave. NE
Albuquerque, NM 87107
Mailing Address
P.O. Box 11592
Albuquerque, NM 87192
Ph 505-884-0155
Fax 505-884-6073

**DENVER**
10700 E. Geddes Avenue
Suite 170
Englewood CO 80112
Ph 303-803-1809
Fax 303-803-1818

**COLORADO SPRINGS**
7222 Commerce Center Drive
Suite 245
Colorado Springs, CO 80919
Mailing Address
P.O. Box 7349
Colorado Springs, CO 80933
Ph 719-264-1236
Fax 719-264-1450

**MWIEIC.com**

McDADE-WOODCOCK, INC.

February 24, 2012

Weaver Construction Management Inc.
3679 S. Huron St. Suite 404
Englewood, CO 80110

**Attn:** John Jacob

**MWI Project:** #1402

**Ref:** Submittal 16289-002A

**Project:** Harold D Thompson RWRF

Dear Mr. Jacob,

The following is McDade-Woodcock's response to the Engineers comments in regards to Submittal 16289-002.

Comment:

1) Panelboard HW-H1
   a. Breaker changes will be made.
   b. Panel will be changed from 4-wire to 3-wire. Breaker changes will be made. Please see attached sheet for cost changes.
   c. Panel will be Bottom Fed.

2) Dry-Type transformer (30 KVA) TX-HWL1
   a. Windings to be changed to Aluminum-See attached for cost savings.
   b. Being as the transformer requires NEMA-TP rating the efficiency rating differences are minimal. Environmental conditions where the transformer is to be installed does not necessitate copper windings be used. McDade – Woodcock Inc. suggest the use of Aluminum windings for all indoor dry-type transformers. Please refer to the attached sheet for cost savings.

3) Disconnect Switch (MUA-1) will changed from NEMA-4x to NEMA-3R. See attached for cost revisions.

Please contact me if you have any questions.

Patrick Danenberg
Project Manager
McDade-Woodcock Inc.
patd@mwieic.com

**CORPORATE**
2404 Claremont Ave. NE
Albuquerque, NM 87107
Mailing Address
P.O. Box 11592
Albuquerque, NM 87192
Ph 505-884-0155
Fax 505-884-6073

**DENVER**
15335 E. Fremont Drive
Centennial, CO 80112
Ph 303-803-1809
Fax 303-803-1818

**COLORADO SPRINGS**
7222 Commerce Center Drive
Suite 245
Colorado Springs, CO 80919
Mailing Address
P.O. Box 7349
Colorado Springs, CO 80933
Ph 719-264-1236
Fax 719-264-1450

2/12/2012

# HDT RWRF - changes from submittal comments

## 16289-001, EM BLDG

| | equipment | change | net |
|---|---|---|---|
| 1) | MDP-1 | a) change 1200A branch breaker to provision<br>b) omit "bussed space" NPs | ($2,230.00 |
| 2) | EDB-1 | a) omit "bussed space" NPs<br>b) change 70/3 to 70/2 | ($5) |
| 3) | EM-L1 | a) change 20/2 to 50/2<br>b) cyhange from TOP feed to BOTTOM feed | $0 |
| 4) | 45kVA | a) change from 80°C rise w/CU windings to 150°C rise w/AL windings | ($1,121) |

## 16289-002, HW BLDG

| | equipment | change | net |
|---|---|---|---|
| 1) | HW-H1 | a) change 60/3 for phase monitor to 20/3<br>b) change 60/3 for SPD to 30/3<br>c) change from 3ph, 4w to 3ph, 3w<br>d) add 1 - 15/3 breaker<br>e) change 20/1 to 20/2<br>f) change from TOP feed to BOTTOM feed | $1,701 |
| 2) | 30kVA | a) change from 80°C rise w/CU windings to 150°C rise w/AL windings | ($920.00 |
| 3) | MUA-1 disconnect | a) change from N4X enclosure to N3R | ($279.00 |
| | | total changes: | ($2,854) |

NOTE: Changing from 3ph, 4w to 3ph, 3w requires EGB breakers rather than GHB breakers which then changes the panel from a PRL2a to a PRL3E. Also, the SPD changes from a WYE unit to a DELTA unit.

**GMS, INC.**
CONSULTING ENGINEERS
611 NORTH WEBER, SUITE 300
COLORADO SPRINGS, COLORADO 80903-1074

TELEPHONE (719) 475-2935
TELEFAX (719) 475-2938

EDWARD D. MEYER, P.E.
ROGER J. SAMS, P.E.
GREGORY R. WORDEN, P.E.
THOMAS A. McCLERNAN, P.E.

KEN L. WHITE, P.L.S.
DAVID R. FRISCH, P.L.S.
MARK A. MORTON, P.E.
JASON D. MEYER, P.E.

February 6, 2012

Mr. Wes Weaver, President
Weaver Construction Management, Inc.
3679 South Huron Street, Suite 404
Englewood, CO 80110

***Via Email to: wes@weavergc.com***
***No Hard Copy to Follow***

Re: Harold D. Thompson Regional Water Reclamation Facility (HDTRWRF)
Lower Fountain Metropolitan Sewage Disposal District (LFMSDD)

Dear Wes:

Reference is made to your shop submittal identified as follows:

| | |
|---|---|
| Submittal No.: | 16289-002 |
| Date of Submittal: | January 27, 2012 |
| Title: | Electrical Equipment for Headworks Building: Surge Protection; Enclosed Switches; Panelboards; Low Voltage (Dry-Type) Transformers |
| Specification Sections: | 16289, 16410, 16442 & 16461 |
| Manufacturer: | Eaton Corporation |

The referenced submittal has been stamped ***"No Exception Taken"***, ***"Make Corrections Noted"*** and ***"Submit Specified Item"***. Our comments are as follows:

1. Panelboard HW-H1:

   a. Reference Construction Drawing ES-2. Note the following changes to Panelboard HW-H1 schedule. Please note the rating of the breakers noted below differs from those shown on the schedule of the drawings.

      1) Change the 60A, 3-pole breaker for the phase monitor (poles 43, 45, 47) to 20A, 3P.

      2) Change the 60A, 3-pole breaker for SPD to a 30A, 3-pole breaker.

   b. For the panelboard submittal, change the panelboard from 3-phase, 4-wire to 3-phase, 3-wire. Change the quantity of 15A, 3-pole breakers from 6 to 7 and change the 20A, 1-pole breaker to a 20A, 2-pole breaker.

   c. The panelboard is submitted as a top-feed. This is acceptable, but Contractor to verify feed location, as bottom-feed arrangement would appear to be preferred.

2. Dry Type Transformer, 30KVA:

    a. Approved as submitted. However, change the transformer from copper winding, 80-degree rise, to aluminum winding, 150-degree rise unit. The transformer must still have NEMA TP-1 listing. This change is intended as a cost-savings measure for the Owner.

    b. We request MWI provide feedback on this alterative both in terms of whether this will provide reasonable, reliable service and if this is a cost-savings to the project. We also request feedback from MWI on what long-term drawbacks may be experienced should this alternative be incorporated into the project.

3. Disconnect Switch for MUA-1:

    a. Approved as submitted. However, switch submitted is stainless steel, NEMA 4X. Painted steel, NEMA 3R disconnect switch is also acceptable

Please call if you should have any questions.

Sincerely,

David R. Frisch

David R. Frisch, P.L.S.

DRF/kmw

ec (letter only):
Mr. Jim Heckman, Manager, LFMSDD, lfmanager@lfmsdd.org
Ms. Cindy Murray, Office Manager, Fountain Sanitation District, fsdistrict@fsd901.org
Mr. Jeff Burst, Project Supt., Weaver Construction Management, Inc., jeff@weavergc.com
Mr. John Jacob, Project Mgr., Weaver Construction Management, Inc., john@weavergc.com
Mr. Tyler Ammerman, Weaver Construction Management, Inc., tammerman@weavergc.com
Ms. Leslie Brown, Weaver Construction Management, Inc., leslie@weavergc.com
Mr. Mark Reasinger, P.E., Plant Engineering Consultants, Inc., mreasinger@planteci.com
cc: Mr. Jerry Miller, Resident Project Representative, GMS, Inc.

# Contact Information

*For new project opportunities, contact:*

**Sales Person**

MICHAEL FITZGERALD
8022 SOUTHPARK CIRCLE SUITE 300
LITTLETON, CO 80120
Phone: 303-738-2323
Fax: 303-738-2322
MICHAELFFITZGERALD@eaton.com

*For logistical support, contact:*

**Project Coordinator**

Rick Owen
175 VISTA BOULEVARD
ARDEN, NC, 28704
Phone: 828-651-0866
Fax: 828-647-9112
RickOwen@eaton.com

*For technical support, contact:*

**Project Engineer**

Marin Huscher
175 VISTA BOULEVARD
ARDEN, NC, 28704
Phone: 828-651-0761
Fax: 800-647-9112
MarinRHuscher@eaton.com

# HDT RWRF

## Re-Submittal for Approval

General Order
SDN0301918
Volume 1 of 1

**Equipment:**

**REXEL COLORADO SPRINGS CO PO# PCSP3202147**
**MCDADE WOODCOCK INC/MWI COLORADO**

**Date: 02/22/2012**

# PROJECT COMMENTS

| Approved | Approved as Noted | Partial Approval<br>Revise and Re-submit | Rejected |
|---|---|---|---|
| Release all for manufacture.<br>No re-submittal required. | Release all for manufacture.<br>Make necessary changes<br>Show changes on const. drawings. | Release approved sections<br>for manufacture. Re-submit.<br>Rejected sections | No release<br>Re-submit all. |
| ☐ | ☐ | ☐ | ☐ |

The following information is pertinent with the return of this submittal. Cutler Hammer requires all information to be initialed and a final signature of responsible party.

- ☐ Lug Sizes for all equipment have been verified
- ☐ Top or Bottom Entry for all equipment has been verified
- ☐ Shipping splits have been verified
- ☐ Nameplate information has been verified for all equipment
- ☐ Orientation of breakers has been verified for all equipment

Stamp or Signature

_____

**Customer Comments**:

**No Comments** (check here)..... ☐

**General Order Number: SDN0301918**

# TAB 1 Safety Switches

1 Safety Switches
DH362FRK,
BE31A, 600 VAC/DC, 60 Amps, 3-Pole, Fusible with No Neutral, NEMA 3R Enclosure

1 Heavy Duty Switch - Fusible, 3-Pole, 600 VAC, 60 A, NEMA 3R (DH362FRK)

Designations: **MAU-1**

## Safety Switch General Information

### Global Specifications

| | |
|---|---|
| System Voltage | 600 VAC/DC |
| Switch Type | Single Throw - Heavy Duty |
| Poles/Blades | 3-Pole |
| Amperage | 60 |
| Protection | Fusible with No Neutral |
| Enclosure Type | NEMA 3R |
| Special Paint | ANSI-61 (Gray) Standard |
| Fuse Clips | Standard |
| Switch Lugs | Standard |
| Fungus Proof Treatment | N |
| Lock-On Provision | N |
| Trapped Key Interlock | None |
| Fuse Pullers | N |
| Control Pole | N |
| Ground Lugs | N |
| 316 Stainless | N |
| Stainless Mechanism | N |
| Mill Duty | N |

### Cover Controls

### Nameplate

### Field Installed Kits

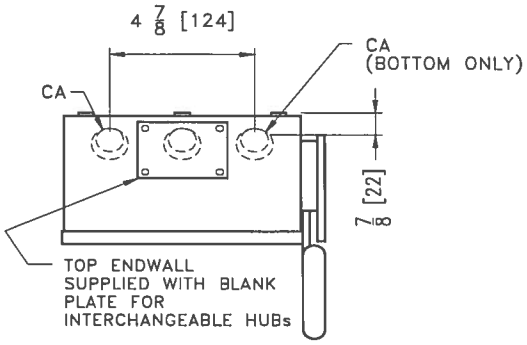
### Safety Switch Catalog No.
DH362FRK

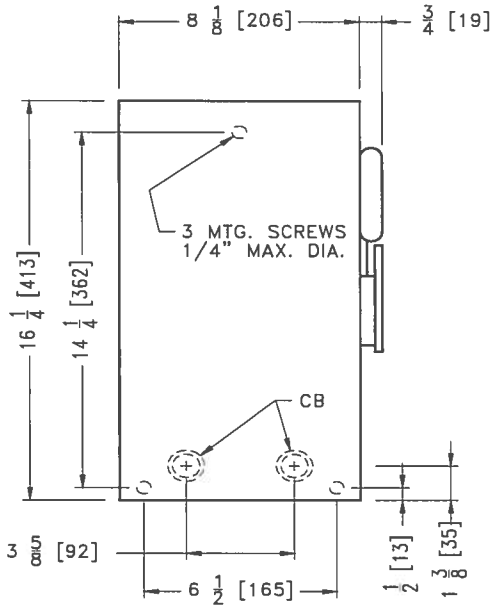


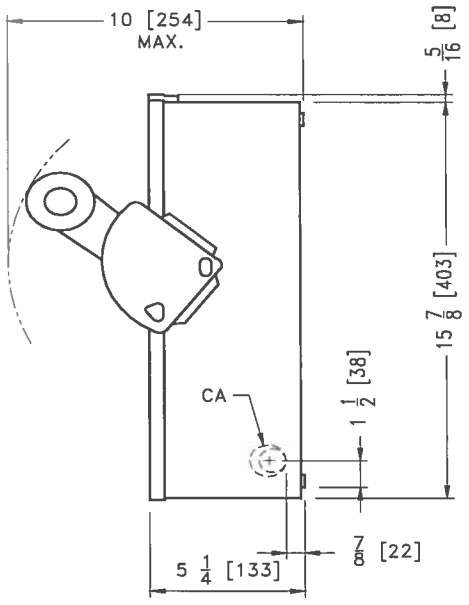
| | | | | | |
|---|---|---|---|---|---|
| PREPARED BY: Fitzgerald, Michael F | DATE: 02/22/12 | Eaton Corporation | | | |
| APPROVED BY | DATE | JOB NAME: HDT RWRF | DESIGNATION: MAU-1 | | |
| VERSION: 7.8 | | TYPE | | DRAWING TYPE: Customer Appr. | |
| NEG-ALT NUMBER: DN851005V102-0008 | REVISION | DWG SIZE: A | G.O.: SDN0301918 | ITEM | SHEET: 1 OF 2 |

REFERENCE
DWG NO 95-955-11

NOTES:
1. 30-60 AMPERES, 600 VOLTS HEAVY DUTY K-SERIES DESIGN.
2. 2 AND 3 POLE FUSIBLE AND NON-FUSIBLE SWITCHES.
3. NEMA 3R ENCLOSURE: 0.052" ZINC COATED STEEL.
4. MEETS FEDERAL SPECIFICATIONS WS865C.
5. MEETS UL 98 FOR SWITCHES, UL 50 FOR ENCLOSURES.
6. MEETS NEC WIRE BENDING SPACE REQUIREMENTS.
7. MEETS NEMA STANDARDS KS1.
8. UL LISTED, FILE NO. 5239.
9. ANSI 61 LIGHT GRAY BAKED ENAMEL FINISH.
10. SIDE HINGED WITH DRIP SHIELD.
11. USE TYPE DS/CS GROUP 1 HUB.




| CONDUIT KNOCKOUT SIZES in [mm] | |
|---|---|
| CA | CB |
| 3/4 [19], 1 [25], 1 1/4 [32] | 1/2 [13], 3/4 [19], 1 [25], 1 1/4 [32] |

ALL KNOCKOUTS ARE CONCENTRIC UNLESS NOTED OTHERWISE

DIMENSIONS IN in(mm)
4/98



| | | | | | |
|---|---|---|---|---|---|
| PREPARED BY: Fitzgerald, Michael F | DATE: 02/22/12 | Eaton Corporation | | | |
| APPROVED BY | DATE | JOB NAME: HDT RWRF | DESIGNATION: MAU-1 | | |
| VERSION: 7.8 | | TYPE | | DRAWING TYPE: Customer Appr. | |
| NEG-ALT NUMBER: DN851005V102-0008 | REVISION | DWG SIZE: A | G.O.: SDN0301918 | ITEM | SHEET: 2 OF 2 |

# Technical Data

## Product Description

- Used to open or close a circuit.
- Non-fusible safety switches provide a means to manually connect or disconnect the load from the source.
- Fusible safety switches provide a means to manually open and close a circuit and overcurrent protection by means of installed fuses.
- Also commonly referred to as a disconnect switch or disconnect.
- Available from 30 – 1200 amperes.

## Application Description

8

## General Duty

*Plug Fuse General-Duty Safety Switch*

*Cartridge Fuse General-Duty Safety Switch*

**For residential and commercial applications. Suitable for light-duty motor circuits and service entrance.**

- 30 – 600 amperes.
- Suitable for service entrance applications unless otherwise noted.
- Fusible and non-fusible switches are 100% load break and 100% load make rated.
- The continuous load current of fusible switches is not to exceed 80% of the rating of fuses employed in other than motor circuits. Non-fusible switches are 100% fully rated.
- 200 – 600 amperes features K-series design.
- Horsepower rated.
- Fusible and non-fusible switches. One-pole S/N through 4-wire; 120/240, and 240 Vac.
- Ample wire bending space provides for easier installation.
- With Class R fuses, switches may be used on systems capable of delivering 100,000 amperes rms symmetrical.

**Note:** Plug fuse switches are not service entrance rated.

## Heavy Duty

*Heavy-Duty Safety Switches*

**For heavy commercial and industrial applications where reliable performance and service continuity are critical.**

- 30 – 1200 amperes.
- 600 Vac, 600 Vdc maximum.
- Horsepower rated.
- Fusible and non-fusible switches are 100% load break and 100% load make rated.
- The continuous load current of fusible switches is not to exceed 80% of the rating of fuses employed in other than motor circuits. Non-fusible switches are 100% fully rated.
- Suitable for service entrance applications unless otherwise noted.
- Visible double break quick-make, quick-break rotary blade mechanism. Two points of contact provide a positive open and close, easier operation, and also help prevent contact burning for longer contact life.
- Triple padlocking capability. Personnel safety feature since the large hasp can accommodate up to three 3/8-inch (9.5 mm) shank locks. Cabinet door can be further padlocked at the top and bottom.
- Interlocking mechanism. Door cannot be opened when the handle is in the ON position. Built-in defeater mechanism provides for user access when necessary.
- For the toughest heavy commercial and industrial applications, refer to **Page 8-47** for catalog information on our Mill-Duty Safety Switch.
- Deionizing arc chutes. Arc chutes confine and suppress the arcs produced by opening contacts under load.

## 6-Pole Switches

*6-Pole Motor Circuit*

**A compact safety switch that's ideal for use in heavy industry...when an "in sight" disconnecting means is required for two-speed motors that are remote from their motor control devices.**

- 600 Vac, 250 Vdc maximum.
- 30 – 200 amperes.
- Fusible or non-fusible.
- Trunk-type latches keep the cover tightly closed and a neoprene gasket seals out moisture and dust from the switch assembly.
- Visible double break quick-make, quick-break rotary blade mechanism. Two points of contact provide a positive open and close, easier operation, and also help prevent contact burning for longer contact life.
- Clear line shield protection.
- Built-in fuse pullers.
- Clearly visible handle.
- Triple padlocking capability. Cabinet door can be further padlocked at the top and bottom.
- Deionizing arc chutes. Arc chutes confine and suppress the arcs produced by opening contacts under load.

- **Receptacle Switches** — These heavy-duty switches are pre-wired and interlocked to polarized receptacles for 3-phase, 3-wire, grounded type power plugs. These are used for portable power applications such as welders, infrared ovens, batch feeders, conveyors, truck and marine docks. Receptacles are interlocked to handle mechanisms so that power plugs may not be inserted or removed when the switch is in the ON position unless noted otherwise. Ratings are 30 – 100 amperes, 600 Vac, NEMA 12/3R, 4X stainless steel enclosures.
- **Non-Metallic Switch** — This switch has a Halyester or KRYDON™ enclosure. These are compression molded fiberglass reinforced polyester enclosure, which is capable of withstanding almost any corrosive environment. Ratings are 30 – 200 amperes, 240 – 600 Vac, fusible and non-fusible. Enclosure is NEMA 4X rated.
- **NEMA 7/9 Hazardous Location Disconnect Switch** — See **Page 8-43** for information.

8

## Features, Benefits and Functions

### General-Duty (Cartridge Fuse)

- Visible double break quick-make, quick-break rotary blade mechanism.
- Side opening door on all enclosures.
- Mechanically interlocked cover to prevent easy access when the switch is in the ON position.
- With Class R fuses, switches may be used on systems capable of delivering 100,000 amperes rms symmetrical.
- Clearly visible and accessible neutral where applicable.
- Visible ON/OFF indication.
- Tangential knockouts on 30 – 60 ampere designs.
- Ample wiring space.
- Double padlocking capability on 30 – 100 amperes.
- Triple padlocking capability on 200 – 600 amperes.
- Additional door locking capability.
- Bilingual English/Spanish door label on 30 – 100 amperes.
- Tri-lingual nameplates.

### Heavy-Duty

- Visible double break quick-make, quick-break rotary blade mechanism.
- Mechanically interlocked cover to prevent easy access when the switch is in the ON position.
- Clear line shield with probe holes.
- Clearly visible palm fitting red handle.
- Triple padlocking capability.
- Deionizing arc chutes to confine and suppress the arcs produced by opening contacts under load.
- Tangential knockouts on NEMA 1 and NEMA 3R enclosures through 200 amperes.
- Built-in fuse pullers on NEMA 4X and NEMA 12 enclosures through 200 amperes.
- Additional door locking capability.
- Complete accessory and renewal parts data shown on inner door label.
- 30 – 800 ampere NEMA 12 designs convertible to NEMA 3R by opening factory installed drain hole.
- 30 – 800 ampere switches are seismic qualified and exceed the requirements of the Uniform Building Code® (UBC) and California Code Title 24.
- Tri-lingual nameplates.

## Standards and Certifications

- UL 98.
- UL 50.
- NEMA KS-1.

## Elevator Control Switch

*Elevator Control Switch*

## Features, Benefits and Functions

### Standard Features

- 30 – 200 ampere 600 Vac 3-phase fused power switch.
- 200,000 ampere rms short-circuit current rating.
- Shunt trip 120 volts.
- Control power terminal block.
- Ground lug per NEC.
- Class J Fuse mounting only (Class J Fuses not included).
- Key to Test switch 120 volts.
- Mechanically interlocked auxiliary contact for hydraulic elevators with automatic recall (5 A, 120 Vac rated) 1NO, 1NC.

### Optional Features

- Control power transformer with fuses and blocks.
- Fire safety interface relay.
- Pilot light — ON.
- Isolated neutral lug (oversized 200% rated neutral option available where required by excessive non-linear loads).
- Fire Alarm Voltage Monitoring Relay (to monitor Shunt Trip voltage).
- NEMA 3R, 4 and 12 enclosures available through 200 amperes.
- Phase failure and undervoltage relay available, consult factory.
- For added protection, use Eaton fuse covers to improve maintenance personnel protection, through 200 amperes (OSHA 1910.333, Paragraph C).

## Standards and Certifications

- UL 98 Enclosed and Deadfront Switch Guide 96NK3917, File No. E182262.
- NEMA 1, UL 50, listed enclosure.
- cUL® per Canadian Standards C22.2, No. 0-M91-CAN/CSAT C22.2, No. 4-M89 Enclosed Switch.

# Product Specifications

**Table 8-24. Safety Switch Selection Guide**

| Type | | Fuse Type | | Fuse Class | Ampere Rating | Number of Poles | Enclosure Types | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | NEMA 1 | NEMA 3R | NEMA 12 | NEMA 4 Painted Steel | NEMA 4X Stainless Steel | NEMA 4X Non-Metallic | NEMA 7/9 |
| General-Duty | Single Throw Max. 240 Vac Horsepower Rated | Fusible | Plug | — | 30 | 1 and 2 | YES | YES | — | — | — | — | — |
| | | | Cartridge | H | 30 – 600 | 2 and 3 | YES | YES | — | — | — | — | — |
| | | Non-Fusible | — | — | 30 – 600 | 2 and 3 | YES | YES | — | — | — | — | — |
| Heavy-Duty | Single Throw Max. 600 Vac Horsepower Rated | Fusible | Cartridge | H<br>L | 30 – 600<br>800 – 1200 | 2, 3 and 4 | YES Up to 1200 A | YES Up to 1200 A | YES ① Up to 1200 A | YES 400 – 800 A | YES Up to 1200 A | YES Up to 200 A | YES ② Up to 200 A |
| | | Non-Fusible | — | — | 30 – 1200 | 2, 3 and 4 | YES | YES | YES ① Up to 1200 A | YES 400 – 800 A | YES Up to 1200 A | YES Up to 200 A | YES Up to 200 A |
| 6-Pole Motor Circuit | Single Throw Max. 600 Vac | Fusible | Cartridge | H | 30 – 200 | 6 | — | YES | YES ① | — | YES | — | — |
| | | Non-Fusible | — | — | 30 – 200 | 6 | — | YES | YES ① | — | YES | — | — |
| Double Throw | Max. 600 Vac Horsepower Rated | Fusible | Cartridge | H<br>T (600 V)<br>T (240 V) | 30 – 200<br>400<br>600 | 2 and 3 | YES Up to 600 A | YES Up to 400 A | — | — | — | — | — |
| | | Non-Fusible | — | — | 30 – 800 | 2, 3, 4 and 6 | YES | YES | YES Up to 400 A | — | YES Up to 400 A | — | — |
| Rotary Switches | Max. 600 Vac | Non-Fusible | — | — | 16 – 125 | 3, 4 | YES | YES ① | YES ① | — | YES | YES | — |

① NEMA Type 12 enclosures (30 – 800 amperes) can be field modified to meet NEMA 3R rainproof requirements when a factory provided drain screw is removed.
② Class J fuse clips provided.

**Table 8-25. EnviroLine Safety Switch Selection Guide**

| EnviroLine | Fuse Type | | Fuse Class | Ampere Rating | Number of Poles | Enclosure Types | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | NEMA 1 | NEMA 3R | NEMA 12 | NEMA 4 Painted Steel | NEMA 4X Stainless Steel | NEMA 4X Non-Metallic |
| Stainless Enclosure with Stainless Mechanism | Fusible | Cartridge | H | 30 – 400 | 2 and 3 | — | — | — | — | YES | — |
| | Non-Fusible | — | — | 30 – 400 | 3 | — | — | — | — | YES | — |
| Viewing Window Upper or Lower ③④⑤ | Fusible | Cartridge | H<br>L | 30 – 600<br>800 | 3 | — | — | YES ⑥ | YES | YES | — |
| | Non-Fusible | — | — | 30 – 800 | 3 | — | — | YES ⑥ | YES | YES | — |
| Receptacle | Fusible | Cartridge | H | 30 – 100 | 3 | — | — | YES | — | YES | — |
| | Non-Fusible | — | — | 60 | 3 | — | — | YES | — | YES | — |
| Non-Metallic | Fusible | Cartridge | H | 30 – 200 | 3 | — | — | — | — | — | YES |
| | Non-Fusible | — | — | 30 – 200 | 3 | — | — | — | — | — | YES |

③ 800 ampere upper window switches are not UL listed.
④ Lower Window switches are available through 600 amperes.
⑤ 30 – 100 ampere switches provided with full view window.
⑥ NEMA Type 12 enclosures (30 – 800 amperes) can be field modified to meet NEMA 3R rainproof requirements when a factory provided drain screw is removed.

## General-Duty

**Table 8-35. Short Circuit Ratings Using Class "R", "J" or "T" Fusing where Applicable**

| Ampere Rating | Voltage Ratings | |
|---|---|---|
| | Type 1 | Type 3R |
| 30 | 100k at 240 | 100k at 240 |
| 60 | 100k at 240 | 100k at 240 |
| 100 | 100k at 240 | 100k at 240 |
| 200 | 100k at 240 | 100k at 240 |
| 400 | 100k at 250 | 100k at 250 |
| 600 | 100k at 250 | 100k at 250 |

**Note:** Class "H" fuse clips supplied as standard for 30 – 600 amperes. Rated at 10,000 rms symmetrical when using Class "H" fuses.

## Heavy-Duty

**Table 8-36. Short Circuit Ratings Using Class "R", "J" or "T" Fusing where Applicable**

| Ampere Rating | Voltage Ratings | | | |
|---|---|---|---|---|
| | Type 1 | Type 3R | Type 12 | Type 4 and 4X |
| 30 | 200k at 600 | 200k at 600 | 200k at 600 | 200k at 600 |
| 60 | 200k at 600 | 200k at 600 | 200k at 600 | 200k at 600 |
| 100 | 200k at 480<br>100k at 600 | 200k at 480<br>100k at 600 | 200k at 600 | 200k at 600 |
| 200 | 200k at 600 | 200k at 600 | 200k at 600 | 200k at 600 |
| 400 | 200k at 480<br>100k at 600 | 200k at 480<br>100k at 600 | 200k at 480<br>100k at 600 | 200k at 480<br>100k at 600 |
| 600 | 200k at 480<br>100k at 600 | 200k at 480<br>100k at 600 | 200k at 480<br>100k at 600 | 200k at 480<br>100k at 600 |
| 800 | 200k at 480<br>100k at 600 | 200k at 480<br>100k at 600 | 200k at 480<br>100k at 600 | 200k at 480<br>100k at 600 |
| 1200 | 200k at 600 | 200k at 600 | 200k at 600 | 200k at 600 |

**Note:** Class "H" fuse clips supplied as standard for 30 – 600 amperes. Class "L" fuse clips supplied as standard for 800 – 1200 amperes. Rated at 10,000 rms symmetrical when using Class "H" fuses.

## Double Throw

**Table 8-37. Short Circuit Ratings Using Class "R", "J" or "T" Fusing where Applicable**

| Ampere Rating | Voltage Ratings | | | |
|---|---|---|---|---|
| | Type 1 | Type 3R | Type 12 | Type 4 and 4X |
| 30 | 100k at 600 | 100k at 600 | 100k at 600 | 100k at 600 |
| 60 | 100k at 600 | 100k at 600 | 100k at 600 | 100k at 600 |
| 100 | 100k at 600 | 100k at 600 | 100k at 600 | 100k at 600 |
| 200 | 100k at 600 | 100k at 600 | 100k at 600 | 100k at 600 |
| 400 | 100k at 600 | 100k at 600 | 100k at 600 | 100k at 600 |
| 600 | 100k at 600 | 100k at 600 | 100k at 600 | 100k at 600 |
| 800 | 100k at 600 | 100k at 600 | — | — |

**Note:** Class "H" fuse clips supplied as standard for 30 – 600 amperes except Class "T" for 400 amperes at 600 volts and 600 amperes at 240 volts. Rated at 10,000 rms symmetrical when using Class "H" fuses.

**Note: Table 8-37** is not applicable to the Compact Design shown on **Page 8-32.** The Compact Design is suitable for use on a circuit capable of delivering not more than 10,000 rms symmetrical amperes.

**Note:** Class "R" fuse adapter kits are shown on **Page 8-6.** Individual adapter kits are applicable as shown on **Page 8-6** and yield the short circuit ratings per the tables above when Class "R" fuses are installed. When installed, Class "R" fuse adapter kits reject all fuses except Class "R."

**Note:** Class "J" fuse provisions can be obtained on most 60 – 400 ampere safety switches by moving the fuse base to a new position as instructed by the device publication label. Class "J" fuse adapter kits, where needed, are shown on **Page 8-5** and yield the short circuit ratings per the tables above when Class "J" fuses are installed. Class "J" fuse provisions must be factory installed on 30 ampere heavy-duty switches. Catalog numbers are shown in **Table 8-15** on **Page 8-10.** Class "J" fusing is not applicable on 30 – 200 ampere general-duty switches, 30 – 100 ampere double throw switches, 600 ampere double throw switches, and any switch higher than 600 amperes.

**Note:** Class "T" fuse adapter kits are shown on **Page 8-6.** Individual adapter kits are applicable to 200 – 800 ampere switches as shown on **Page 8-6** and yield the short circuit ratings per the tables to the left when Class "T" fuses are installed. On 1200 ampere switches, Class "T" fuse provisions can be obtained by moving the fuse base to a new position as instructed by the device publication label.

## Non-Fusible Switches

The UL listed short circuit ratings for Cutler-Hammer Non-Fusible switches by Eaton Corporation are based on the switches being properly protected by overcurrent protective devices. For applications that require a UL listed short circuit rating of 10,000 rms symmetrical amperes or less, a Cutler-Hammer Non-Fusible switch must be properly protected by any overcurrent protective device rated no greater than the ampere rating of the switch. For applications that require a UL listed short circuit rating of greater than 10,000 rms symmetrical amperes, a Cutler-Hammer Non-Fusible switch must be properly protected by the appropriate class and size fusing noted on the switch publication (located on the inside cover). Otherwise, this Non-Fusible switch must be replaced with a Cutler-Hammer Fusible switch that utilizes the appropriate fusing required. Molded case circuit breaker protection of Non-Fusible Cutler-Hammer switches for applications that require a short circuit rating of greater than 10,000 rms symmetrical amperes has not been evaluated. Refer to the reference tables for typical Cutler-Hammer fusible switch UL listed short circuit ratings.

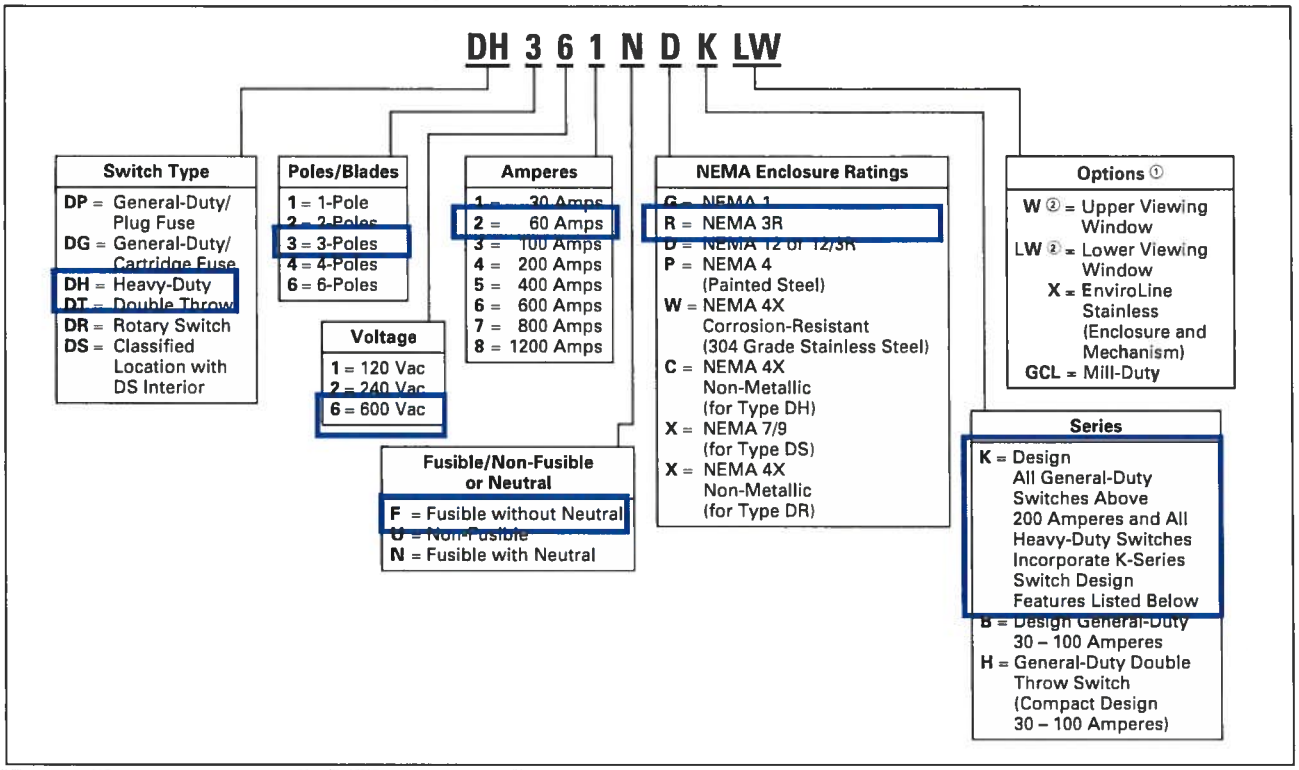
**Note:** Safety switch short circuit ratings are applicable to ac only.

**Note:** Safety switch $I^2t$ and Ip values are identical to UL maximum acceptable $I^2t$ and Ip values for the corresponding class fuse.

8

## Product Selection

**Table 8-38. Safety Switch Catalog Numbering System**

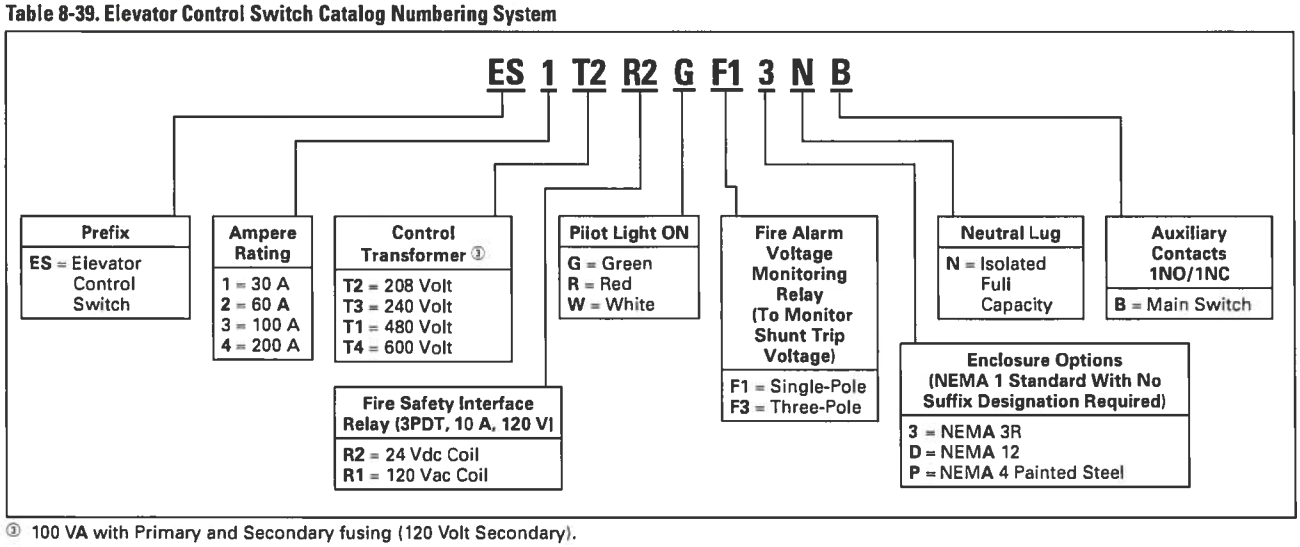



① See **Pages 8-8** through **8-11** for additional Flex Center options.

② Effective August 2003, 30 – 100 ampere window switches are replaced by a full view window which allows blade position verification and blown fuse indication. See **Page 8-37** for catalog numbers.

**Note:** This table is intended for use in breaking down existing catalog numbers. It is not intended for building new catalog numbers.

**Table 8-39. Elevator Control Switch Catalog Numbering System**

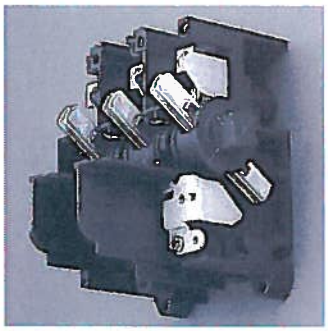



③ 100 VA with Primary and Secondary fusing (120 Volt Secondary).

**Catalog Number Example: ES3T1R1GF3**

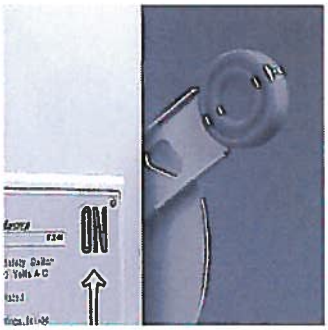
- 100 Ampere S.T. Switch 480V-3P — ES3.
- 480 – 120 Volt CPT — T1.
- 120 Vac Coil Fire Safety Interface Relay — R1.
- Pilot Light — ON (Green) — G.
- Fire Alarm Voltage Monitoring Relay (Three-Pole) — F3.

## All General-Duty Switches Above 100 Amperes and All Heavy-Duty Switches Incorporate These K-Series Switch Design Features



***Visible Double Break Rotary Blade Mechanism***

Two points of contact provide a positive open and close, easier operation, and also help prevent contact burning for longer contact life.

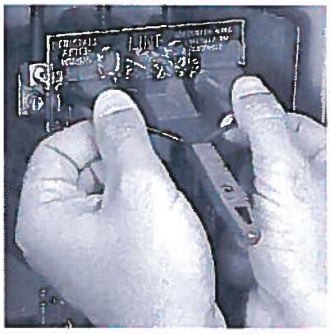



***Clearly Visible Handle***

The position (ON or OFF) can be clearly seen from a distance and the length provides for easy operation.

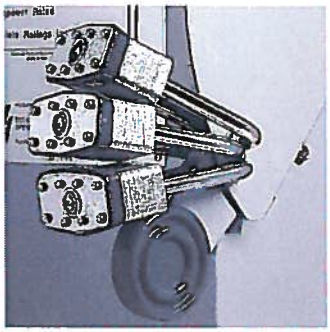
***Interlocking Mechanism***

Door cannot be opened when the handle is in the ON position. Front and side operable defeater mechanism provides for user access when necessary on single throw switches.



***Clear Line Shield***

Protects against accidental contact with energized parts. Probe holes enable the user to test if the line side is energized without removing the shield. Not typically provided on general-duty switches, but available as a field kit or factory installed.

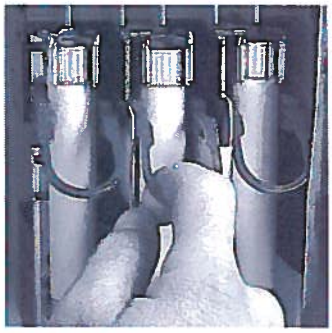


***Triple Padlocking Capability***

Personnel safety feature since the large hasp can accommodate up to three 3/8-inch (9.5 mm) shank locks.

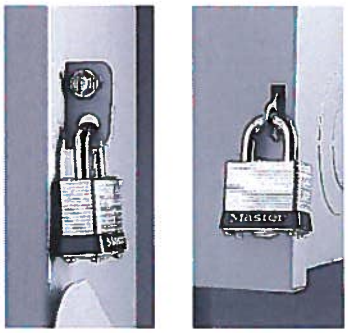
***Tangential Knockouts***

An ample number are provided on the top, bottom and sides of both NEMA Types 1 and 3R enclosures through 200 amperes.



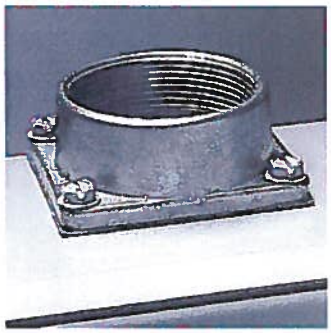
***Built-in Fuse Pullers (NEMA 12 and 4X 30 – 200 Amperes Only)***

Provide easy removal of fuses.




***Additional Locking Capability***

Cabinet door can be further padlocked at the top and bottom as applicable.



***Bolt-on Hub Kits***

For switches in a NEMA Type 3R, 30 – 200 A. Use a Myers type hub for all others

8

# TAB 2 Panelboards

1 Pow-R-Line1a
42 Circuits, 225A, Fully Rated, 208Y/120V 3Ph 4W, Copper Bus, 10k AIC,150A, 3P EDB Main Breaker[Bottom Fed], Surface Mounted, Surge Protective Device, 160 kA SPD Series - Standard w/ Surge Counter

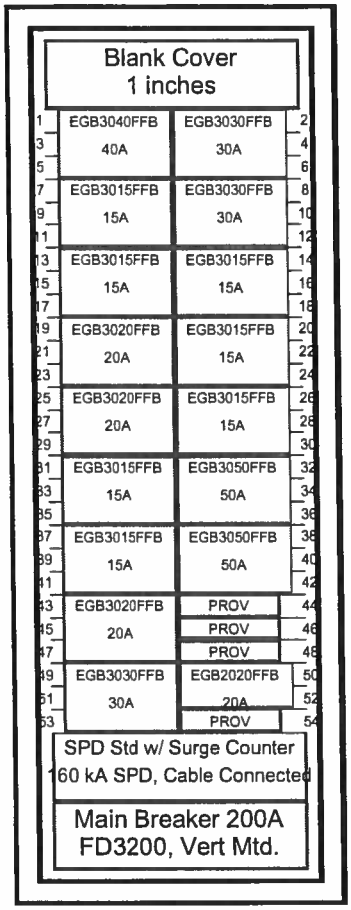
| | |
|---|---|
| 1 | 150A, 3P EDB Main Breaker |
| 2 | 15A, 1P BAB Branch Breaker |
| 1 | 30A, 3P BAB-H Branch Breaker |
| 1 | 40A, 2P BAB Branch Breaker |
| 12 | 1P BAB Branch Provision Only |
| 1 | 50A, 2P BAB Branch Breaker |
| 1 | 30A, 2P BAB Branch Breaker |
| 1 | 20A, 2P BAB Branch Breaker |
| 17 | 20A, 1P BAB Branch Breaker |
| 1 | SPD Factory Cable Connected to 30A Branch Breaker |
| 1 | Surge Protective Device, 160 kA SPD Series - Standard w/ Surge Counter |
| 1 | Copper Main Bus, 225 Amps |
| 1 | Std. Bolted Cu Ground Bar (Cu Cable Only) |
| 1 | Panel Nameplate - White with Black Letters - Screw on |
| 1 | Circuit Directory - Metal Frame with Plastic Cover |
| 1 | Type 1 Enclosure:EZB2060R |
| 1 | EZ Trim, Door in Door, Concealed Hardware:EZT2060S |

Designations: **EM-L1**

1 Pow-R-Line3E
54 Circuits, 250A, Fully Rated, 480V 3Ph 3W, Copper Bus, 14k AIC,200A, FD 3P Main Breaker[Bottom Fed], Surface Mounted, Surge Protective Device, 160 kA SPD Series - Standard w/ Surge Counter

| | |
|---|---|
| 1 | 200A, FD 3P Main Breaker |
| 7 | 15A, EGB 3P Branch Breaker |
| 3 | 20A, EGB 3P Branch Breaker |
| 2 | 50A, EGB 3P Branch Breaker |
| 1 | 40A, EGB 3P Branch Breaker |
| 3 | 30A, EGB 3P Branch Breaker |
| 1 | 20A, EGB 2P Branch Breaker |
| 4 | 1P EGB Branch Provision Only |
| 1 | SPD Factory Cable Connected to 30A Branch Breaker |
| 1 | Surge Protective Device, 160 kA SPD Series - Standard w/ Surge Counter |
| 1 | Copper Main Bus, 250 Amps |
| 1 | Std. Bolted Cu Ground Bar (Cu Cable Only) |
| 1 | Panel Nameplate - White with Black Letters |
| 1 | Circuit Directory - Metal Frame with Plastic Cover |
| 1 | Service Entrance Label |
| 1 | Type 1 Enclosure:EZB2060R |
| 1 | EZ Trim, Door in Door, Concealed Hardware:EZT2060S |

Designations: **HW-H1**




**General Information** **(Section 1 of 1)**

| | | | |
|---|---|---|---|
| **Service Voltage:** | 480V 3Ph 3W | **Enclosure:** | Type 1 |
| **Bus Rating & Type:** | 250A Copper | **Neutral Rating:** | None |
| **Ground Bar:** | Std. Bolted Copper, Cu cable only | | |
| **S.C. Rating:** | 14k A.I.C.Fully Rated | | |
| **Main Device Type:** | Main Breaker - Bottom Cable Entry | | |
| **Main Terminals:** | Mechanical - (1) #14-4/0 (Cu/Al) | | |
| **Neutral Terminals:** | None | | |
| **Box Catalog No.:** | EZB2060R | | |
| **Trim:** | EZ Trim, Door in Door, Concealed Hardware (EZT2060S) | | |
| | Surface Mounted | | |
| **Box Dimensions:** | 60." [1524.0mm]H x 20" [508.0mm]W x 5.75" [146.0mm]D | | |
| **Min. Gutter Size:** | Top = 5.5" [139.7mm] Bottom = 5.5" [139.7mm] Left = 4" [101.6mm] Right = 4" [101.6mm] | | |

**Panel ID Nameplate:** **(1) HW-H1 (sec 1)**
**Type:** Plastic, adhesive-backed **(2) 480V 3Ph 3W**
**Color:** White with Black Letters **(3)**

**UL**
**Service Entrance Label**

Trim Lock:Standard Lock & Key (Keyed WEM2)
Circuit Directory:Metal Frame with Plastic Cover
SPD Factory Cable Connected to 30A Branch Breaker
Main Circuit Breaker Trip Type: Thermal-Magnetic

**Device Modifications:**

| Ref # | Description |
|---|---|

**Branch Devices**

| Qty | Poles | Trip | Frame | Amps | KAIC |
|---|---|---|---|---|---|
| 1 | 2 | 20 | EGB | 125 | 14 |
| 7 | 3 | 15 | EGB | 125 | 14 |
| 3 | 3 | 20 | EGB | 125 | 14 |
| 3 | 3 | 30 | EGB | 125 | 14 |
| 1 | 3 | 40 | EGB | 125 | 14 |
| 2 | 3 | 50 | EGB | 125 | 14 |
| 4 | 1 | | PROV | | |

**Notes:**



| | | | |
|---|---|---|---|
| PREPARED BY: **Fitzgerald, Michael F** | DATE: **02/22/12** | **Eaton Corporation** | |
| APPROVED BY: | DATE: **02/22/12** | JOB NAME: **HDT RWRF** | DESIGNATION: **HW-H1** |
| VERSION: **7.8** | | TYPE: **PRL3E** | DRAWING TYPE: **Customer Approval** |
| NEG-ALT NUMBER: **DN851005V102-0008** | REVISION: | DWG SIZE: **A** | G.O.: **SDN0301918** | ITEM: | SHEET: **1 OF 1** |

# Technical Data

## Product Types, continued

**Retrofit Panelboard**
**PRL-1R and PRL-2R**

**Bolt-On Circuit Breakers**
**480Y/277 Vac;**
**240 Vac, 480Y/277 Vac**

Main lugs only
225A maximum

Main circuit breaker
225A maximum

Branch circuit breakers
100A maximum,
Single-, two and three-pole

**Type PRL3a**

**Bolt-On Circuit Breakers**
**240, 480 or 600 Vac;**
**250 Vdc Maximum**

Main lugs only
800A maximum

Main circuit breaker
600A maximum

Branch circuit breakers
225A maximum,
Single-, two- and three-pole

**Type PRL3E**

**Bolt-On Circuit Breakers**
**240, 480Y/277 or 480 Vac;**
**250 Vdc Maximum**

Main lugs only
600A maximum

Main circuit breaker
600A maximum

Branch circuit breakers
125A maximum,
Single-, two- and three-pole

**Type PRL4**

**Circuit Breakers or Fusible Switches**
**240, 480 or 600 Vac; 600 Vdc Maximum**

Main lugs only
1200A maximum

Main circuit breaker
1200A maximum

Main fusible switch
1200A maximum

Branch circuit breakers
1200A maximum,
Single-, two- and three-pole

Branch fusible switches
1200A maximum,
two- and three-pole

**Type PRL5P**

**Plug-On Circuit Breakers**
**240, 480 or 600 Vac;**
**250 Vdc Maximum**

Main lugs only
1200A maximum

Main circuit breaker
1200A maximum

Branch circuit breakers
1200A maximum,
Single-, two- and three-pole

## Product Types, continued

**Pow-R-Command**

**Bolt-On Circuit Breakers**
**240 or 480Y/277 Vac**

Main lugs only
400A maximum

Main circuit breaker
400A maximum

Branch circuit breakers
225A maximum,
Single-, two- and three-pole

Integral power switching controls

**Metering Service Section**

**Bolt-On Circuit Breaker or Fusible Switch 240, 480 or 600 Vac**

Service entrance panels combining a main disconnect with a power company metering compartment
400–1200A

**Elevator Control Panelboard**

**Bolt-On Fusible Switches**
**600 Vac Maximum**

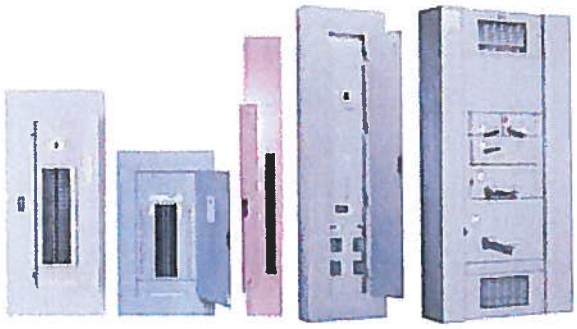
Controls for up to four elevators in a single Panelboard

Main lugs only
800A maximum

Branch overcurrent devices
15–200A fusible switches with Class J fuse clips maximum

Designed to meet specific sections of various codes impacting elevators

**Pow-R-Line C Panelboards**





## Product Description

### Lighting and Distribution Panelboards

Eaton's assembled panelboards are designed for sequence phase connection of branch circuit devices. This allows complete flexibility of circuit arrangement (single-, two- or three-pole) to allow balance of the electrical load on each phase.

Sturdy, rigid chassis assembly ensures accurate alignment of interior with panel front; prevents flexing and minimizes possibility of loosening or damage to current carrying parts during and after installation.

Four-point in-and-out adjustment of panel interior is provided to meet critical depth dimensions on flush installations. This compensates for possible misalignment of box at installation.

Main lugs are mechanical solderless type and approved for copper or aluminum conductors.

***Enclosures***

Boxes are code-gauge galvanized steel, which include a painted box finished in ANSI-61 light gray to match the trim.

Standard panelboard cabinets are designed for indoor use. Alternate types are available for indoor and special purpose applications.

All enclosures are furnished in accordance with Underwriters Laboratories standards and include wiring gutters with proper wire bending space. Special cabinets can be provided at an additional charge.

The box dimensions shown are inside dimensions. For outside dimensions, add 1/4-inch (6.4 mm).

Standard panelboard boxes are supplied without knockouts (blank endwalls).

***Fronts***

Fronts (trims) for all panelboards are made of code-gauge steel and have a high durability ANSI-61 light gray finish applied by a baked-on polyester powder coating paint system.

The fronts for lighting and appliance branch circuit panelboards and small power distribution panelboards include a door with rounded corners and concealed hinges. A flush-type latch and lock assembly is included. All locks are keyed alike. These trims are available in both surface- and flush-mounted designs.

***EZ Trim Features Standard Door-in-Door with No Exposed Hardware or Sharp Edges (no Tools are Required for Installation)***

***The Three-Piece Trim for Larger Power Distribution Panelboards Provides for Easy Handling and Installation***

Fronts for power distribution panelboards utilize a unique breaker front cover design in which each device has a dedicated bolt-on steel cover. The individual covers form a single deadfront for the panelboard that is used in conjunction with two wiring gutter covers to complete the trim. A door is not finished as part of the standard offering on these panelboards but can be provided, for an additional charge, using a deeper than standard box.

## Application Description

### Panelboard Selection Factors

10

In selecting a panelboard, the following factors must be considered:

- Service (voltage and frequency)
- Interrupting capacity (fully or series rated)
- Ampere rating of main
- Ampere ratings of branches
- Environment

### Panelboard Short-Circuit Rating

The short-circuit rating of Eaton's assembled panelboards are test verified by, and listed with, Underwriters Laboratories (UL). Generally, these ratings are that of the lowest interrupting rated device in the panel.

Certain exceptions to this rule exist where branch devices have been UL tested in combination with specific main devices having a higher interrupting rating. Where these defined main devices and branch breaker combinations are utilized, the series short-circuit rating of the assembled panelboard will be the same as the tested rating of the approved rated main device in series with the branches. Available main and branch breaker combinations are tabulated starting on **Page 366**. All combinations shown are UL tested and listed.

These series ratings apply to panels having main devices, or main lug only panelboards fed remotely by the device listed in the series ratings chart as the main, for which UL listed tests were conducted.

### Service Entrance Equipment

The National Electrical Code (NEC) requires that:

- A panel used as service entrance equipment must be located near the point where the supply conductors enter the building
- A panelboard having main lugs only shall have a maximum of six service disconnects to de-energize the entire panelboard from the supply conductors. Where more than six disconnects are required, a main service disconnect must be provided
- A disconnectable electrical bond must be provided between the neutral and ground
- A service entrance type UL label must be factory installed
- Ground fault protection of equipment shall be provided for each service disconnect rated 1000A or more if the electrical service is a solidly grounded wye system of more than 150V to ground, but not exceeding 600V phase-to-phase

**Note:** Service entrance panels must be identified as such on the order.

### Panelboard Standards

In 2008, both the National Electrical Code (Article 408) and UL 67 were updated to remove the mandated 42-circuit limitation. Eaton offers panelboards with more than 42 circuits for those jurisdictions that have adopted the 2008 NEC or later.

For jurisdictions that have not adopted the 2008 or later version of the National Electrical Code, the 42-circuit limitation for Lighting and Appliance Branch Panelboards remains in place. Check with your local code officials to determine specific jurisdiction status.

### Panelboard Installation

NEC requires that the operating handle of the topmost mounted device be no more than 6 feet 7 inches (2006.6 mm) above the finished floor and should be installed per NEC and manufacturer's instructions.

Additional boxes and fronts are required when the components required for one panelboard exceed the standard box dimensions.

### Multi-Section Panelboards

When two or more separate enclosures are required, separate fronts for each box are standard. A common front can be furnished at additional charge.

### Interconnecting Multi-Section Panelboards

When a panelboard, for connection to one feeder, must be furnished in more than one section (Box), each section must be furnished with main bus and terminals of the same rating, unless a main overcurrent device is provided in each section.

Sub-feed or through-feed provisions must also be included (and priced) to provide connection capability to the second section.

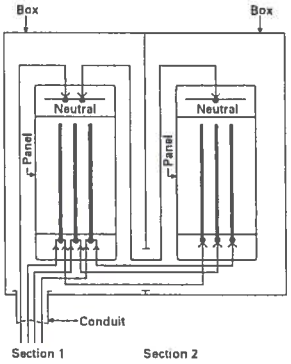
**Note:** Sub-feed or through-feed lugs cannot be used on any panelboard that is not protected by a single main overcurrent device either in the panelboard or immediately upstream, i.e., service entrance panelboards with main lugs only using the six disconnect rule.

### Sub-Feed Lugs

Sub-feed lugs (see figure below) are one means of interconnecting multi-section panels. The sub-feed (second set of) lugs are mounted directly beside the main lugs. These are required in each section except the last panel in the lineup. The feeder cables are brought into the wiring gutter of the first section and connected to the main lugs. Another set of the same size cables are connected to the sub-feed lugs (Section 1) and are carried over to the main lugs of the adjacent panel. Cross connection cables are not furnished by Eaton. Sub-feed lugs are only available on main lug only panels.

**Note:** Sub-feed lugs may not be used on main lug only (six disconnect rule) service entrance panels.

### Sub-Feed Lugs

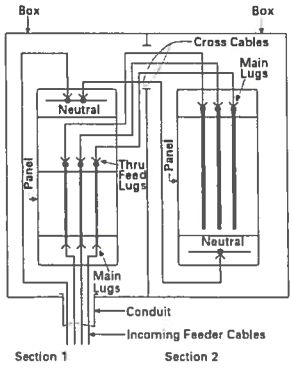



### Through-Feed Lugs

Through-feed lugs (see figure below) are another method to interconnect multi-section panelboards. The incoming feeder cables are connected to the main lugs or main breaker at the bottom of panel (Section 1). Another set of lugs (through-feed) are located at the opposite end of the main bus. The interconnecting cables are connected to the through-feed lugs in Section 1 and are carried over to the main lugs in Section 2. The connection arrangement could be reversed, i.e., main lugs at top; through-feed lugs at bottom end of panel. Cross cables are not furnished by Eaton.

**Note:** Through-feed lugs may not be used on main lug only (six disconnect rule) service entrance panels.

### Through-Feed Lugs

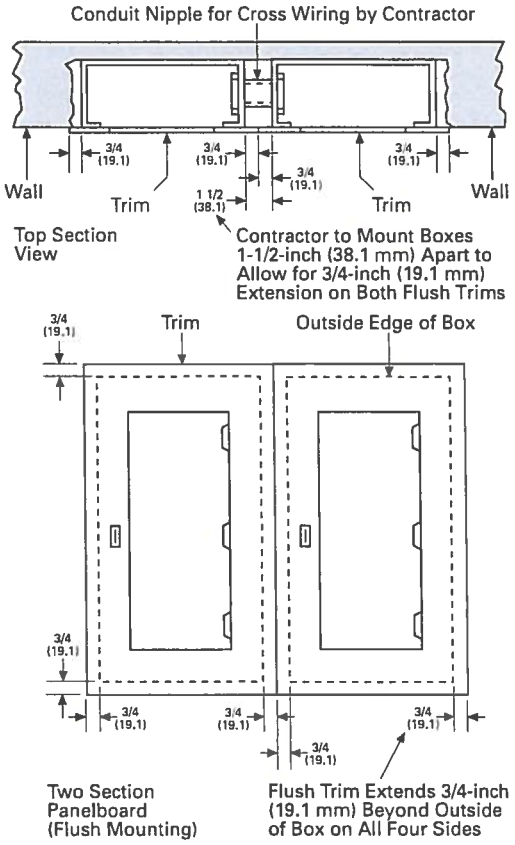



### Multiple Section Panelboard—Flush Mounted

Shown below is the standard method for flush mounting multiple section lighting and distribution panelboards using standard flush trims.

10

### Multiple Section Panelboard Flush Mounted—Dimensions in Inches (mm)




### Overcurrent Protection

The following requirements will be found in the NEC:

Each lighting and appliance branch circuit panelboard shall be individually protected on the supply side by not more than two main circuit breakers or two sets of fuses having a combined rating not greater than that on the panelboard.

10

### Branch Circuit Loading for Lighting Panels

The size of mains and branches should be selected based on the following:

- Motor circuits: NEC Article 430
- Diversity factor
- Provision for future loading

**Exception Number 1:** Individual protection for a lighting panelboard is not required when the panelboard feeder has overcurrent protection not greater than that of the panelboard.

**Exception Number 2:** For existing installations, individual protection for lighting panelboards is not required where such panelboards are used as service equipment in supplying an individual residential occupancy and where any bus supplying 15 or 20A circuits is protected on the supply side by an overcurrent device.

### Ambient Temperatures

The primary function of an overcurrent device is to protect the conductor and its insulation against overheating. In selecting the size of the devices and conductors, consideration should be given to the ambient temperature surrounding the conductors within and external to the panelboard. Cumulative heating within the panelboard may cause premature operation of the overcurrent protective devices.

Underwriters Laboratories test procedures are based, in part, on 80% loading of panelboard branch circuit devices. The NEC limits the loading of overcurrent devices in panelboards to 80% of rating where in normal operation the load will continue for three hours or more. Further derating may be required, depending on such factors as ambient temperature, duty cycle, frequency or altitude.

**Exception:** There is one exception to this rule in both UL and NEC. It applies to assemblies and overcurrent devices that have been listed for continuous duty at 100% of its rating.

### Special Conditions

Standard panelboards, assembled with standard components, are adequate for most applications. However, special consideration should be given to those required for application under special conditions such as:

- Excessive vibration or shock
- Frequencies above 60 cycles
- Altitudes above 6600 feet (2011.7m)
- Damp environment (possible fungus growth)
- Compliance with federal, state and municipal electrical codes and standards

### Seismic Considerations

The Uniform Building Code® and the International Building Code, as well as local and state building codes, place an emphasis on seismic building design requirements. Electrical distribution systems are treated as attachments to the building and therefore, fall into this category.

All Eaton panelboards are seismic qualified at the highest possible level, and have been tested in accordance with ANSI C37.81. This standard quantifies actual earthquake conditions, as well as equipment seismic capability.

### Harmonic Currents

Standard panelboard neutrals are rated for 100% of the panelboard current. However, since harmonic currents can cause overheated neutrals, an option is provided for neutrals to be rated at 200% (1200A maximum neutral for 600A main bus) of the panelboard phase current.

Panelboards with the 200% rated neutral are UL listed as suitable for use with non-linear loads.

Prior to specifying the 200% rated neutral, Eaton recommends a harmonic survey be conducted of the distribution system, be it new or existing.

### Surge Protective Devices

The quality of power feeding sensitive electronic loads is critical to the reliable operation of any facility. In modern offices, hospitals, and manufacturing facilities, the most frequent causes of microprocessor-based equipment downtime and damage are voltage transients and electrical noise.

Electrical loads and microprocessor-based equipment are highly susceptible to both high and low energy transients. High energy transients include lightning induced surges and power company switching. These high energy transients can destroy components instantly.

More frequently the electrical system experiences low energy transients and high frequency noise.

The effects of continual low energy transients and high frequency noise can cause erratic equipment performance or sudden failure of electronic circuit board components.

Eaton can provide protective and diagnostic systems integral to panelboards. The surge protective device (SPD) is integrated into the panelboards using a "zero lead length" direct bus bar connection.

*Pow-R-Line 4*

The SPD protects sensitive electronic equipment from the damaging effects of high and low energy transients, as well as high frequency noise.

### Standards and Certifications

Eaton's panelboards are designed to meet the following applicable industry standards, except where noted:

- Underwriters Laboratories:
  - Panelboards: UL 67
  - Cabinets and Boxes: UL 50

**Note:** Only panelboards containing UL listed devices can be UL labeled.

- National Electrical Code
- NEMA Standards: PB 1
- Federal Specification W-P-115c:
  - Circuit Breakers—Type I Class I
  - Fusible Switch—Type II Class I

UL Listed

## Technical Data and Specifications

### Panelboard Selection Guide

| Panelboard Type | Device Type | Maximum Voltage Rating AC | DC | Maximum Main Rating (Amperes) MLO | Main Device | Branch Circuits Ampere Range | Sub-Feed Breaker Maximum Amperes | AC Interrupting Capacity rms Symmetrical Amperes (kA) Fully Rated | Series Rated |
|---|---|---|---|---|---|---|---|---|---|
| [redacted] | | | | | | | | | |
| PRL1R | Breaker | 240 | — | 225 | 225 | 15–100 | — | 10–22 | 22–100 |
| PRL1aF | Fusible | 240 | — | 400 | 400 | 15–30 | 400 | 200 | — |
| PRL1a-LX | Breaker | 240 | — | 225 | 225 | 15–100 | — | 10–22 | 22–100 |
| PRL2a | Breaker | 240 | 250 | 400 | 400 | 15–100 | 400 | 65 | 65–200 |
| | Breaker | 480Y/277 | 250 | 400 | 400 | 15–100 | 400 | 14 | 22–150 |
| PRL2R | Breaker | 240 | — | 225 | 225 | 15–100 | — | 10–22 | 22–200 |
| | Breaker | 480Y/277 | — | 225 | 225 | 15–100 | — | 14 | 22–100 |
| PRL2aF | Fusible | 480Y/277 | — | 400 | 400 | 15–30 | 400 | 200 | — |
| PRL2a-LX | Breaker | 240 | 250 | 225 | 225 | 15–100 | — | 65 | 65–200 |
| | Breaker | 480Y/277 | 250 | 225 | 225 | 15–100 | — | 14 | 22–150 |
| PRL3a | Breaker | 240 | 250 | 800 | 600 | 15–225 | 600 | 10–200 | 22–200 |
| | Breaker | 480 | 250 | 800 | 600 | 15–225 | 600 | 14–100 | 22–150 |
| | Breaker | 600 | 250 | 800 | 600 | 15–225 | 600 | 14–35 | — |
| PRL3E | Breaker | 240 | 250 | 600 | 600 | 15–125 | 400 | 25–100 | 100–200 |
| | Breaker | 480Y/277 | 250 | 600 | 600 | 15–125 | 400 | 18–65 | 65–100 |
| | Breaker | 480 | 250 | 600 | 600 | 15–125 | 400 | 18–65 | 65–100 |
| PRL4B | Breaker | 240 | 600 | 1200 | 1200 | 15–1200 | — | 10–200 | 22–200 |
| | Breaker | 480 | 600 | 1200 | 1200 | 15–1200 | — | 14–200 | 22–150 |
| | Breaker | 600 | 600 | 1200 | 1200 | 15–1200 | — | 14–200 | — |
| PRL4F | Fusible | 240 | 250 | 1200 | 1200 | 30–1200 | — | 100–200 | — |
| | Fusible | 600 | 250 | 1200 | 1200 | 30–1200 | — | 100–200 | — |
| PRL5P | Breaker | 240 | 250 | 1200 | 1200 | 15–1200 | — | 10–200 | 22–200 |
| | Breaker | 480 | 250 | 1200 | 1200 | 15–1200 | — | 14–200 | 22–150 |
| | Breaker | 600 | 250 | 1200 | 1200 | 15–1200 | — | 14–200 | — |
| PRC100/50 PRC25 | Breaker | 240 | — | 400 | 400 | 15–225 | — | 10–65 | 22–100 |
| | Breaker | 480Y/277 | — | 400 | 400 | 15–225 | — | 14 | 65–100 |
| Elevator Control | Fusible | 240 | — | 800 | 800 | 15–200 | — | 200 | — |
| | Fusible | 480Y/277 | — | 800 | 800 | 15–200 | — | 200 | — |
| | Fusible | 480 | — | 800 | 800 | 15–200 | — | 200 | — |

10

### *Terminal Wire Ranges, Pressure-Type Al/Cu Terminals Except as Noted*

**Note:** All terminal sizes are based on wire ampacities corresponding to those shown in NEC Table 310-16 under the 75°C insulation columns (75°C wire). The use of smaller size, (in circular mills), regardless of insulation temperature rating, is not permitted.

Where copper-aluminum terminals are supplied on designated panelboard types, best results are obtained if a suitable joint compound is applied when aluminum conductors are used.

Check Eaton's standard terminal sizes versus customer requirements. In particular, 400 and 800A breakers often require nonstandard lugs.

Optional 750 kcmil mechanical screw-type terminals are available upon request. Panelboard dimensions may be affected, refer to Eaton.

## Standard Main Lug Terminals

| | Wire Size Ranges for Ampere Capacity | | | | | | |
|---|---|---|---|---|---|---|---|
| **Panel Type** | **100A** | **225A** | **250A** | **400A** | **600A** | **800A** | **1200A** |
| [redacted] | | | | | | | |
| PRL2a | #12–1/0 | #6–300 kcmil | — | (2) #4–500 kcmil | — | — | — |
| PRL1R | #12–1/0 | #6–300 kcmil | — | (2) #4–500 kcmil | — | — | — |
| PRL2R | #12–1/0 | #6–300 kcmil | — | (2) #4–500 kcmil | — | — | — |
| PRL1aF | #12–1/0 | #6–300 kcmil | — | (2) #4–500 kcmil | — | — | — |
| PRL2aF | #12–1/0 | #6–300 kcmil | — | (2) #4–500 kcmil | — | — | — |
| PRL3a | #12–1/0 | — | #6–350 kcmil | (2) #4–500 kcmil | (2) #4–500 kcmil | (3) #4–500 kcmil | — |
| PRL3E | #12–1/0 | — | #6–350 kcmil | (2) #4–500 kcmil | (2) #4–500 kcmil | — | — |
| PRL4 | — | — | #4–500 kcmil | (2) #4–500 kcmil | (2) #4–500 kcmil | (3) #4–500 kcmil | (4) #4–500 kcmil |
| PRL1a-LX | #12–1/0 | #6–300 kcmil | — | — | — | — | — |
| PRL2a-LX | #12–1/0 | #6–300 kcmil | — | — | — | — | — |
| PRC100/PRC50 | #12–1/0 | — | #6–350 kcmil | (2) #4–500 kcmil | — | — | — |
| PRC25 | #12–1/0 | #6–300 kcmil | — | (2) #4–500 kcmil | — | — | — |
| PRL5P | — | — | — | (1) #1/0–500 kcmil<br>or<br>(2) #1/0–250 kcmil | (2) #4–500 kcmil | (2) #2–500 kcmil<br>or<br>(3) #2–400 kcmil | (4) #4–750 kcmil |
| Elevator Control | — | — | #4–500 kcmil | (2) #4/0–500 kcmil | (2) #4/0–500 kcmil | (3) #4/0–500 kcmil | — |

## Standard Circuit Breaker Terminals

| Breaker Type | Ampere Rating | Wire Range |
|---|---|---|
| [redacted]BHW, BABRSP, [redacted]PHW | 15–70 | #14–#4 |
| | 90–100 | #8–1/0 |
| [redacted]S, ED, EDH, EDC | 100–225 | #4–4/0 or #6–300 kcmil |
| EGB, EGE, EGS, EGH | 15–50 | #14–3/0 AL/CU |
| | 60–125 | #6–3/0 AL/CU |
| EHD, FD, FD, HFD, FDC, HFDDC [2] | 15–100 | #14–1/0 |
| | 125–225 | #4–4/0 |
| FCL | 15–100 | #14–1/0 |
| GHB, HGHB, GHQ, GHQRSP | 15–20 | #14–#10 |
| | 25–100 | #10–1/0 |
| EGB, EGS, EGH | 15–50 | #14–1/0 |
| | 60–125 | #6–2/0 |
| JD, HJD, JDC, HJDDC [2] | 70–250 | #4–350 kcmil |
| DK | 250–350 | 250–500 kcmil |
| | 400 | (2) 3/0–250 kcmil or (1) 3/0–500 kcmil |
| KD, HKD, KDC, HKDDC, [2] CKD, CHKD | 225 | (1) #3–350 kcmil |
| | 350 | (2) 3/0–250 kcmil or |
| | 400 | (2) 3/0–250 kcmil or (1) 3/0–500 kcmil |
| LHH | 150–400 | #2–500 kcmil |
| | 150–400 | (2) #2–500 kcmil |
| | 150–400 | (1) 500–750 kcmil |
| LGE, LGH, LGC, LGU, LHH [1] | 250–400 | (1) #2–500 kcmil |
| | 500–600 | (2) #2–500 kcmil |
| LD, HLD, LDC, HLDDC [2] CLD, CHLD | 300–500 | (2) 250–350 kcmil |
| | 600 | (2) 400–500 kcmil |
| MDL, HMDL, HMDLDC [2] CMDL, CHMDL | 400–600 | (2) #1–500 kcmil |
| | 700–800 | (3) 3/0–400 kcmil |
| ND, HND, CND, CHND, NDC, CNDC | 800–1000 | (3) 3/0–400 kcmil |
| | 1200 | (4) 4/0–500 kcmil |
| LCL | 125–225 | (1) #6–350 kcmil |
| | 250–400 | (1) #4–250 kcmil and (1) 3/0–600 kcmil |
| FB-P | 15–100 | #14–1/0 |
| LA-P | 70–225 | #6–350 kcmil |
| | 250–400 | (1) #4–250 kcmil and (1) 3/0–600 kcmil |
| NB-P, NBDC [2] | 300–700 | (2) #1–500 kcmil |
| | 800 | (3) 3/0–400 kcmil |

## FDPW Switch Terminals

| Ampere Rating | Wire Range |
|---|---|
| 30 | #14–1/0 |
| 60 | #14–1/0 |
| 100 | #14–1/0 |
| 200 | #4–300 kcmil |
| 400 | 250–750 kcmil or (2) 3/0–250 kcmil |
| 600 | (2) #4–600 kcmil or (4) 3/0–250 kcmil |
| 800 | (3)250–750 kcmil or (6) 3/0–250 kcmil |
| 1200 | (4) 250–750 kcmil or (8) 3/0–250 kcmil |

## Elevator Control Panel Feeder Terminals

| Ampere Rating | Wire Range |
|---|---|
| 30 | #14–1/0 |
| 60 | #14–1/0 |
| 100 | #14–1/0 |
| 200 | #4–300 kcmil |

***Notes***

[1] LHH is 400A maximum.
[2] Suitable for DC applications only.

# Eaton's SPD Series for integration into electrical distribution equipment


## Contents



Powering Business Worldwide

## Introduction

### Eaton's SPD Series surge protective devices

Eaton's SPD Series surge protective devices are the latest and most advanced UL® 1449 3rd Edition certified surge protectors. Units are available integrated within Eaton electrical assemblies, including panelboards, switchboards, motor control centers, switchgear, and bus plugs. Side-mount versions of the SPD Series are also available for installation external to an electrical assembly. Application of SPD Series units throughout a facility will ensure that equipment is protected with the safest and most reliable surge protective devices available.

SPD Series units are available in all common voltages and configurations and also in a variety of surge current capacity ratings from 50 through 400 kA. Three feature package options are also available to choose from. The breadth of the SPD Series' features, options, and configurations ensures that the correct unit is available for all electrical applications, including service entrances, distribution switchboards, panelboards, and point-of-use applications.

## Applications

The SPD Series is available as an integrated device within the following Eaton electrical assemblies:

- Panelboards
- Switchboards
- Motor control centers
- Switchgear
- Automatic transfer switches
- Bus plugs

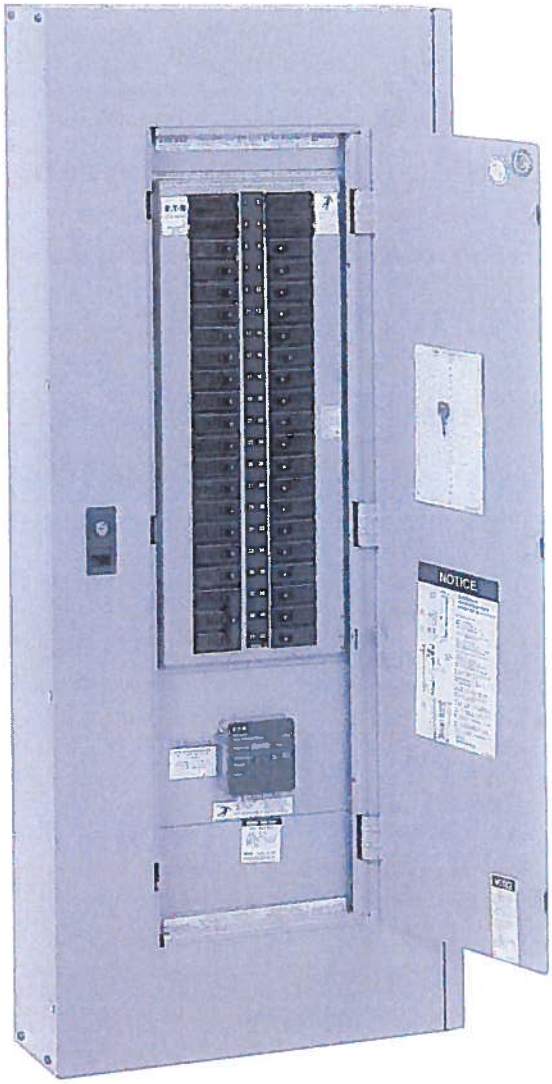
## Features

- Uses thermally protected metal oxide varistor (MOV) technology
- 20 kA nominal discharge current ($I_n$) rating (maximum rating assigned by UL)
- 50 through 400 kA surge current capacity ratings
- Three feature package options
- 200 kA short circuit current rating (SCCR)
- 10-year warranty

## Standards and certifications

c UL us

- UL 1449 3rd Edition recognized component for the United States and Canada, covered by Underwriters Laboratories certification and follow-up service




SPD Series Unit Integrated Within an Eaton Panelboard

## Feature package options

The SPD Series provides users with the option of selecting between three feature packages. These feature packages are the basic, standard, and standard with surge counter. The proper feature package can be selected based on the requirements of the application or specification.

**Table 1. Feature Package Comparison**

| Feature | Basic | Standard | Standard with Surge Counter |
|---|---|---|---|
| Surge protection using thermally protected MOV technology | ✔ | ✔ | ✔ |
| Dual-colored protection status indicators for each phase | ✔ | ✔ | ✔ |
| Dual-colored protection status indicators for the neutral-ground protection mode | ✔ | ✔ | ✔ |
| Audible alarm with silence button | | ✔ | ✔ |
| Form C relay contact | | ✔ | ✔ |
| EMI/RFI filtering, providing up to 50 dB of noise attenuation from 10 kHz to 100 MHz | | ✔ | ✔ |
| Surge counter with reset button | | | ✔ |

## Remote display mounting option

The SPD Series offers the option of mounting its display remotely from the device. This is useful for applications where OEMs or other integrators would like to embed the unit within a piece of equipment and still be able to view its display.

SPD Series unit catalog numbers ending with 'B' (refer to catalog number configuration on **Page 7**) should be ordered for applications where the display is to be mounted remotely. These units include the SPD Series unit and the remote display panel.

In addition to the unit itself, a remote display cable will have to be purchased. Remote display cables are available in 4, 8, and 12 foot lengths.

**Table 2. Remote Display Cables**

| Description | Catalog Number |
|---|---|
| 4 ft remote display cable | **SPDRDCAB04** |
| 8 ft remote display cable | **SPDRDCAB08** |
| 12 ft remote display cable | **SPDRDCAB12** |

**Note:** Integrated units factory-installed with Eaton switchgear assemblies do not require the purchase of a remote display cable. The cable is provided and all required mounting is performed at the factory.

Existing SPD Series units previously installed without a remote display also have the capability of mounting their displays remotely from the device. Complete remote display kits are available that contain all items required to mount the display remotely, including the remote display cable. Remote display kits are available in 4, 8, and 12 foot cable length options.

**Table 3. Remote Display Kits**

| Description | Catalog Number |
|---|---|
| Remote display kit with 4 ft remote display cable | **SPDRDKIT04** |
| Remote display kit with 8 ft remote display cable | **SPDRDKIT08** |
| Remote display kit with 12 ft remote display cable | **SPDRDKIT12** |

For the dimensions of the cutout required to accommodate the remote display panel, see **Figure 1** below.

## Dimensions

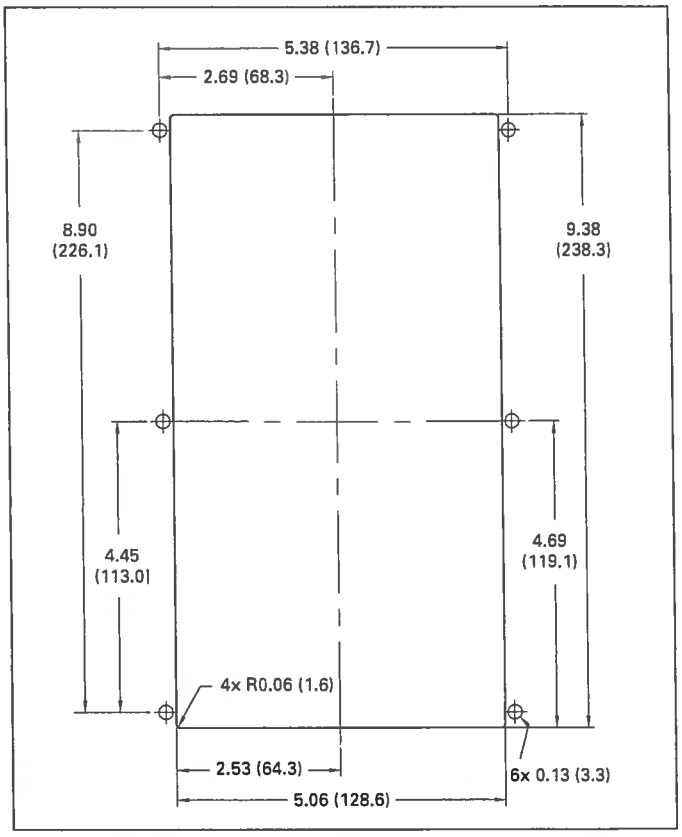



**Figure 1. Dimensions of the Cutout Required to Accommodate the Optional Remote Display Panel**

## Dimensions (continued)

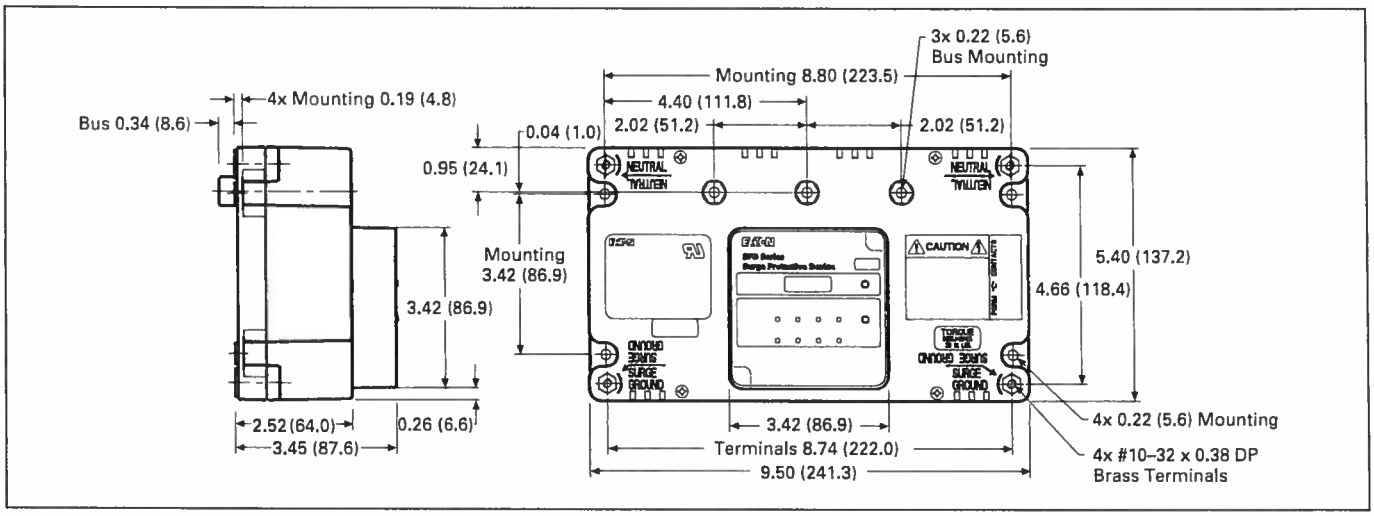



**Figure 2. Dimensions of 50 through 200 kA Integrated Units**

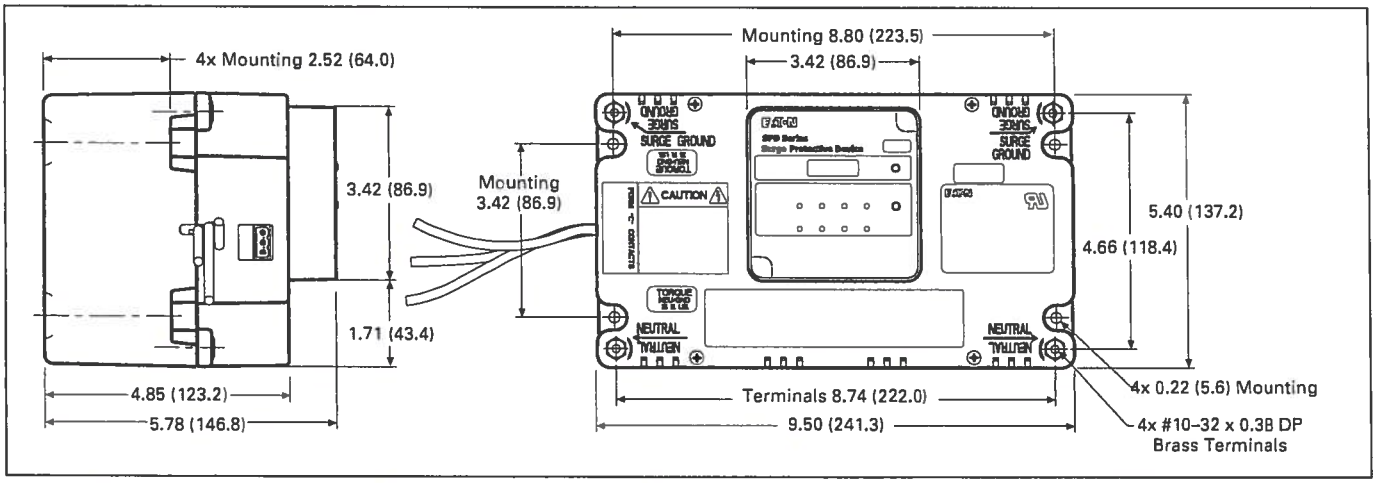



**Figure 3. Dimensions of 250 through 400 kA Integrated Units**

## Performance data

### ANSI/UL 1449 3rd Edition voltage protection ratings

Voltage protection rating (VPR) data is included for both direct bus mounted units (catalog number ending with 'A') and units interfaced to the electrical assembly via a circuit breaker (catalog number ending with 'B,' 'C,' or 'J'). Direct bus mounted units are available for installation within Eaton PRL1a, 2a, 3a, and 3E panelboards only.

**Table 4. 50 kA Direct Bus Mounted Integrated Unit VPR**

| | Protection Mode | | | |
|---|---|---|---|---|
| **Voltage Code** | **L-N** | **L-G** | **N-G** | **L-L** |
| 240S | 500 | 1000 | 500 | 1000 |
| 208Y and 220Y | 500 | 1000 | 500 | 1000 |
| 400Y and 480Y | 1000 | 2000 | 1000 | 2000 |
| 600Y | 1200 | 2500 | 1200 | 2500 |
| 240D | N/A | 1000 | N/A | 900 |
| 480D | N/A | 2000 | N/A | 2000 |
| 600D | N/A | 2500 | N/A | 2500 |
| 240H | 500 | 1000 | 500 | 1000 |

**Table 5. 80–100 kA Direct Bus Mounted Integrated Unit VPR**

| | Protection Mode | | | |
|---|---|---|---|---|
| **Voltage Code** | **L-N** | **L-G** | **N-G** | **L-L** |
| 240S | 500 | 600 | 500 | 900 |
| 208Y and 220Y | 500 | 600 | 500 | 900 |
| 400Y and 480Y | 1000 | 1200 | 1000 | 1800 |
| 600Y | 1200 | 1500 | 1200 | 2500 |
| 240D | N/A | 1000 | N/A | 900 |
| 480D | N/A | 1800 | N/A | 1800 |
| 600D | N/A | 2500 | N/A | 2500 |
| 240H | 500 | 600 | 500 | 900 |

**Table 6. 120–200 kA Direct Bus Mounted Integrated Unit VPR**

| | Protection Mode | | | |
|---|---|---|---|---|
| **Voltage Code** | **L-N** | **L-G** | **N-G** | **L-L** |
| 240S | 500 | 600 | 500 | 800 |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 400Y and 480Y | 900 | 1000 | 900 | 1800 |
| 600Y | 1200 | 1200 | 1200 | 2500 |
| 240D | N/A | 900 | N/A | 900 |
| 480D | N/A | 1800 | N/A | 1800 |
| 600D | N/A | 2500 | N/A | 2500 |
| 240H | 500 | 600 | 500 | 800 |

**Table 7. 250–300 kA Circuit Breaker Interfaced Integrated Unit VPR**

| | Protection Mode | | | |
|---|---|---|---|---|
| **Voltage Code** | **L-N** | **L-G** | **N-G** | **L-L** |
| 240S | 600① | 700 | 600 | 1000 |
| 208Y and 220Y | 600① | 700 | 600 | 1000 |
| 400Y and 480Y | 1000 | 1200 | 900 | 1800 |
| 600Y | 1500 | 1500 | 1200 | 2500 |
| 240D | N/A | 1000 | N/A | 1000 |
| 480D | N/A | 1800 | N/A | 1800 |
| 600D | N/A | 2500 | N/A | 2500 |
| 240H | 600① | 700 | 600 | 1000 |

① L-N VPR for 250–300 kA units containing the standard and standard with surge counter feature packages is 600V. L-N VPR for units containing the basic feature package is 700V. All other VPR numbers reported in all tables represent the VPR for all feature packages.

**Table 8. 50 kA Circuit Breaker Interfaced Integrated Unit VPR**

| | Protection Mode | | | |
|---|---|---|---|---|
| **Voltage Code** | **L-N** | **L-G** | **N-G** | **L-L** |
| 240S | 700 | 1200 | 700 | 1200 |
| 208Y and 220Y | 700 | 1200 | 700 | 1200 |
| 400Y and 480Y | 1200 | 2000 | 1200 | 2000 |
| 600Y | 1500 | 2500 | 1500 | 2500 |
| 240D | N/A | 1200 | N/A | 1200 |
| 480D | N/A | 2000 | N/A | 2000 |
| 600D | N/A | 2500 | N/A | 2500 |
| 240H | 700 | 1200 | 700 | 1200 |

**Table 9. 80–100 kA Circuit Breaker Interfaced Integrated Unit VPR**

| | Protection Mode | | | |
|---|---|---|---|---|
| **Voltage Code** | **L-N** | **L-G** | **N-G** | **L-L** |
| 240S | 700 | 700 | 700 | 1000 |
| 208Y and 220Y | 700 | 700 | 700 | 1000 |
| 400Y and 480Y | 1200 | 1200 | 1200 | 1800 |
| 600Y | 1500 | 1500 | 1500 | 2500 |
| 240D | N/A | 1200 | N/A | 1200 |
| 480D | N/A | 2000 | N/A | 2000 |
| 600D | N/A | 2500 | N/A | 2500 |
| 240H | 700 | 700 | 700 | 1000 |

**Table 10. 120–200 kA Circuit Breaker Interfaced Integrated Unit VPR**

| | Protection Mode | | | |
|---|---|---|---|---|
| **Voltage Code** | **L-N** | **L-G** | **N-G** | **L-L** |
| 240S | 700 | 700 | 600 | 1000 |
| 208Y and 220Y | 700 | 700 | 600 | 1000 |
| 400Y and 480Y | 1000 | 1200 | 1000 | 1800 |
| 600Y | 1500 | 1500 | 1200 | 2500 |
| 240D | N/A | 1000 | N/A | 1000 |
| 480D | N/A | 2000 | N/A | 1800 |
| 600D | N/A | 2500 | N/A | 2500 |
| 240H | 700 | 700 | 600 | 1000 |

**Table 11. 400 kA Circuit Breaker Interfaced Integrated Unit VPR**

| | Protection Mode | | | |
|---|---|---|---|---|
| **Voltage Code** | **L-N** | **L-G** | **N-G** | **L-L** |
| 240S | 700 | 700 | 600 | 1000 |
| 208Y and 220Y | 700 | 700 | 600 | 1000 |
| 400Y and 480Y | 1000 | 1200 | 900 | 1800 |
| 600Y | 1500 | 1500 | 1200 | 2500 |
| 240D | N/A | 1000 | N/A | 1000 |
| 480D | N/A | 1800 | N/A | 1800 |
| 600D | N/A | 2500 | N/A | 2500 |
| 240H | 700 | 700 | 600 | 1000 |

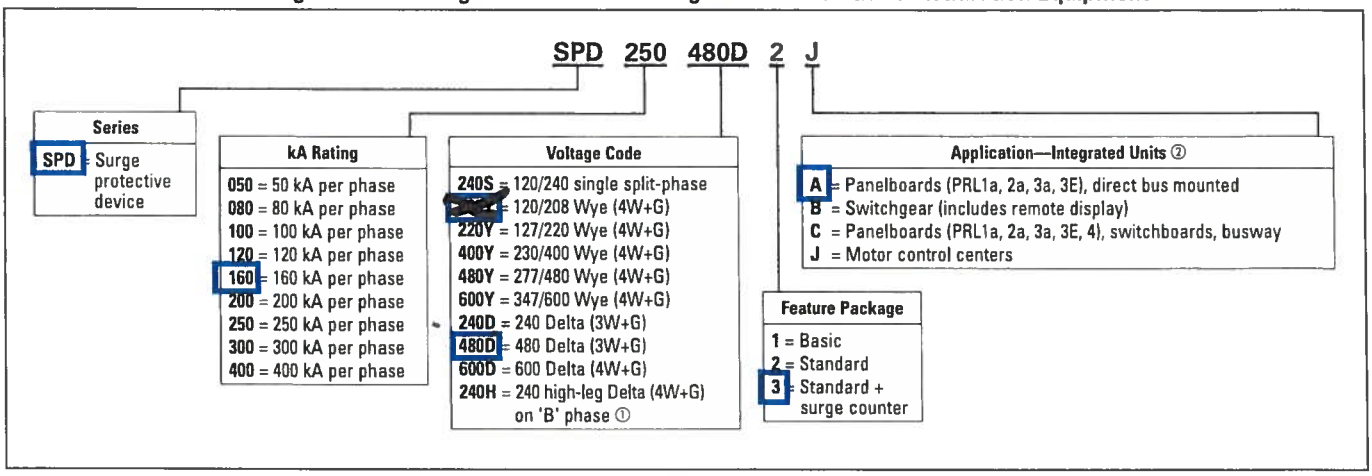
## Specifications

**Table 12. SPD Series Specifications**

| Description | Specification |
|---|---|
| Surge capacity ratings available | 50, 80, 100, 120, 160, 200, 250, 300, 400 kA per phase |
| Nominal discharge current ($I_n$) | 20 kA |
| Short circuit current rating (SCCR) | 200 kA |
| SPD type | Basic feature package = Type 1 (can also be used in Type 2 applications)<br>Standard and Standard with Surge Counter feature packages = Type 2 |
| Single split phase voltages available | 120/240 |
| Three-phase Wye system voltages available | [redacted]127/220, 230/400, 277/480, 347/600 |
| Three-phase Delta system voltages available | 240, 480, 600 |
| Input power frequency | 50/60 Hz |
| Power consumption (basic units):<br>[redacted]220Y, 240S, 240D, and 240H voltage codes<br>400Y, 480Y, and 480D voltage codes<br>600Y and 600D voltage codes | <br>0.5W<br>1.1W<br>1.3W |
| Power consumption (standard and standard with surge counter units):<br>[redacted]220Y, 240S, 240D, and 240H voltage codes<br>400Y, 480Y, and 480D basic voltage codes<br>600Y and 600D voltage codes | <br>0.6W<br>1.7W<br>2.1W |
| Protection modes | Single split phase ..... L-N, L-G, N-G, L-L<br>[redacted]<br>Three-phase Delta ..... L-G, L-L<br>Three-phase high-leg Delta ... L-N, L-G, N-G, L-L |
| Maximum continuous operating voltage (MCDV)<br>240S, [redacted]220Y, and 240H MCOV<br>400Y and 480Y MCDV<br>600Y MCOV<br>240D MCOV<br>480D MCDV<br>600D MCDV | <br>150 L-N, 150 L-G, 150 N-G, 300 L-L<br>320 L-N, 320 L-G, 320 N-G, 640 L-L<br>420 L-N, 420 L-G, 420 N-G, 840 L-L<br>320 L-G, 320 L-L<br>640 L-G, 640 L-L<br>840 L-G, 840 L-L |
| Ports | 1 |
| Operating temperature | –4°F through 122°F (–20°C through 50°C) |
| Operating humidity | 5% through 95%, noncondensing |
| Operating altitude | Up to 16,000 ft (5000m) |
| Seismic withstand capability | Meets or exceeds the requirements specified in IBC® 2006, CBC 2007, and UBC® Zone 4 |
| Weight | 50–200 kA units approximately 3.5 lbs (1.6 kg)<br>250–400 kA units approximately 7.0 lbs (3.2 kg) |
| Form C relay contact ratings | 150 Vdc or 125 Vac, 1A maximum |
| Form C relay contact logic | Power ON, normal state—NO contact = open, NC contact = closed<br>Power OFF or fault state—NO contact = closed, NC contact = open |
| EMI/RFI filtering attenuation | Up to 50 dB from 10 kHz to 100 MHz |
| Agency certifications and approvals | UL 1449 3rd Edition recognized component for the U.S. and Canada<br>UL 1283 (Type 2 SPDs only) |
| Warranty | 10 years |

## Catalog number selection

**Table 13. SPD Series Catalog Number Configuration for Units Integrated into Electrical Distribution Equipment**




**Example:** SPD250480D2J = SPD Series, 250 kA per phase, 480D voltage, standard feature package, motor control center application

① Please consult the factory for 240 high-leg Delta (4W+G) applications with high leg on 'C' phase.

② Units used in PRL1a, 2a, 3a, and 3E panelboard applications are available in 50–200 kA ratings only. Use the 'C' option for PRL1a, 2a, 3a, and 3E panelboard applications when unit is connected through a circuit breaker.

## Technical support information

If you have any questions or need additional information, please contact the Eaton Technical Resource Center at 800-809-2772, option 4, option 2. You may also submit inquiries via e-mail: surgeprotection@eaton.com.

# TAB 3 Dry Type Transformers

1 Dry Type Transformer
Standard Transformer Catalog Number: V48M28T45EE
Transformer Type: General Purpose Vented
3 PHASE, 45 KVA, 480 Primary Volts, 208Y/120 Secondary Volts,
150C Temperature Rise, Aluminum Winding Material, NEMA 2 (N3R w/opt'l weathershield) Enclosure Type, 60 HZ,
Frame 912B, Wiring Diagram 280B
Standard Values
K-Factor: 1
TAPS: 2@+2.5%, 4@-2.5%
NEMA ST20 Sound Level: 45
Nema TP-1 Energy Efficient: Y
Infrared Viewing Window: None

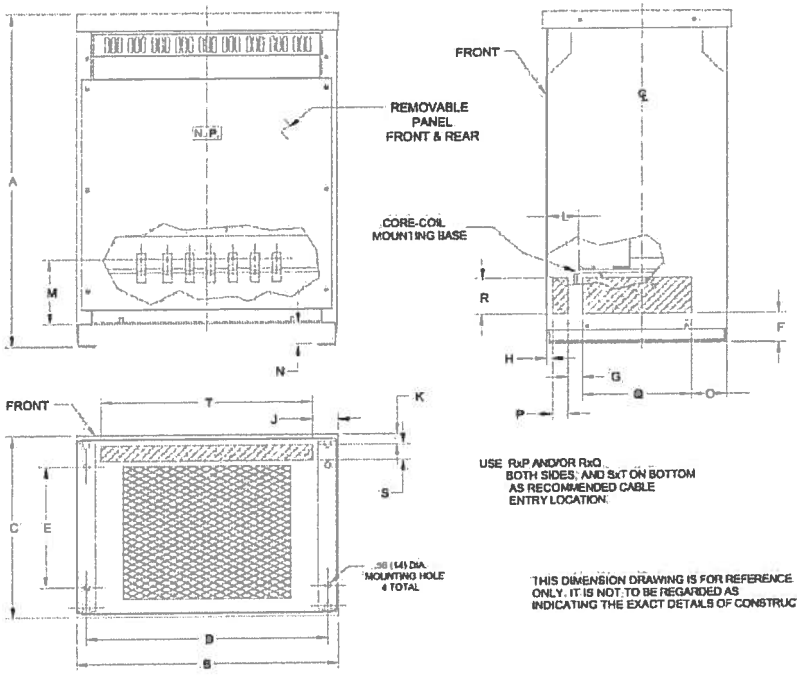
Field-Installed Accessories
Lug Kit: LKS1

Designations: **EM-TX1**

1 Dry Type Transformer
Standard Transformer Catalog Number: V48M28T30EE
Transformer Type: General Purpose Vented
3 PHASE, 30 KVA, 480 Primary Volts, 208Y/120 Secondary Volts,
150C Temperature Rise, Aluminum Winding Material, NEMA 2 (N3R w/opt'l weathershield) Enclosure Type, 60 HZ,
Frame 912B, Wiring Diagram 280B
Standard Values
K-Factor: 1
TAPS: 2@+2.5%, 4@-2.5%
NEMA ST20 Sound Level: 45
Nema TP-1 Energy Efficient: Y
Infrared Viewing Window: None

Field-Installed Accessories
Lug Kit: LKS1

Designations: **T30**




USE RxP AND/OR RxQ BOTH SIDES, AND SxT ON BOTTOM AS RECOMMENDED CABLE ENTRY LOCATION.

THIS DIMENSION DRAWING IS FOR REFERENCE ONLY. IT IS NOT TO BE REGARDED AS INDICATING THE EXACT DETAILS OF CONSTRUCTION.

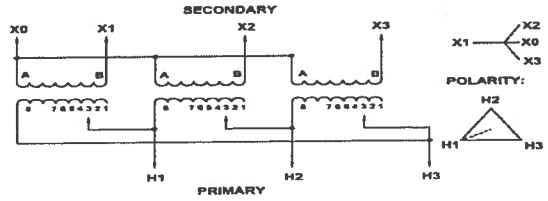
DIMENSIONS IN INCHES (MM)

| FRAME | A | B | C | D | E | F | G | H | J | K |
|---|---|---|---|---|---|---|---|---|---|---|
| FR912B | 30.00(752) | 23.00(584) | 16.50(419) | 21.04(534) | 11.00(279) | 2.62(67) | 1.25(32) | .50(13) | 2.29(58) | .86(22) |

| L | M | N | O | P | Q | R | S | T |
|---|---|---|---|---|---|---|---|---|
| 3.60(91) | 5.85(149) | 1.89(48) | 3.12(79) | 1.40(36) | 9.51(242) | 3.25(83) | 1.40(36) | 18.50(467) |

Rev4-Ena/10

| VOLTS | TAP |
|---|---|
| 504 | 1 |
| 492 | 2 |
| 480 | 3 |
| 468 | 4 |
| 456 | 5 |
| 444 | 6 |
| 432 | 7 |




| | |
|---|---|
| Style Number: | V48M28T30EE |
| kVA Rating: | 30 |
| K-Factor: | 1 |
| NEMA TP-1: | Y |
| Primary Voltage: | 480 |
| Secondary Voltage: | 208Y/120 |
| Taps: | 2@+2.5%, 4@-2.5% |
| Temperature Rise: | 150C |
| Winding Material: | Aluminum |
| Frequency (Hz): | 60 |
| Sound Level (dB): | 45 |
| Average Impedance %: | 4.57 |
| Weight (lbs): | 292 |
| Infrared Viewing Window: | Not Included |
| Accessories Included: Lug Kit: | Not Included |



| | | | |
|---|---|---|---|
| PREPARED BY: Fitzgerald, Michael F | DATE: 02/22/12 | Eaton Corporation | Pittsburgh, PA |
| APPROVED BY: | DATE: | JOB NAME: HDT RWRF | |
| | | DESIGNATION: T30 | |
| VERSION: 7.8 | | TYPE: V48M28T30EE | DRAWING TYPE: Customer Appr. |
| NEG-ALT NUMBER: DN851005V102-0008 | REVISION: | DWG SIZE: A | G.O.: SDN0301918 |
| | | | ITEM: |
| | | | SHEET: 1 OF 1 |

# Technical Data

# NEMA TP-1 Energy-Efficient Transformers

Type DT-3

## Product Description

**Note:** The following pages provide listings for most standard transformer ratings and styles. For other ratings or styles not shown, or for special enclosure types (including stainless steel), refer to Eaton.

### Types DS-3, DT-3

- Ventilated, NEMA 2 enclosure standard
- Suitable for indoor applications, outdoors when weathershields are also installed
- Upright mounting only
- 220°C insulation system
- 150°C rise standard; 115°C or 80°C rise optional
- Available in single-phase ratings 15–167 kVA, 600 volts primary (DS-3)
- Available in three-phase ratings 15–1500 kVA and up to 600 volts primary (DT-3)

## Application Description

**NEMA TP-1-2002** compliant energy-efficient transformers are specifically designed to meet the energy efficiency standards set forth in NEMA Standards publication, TP-1-2002, *"Guide for Determining Energy Efficiency for Distribution Transformers."* Surveys have shown that the average loading of low voltage dry-type distribution transformers, over a 24-hour period, is approximately 35%. NEMA TP-1 compliant transformers are optimized to offer maximum efficiency at 35% of nameplate rating.

The range of products covered by NEMA TP-1-2002 are:

### NEMA TP-1-2002 Product Range

| Rating | Voltage Class | Voltage |
|---|---|---|
| | Primary voltage | 34.5 kV and below |
| | Secondary voltage | 600V and below |
| Dry-Type Rating | Single-phase | 10–833 kVA |
| | Three-phase | 15–2500 kVA |
| Liquid Rating | Single-phase | 10–833 kVA |
| | Three-phase | 15–2500 kVA |

Transformers that are currently specifically excluded from the scope of NEMA Standard TP-1-2002 include:

- Liquid-filled transformers below 10 kVA
- Dry-type transformers below 15 kVA
- AC and DC drives transformers
- Rectifier transformers designed for high harmonics
- Autotransformers
- Non-distribution transformers, such as UPS transformers
- Special impedance or regulation transformers
- Regulating transformers
- Sealed and non-ventilated transformers
- Machine tool transformers
- Welding transformers
- Transformers with tap ranges greater than 15%
- Transformers with a frequency other than 60 Hz
- Grounding transformers
- Testing transformers

Efficiency levels set forth in NEMA TP-1-2002.

### NEMA TP-1-2002 Efficiency Levels

**Tables of Energy Efficiency**
**NEMA Class 1 Efficiency Levels**
**Dry-Type Distribution Transformers—Low Voltage (600V and below)**

| Single-Phase | | Three-Phase | |
|---|---|---|---|
| kVA | Efficiency | kVA | Efficiency |
| 15 | 97.7 | 15 | 97.0 |
| 25 | 98.0 | 30 | 97.5 |
| [illegible] | [illegible] | [illegible] | [illegible] |
| 50 | 98.3 | 75 | 98.0 |
| 75 | 98.5 | 112.5 | 98.2 |
| 100 | 98.6 | 150 | 98.3 |
| 167 | 98.7 | 225 | 98.5 |
| 250 | 98.8 | 300 | 98.6 |
| 333 | 98.9 | 500 | 98.7 |
| — | — | 750 | 98.8 |
| — | — | 1000 | 98.9 |

## Features, Benefits and Functions

- 60 Hz operation (except as noted)
- Short-term overload capability as required by ANSI
- Meet NEMA ST-20 sound levels
- Meet federal energy efficiency requirements for low voltage dry-type distribution transformers effective as of January 1, 2007

## Standards and Certifications

- UL listed

UL Listed

***Industry Standards***

All Eaton dry-type distribution and control transformers are built and tested in accordance with applicable NEMA, ANSI and IEEE Standards. All 600 volt class transformers are UL listed unless otherwise noted.

***Seismically Qualified***

Eaton manufactured dry-type distribution transformers are seismically qualified and exceed requirements of the Uniform Building Code (UBC), International Building Code (IBC) and California Code Title 24.

## Accessories

Please refer to Section 9.7 **Page 319**.

## Technical Data and Specifications

### Frequency

Eaton standard dry-type distribution transformers are designed for 60 Hz operation. Transformers required for other frequencies are available and must be specifically designed.

### Overload Capability

Short-term overload is designed into transformers as required by ANSI. Dry-type distribution transformers will deliver 200% nameplate load for one-half hour, 150% load for one hour and 125% load for four hours without being damaged, provided that a constant 50% load precedes and follows the overload. See ANSI C57.96-01.250 for additional limitations.

Continuous overload capacity is not deliberately designed into a transformer because the design objective is to be within the allowed winding temperature rise with nameplate loading.

### Insulation System and Temperature Rise

Industry standards classify insulation systems and rise as shown below:

**Insulation System Classification**

| Ambient | + Winding Rise | + Hot Spot | = Temp. Class |
|---|---|---|---|
| 40°C | 55°C | 10°C | 105°C |
| 40°C | 80°C | 30°C | 150°C |
| 25°C | 135°C | 20°C | 180°C |
| 40°C | 115°C | 30°C | 185°C |
| 40°C | 150°C | 30°C | 220°C |

The design life of transformers having different insulation systems is the same—the lower-temperature systems are designed for the same life as the higher-temperature systems.

### Enclosures

Eaton's ventilated transformers, Types DS-3 and DT-3, use a NEMA 2 rated (drip-proof) enclosure as standard, and are rated NEMA 3R with the addition of weathershields.

### Winding Terminations

Primary and secondary windings are terminated in the wiring compartment. Encapsulated units have copper leads or stabs brought out for connections. Ventilated transformers have leads brought out to terminals that are pre-drilled to accept Cu/Al lugs. Aluminum-wound transformers have aluminum terminals; copper-wound models have copper terminals. **Lugs are not supplied with these transformers.** Eaton recommends external cables be rated 90°C (sized at 75°C ampacity) for encapsulated designs and 75°C for ventilated designs.

### Series-Multiple Windings

Series-multiple windings consist of two similar coils in each winding that can be connected in series or parallel (multiple). Transformers with series-multiple windings are designated with an "x" or "/" between the voltage ratings, such as voltages of "120/240" or "240 x 480." If the series-multiple winding is designated by an "x," the winding can be connected only for a series or parallel. With the "/" designation, a mid-point also becomes available in addition to the series or parallel connection. As an example, a 120 x 240 winding can be connected for either 120 (parallel) or 240 (series), but a 120/240 winding can be connected for 120 (parallel), or 240 (series), or 240 with a 120 mid-point.

For additional information, please refer to Section 9.7 **Page 319**.

### Sound Levels

All Eaton 600 volt class general-purpose dry-type distribution transformers are designed to meet NEMA ST-20 sound levels listed here. These are the sound levels measured in a soundproof environment. Actual sound levels measured at an installation will likely be higher (as much as 15 dB greater) due to electrical connections and environmental conditions. Lower sound levels are available and should be specified when the transformer is going to be installed in an area where sound may be a concern.

**Average Sound Levels** ①

**NEMA ST-20 Average Sound Level in dB**

| kVA | Up to 1.2 kV Ventilated | Encapsulated | Above 1.2 kV Ventilated |
|---|---|---|---|
| 0–9 | 40 | 45 | 45 |
| 10–50 | 45 | 50 | 50 |
| 51–150 | 50 | 55 | 55 |
| 151–300 | 55 | 57 | 58 |
| 301–500 | 60 | 59 | 60 |
| 501–700 | 62 | 61 | 62 |
| 701–1000 | 64 | 63 | 64 |
| 1001–1500 | 65 | 64 | 65 |

***Notes***

① Currently being reviewed and revised by NEMA.

For other ratings or styles not shown, or for special enclosure types (including stainless steel), refer to Eaton.

## Catalog Number Selection

### General-Purpose, Energy-Efficient, Mini–Power Center, Shielded Isolation, Nonlinear, Buck-Boost, Marine Duty Transformers—Example: S20N11S05A

T S 20 N 11 S 05 A

**Prefix Options**
C = CSA labeled ventilated transformer

**Marine Duty**
QS = EPM marine (1-Ph encapsulated)
LY = EPTM Marine (3-Ph encapsulated)
RT = DS-3M marine (1-Ph ventilated)
MV = DT-3M marine (3-Ph ventilated)

**Type**
S = EP (single-phase encapsulated)
Y = EPT (three-phase encapsulated)
T = DS-3 (single-phase ventilated)
V = DT-3 (three-phase ventilated)
P = Mini-power center
Z = Class 1 Division 2 Groups C and D
X = Harmonic mitigating (three-phase ventilated)

**Nonlinear**
H = KT-4 (three-phase ventilated)
B = KT-9 (three-phase ventilated)
N = KT-13 (three-phase ventilated)
G = KT-20 (three-phase ventilated)
J = KT-30 (three-phase ventilated)
A = KT-40 (three-phase ventilated)
K = KT-50 (three-phase ventilated)
HT = KT-4 (single-phase ventilated)
NT = KT-13 (single-phase ventilated)
GT = KT-20 (single-phase ventilated)

**Primary Voltage**
13 = 110 x 220
12 = 120
10 = 120 x 240
29 = 208
72 = 200
25 = 220
23 = 230
24 = 240
20 = 240 x 480
27 = 277
38 = 380
39 = 400
43 = 416
44 = 440
48 = 480
60 = 600
42 = 2400
46 = 4160
49 = 4800
40 = Export model
54 = 120/208/240/277

**Taps**
D = 2 at +2.5%, 2 at –2.5%
E = 1 at +5%, 1 at –5%
F = 1 at –10%
G = 2 at –5%
J = 4 at –2.5%
K = 1 at –10% x 2 at –5%
M = 2 at +2.5%, 4 at –2.5%
N = None
R = 1 at +5%, 2 at –5%
P = 1 at +5%, 2 at –5% x 2 at +2.5%, 4 at –2.5%
T = 1 at +4.2%, 1 at –4.2%
U = 1 at +2.5%, 3 at –2.5%
W = 1 at +3.5%, 1 at –3.5%
X = 2 at +3.1%, 2 at –3.1%

**kVA**

| | | | |
|---|---|---|---|
| 81 = 0.05 | 03 = 3 | [redacted] | 62 = 250 |
| 85 = 0.075 | 05 = 5 | | 33 = 300 |
| 82 = 0.10 | 06 = 6 | 50 = 50 | 54 = 333 |
| 83 = 0.15 | 07 = 7.5 | 75 = 75 | 55 = 500 |
| 26 = 0.25 | 09 = 9 | 99 = 100 | 60 = 600 |
| 51 = 0.50 | 10 = 10 | 12 = 112.5 | 77 = 750 |
| 76 = 0.75 | 15 = 15 | 49 = 150 | 11 = 1000 |
| 01 = 1 | 21 = 22.5 | 67 = 167 | 14 = 1500 |
| 16 = 1.5 | [redacted] | 22 = 225 | |
| 02 = 2 | 30 = 30 | | |

**Phase**
A = Buck and boost
B = 80°C rise
F = 15°C rise
P = 115°C rise epoxy
E = Electrostatic shield
S = Single
T = Three

**Secondary Voltage**

| | |
|---|---|
| 04 = 12/24 | 20 = 240 x 480 |
| 06 = 16/32 | 21 = 240/480 |
| 08 = 24/48 | 27 = 277 |
| 14 = 110/220 | 38 = 380 delta |
| 12 = 120 | 37 = 380Y/220 |
| 10 = 120 x 240 | 34 = 400Y/231 |
| 11 = 120/240 | 51 = 416Y/240 |
| 54 = 127/254 | 35 = 440Y/254 |
| 19 = 190Y/110 | 62 = 460Y/266 |
| 28 = 208Y/120 | 47 = 480Y/277 |
| 29 = 208 | 48 = 480 delta |
| 25 = 220 delta | 60 = 600 delta |
| 31 = 220Y/127 | 61 = 600Y/346 |
| 26 = 220 delta/110 midtap | 42 = 2400 |
| 22 = 240 delta/120 midtap | 41 = 4160Y/2400 |
| 64 = 240Y/139 | 46 = 4160 |
| 24 = 240 delta | 49 = 4800 |

**Suffix Options**
A...Y = ①
CU = ②
SS = ③
ZZ = ④
NV = ⑤
X = ⑥
LS_ _ = ⑦
AF = ⑧
TR = ⑨
SR = ⑩
CE = ⑪
T = ⑫
EE = ⑬
NON = ⑭
POS = ⑮
NEG = ⑯
THR = ⑰
E3 = ⑱
SS4X = ⑲
Z = ⑳
S6 = ㉑
I2 = ㉒
I3 = ㉓
I4 = ㉔
N3 = ㉕

***Notes***

① Model number is not used on newly designed/redesigned transformers.
② Copper windings.
③ Grade 304 stainless steel enclosure (does not imply a NEMA 4X rating).
④ Open type core and coil assembly.
⑤ Totally enclosed non-ventilated DS-3 or DT-3.
⑥ 50/60 Hz.
⑦ Low sound design. LS47 indicates low sound equal to 47 dB, LS42 indicates 42 dB.
⑧ Fungus proof.
⑨ Certified test report of standard production tests for the specific serial number to be shipped.
⑩ Certified sound level report.
⑪ CE Marked.
⑫ Thermal indicator embedded in center coil. Suffix "TT" indicates two thermal indicators of different temperature ratings, are installed.
⑬ NEMA TP-1 efficient.
⑭ 0° phase-shift (used with HMTs).
⑮ +15° phase-shift (used with HMTs).
⑯ –15° phase-shift (used with HMTs).
⑰ –30° phase-shift (used with HMTs).
⑱ CSL3 DOE 2007 energy-efficient.
⑲ NEMA 4X Grade 304 stainless steel enclosure.
⑳ Easy install base.
㉑ Grade 316 stainless steel enclosure (does not imply NEMA 4X rating).
㉒ Integral 2-inch infrared viewing window.
㉓ Integral 3-inch infrared viewing window.
㉔ Integral 4-inch infrared viewing window.
㉕ NEMA premium efficiency.

For Eaton's industrial control transformers catalog number selection, see **Page 316.**

Contact your local Eaton sales office for voltage combinations not shown. Use table for catalog number breakdown only. Do not use to create catalog numbers because all combinations may not be valid.

## Terminal Lug Kits for Type DT-3 Transformers

| Typical Sizing | Terminal Lugs Cable Range | Quantity | Hardware Bolt Size | Quantity | Catalog Number |
|---|---|---|---|---|---|
| 15–37.5 kVA single-phase<br>15–45 kVA three-phase | #14–#2<br>#6–250 kcmil | 8<br>4 | 1/4-20 x 3/4 | 8 | **LKS1** |
| 50–75 kVA single-phase<br>75–112.5 kVA three-phase | #6–250 kcmil | 12 | 1/4-20 x 3/4<br>1/4-20 x 1-3/4 | 8<br>8 | **LKS2** |
| 100–167 kVA single-phase<br>150–300 kVA three-phase | #6–250 kcmil<br>#2–600 kcmil | 3<br>22 | 1/4-20 x 3/4<br>3/8-16 x 2 | 3<br>16 | **LKS3** |
| 500 kVA three-phase | #2–600 kcmil | 29 | 3/8-16 x 2 | 18 | **LKS4** |

## Rodent Screens

| Description | Frame Size(s)① | Catalog Number |
|---|---|---|
| Rodent screens are used to discourage entry by birds or rodents. | 908, 909 | **RS01** |
| | 910A, 911, 912 | **RS02** |
| | 913B, 914B, 915B | **RS03** |
| | 916 | **RS04** |
| | 917, 918, 918A | **RS05** |
| | 919, 920, 919E, 919EX, 920E, 920EX | **RS06** |
| | 916A, 916B | **RS07** |
| | 922 | **RS08** |
| | 923 | **RS09** |
| | 814, 821, 814E | **RS11** |
| | 815 | **RS12** |
| | 816 | **RS13** |
| | 817, 818 | **RS14** |
| | 819, 820 | **RS15** |
| | 912B, 912Z | **RS16** |
| | 914D, 915D, 914Z, 915Z | **RS17** |
| | 916Z | **RS07** |

## Replacement Parts for Mini-Power Centers

| Frame | Deadfront Cover (Breaker Cover) | Front Cover |
|---|---|---|
| 283 | 47-37503 | 7074C98H04 |
| 284 | 47-37503-2 | 7074C98H01 |
| 285 | 47-37503-3 | 7074C98H02 |
| 286 | 47-37503-4 | 7074C98H02 |
| 287 | 47-37503-5 | 7074C98H03 |
| 289 | 47-37459 | 7074C44H01 |
| 290 | 47-37459-2 | 7074C44H02 |
| 291 | 47-37459-3 | 7074C44H03 |
| 289A | 47-42072-1 | 7074C44H01 |
| 290A | 47-42072-2 | 7074C44H02 |
| 291A | 47-42072-3 | 7074C44H03 |

***Notes***

① Effective June 1, 2001, frame numbers will have a prefix of FR, e.g., **FR819**. Dimensions, accessories and so on are still applicable as if the FR did not exist.

Lugs are rated Al/Cu and are suitable for use with either aluminum or copper conductors.