Generator Square D manuals

SUBMITTAL REVIEW

- [x] APPROVED
- [ ] APPROVED AS NOTED

If checked above, fabrication MAY be undertaken. Approval does not authorize changes to Contract Sum unless stated in a Change Order.

If checked below, fabrication MAY NOT be undertaken. Resubmit corrected copies for final approval. Correction shall be limited to items marked.

- [ ] REVISE AND RESUBMIT
- [ ] REJECTED

5/10

Approval is only for general conformance with the design concept of the project. Contractor at all times remains responsible for compliance with the Contract Documents. Deviations are not approved unless Contractor has in writing called Engineer's attention to such deviation at the time of submission and Engineer has in writing aporoved the specific deviation. No acceptance by Engineer relieves Contractor from responsibility for errors or omissions in Compliance Submittals.

PEC

PROFESSIONAL ENGINEERING CONSULTANTS, P.A.

BY Rick Whitehill DATE 1/7/16

Wastewater Treatment Plant #2

Operation and Maintenance Manual

Factory Order #: 36419323

10/27/2015

Wichita, KS

Distributor:
American Electric

Contractor / Installer:
Shelley Electric, Inc.

Consulting Engineer:
PEC

Steve Vossman
Sales Representative

Rick Simpson
Project Manager
North American Operating Division
(417) 887-2307
rick.simpson@schneider-electric.com

Make the most of your energy℠

Schneider Electric

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Schneider Electric

Schneider Electric Conditions of Sale

Proposal-based Projects

Note

The following Conditions of Sale are subject to change. All transactions for all products sold by Schneider Electric USA ("Schneider Electric"), including all Schneider Electric brand products, are subject to the latest published Conditions of Sale of Schneider Electric and to any Special Conditions of Sale which may be contained in applicable Schneider Electric quotations and acknowledgments.

Schneider Electric Standard conditions of Sale will apply in all transactions between customers and Schneider Electric, unless the Proposal-based Project Conditions of Sale, apply as defined in the following paragraph.

Proposal-based Projects Definitions

Transactions that exhibit some or all of the following attributes: Unique customer requirements that are typically negotiated and quoted, requires approval drawings and project management by Schneider Electric, and for which there is a specific direct-ship address.

Governing Provisions and Acceptance

All quotations are subject to these conditions of sale. Acceptance of an order by Schneider Electric shall be expressly conditioned on Purchaser's assent to these conditions. Purchaser's direction to proceed with engineering, manufacture or shipment by Schneider Electric shall be deemed evidence of this assent. No modified or other conditions will be applicable unless those conditions are so stated in Schneider Electric's proposal or are specifically agreed to in writing and signed by an authorized official of Schneider Electric. Failure to object to provisions contained in any Purchase Order or other communication from the Purchaser (including, without limitation, penalty clauses of any kind) shall not be construed as a waiver of these Conditions nor an acceptance of any other provisions. These terms are a complete statement of the parties' agreement and may only be modified in writing signed by both parties. These terms may not be modified by course of dealing, course of performance or usage of trade. These terms supersede all previous written or oral quotations, statements or agreements. Any contract for sale by and between the parties shall be governed by and construed according to the laws of the State of Illinois without regard to its rules on the conflict of laws. The Convention on the International Sale of Goods is expressly excluded.

Quotations

Quotations shall be valid for no more than thirty (30) days from the date quotation is communicated from seller to purchaser, unless otherwise stated in the quotation. All quotations are subject to change by Schneider Electric Company at any time upon notice to Purchaser. Quotations are made based on Schneider Electric's interpretation of the plans and specifications submitted to Schneider Electric by the Purchaser. It is Purchaser's obligation to review the quotation carefully and to immediately advise Schneider Electric of any differing interpretation Purchaser has so any necessary change can be made.

Order Entry

A complete, signed purchase order must be received before entry of an order into Schneider Electric's system. Considerable detail is involved in the manufacture of power equipment. To facilitate timely shipment, complete details and information, including Purchaser's requested on-site dates must be provided at the time of order entry. Shipment dates are approximate and are based upon timely receipt of all necessary information from the Purchaser. Lack of complete information may result in delays of drawings or manufacture. Such delays shall relieve Schneider Electric from compliance with the quoted delivery dates and may lead to price escalation. Failure to provide a complete signed purchase order within twenty (20) days of notification of award may result in renegotiation of price or shipment dates.

Approval Drawings

When required by a specific Purchase Order, drawings will be submitted for approval per agreed upon schedules, and price policy, below, to assure Schneider Electric has designed the equipment as described in Purchaser's specifications, as modified by Schneider Electric's quotation. If at time of drawing approval Schneider Electric has not designed the equipment to meet the specifications, as modified by Schneider Electric's quotation, Schneider Electric will make the appropriate changes at no charge to Purchaser. Where the Purchaser's specification is not definitive, Schneider Electric shall have the right to design the product in line with good commercial practice, without further obligation to Purchaser. If at drawing approval, Purchaser makes changes outside the design as stated in the specifications, such changes shall be treated as a change order as provided below.

Price Policy

Quoted prices are firm provided: A) The order is received with complete engineering details and is released for manufacture within sixty (60) calendar days from the originally anticipated release date. B) All required approval drawings are returned and equipment released by Purchaser no later than sixty (60) calendar days from the original date of issuance of approval drawings by Schneider Electric. The returned drawings must be released for manufacture for shipment on the agreed date. Drawing re-submittals which are required for any reason other than to correct Schneider Electric errors will not extend the sixty (60) day deadline. If the Purchaser causes delay of shipment in any way or returns approval drawings beyond the time stated above, Purchaser may be subject to charges which shall not exceed 2% of the purchase order price for each full month or fraction thereof that shipment is delayed, as compensation to Schneider Electric for expenses created by such delay and not as a penalty. In addition to the 2% charge per month, if shipment is delayed through the fault of Purchaser for more than 180 days from the original date of issuance of approval drawings, the price may be subject to revision.

Pricing-Purchaser Changes

All prices cover a bill of material as described in Schneider Electric specifications or quotations to be designed and manufactured to Schneider Electric standard designs, unless otherwise agreed in writing between the parties. Purchaser may make minor changes not affecting the time or cost of performance without charge prior to the start of manufacture. If any changes are requested by the Purchaser after submission of the original Purchase Order which affect the cost or time of performance, additional billing will be made with the amount of price adder dependent on the change and status of the order when the change is made. Changes may also result in an extension of time for shipment. All changes will be agreed to by the parties, in writing, prior to implementation. Purchaser's rescheduling shipment will be considered a change. All expenses incurred by Schneider Electric in connection with the storage of equipment, including demurrage, packing, storage charges, insurance and handling charges by Schneider Electric will be paid by the Purchaser upon submission of invoices by Schneider Electric. Schneider Electric will issue price changes for any change requested by the Purchaser that affects modification of equipment, changes the bills of material, engineering or drawings or delivery schedule as follows: A) If Purchaser makes a change to an order prior to being released to engineering, the net price will be adjusted by re-pricing the equipment with prices in effect at the time of the change. A commensurate delay in the shipping date will be based on the changes involved. B) For changes made after the order is released to engineering, the net price and ship date will be adjusted as described in paragraph A above. An additional charge based on Schneider Electric standard engineering billing charges and cost of parts ($250 minimum) will be made to cover any extra engineering and drafting, scrap or rework of parts, or cost of modification. C) If during the drawing approval process, the Purchaser makes changes outside the design covered by the specifications, Schneider Electric will be reimbursed as described in paragraph A and B above, plus any additional charges for any extra cost incurred as a direct result of the changes and allowed a commensurate delay in shipping date based on the changes involved. Changes to the order can not be processed until a formal signed change order is received from the Purchaser.

Substitutions

Schneider Electric may furnish suitable substitutes for material unobtainable because of priorities or regulations established by governmental authority or non-availability of materials from suppliers, provided such substitutions do not adversely affect the technical soundness of the equipment. Schneider Electric assumes no liability for deviation from published dimensions and descriptive information not essential to proper performance of the product.

Taxes

Any manufacturer's tax, retailer's tax, occupation tax, use tax, sales tax, excise tax, (except federal excise tax on vehicles), duty, customs, inspecting or testing fee, or other tax, fee or charge of any nature whatsoever, imposed by any governmental authority or measured by any transaction between Schneider Electric and Purchaser, shall be paid by the Purchaser in addition to the prices quoted or invoiced, and such charges will appear as a separate line item on the invoice. In the event Schneider Electric will be required to pay any such tax, fee, or charge, Purchaser shall reimburse Schneider Electric or, in lieu of such payment, Purchaser shall supply Schneider Electric at the time the order is submitted with an exemption certificate or other document acceptable to the tax authority. Purchase Orders must state the existence and amount of any such tax, fee or charge for which Purchaser claims an exemption.

Terms of Payment

Acceptance of all Purchase Orders is subject to Purchaser meeting Schneider Electric credit standards. Terms are subject to change for failure to meet such standards. Terms are net thirty (30) days from date of invoice of each shipment, unless otherwise stated in Schneider Electric's quotation. For an authorized distributor or authorized reseller order, applicable terms of payment are stated in the quotation or applicable discount schedule. Schneider Electric reserves the right at any time to demand full or partial payment before proceeding with a contract of sale if, in its sole judgment, as a result of changes in the financial condition of the Purchaser the terms of payment originally specified are no longer justified.

Progress Payments/ Payment Term

All proposal-based projects are Net 30 days from date of invoice of each shipment. On projects exceeding $1,000,000 Net, progress payments are payable according to the following milestones:

- 30% Release to manufacturing
- 70% (balance) due at shipment

Payments

If delivery is delayed or deferred by the Purchaser beyond the scheduled date, payment shall be due in full when Schneider Electric is prepared to ship. The equipment may be stored at the risk and expense of the Purchaser. If the Purchaser defaults when any payment is due, then the whole contract price shall become due and payable upon demand, or Schneider Electric at its option, without prejudice to other lawful remedies, may defer delivery or cancel the contract for sale. If Purchaser become insolvent, or bankrupt or in the event any proceeding is brought against the Purchaser, voluntarily or involuntarily under the bankruptcy or any insolvency law, Schneider Electric may cancel any order then outstanding at any time and recover its proper cancellation charges from the Purchaser or the Purchaser's estate.

Delivery

F.O.B. Point of Shipment

When the Schneider Electric quotation is based on delivery F.O.B. point of shipment, freight prepaid and allowed for delivery within the continental United States, Product is sold F.O.B. point of shipment, freight prepaid and allowed for orders over $2000 net. Delivery by Schneider Electric to the point of shipment constitutes delivery to the Purchaser; and title and all risk of loss or damage in transit shall pass to the Purchaser at time of delivery at the F.O.B. point. Schneider Electric is not responsible for breakage or delays by carrier after having received "in good order" receipts from the carrier. Purchaser is responsible for pursuing any damage claims with the carrier. For orders under $2000 net the above terms apply except freight is prepaid not allowed. No allowance will be made in lieu of transportation if the Purchaser accepts shipment at factory, warehouse or freight station or otherwise supplies its own transportation. Freight prepaid is defined as: a) Shipments to destinations within the continental United States to the accessible common carrier point nearest the first destination. b) Shipments to U.S. destinations outside the continental United States shall be to the common carrier free delivery point in the United States nearest the original port of embarkation. All charges associated with F.A.S., C.I.F., or other charges such as pier transfer, lift, ocean freight, and marine or war insurance shall be paid by the Purchaser, unless otherwise specifically agreed in a specific Purchase Order. In no event will Schneider Electric be responsible for demurrage or detention charges.

Delivery: F.O.B. Destination

When the Schneider Electric quotation is based on delivery F.O.B. Destination, for shipments for delivery within the continental United States, Schneider Electric will retain title and all risk of loss or damage in transit to the common carrier free delivery point in the United States nearest the first destination for a price addition of 2% of the net price. If the Purchaser elects this Option, Purchaser's obligations shall be as follows: a) Purchaser shall have the responsibility of inspecting the equipment for apparent loss or damage immediately upon its arrival at the free delivery point. b) In the event of apparent shipping loss or damage, Purchaser shall make written notation of the loss on the carrier's delivery receipt and, within 72 hours of delivery shall notify the Schneider Electric Customer Information Center. Purchaser shall not remove product from the point of examination and shall retain the shipping container and packing material. Purchaser shall request the carrier to make an inspection and send Schneider Electric a copy of the carrier's inspection report. c) In the event of concealed damage which occurred during transit and is discovered by the Purchaser after delivery, Purchaser shall report such damage immediately, but in no event later than 15 days after delivery, to the delivering carrier, and within 72 hours of discovery, shall notify the local Schneider Electric field office. If such notification is not made, Schneider Electric shall not be liable for loss or damage in transit.

Shipment and Routing

Schneider Electric shall select the point of origin of shipment, the method of transportation and the routing of the shipment. Purchasers that request expedited or special modes of transportation or routing involving air, premium or any other non-standard Schneider Electric shipping shall be assessed additional charges for shipping, handling, freight and expediting. Any rebates, allowances, discounts, or incentives received by Schneider Electric from its carriers shall be retained by Schneider Electric. All prices include domestic packaging only. When other than domestic packaging is required, contact your local Schneider Electric field office. Purchaser specified packaging and marking may be subject to additional charges.

Shortages

Claims for shortages or errors must be submitted to Schneider Electric within 30 days after invoice date, and failure to give such notice shall constitute unqualified acceptance and a waiver of all such claims by the Purchaser.

Installments

Schneider Electric reserves the right to make shipments in installments, unless otherwise expressly stipulated in a specific Purchase Order; and all such installments when separately invoiced shall be paid for when due per invoice without regard to subsequent shipments. Delay in shipment of any installment shall not relieve Purchaser of its obligation to accept remaining shipments.

Force Majeure

Schneider Electric shall not be liable for any damages as a result of any delays due to any causes beyond Schneider Electric's control, including, without limitation, an act of God; act of Purchaser or Schneider Electric supplier; embargo or other governmental act, regulation or request; fire; accident; strike; slowdown; flood; fuel or energy shortage; sabotage; war; riot; delay in transportation and inability to obtain necessary labor, materials or manufacturing facilities from usual sources. In the event of any such delay, the date of delivery shall be extended for a period of time reasonably necessary to overcome the effect of such delay.

Standard Warranty

Schneider Electric warrants equipment manufactured by it and sold through authorized sales channels to be free from defects in materials and workmanship for 12 months from the issuance of the customer provisional acceptance letter or 18 months from the invoice date of the last component of the order whichever occurs first. If within such period, any such equipment shall be proved to Schneider Electric's satisfaction to be non-conforming, such equipment shall be repaired or replaced at Schneider Electric's option. This warranty shall not apply (a) to equipment not manufactured by Schneider Electric, (b) to equipment that has been repaired or altered by other than Schneider Electric so as, in its judgment, to affect the same adversely, or (c) to equipment that has been subjected to negligence, accident, or damage by circumstances beyond Schneider Electric's control, or improper operation, maintenance or storage, or to other than normal use or service. With respect to equipment not manufactured by Schneider Electric, the warranty obligations of Schneider Electric shall in all respects conform and be limited to the warranty actually extended to Schneider Electric by its supplier. Non-conforming products must be returned at Schneider Electric's expense for evaluation unless this is waived in writing. Replacement products may be new or reconditioned. The foregoing warranties do not cover reimbursement for labor, transportation, removal, installation, temporary power, or any other expenses that may be incurred in connection with repair or replacement. Any part or component changed or repaired in the context of the contractual warranty will itself benefit of a 3 month warranty but shall not cause the warranty duration of the overall System / Solution to be extended.

Optional Warranties

(Only available on equipment to be located in the U.S.)
Option 1—Extended: 2 to 5 years from Shipment. If requested by the Purchaser, and specifically accepted in writing by Schneider Electric, the standard warranty will be extended to two (2) years from date of invoice for a price addition of 1% of the net face value of the Purchase Order, will be extended to three (3) years from date of invoice for a price addition of 3% of the net face value of the Purchase Order, will be extended to four (4) years from date of invoice for a price addition of 5% of the net face value of the Purchase Order, or will be extended to five (5) years from date of invoice for a price addition of 7% of the net face value of the Purchase Order.
Option 2—Special Warranty: If requested by the Purchaser, and specifically accepted in writing by

Schneider Electric, the standard warranty will be extended, for a price addition of 3% of the net face value of the Purchase Order, to cover reimbursement of the direct costs of: a) Removal of non-conforming equipment or part thereof; b) Transporting equipment or parts to and from the place of repair;
c) Off-loading of truck and reinstallation at the original site. Such special warranty, which may be chosen to cover a period not exceeding that of the standard or extended warranty (see above) selected, will not include the cost of providing temporary power or removing or replacing other apparatus or structures, or costs of transportation beyond a common carrier free delivery point in the continental United States. Further, the obligation of Schneider Electric for expenses and costs arising under this special warranty coverage will not exceed 50% of the net invoice price on the equipment being repaired. This warranty does not change or affect the allocation of risk or loss during shipment.
Option 3—Extended Warranty: Preventative Maintenance Agreements. If requested by the Purchaser, and specifically accepted by Schneider Electric, a Preventative Maintenance Agreement is available to provide preventative maintenance on equipment covered by the agreement. Terms of the preventative maintenance agreement shall be as defined in a separate Services Agreement agreed to by the parties.

Software

Any software or computer information, in whatever form, provided with equipment manufactured by Schneider Electric is licensed to Purchaser solely pursuant to standard licenses of Schneider Electric or its supplier of such software or computer information, which licenses are, hereby incorporated by reference. Schneider Electric does not warrant that such software or computer information will operate error free or without interruption, and warrants only that during the warranty period applicable to the equipment that the software will perform its essential functions. If such software or computer information fails to conform to such warranty, Schneider Electric will, at its option, provide an update to correct the non-conformance or replace the software or computer information with the latest available version containing a correction. Schneider Electric shall have no other obligation to provide updates or revisions.

Limitations

These disclaimers and limitations of remedies apply to all warranties offered to Purchaser and to all Purchase Orders. **The warranties set forth above are exclusive and in lieu of all other expressed or implied warranties (except warranties of title), including, but not limited to implied warranties of merchantability and fitness for a particular purpose.** Except as may be expressly provided in an authorized writing by Schneider Electric, Schneider Electric shall not be subject to any other obligations or liabilities whatsoever other than as stated above with respect to equipment sold or services rendered by Schneider Electric. Notwithstanding anything to the contrary herein contained **Schneider Electric Company, its contractors and suppliers of any tier, shall not be liable in contract, in tort (including negligence or strict liability) or otherwise for lost time, lost profits, or special, indirect, incidental or consequential damages of any kind whatsoever.** The remedies of the Purchaser are exclusive and the total cumulative liability of Schneider Electric, its contractors and suppliers of any tier, with respect to this contract or anything done in connection therewith, such as the use of any product covered by or furnished under the contract, whether in contract, in tort (including negligence or strict liability) or otherwise, shall not exceed the price of the product, part, or service on which such liability is based.

Intellectual Property

As to equipment proposed and furnished by Schneider Electric, Schneider Electric shall defend any suit or proceeding brought against Purchaser so far as based on a claim that such equipment constitutes an infringement of any copyright, trademark or patent of the United States.

This obligation shall be effective only if Purchaser shall have made all payments then due hereunder and if Schneider Electric is notified promptly in writing and given authority, information, and assistance at Schneider Electric's expense for the defense of the same. In the event the use of such equipment by Purchaser is enjoined in such a suit, Schneider Electric shall, at its expense, and at its sole option, either (a) procure for the Purchaser the right to continue using such equipment (b) modify such equipment to render it non-infringing (c) replace such equipment with non-infringing equipment, or (d) refund the purchase price (less depreciation) and the transportation and installation costs of such equipment. Schneider Electric will not be responsible for any compromise or settlement made without its written consent. The foregoing states the entire liability of Schneider Electric for patent, trademark or copyright infringement, and in no event shall Schneider Electric be liable if any infringement charge is based on the use of Schneider Electric equipment for a purpose other than that for which it was sold by Schneider Electric. As to any equipment furnished by Schneider Electric to Purchaser and manufactured in accordance with designs proposed by Purchaser, the Purchaser shall indemnify Schneider Electric against any award made against Schneider Electric for patent, trademark, or copyright infringements.

Witness of Tests and Factory Inspections

Normal production schedules do not provide the opportunity for Purchaser to witness routine factory tests on equipment or make factory inspections. Witnessing of tests or factory inspections by the Purchaser may result in delays of production for which Schneider Electric will not be responsible. Witness testing and factory inspections must be requested at time of quotation and confirmed at order entry. Standard Schneider Electric factory testing and inspection will apply. Schneider Electric will notify Purchaser fourteen (14) calendar days prior to scheduled witness testing or inspection. In the event Purchaser is unable to attend, the Parties may mutually agree on a rescheduled date. However, Schneider Electric, at its sole option, may consider the witness tests and/or inspection waived, and ship and invoice the Products. Purchaser will be responsible for paying for all scheduled witness testing, whether or not Purchaser attends.

Return of Equipment

No equipment may be returned without first obtaining Schneider Electric's written permission and a returned material identification tag. Returned equipment must be of current manufacture, in the original packaging, unused, undamaged and in saleable condition, securely packed to reach Schneider Electric without damage and labeled with the return authorization number. Any cost incurred by Schneider Electric to put equipment in first class condition will be charged to the Purchaser. Returns will be credited at price invoiced by Schneider Electric less a restocking fee of 25% invoice price. Special Order and Custom equipment is not returnable. Schneider Electric shall bear the cost of returns resulting from Schneider Electric error, and method and route of return will be at the discretion of Schneider Electric. Costs incurred by failure to follow Schneider Electric direction will be borne by the Purchaser.

Nuclear Applications Terms and Conditions

Unless otherwise agreed in writing by a duly authorized representative of Schneider Electric, products sold hereunder are not intended for use in or in connection with any nuclear facility or activity. If so used, Schneider Electric disclaims all liability for any damage, injury or contamination; and Purchaser shall indemnify Schneider Electric against any such liability, whether arising as a result of breach of contract, warranty or tort (including negligence) or otherwise.

Patterns and Tools

Notice will be given if special patterns or tools are required to complete any order. Charges for such patterns or tools do not convey title thereto or the right to remove them from Schneider Electric's plant. If patterns or tools are not used for a period of two years, Schneider Electric shall have the right to scrap them without notice.

Product Notices

Purchaser shall promptly supply the user (including its employees) of the product with all Schneider Electric supplied product notices, warnings, instructions, recommendations and similar materials.

Errors

Schneider Electric reserves the right to correct errors or omissions in quotations, acknowledgments, invoices, or other documents.

OSHA Compliance

Compliance with OSHA or similar federal, state or local laws during the operation or use of the product(s) is the sole responsibility of the Purchaser.

Termination

Any order may be terminated by the Purchaser only upon written notice to Schneider Electric will be subject the following cancellation schedule:

- 20% after issuance of approval drawings
- 50% at release to manufacturing
- 100% at start of fabrication

Cancellation

Schneider Electric shall have the right to cancel any order or contract at any time by written notice for any material breach of the contract by the Purchaser, including material delays in releasing equipment for manufacture or approval drawings and excessive changes to specifications or drawings.

Schneider Electric USA, Inc.
1415 S. Roselle Road
Palatine, IL 60067 USA
1-888-778-2733
www.schneider-electric.us

Item No.	Qty.	Catalog Number / Details

BILL OF MATERIALS

Item No.	Qty.	Catalog Number / Details
001-00	1	**Designation:** PG-LV NQ MB Panel (INTERIOR) NQ Panelboard Consisting of 208Y/120V 3Ph 4W 60Hz SCCR: 22kA Feeders Series Rated w/ QD Circuit Breaker Suitable For Use As Service Entrance UL Single Main: 225A/3P QD Circuit Breaker Incoming Conductors: 1 - #4 - 300 kcmil AL Ground Bar Bus: Aluminum: Tin Plated 42 Circuit Interior Type 3R/4/4X/5/12 Stainless Steel Box: 50H x 20W x 6.5D Incoming: Top Trim w/ Box Box Cat No: MH50WPSSULNF Ref. Drawing: PBA711SS Feeders: 32 - 20A/1P QOB 4 - 35A/2P QOB 1 - 20A/2P QOB Optional Features: Standard Panel (Box Ahead),Standard Solid Neutral,Standard Ground Bar Group User Placement
005-00	1	**Designation:** PG-LV MH50WPSSULNF (BOX) NQ 3R,4,4X,5,12 Stainless Box 20 W 50 H 6.5D
003-00	2	**Designation:** T-LV1, T-LV2 CLASS 7230 PADMOUNT TRANSFORMER SQUARE D 7230 PAD-MOUNTED TRANSFORMER -- LIQUID FILLED: MINERAL OIL 75 kva rated PRIMARY VOLT: 12470 DELTA 95 KV BIL SECONDARY VOLT: 208GY/120 30 KV BIL STANDARD 60 HERTZ IMPEDANCE: 3.5% +/- 7.5% TOLERANCE CONDUCTOR: ALUMINUM WINDINGS TEMP: 120 DEGREES INSULATION CLASS 65 RISE OVER 30 AVG - 40 MAX AMB TAPS: 2-2.5% FCAN, 2-2.5% FCBN ALTITUDE: STD. 3300 FEET MAXIMUM 51 DB SOUND LEVEL MODIFICATIONS: ------------- HIGH VOLTAGE - DEAD FRONT, RADIAL FEED WITH PROV. FOR SURGE ARRESTERS #4 TO 4/0 INCOMING CABLE 15 KV CLASS 200 AMP BUSHINGS SOLIDLY GROUNDED SYSTEM WITH THREE DIST. MOVE 9 KV ARRESTERS

Item No.	Qty.	Catalog Number / Details

THREE WELLS AND THREE FEED-THRU
UNDER OIL SWITCH: TWO POSITION 200A
FUSING: BAY-O-NET FAULT & CL FUSES
BAYO-NET FLAPPER VALVE
ONE SET OF SPARE FUSES
LOW VOLTAGE BUSHINGS: EPOXY
TIN PLATED ALUMINUM (POLYMER)
4 HOLE LV & NEUTRAL BUSHING SPADE
UL LISTED
ENERGY EFFICIENT PER DOE 2010
MIN EFFICIENCY (50% LOAD) = 98.91%
ALUMINUM TRANSFORMER NAMEPLATE
PAINT COLOR MUNSELL #7.0GY-3.29/1.5
UNDERCOATING

ACCESSORIES:

SUBSTATION ACCESSORY GROUP INCLUDED
1" DRAIN VALVE W/ 3/8" SAMPLER
DIAL TYPE THERMOMETER
LIQUID LEVEL GAUGE
PRESSURE VACUUM GAUGE
STANDARD PRESSURE RELIEF VALVE
NITROGEN TEST PORT
304 STAINLESS STEEL
STAINLESS STEEL: ENTIRE UNIT
PENTAHEAD BOLTS

TRANSFORMER TESTS:

RATIO TEST
POLARITY TEST
PHASE RELATION TEST
NO-LOAD LOSS TEST
EXCITATION CURRENT TEST
IMPEDANCE VOLTAGE TEST
LOAD LOSS TEST
APPLIED POTENTIAL TEST
INDUCED POTENTIAL TEST
LEAK TEST
RESISTANCE MEASUREMENT TEST
CERTIFIED TEST REPORT
FACTORY QC IMPULSE TST HV ONLY
DESIGNATION ON TEST REPORT

NOTES:

SPECIFICATION ON RECORD

STANDARDS: IEEE C57.SERIES

CABLE TERMINATORS (ELBOWS) AND SECONDARY
LUGS ARE NOT INCLUDED WITH THE TRANSFORMER

Revision (03112014/04012014) XXX

004-00	1	**Designation:** Spec Section 260573 ES168623-ENGINEERING ANALYSIS SC, TCC & DC

SQUARE D
Schneider Electric

JOB NAME: WASTEWATER TREATMENT PLANT #2
JOB LOCATION: WICHITA, KS

PURCHASER: AMERICAN ELECTRIC CO
PURCHASER PO #:

USER: WICHITA WATER & SEWER DEPT
USER LOCATION:

DRAWING STATUS: RECORD

SQUARE D QUOTATION NUMBER: 36419323
QUOTATION REVISION #:
SALES CONTACT: DAVE GATLIN
SALES CONTACT LOCATION: 436

CUSTOMER: SHELLEY ELECTRIC, INC.
CUSTOMER PO #:

ARCHITECT: PEC
CONS. ENGINEER:

TABLE OF CONTENTS
SQUARE D FACTORY ORDER NUMBER: 36419323-003

REV: -

REV	DESCRIPTION	BY	DATE				

GENERAL NOTES

PRODUCT DESCRIPTION AND RATINGS

POWER SYSTEM DATA:

KVA 75.0 PRIMARY 12470 SECONDARY 208Y/120
3 PHASE 60 HZ CLASS ONAN

ENCLOSURE DATA:

GENERAL PURPOSE - OUTDOOR
FINISH GREEN 7GY/3.29/1.5 MUNSELL

ESTIMATED SHIPPING WEIGHTS:

CORE AND COILS:	589
ENCLOSURE:	2099
TOTAL:	2688

PRODUCT INFORMATION

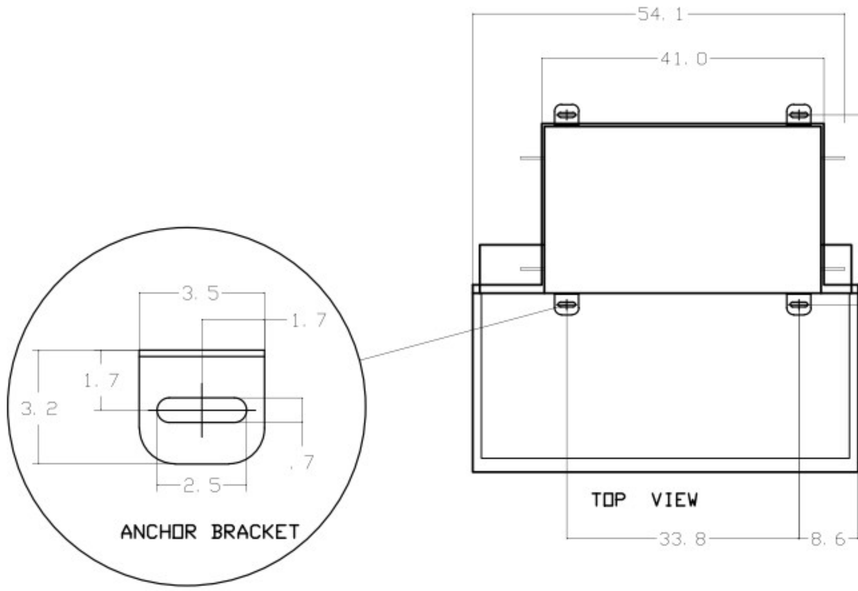
TRANSFORMER RATING

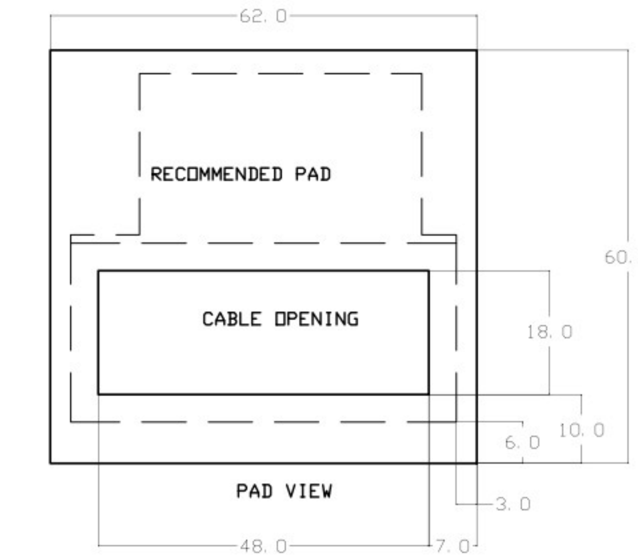
KVA:	75.0
PRIMARY VOLTAGE:	12470
BASIC IMPULSE LEVEL (KV):	95
PRIMARY VOLTAGE CONNECTION:	DELTA
SECONDARY VOLTAGE:	208Y/120
BASIC IMPULSE LEVEL (KV):	30
SECONDARY VOLTAGE CONNECTION:	WYE
PRIMARY CONDUCTOR:	ALUMINIUM
SECONDARY CONDUCTOR:	ALUMINIUM
TAPS:	2AN2BN (+2, -2 @ 2.5%)
KVA 75.0 PRIMARY 12470	SECONDARY 208Y/120
IMPEDANCE:	3.50 (+-7.5% ANSI TOLERANCE)
TEMPERATURE RISE:	65 DEGREES C
FLUID TYPE:	MINERAL OIL
GALLONS:	146

STYLE # V6AA768BJ3

JOB NAME: WASTEWATER TREATMENT PLANT #2	EQUIPMENT DESIGNATION: T-LV1, T-LV2
JOB LOCATION: WICHITA, KS	EQUIPMENT TYPE:
DRAWN BY: C. KLIETHERMES	DRAWING TYPE: GENERAL NOTES
ENGR: C. KLIETHERMES	SQUARE D Schneider Electric
DATE: 072915	
DRAWING STATUS: RECORD	DWG# F36419323-003-01-1 PG 1 OF 2 REV –

REV	DESCRIPTION	BY	DATE

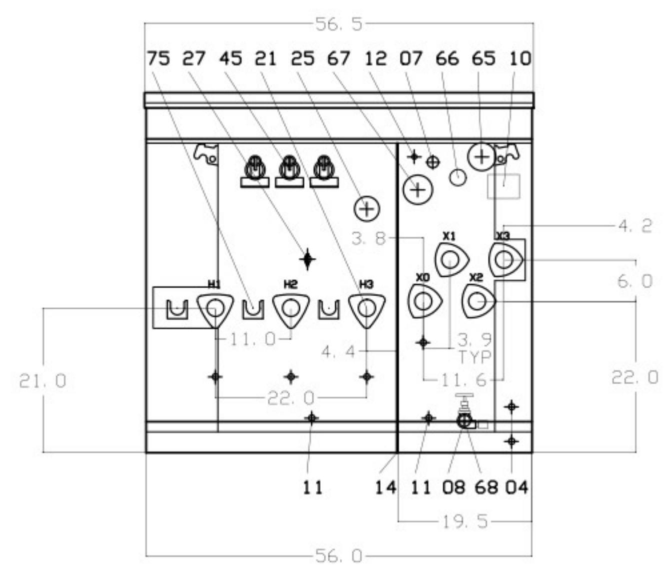




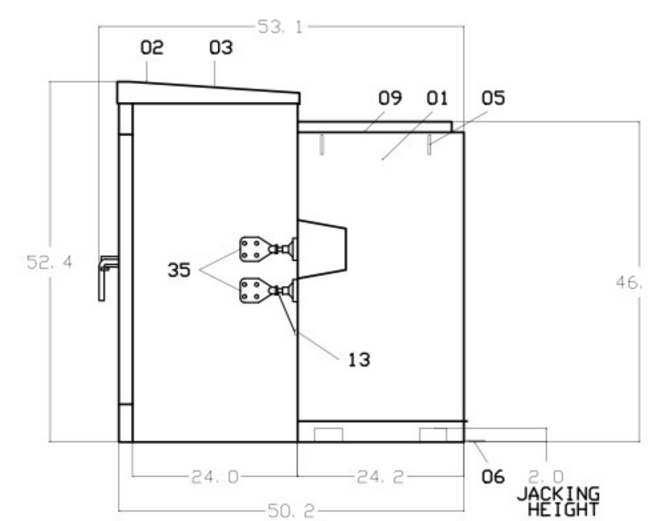
THIS OUTLINE IS FOR ERECTION OR MOUNTING PURPOSES. IT IS NOT TO SCALE AND SHOULD NOT BE REGARDED AS INDICATING THE EXACT DETAILS OF CONSTRUCTION.

01 TANK
02 CABINET BOLTED-ON, REMOVABLE SILLS, OPEN BOTTOM 1.25 INCH FLANGE, HINGED LIFT-OFF DOOR, PROVISION FOR PADLOCK, STOP IN OPEN POSITION.
03 WEATHER COVER, REMOVABLE OR HINGED
04 PROVISIONS FOR TANK TO CABINET GROUND
05 LIFTING HOOKS, 4 TOTAL
06 ANCHORING BRACKETS
07 1 INCH FILL PLUG W/ PRESSURE TEST VALVE
08 1 INCH DRAIN PLUG
09 HANDHOLE, 9.5 INCH X 17.5 INCH, BOLTED-ON COVER
10 NAMEPLATE MOUNTED ON TANK WALL
11 GROUND PAD .50-13-TAP, HV AND LV COMPARTMENT
12 PRESSURE RELIEF DEVICE
13 LV NEUTRAL GROUND PAD .50-13-TAP WITH GROUND STRAP
14 HV/LV BARRIER (STEEL)
21 HV BUSHING, WELLS 36.6/21.1 KV 150 BIL 200 AMP
25 TAP CHANGER
27 LBOR SWITCH, 2 POSITION 38 KV 300 AMP
35 LOW VOLTAGE BUSHING, ANSI SPADES, WITH 4 HOLES
45 DRAWOUT FUSEHOLDERS WITH FLAPPER & DRIP SHIELDS
65 PRESSURE VACUUM GAUGE
66 OIL LEVEL GAUGE
67 THERMOMETER
68 DRAIN VALVE WITH SAMPLER
75 PARKING STAND

** CL FUSE - HI-TECH SHORTY 17.2KV 30AMP HTSS240030 X 3
** DRAWOUT FUSE - ALAMO 10AMP CURRENT SENSING 1B11143G06
** FINISH COLOR - GREEN (MUNSELL 7GY 3.29/1.5)
** FLUID TYPE - MINERAL OIL
** PENTA-HEAD CABINET BOLT
** 304L STAINLESS STEEL TRANSFORMER
** UNDERCOAT
** FEED-THRU INSERT X 3
** 9KV ELBOW ARRESTER-15KV INTERFACE
** SPARE DRAWOUT FUSE X 3
** UL LISTED

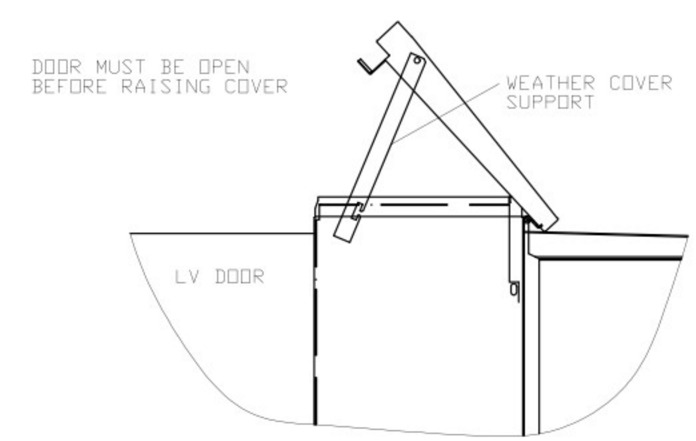


FRONT VIEW
SHOWN WITHOUT DOORS



36.5 OPEN DOOR SWING

RIGHT VIEW



STYLE # V6AA768BJ3

JOB NAME: WASTEWATER TREATMENT PLANT #2	EQUIPMENT DESIGNATION: T-LV1, T-LV2
JOB LOCATION: WICHITA, KS	EQUIPMENT TYPE: LIQUID FILLED TRANSFORMER
DRAWN BY: C. KLIETHERMES	DRAWING TYPE: OUTLINE
ENGR: C. KLIETHERMES	SQUARE D Schneider Electric
DATE: 072915	
DRAWING STATUS: RECORD	DWG# F36419323-003-01-2 PG 2 OF 2 REV –

REV	DESCRIPTION	BY	DATE								

SQUARE D
Schneider Electric

MADE IN USA

US D. O. E 10 CFR PART 431 COMPLIANT
CLASS ONAN 60 HERTZ
THREE PHASE DISTRIBUTION TRANSFORMER

KVA	AT CONTINUOUS RISE C	% IMPEDANCE	SERIAL	MFG DATE	GALLONS OIL
75	65		36419323-003		146

HIGH VOLTAGE	HV BIL KV	HV MTL
12470	95	AL

LOW VOLTAGE	LV CURRENT	LV BIL KV	LV MTL
208Y/120	208	30	AL

THE 25 C LIQUID LEVEL IS 5. 00 INCHES BELOW TOP OF HIGHEST MANHOLE FLANGE.
LIQUID LEVEL CHANGES 0. 26 INCHES FOR EACH 10 C CHANGE IN AVERAGE LIQUID TEMPERATURE.
MAXIMUM OPERATING PRESSURES OF LIQUID PRESERVATION SYSTEM: 7. 00 PSI POSITIVE 7. 00 PSI NEGATIVE.
TANK DESIGNED FOR 7 PSI VACUUM FILLING.

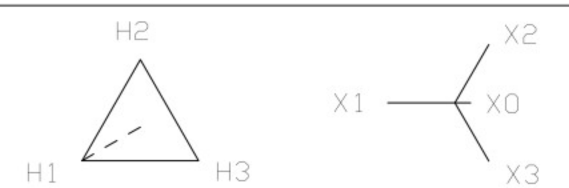
APPROXIMATE WEIGHTS IN POUNDS	
CORE & COILS	589
OIL	1095
CASE	1004
TOTAL	2688

TAP CHANGER RATINGS		
TAP	VOLTAGE	CURRENT
1	13095	3. 31
2	12785	3. 39
3	12470	3. 47
4	12160	3. 56
5	11850	3. 65

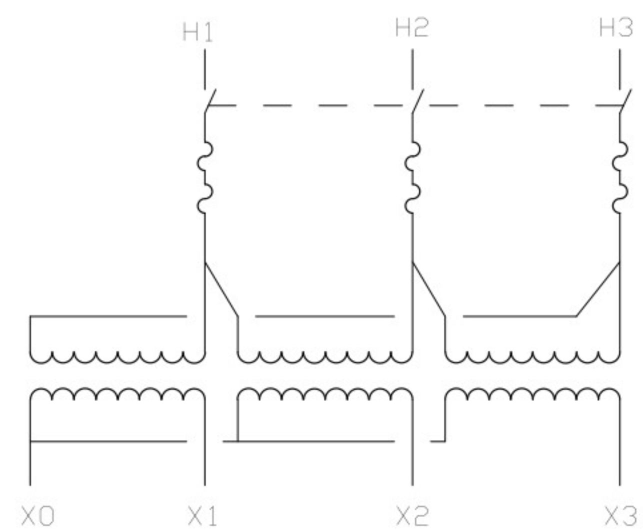
INSULATING LIQUID:
CONTAINS MINERAL OIL WITH NO DETECTABLE LEVEL OF PCB, LESS THAN 1PPM, AT THE TIME OF MANUFACTURE
CAUTION: 1. BEFORE OPERATING READ INSTRUCTION BOOK 43500-054-03R2

2. TANK MUST BE SOLIDLY GROUNDED.

c UL us LISTED
LIQUID-IMMERSED DISTRIBUTION TRANSFORMER
16ER FILE NO. E232617



PHASOR DIAGRAMS



V6AA768BJ3
JC999999999 1LUJ

NOTE:
IMPEDANCE, MFG. DATE, AND SERIAL NUMBER WILL BE STAMPED ON NAMEPLATE AFTER FINAL TEST

STYLE # V6AA768BJ3

JOB NAME: WASTEWATER TREATMENT PLANT #2	EQUIPMENT DESIGNATION: T-LV1, T-LV2
JOB LOCATION: WICHITA, KS	EQUIPMENT TYPE: LIQUID FILLED TRANSFORMER
DRAWN BY: C. KLIETHERMES	DRAWING TYPE: RATED NAMEPLATE
ENGR: C. KLIETHERMES	SQUARE D Schneider Electric
DATE: 072915	
DRAWING STATUS: RECORD	DWG# N36419323-002-01-1 PG 1 OF 1 REV –

Three Phase, Liquid Filled, Compartmental Type, Pad Mounted Transformers
Class 7230

Instruction Bulletin

Retain for future use.

a brand of Schneider Electric

SQUARE D

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HAZARD CATEGORIES AND SPECIAL SYMBOLS

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** property damage.

NOTE: Provides additional information to clarify or simplify a procedure.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

WARRANTY

WARRANTY TO CUSTOMERS PURCHASING THROUGH AUTHORIZED SCHNEIDER ELECTRIC DISTRIBUTORS AND CUSTOMERS PURCHASING DIRECTLY FROM SCHNEIDER ELECTRIC.

Schneider Electric warrants equipment manufactured by it to be free from defects in materials and workmanship for eighteen (18) months from date of invoice from Schneider Electric or its authorized sales channels. If within the applicable warranty period purchaser discovers such item was not as warranted and promptly notifies Schneider Electric in writing, Schneider Electric shall repair or replace the items or refund the purchase price, at Schneider Electric’s option. This warranty shall not apply (a) to equipment not manufactured by Schneider Electric, (b) to equipment which shall been repaired or altered by others than Schneider Electric, (c) to equipment which shall have been subjected to negligence, accident, or damage by circumstances beyond Schneider Electric’s control, or to improper operation, maintenance or storage, or to other than normal use or service. With respect to equipment sold but not manufactured by Schneider Electric, the warranty obligations of Schneider Electric shall in all respects conform and be limited to the warranty actually extended to Schneider Electric by its supplier. The foregoing warranties do not cover reimbursement for labor, transportation, removal, installation, or other expenses which may be incurred in connection with repair or replacement.

Except as may be expressly provided in an authorized writing by Schneider Electric, Schneider Electric shall not be subject to any other obligations or liabilities whatsoever with respect to equipment manufactured by Schneider Electric or services rendered by Schneider Electric.

THE FOREGOING WARRANTIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER EXPRESS AND IMPLIED WARRANTIES EXCEPT WARRANTIES OF TITLE, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

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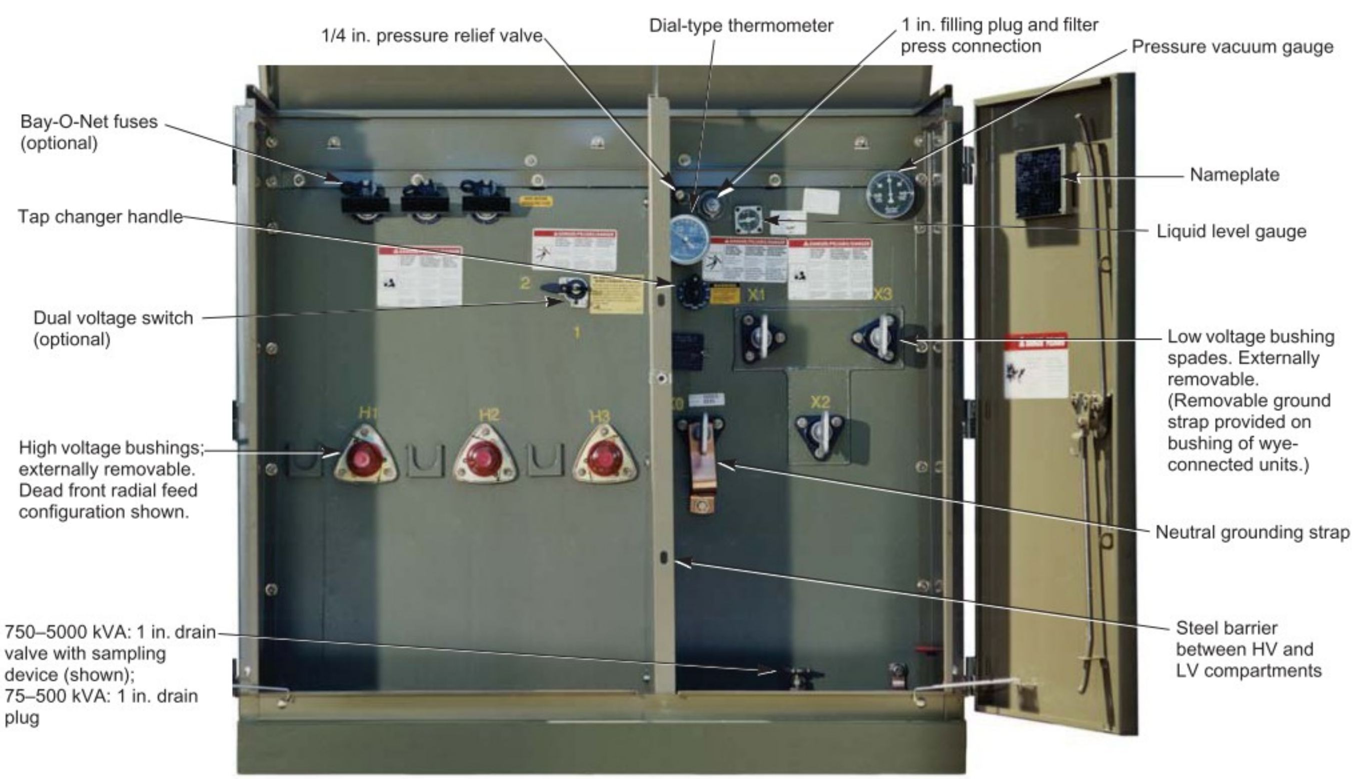
SECTION 1—STANDARD FEATURES

Figure 1: External Features

The pad mounted transformer differs from the substation or pole-style transformer by its applications and external appearance. Designed for application with underground feeders, the pad mounted transformer is tamper resistant and compartmentalized on the front.

Figure 2: Terminal Compartment Features



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SECTION 2—INTRODUCTION

This instruction bulletin details information about installing, operating, and maintaining liquid filled, compartmental type, pad mounted transformers. Each transformer has its own specification and unique construction features. These features are detailed in the transformer outline and nameplate drawings.

This instruction bulletin is not an application guide for the transformer or a substitute for adequate training in safe working procedures for this and related electrical equipment. Installation of this electrical equipment may require special licenses or training. Consult applicable national, industry, and local codes for specific requirements.

The successful operation of any transformer depends on various factors such as installation, loading, service conditions, and maintenance. Electrical systems in which transformers, along with vacuum or SF^6 circuit breakers, are used are capable of high frequency overvoltages which will not be suppressed by lightning arrestors. These medium voltage systems may require a detailed, high frequency overvoltage system analysis and/or the addition of high frequency overvoltage protection. The transformer should be installed in conditions as specified in ANSI/IEEE Section C57.12.00 *Usual Service Conditions*, unless the transformer is designed specifically for operation in conditions other than the usual service conditions.

NOTE: If additional information is needed that is not covered by this instruction bulletin, contact the nearest Schneider Electric field sales representative, or Square D Services at 1-800-634-2003.

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SECTION 3— SAFETY PRECAUTIONS

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- Read and understand this entire instruction bulletin before installing, operating, or maintaining a liquid filled transformer. Follow all applicable local and national codes.
- Disconnect all power and verify the transformer is de-energized before servicing the transformer. Operation of a primary protective device may be evidence of a faulted transformer. Do not re-energize the transformer until the cause of operation of the primary protective device is found and corrected.
- Many parts of the transformer operate at high voltages. DO NOT TOUCH. Use only electrically insulated tools and clothing, and protective gear when working around electrical equipment.
- Do not rely on visual indications such as switch position or fuse removal for determining a de-energized condition. Always assume that a terminal is energized unless it is checked with a properly rated meter to ensure the terminal is de-energized and grounded.
- Before servicing the transformer, ensure all static charge has been discharged by grounding the coils with an appropriate grounding device.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Do not remove, paint over, or cover the warning labels and nameplates on the transformer.

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SECTION 4—RECEIVING, HANDLING, AND STORAGE

This transformer has been furnished with a pentahead locking bolt that must be loosened to open the compartment. This bolt can be turned with a standard pentahead socket wrench, as used widely in the utility industry. Sockets can be obtained from the Snap-On Company (tool #B2191) or from other tool distributors.

Receiving

Initial Inspection

Before unloading the transformer, follow steps 1–3:

1. Verify that the serial number on the transformer nameplate matches the serial number listed on the bill of lading. If the numbers do not match, contact your local Schneider Electric field sales representative immediately.
2. Review the shipping papers to ensure the shipment is complete. Accessories, hardware, or both may arrive in a separate container on a separate pallet. Claims for shortages or errors must be made in writing to Schneider Electric within 60 days after delivery. Failure to give such notice will constitute unqualified acceptance and a waiver of all such claims by the purchaser.

   For details concerning claims for equipment shortages and other errors, refer to the Schneider Electric “Terms and Conditions of Sale”.
3. Before unloading the transformer, complete external features checks a–f:

   a. Check for any obvious dents or scratches in the tank walls or cooling radiator. Such dents and/or scratches in the paint finish can most often be corrected by simple touch-up procedures (see “Exterior Finish” on page 33).

   b. Check for liquid coolant leaks. Look for oily streaks on the transformer surface, at weld seams, on high or low voltage bushing parts, and any collection of the insulating coolant at the base of the transformer. If found, investigate them thoroughly to determine if a leak does exist on the transformer. A “pinhole” leak or any bushing leak resulting in a very slow loss of liquid is field repairable. Refer to pages 33–34 for information on repairing leaks.

   c. Check for broken, cracked, or damaged bushings.

   d. Check for missing or damaged parts, or packaging which shipped separately from the transformer.

   e. Check the nameplate for design compliance. Voltage, kVA ratings, percentage impedance voltage (%IZ), and other design features must comply with the job specification and outline drawing.

   f. Check for accessory features by reviewing shipping papers, outline and wiring drawings, instruction bulletins, and other pertinent documents that are supplied with the transformer. The transformer outline drawing for the specific order indicates which accessories should be present and their location on the unit.

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Internal Inspection

The objective of the internal inspection is to locate any damage which might have occurred in shipment. **In most cases, an inspection of the internal tank is rarely necessary and is required only if there is obvious indication the tank has sustained severe impact damage in transit. Do not perform an internal inspection unless authorized by Schneider Electric.** Pay particular attention to leads, bolted mechanical and electrical joints, tap changers, current transformers, cores, and insulation structure. If removing the maintenance hand hole cover is necessary, refer to “Opening the Transformer Tank” on page 36.

The tank has been sealed at the factory to eliminate any possibility of contamination of the liquid coolant by moisture. The accumulation of moisture over time can destroy the insulating properties of the liquid coolant. Therefore, if the transformer is opened for internal inspection, do not leave it open for longer than two hours. Initial inspection of the pressure seal is necessary and can be accomplished by either of the following methods. Consult your local Schneider Electric field sales representative before performing any repairs.

1. Observe the pressure/vacuum gauge. A consistent rise and fall in pressure readings with the rise and fall of liquid coolant and ambient temperature demonstrates an effective seal. A flat or unchanged reading over time and at varying temperatures is evidence of a leak that must be located and repaired. Refer to “Locating Pressure Leaks Above the Liquid Level” on page 33.
2. Pull the pressure relief valve ring momentarily, or loosen the vent plug. The sound of rushing air is an indication the unit has maintained an effective seal. If there is no sound of rushing air, the seal may still be effective, as this may only be an indication that the ambient temperature has decreased sufficiently to lower the pressure to zero. If this is the case, repeat this test at a time of day when the temperature is significantly different. If it is apparent the internal pressure is remaining unchanged following this procedure, review “Maintenance of Internal Features” on page 34 before locating and repairing any leak.

Liquid Sampling

An initial visual inspection and testing of the liquid insulating coolant is not required unless there is indication that moisture or other contaminants have accidently entered the tank during transit. If there are indications of moisture in the insulation, contact your Schneider Electric field sales representative immediately for confirmation of the analysis and for recommendations on the drying procedure to be followed. If sampling the liquid coolant is required, see “Sampling the Liquid” on page 34.

⚠ WARNING

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Do not energize transformer if the liquid level is low.
- Maintain the proper liquid level when the transformer is energized.

Failure to follow these instructions can result in death or serious injury and damage to equipment.

Liquid Level Inspection

The transformer is shipped with the liquid coolant at the correct operation level. Verify this when the transformer is received by reading the level from the level gauge. The indicator should be halfway between the 25° C mark and the “high” or the “low” mark.

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If the transformer is shipped without a liquid level gauge, the liquid level should be checked by removing the liquid level plug located at the 25° C mark. Any unit which does not have the proper liquid level should be checked for leaks and refilled through the vent plug before placing it in service. Refill only with the same type of liquid as that specified on the transformer nameplate.

The transformer was filled or processed at the factory with non-polychlorinated biphenyl (PCB) dielectric fluid in accordance with federal PCB regulations 40 CFR 761, et seq. The non-PCB fluid contained less than 1 ppm at time of processing or filling. The owner should take the necessary precautions so that PCB contamination is not introduced during field filling or maintenance of the transformer.

Consult your Schneider Electric field sales representative if the level is not correct.

Handling

The transformer is shipped on an open carrier trailer to facilitate the use of a crane for unloading. Unloading the unit with a forklift is **NOT** recommended since the weights are often excessive and the coolant radiators are easily damaged. The transformer must be handled in the normal upright position to avoid internal stresses on the core and coil mounting assembly and to prevent trapping air in the windings that could create serious problems when the transformer is energized. The transformer weight is shown on the nameplate.

Unloading and Lifting

⚠ DANGER

HAZARD OF FALLING EQUIPMENT AND CRUSHING

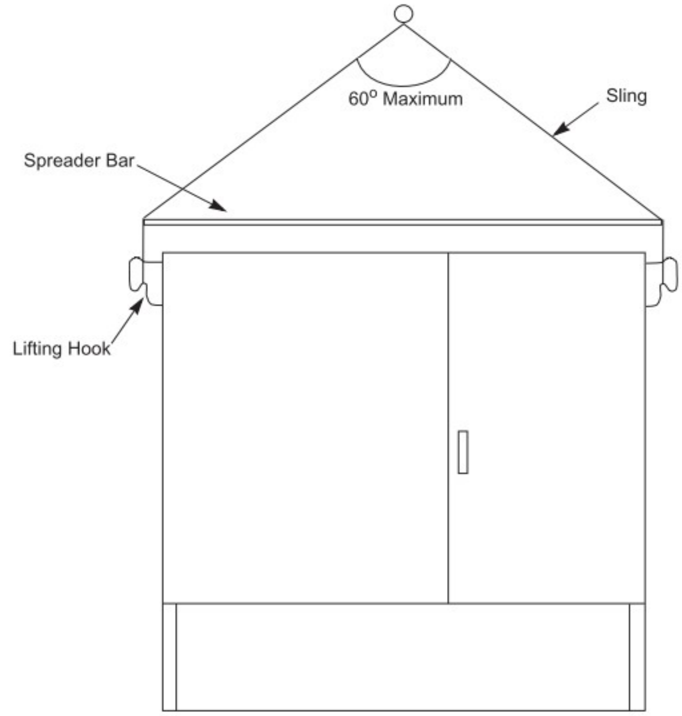
- Use a crane to unload the transformer. DO NOT UNLOAD using a forklift. The transformer is top heavy and may become unbalanced.
- Keep all unnecessary personnel away while handling and moving the transformer.

Failure to follow these instructions will result in death or serious injury.

Lifting hooks or lugs are provided for lifting the complete transformer. When using a single point hitch (see Figure 3 on page 11), the angle between the cables (when viewed from the front or long side of the transformer) must not exceed 60 degrees. If the cables are at least as long as the longest dimension of the transformer tank, the angle will not exceed the maximum.

NOTE: Do not use the holes in the lifting hook on the transformer (if provided) for lifting.

Figure 3: Lifting the Transformer



Jacking may be accomplished at the corners of the tank base plate. Do not attempt to raise the transformer by placing jacks under drain valves, pipe connections, or other attachments. When jacking, use all of the jacking pads. Never attempt to lift the transformer by using cranes or jacks on any part of the transformer other than the fittings provided for this purpose.

When the transformer cannot be handled by a crane, it may be skidded or moved on rollers, but be careful not to damage the tank base structure. When using rollers under large transformers, use skids to distribute the stress over the tank base.

Storing

If the transformer must be stored, it should be stored completely assembled, preferably in its permanent location on the concrete pad. If a level concrete pad is not available, a pallet of adequate strength will keep the unit from direct contact with the ground. Maintain adequate ventilation underneath the transformer. Do not store the transformer in the presence of corrosive gases such as chlorine, acid fumes, etc. Periodically inspect the stored transformer just as a unit that is in service. Ensure that an effective pressure seal is maintained and check for leaks and any rust spots.

Transformers should not be stacked on top of one another. Exercise care to prevent submersion in water.

If a transformer is to be stored more than one year, pressurize the gas space above the liquid with dry nitrogen between 2–3 PSIG. This will prevent moisture from being pulled into the tank by a negative pressure.

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SECTION 5—INSTALLATION

NOTE: Complete start-up services are available from Square D Services. They can provide assistance in a variety of areas, from installation to comprehensive testing and verification of the new equipment. Contact Square D Services at 1-800-634-2003, 24-hours a day.

Shipping braces may be used to secure the unit while it is transported. There are two kinds: those that do not interfere with the operation of the transformer and need not be removed, and those that must be removed for electrical clearances or other reasons. Always check the notes on the outline drawings for instructions on shipping braces that must be removed.

Transformer Location

Follow all local and national codes when locating the transformer. Make sure the radiators are clear of obstructions. The transformer must be at least 24 inches (710 mm) from walls or other obstructions to allow circulation of air around each unit.

For indoor installations, consult local and national codes to ensure all applicable requirements are satisfied. If the transformer is located near combustible materials, make sure the transformer meets or exceeds the minimum clearances as required by the National Electrical Code® (NEC) or other applicable local codes.

Place transformer on a foundation of sufficient strength to support the weight of the transformer, preferably of reinforced concrete. The transformer cabinet should sit flush on the pad, allowing no gaps which would compromise the tamper resistance of the transformer. Do not place the transformer directly on an earthen surface. Ensure the foundation has adequate drainage. Seismic regulations may require that the transformer be anchored to the pad. When supplied, hold-down cleats or brackets should be used to bolt the transformer securely to the pad.

The unit should not be tilted in any direction grater than 1.5°, as a greater tilt will cause deviations in liquid level near fuses, pressure relief devices, or other accessories specifically located at or near the 25° C liquid level.

At altitudes above 3300 ft. (1006 m), the decreased air density reduces the transformer cooling efficiency and bushing BIL rating. Contact your local Schneider Electric field sales representative to verify the suitability of the unit for application at higher altitudes.

Restricting Access to the Transformer

Compartmental-type pad mounted transformers are designed and constructed to be tamper-resistant and therefore need not be located in a restricted area. However, if for any reason modifications are made to the transformer or compartment that compromise the tamper-resistant construction, the transformer must then be located in a restricted area. Modifications of this type may void the warranty. Consult your local Schneider Electric field sales representative before making any modifications to the transformer.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Do not make modifications to the transformer or compartment that will result in compromising the tamper-resistant construction.

Failure to follow this instruction will result in death or serious injury.

Grounding

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Follow all applicable codes for grounding all equipment. Ensure proper grounding. Improper grounding can cause high voltage on the transformer tank and secondary terminals.

Failure to follow this instruction will result in death or serious injury.

Ground the transformer tank at all times. To ground the tank permanently, use ground pads or nuts at the base of the tank wall in both the high- and low-voltage compartments. A good permanent, low-resistance ground is essential for adequate protection from the tank becoming momentarily energized by internal or external faults or lightning surges. Do not use cubicle hold-down bolts, cleats, or any other plug fitting to establish a tank ground.

Conduit Area

1. Locate and terminate all conduit in the transformer enclosure in the “available conduit area” designated on the equipment drawing.
2. Install the conduit properly. Use hubs and ring connectors to protect the cables.

   NOTE: If top entry (such as bus duct), do not use the top of the compartment to support the weight of the conduit or bus duct. Support the conduit or bus duct independently.

   Under seismic conditions, the top of the compartment can move as much as 3 inches (76 mm) in any direction. Any top incoming cables must accommodate this motion.
3. Bond all conduit, stubs, and ring connectors to the transformer ground with approved electrical connections.

Cable Pulling

1. Use only cable sizes suitable for a proper fit with the corresponding lugs.
2. Pull the proper number of line-side and load-side cables according to the load served and the NEC.
3. Position the cables inside the compartment so that they are not subject to physical damage.
4. Maintain the maximum possible bending radii and proper clearance to grounded parts. If any cables are lying or bearing on structural members, support them to relieve this condition or place suitable protective material at the bearing point to protect the cable insulation.

Cable Terminations Using Unshielded Cable

1. Strip a length of insulation from the end of the cable sufficient to fit into the full length of the lug barrel, being careful not to nick or ring the strands. Use a proper insulation stripping tool.
2. Thoroughly clean aluminum cable contact surfaces with a wire brush or scrub them with an abrasive cloth to remove oxides and foreign matter.
3. Immediately apply an acceptable joint compound to the bare aluminum surfaces.

4. If compression-type lugs are furnished on any switch or circuit breaker, or as the main incoming power lugs, unbolt and remove them to create sufficient room for crimping the lugs to the cables with the crimping tool.
   a. Insert the cable into the lug barrel and, using the crimping tool, make the specified number of crimps per the manufacturer's recommendations.
   b. Wipe excess joint compound from the connector and insulation.
   c. With the cables connected, remount the lugs onto the bushings, switches, or circuit breakers. Torque the bolts to the values given in "Electrical Connections" below.
5. Set screw-type lugs are standard on molded case circuit breakers. Torque these lugs to, **but do not exceed**, the specified values. Torque values for circuit breaker and switch lugs are marked on these units.

Cable Terminations Using Shielded Cable

For live front transformers, install properly rated cable stress relief terminator kits on each cable. Follow the instructions provided with the stress relief terminator kit. Install the terminator so the top of the terminator (live part) is at approximately the same height as the top of the lightning arrestors, if provided.

For dead front transformers, use properly rated elbow terminators sized to fit the high voltage bushings. Follow the installation instructions provided with the elbow terminators.

Electrical Connections

All mating joints of electrical connections must be clean and properly tightened. Ensure that there are no strains on the terminals that could cause loose connections. See Table 1 and Table 2 on page 15 for the recommended torque values.

Make external electrical connections in such a way as not to exceed a cantilever load of 100 lb (45 kg) on the bushings. Greater loads may cause bushing damage. Inspect the bushing periodically for broken or cracked porcelain and faulty gaskets.

Table 1: Torque Guidelines

Bolt Size	General Torque Values		
	Grade 2 Plated lb-ft (N•m)	18-8 Stainless Steel lb-ft (N•m)	Silicon Bronze lb-ft (N•m)
1/4-20	4–6 (5–8)	4–6 (5–8)	4–6 (5–8)
5/16-18	6–12 (8–16)	6–12 (8–16)	6–12 (8–16)
3/8-16	15–20 (20–27)	15–20 (20–27)	15–20 (20–27)
1/2-13	25–30 (34–41)	25–30 (34–41)	—

Table 2: QED-3 Circuit Breaker Connector Bolts

Circuit Breaker Type	Torque Value Line/Load Connector Bolts lb-in (N•m)
FA, FH, FC, FI	55–65 (6–7)
KA, KH, KC, KI	65–75 (7–8)
LA, LH	145–160 (16–18)
MA, MH, MX, ME	130–150 (15–17)
NA, NC, NX, NE	130–150 (15–17)

High Voltage Bushing Connections

High voltage bushings are provided according to the job specification as either porcelain live-front with exposed metal eyebolt terminals or as a molded dead-front. Lugs are not required to terminate the cable on a live front bushing. However, with the live front design and the use of shielded cable, a cable stress relief terminator kit must be installed on each high voltage cable. An elbow terminator kit must be installed on the cable to permit connection to the dead front bushing. On the dead front design, the elbow terminator kit includes the necessary cable stress relief. Contact your local Schneider Electric field sales representative for application or order information on the live front or dead front terminator kits. Installation instructions are provided with the terminator kits.

⚠ WARNING

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Unused dead front bushings that are energized must be properly terminated with a grounding cap.

Failure to follow this instruction can result in death or serious injury and damage to equipment.

The one-piece integrated bushing is shipped with a plastic protective cap that should be left in place until the transformer is energized to avoid dirt or moisture contaminating the internal bushing contact points. On an energized transformer, a ground cap must be plugged onto any unused bushing well or insert to avoid partial discharge and subsequent bushing damage.

The transformer nameplate illustrates the internal wiring and external marking of each bushing. Refer to the nameplate on the transformer for clarity on where to connect each incoming cable.

On live front designs, ensure adequate air clearances between all live parts.

ENGLISH

Low Voltage Bushing Connections

Low voltage bushings through 600 volts are supplied with NEMA standard hole drillings and spacings but are not supplied with lugs. Lugs may be stacked or mounted on either face of the spade. A minimum 1 in. (25.4 mm) air clearance must be maintained between live parts, phase-to-phase and phase to ground for 600 volts or less.

Low voltage terminations are high current carrying devices. All bolted or crimped points should be checked prior to energizing the unit to ensure the joints are tight. When threaded terminators are attached to the threaded secondary stud, install a backup nut on the threaded secondary stud and back it up tightly against the threaded terminator to ensure maximum contact and to minimize joint resistance and reduce the possibility of overheating.

SECTION 6—OPERATION

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

De-energize the transformer before operating the tap changer.

Failure to follow this instruction will result in death or serious injury and damage to equipment.

Tap Changer

The no-load, de-energized tap changer is provided to adjust the output voltage to its rated voltage. Do not use it to raise or lower the output (secondary) voltage to any voltage other than the rating appearing on the nameplate. If the tap changer is used to set the voltage different from the rated voltage, it will result in a high noise level, higher core loss, and possible core saturation.

The no-load tap changer is provided with an operating handle, tap position indicator, and provision for padlocking. Some no-load tap changers may have provisions for a Kirk Key, or equivalent, interlock system.

Before energizing or applying voltage to the transformer, turn the tap changer to the desired voltage position. Positions are marked 1, 2, 3, 4, and 5 (or A, B, C, D, and E), and correspond to the primary voltages stamped on the transformer nameplate. The unit is shipped with the tap switch in the rated voltage position, normally position 3 (or C). Each position changes the primary-to-secondary winding ratio by 2.5% and can alter the secondary voltage by this increment. Tap positions of 2.5% are typical but not the rule. Other percentages are supplied as required.

To raise the secondary voltage, move the tap switch to position 4 (or D) or 5 (or E). To lower the secondary voltage, move the tap switch to position 1 (or A) or 2 (or B).

To change the voltage position, perform the following steps:

1. Make sure the transformer is de-energized.
2. Back out the locking screw until it is clear of the locking hole.
3. Turn the operating handle to the desired tap position.
4. Re-tighten the locking screw to minimize the possibility of unintentional movement.

Some large-size units are furnished with a power-transformer tap changer drive which requires pulling of a locking pin and a full turn of the handle for each change in tap position.

ENGLISH

Dual Voltage or Delta/Wye Switch Operation

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

De-energize the transformer before operating the dual voltage or delta/wye switch.

Failure to follow this instruction will result in death or serious injury and damage to equipment.

⚠ WARNING

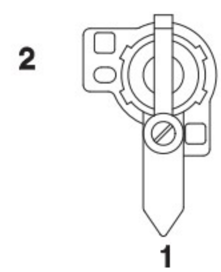
HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

When changing the dual voltage switch, replace fuses with those of the proper rating before energizing the transformer.

Failure to follow this instruction can result in death or serious injury and damage to equipment.

Transformers designed with dual voltage windings or reconnectable delta/wye windings as indicated on the nameplate have a de-energized, two-position, dual voltage or delta/wye switch. The voltage source must be disconnected before operating the hand-operated switch. If the voltage source is not disconnected before the switch is operated, the transformer will be permanently damaged.

Figure 4: Dual Voltage Switch



On a dual voltage switch (see Figure 4), position 1 is the low (or multiple connected) position, while position 2 is the high (or series connected) position. To change the voltage position, perform the following steps:

1. Make sure the transformer is de-energized.
2. Back out the locking screw until it is clear of the locking hole.
3. Pull out the handle until it will rotate.
4. Turn the operating handle to the new position.
5. Release the handle.
6. Re-tighten the locking screw to minimize the possibility of unintentional movement.

Parking Stands

Parking stands, or brackets, are provided with dead-front bushings, and are located next to the bushings. These brackets provide a storage location for parking bushings, to be used for storage of disengaged elbow terminators.

⚠ WARNING

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Unused dead front bushings that are energized must be properly terminated with a grounding cap.

Failure to follow this instruction can result in death or serious injury and damage to equipment.

Live-Line Tools (Hot Sticks)

⚠ DANGER

HAZARDOUS VOLTAGE. HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Do not attempt to operate by hand any device that is designed to be operated by a live-line tool.
- Do not use any live-line tools that have not been inspected and tested in accordance with OSHA 1910.269(j).

Failure to follow these instructions will result in death or serious injury

Some devices such as load-break under-liquid switches, Bay-O-Net fuses, dry well canister fuses, and dead front elbow terminators are designed to be operated with live-line tools such as “shot-gun sticks” or “hot sticks”. Before using any live-line tool, it must be wiped clean, and inspected and tested per OSHA 1910.269(j).

Follow the instructions of the live-line tool manufacturer for proper operation. Do not attempt to operate by hand any device that is designed to be operated with a live-line tool.

Load Break Switch Operation

If provided, a spring-loaded, gang-operated, load-break under-liquid switch is located in the high voltage compartment. This switch is either a two-position (ON-OFF) switch or a three- or four-position switch and is operated with a live-line tool (hot stick). The switch positions are marked on the tank front plate and shown on the transformer nameplate.

The two-position switch is operated by inserting the hot stick into the operating handle and rotating the switch to either the ON or OFF position.

CAUTION

RISK OF EQUIPMENT DAMAGE

Do not stop and reverse direction of the switch until it has changed position.

Failure to follow this instruction will result in equipment damage.

The three- or four-position switch is operated by inserting the hot stick in the index plate and moving the plate over the peg between its present setting and the next setting. The index plate prevents the switch from switching more than 90°, or one position at a time. Next, insert the hot stick into the handle of the switch and turn it approximately 180° until the switch snaps into the next position. (Do not stop and reverse direction of the switch until it has changed position, as this will damage the switch mechanism.) Repeat this procedure until the switch is in the desired position.

Fuses

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Completely de-energize the transformer before replacing fuses.
- Do not energize or de-energize the transformer with single phase switches or fuses.
- Use only ganged three phase switches to energize or de-energize the transformer.
- Do not operate the transformer with any phases open.
- Only qualified personnel with appropriate measurement devices should measure the voltages on the transformer.

Failure to follow these instructions will result in death, personal injury, or damage to the equipment.

⚠ WARNING

RISK OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Operation of a fuse may indicated a faulted transformer. Do not replace the fuse unless the cause of the fuse operation has been positively identified and corrected.

Failure to follow this instruction can result in death or serious injury and damage to equipment.

Operation of a fuse may indicate a faulted transformer. Do not replace the fuse unless the cause of the fuse operation has been positively identified and corrected. If the cause of the fuse operation cannot be positively identified, contact Schneider Electric before testing or energizing the transformer.

Fuses should be operated within their ratings. Replacement fuses must have the equivalent voltage and time-current characteristics of the original fuses.

Bay-O-Net Fuse Operation

The Bay-O-Net fuse is a dead-front, individual-phase disconnect device that is load-break rated and operated by a live-line tool (hot stick). This type of fuse is located in the high voltage compartment above the primary bushings. The Bay-O-Net fuse can be either an expulsion type or a full range current-limiting type fuse (Figures 5 and 6). Before energizing, ensure the Bay-O-Net fuse is properly latched into place.

ENGLISH

Figure 5: Bay-O-Net Expulsion Fuse and Holder with Isolation Link

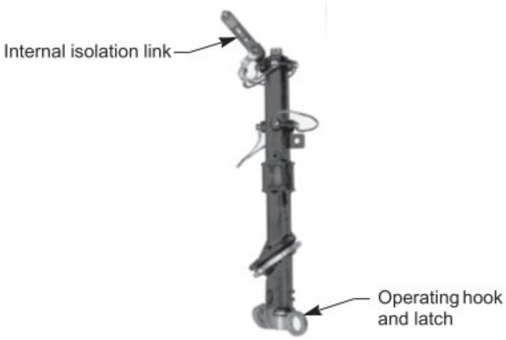


Figure 6: Bay-O-Net Current Limiting Full Range Fuse and Holder

⚠ DANGER

HAZARD OF FUSE AND LIQUID EXPULSION

Release built-up air pressure in the tank before removing the fuse.

Failure to follow this instruction will result in death or serious injury.

To operate the Bay-O-Net Loadbreak Fuseholders, on some models you must first raise the hinged, flip-top weather cover.

1. With both cabinet doors fully open (over 90°), push upward on the front edge of the cover assembly.
2. Tilt the hinged cover backward until the supporting arm (connected to the high-low barrier) can be securely latched in place on the inside of the cover.

With the cover in place, proceed with the operating instructions for the Bay-O-Net Loadbreak Fuseholder.

Remove Fuseholder

1. Vent the transformer by operating the pressure relief valve. See "Pressure Relief Valve" on page 24.
2. Attach a live-line tool to the handle eye.
3. Stand to one side and unlock the handle.
4. Push down and rotate the handle 90° clockwise in the housing to break any adhesion between the gasket and the housing.
5. Firmly pull the fuseholder out approximately 6 in. to open the circuit. Wait a few seconds while the liquid drains back into the tank, then completely withdraw the fuseholder.

Replace Fuse

Replace the fuse by following the fuse manufacturer's instructions that are shipped with the fuse.

Reinstall Fuseholder

1. Attach a live-line tool to the handle eye.
2. Stand to one side and place the end of the fuseholder just inside the housing.
3. Quickly push the fuseholder in until the dust cap seats against the housing.
4. Push down and rotate the locking handle, hooking it over the shoulder of the housing.

When the Bay-O-Net operations are complete, close the hinged weather cover, when provided, as follows:

1. Release the latch on the hinged weather cover by tilting the cover slightly backwards.
2. Lower the cover, making sure it is all the way down. (The upper high-voltage door bolt should engage through the hole in the hinged weather cover.)

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Operation of a primary protective device may be evidence of a faulted transformer. Do not re-energize the unit if there is any indication of a failure.

Failure to follow this instruction will result in death or serious injury.

Dry Well Canister Fuse Operation

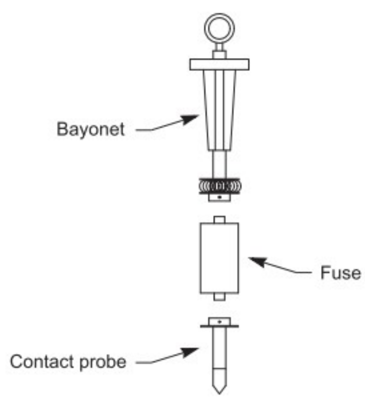
The dry well canister is a fluid-tight, current-limiting fuse holder that extends under fluid into the tank above the high voltage bushings.

The canister fuse normally supplied is a non-load-break-and-make, individually-phased fuse device. If required, the dry well canister is supplied in conjunction with a mechanical interlock to a load-break switch (see “Load Break Switch Operation” on page 18) that prevents removal of the fuse unless the switch is in the “OFF” or de-energized position. When required, a load break-and-make rated canister is supplied (not available on all kVA sizes.)

Load-Break Fuse Operation

To operate or change fuses in load-break fuseholders, follow these instructions:

Figure 7: Load-Break Drawout Fuseholders



Load Break

1. Attach a live-line tool to the hook eye.
2. Quickly pull the fuseholder assembly completely from the housing.

Replace Fuse

1. Unscrew the fuse from the insulating bayonet and contact probe.
2. Replace with new fuse of equivalent rating and characteristics.
3. Tightly screw the new fuse onto the insulating bayonet and contact probe.

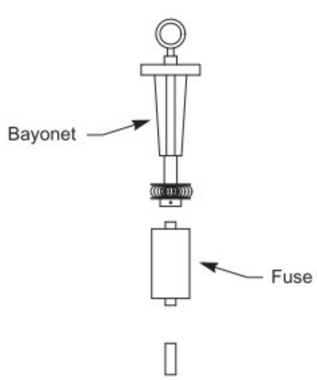
Load Make

1. Attach a live-line tool to the hook eye.
2. Insert the end of the fuseholder until the contact spring has just entered the housing.
3. Quickly push the fuseholder assembly straight into the housing in until the dust cap seats against the housing and grounding clip.

Non-Load-Break Fuse Operation

To operate or change fuses in non-load-break (dead-break) fuseholders, follow these instructions:

Figure 8: Dead-Break Drawout Fuseholders



Remove Fuseholder

1. Attach a live-line tool to the hook eye.
2. Pull the fuseholder straight out from the housing.

Replace Fuse

1. Unscrew the fuse from the insulating bayonet.
2. Replace with new fuse of equivalent rating and characteristics.
3. Tightly screw the new fuse onto the insulating bayonet.

Reinstall Fuseholder

1. Attach a live-line tool to the hook eye.
2. Insert the fuseholder into the housing.
3. Push the fuseholder in firmly until the dust cap seats against the housing and grounding clip.

ENGLISH

Internal Partial Range Current-Limiting Fuse

The internal partial range current-limiting fuse is used in series with a low current interrupting device, such as a protective link or bayonet.

The partial range fuse is designed to clear low impedance (high current) faults, with the expulsion fuse clearing any high impedance faults or overloads. When properly applied, the partial range fuse will only operate for internal transformer faults. Upon operation of a partial range fuse, Schneider Electric recommends removing the unit from service and returning it to Schneider Electric for repair.

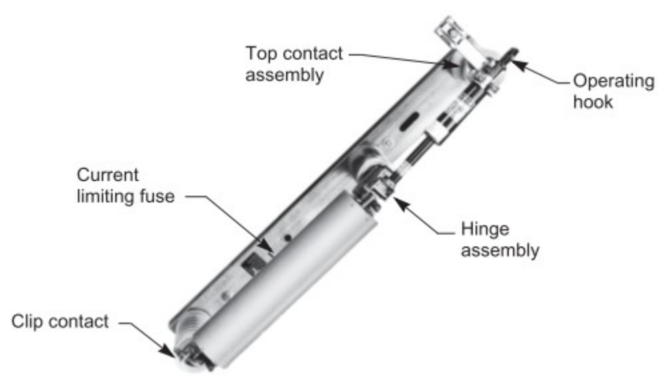
Arc-Strangler Switch Operation

The Arc-Strangler is a 200 A load-break rated, individual-phase switch device, operated with a live-line tool (hot stick). The Arc-Strangler may incorporate a full range, current-limiting fuse on the switch blade or, depending on design, may be tandem-mounted with a clip-style, current-limiting fuse (see Figures 9, 10, and 11).

Figure 9: Arc Strangler

Figure 10: Fused Arc-Strangler

Figure 11: Arc-Strangler with Clip Fuse



To operate the switch, insert the hot stick in the operating hook and pull forward. The Arc-Strangler should swing open. To remove the Arc-Strangler, insert the hot stick in the hinge opening and lift up.

The top and hinge contact assemblies must be rigidly fastened to the insulators to prevent rotation and misalignment of the contacts. The contact spacings are set at the factory and normally do not require adjustment. If contact adjustment is ever required, consult your local Schneider Electric field sales representative.

Weak Link Fuses

When supplied, weak-link expulsion-type cartridge fuses are factory installed under fluid on a terminal block at the top of the internal core and coil assembly (see Figure 12). To replace these fuse elements, remove the tank hand hole cover. See “Opening the Transformer Tank” on page 36.

Figure 12: Expulsion Type Fuse

S & C Fused Switch

When an S & C fused switch is provided, follow the manufacturer's instructions for operating this equipment. Use only S & C tools to operate these switches. Schneider Electric does not recommend using S & C switches to energize or de-energize the transformer.

Accessories

Accessories supplied with the transformer are shown on the outline drawing. When accessories have control wiring or are equipped with alarm contacts, refer to the control wiring diagram or outline drawing for contact type, ratings, and terminal points.

Dial Thermometer

The liquid temperature indicator is a dial-type precision instrument with an indicator pointer coupled to a bi-metallic element. The bi-metallic element fits into a sealed dry well located under the liquid level. This device can be easily installed or removed from the dry well without exposing the transformer liquid. See Figure 2 on page 5 for the location of the dial thermometer.

NOTE: Do not fill the well with liquid before inserting the stem of the thermometer as this may damage the thermometer. Do not tighten the thermometer in the well any more than necessary to place the dial in an upright position.

The dial is calibrated in degrees centigrade and has a red maximum indicating pointer that indicates the maximum temperature reached since the last reset. To reset the indicator pointer, turn the middle knob on the dial face or, on some models, push the Reset button.

Temperature limits for any specific condition of loading should be in accordance with ANSI C57.91, Guide for Loading Mineral-Oil Immersed Transformers. To ensure normal transformer life, the average temperature for any 24-hour period must not exceed 95 °C.

If specified, switch contacts are supplied inside the dial thermometer and brought out through control wires at the bottom of the dial. A variety of contact arrangements are available. Consult your Schneider Electric field sales representative for a specific application.

ENGLISH

Liquid Level Gauge

The liquid level gauge is a precision dial-type instrument with the indicating pointer magnetically coupled to an internal float arm. The level gauge is located at the normal 25 °C fill line (see Figure 2 on page 5). The complete device, including the gauge and float arm, can be installed or removed in the field, although removing the tank cover or hand hole may be necessary.

The liquid level rises and falls around the 25 °C level mark depending on the ambient temperature and the transformer loading conditions. Use Table 3 to determine the variation above or below the normal level before adjusting the fluid level. The indicator comes mounted on the transformer tank and requires no maintenance other than the periodic inspection recommended in “Section 8—Maintenance” on page 30.

Table 3: Liquid Level Gauge

Average Liquid Temperature (°C)	Correct Level (percent of scale above or below 25° C level)
85 (high)	100
70	75
55	50
40	25
25 (normal)	0
10	-33
-5	-67
-20 (low)	-100

Contact your Schneider Electric field sales representative if the liquid level gauge does not agree the readings shown in Table 3. On an energized transformer, a liquid level reading of LOW is unacceptable, since a dangerous flashover condition on internal parts may result. Refer to “Draining and Filling the Tank” on page 35 for information on filling the transformer with liquid coolant.

If specified, switch contacts are supplied inside the level gauge housing with control wires brought out at the bottom of the gauge. The controls will operate if the liquid level drops to the LOW setting or below. Contact your Schneider Electric field sales representative for a specific application.

Pressure Vacuum Gauge

The pressure vacuum gauge is a dial-type precision instrument calibrated in pounds per square inch and has a dial reading of ±10 psi maximum. The gauge is located near the top of the transformer above the liquid level (see Figure 2 on page 5). It is easily installed or replaced by tightening or loosening the gauge from its pipe fitting support.

The internal air pressure varies with liquid level and ambient conditions. Pressure readings between ±5 psi are considered normal as long as there is some variation of readings between changing liquid levels. A flat or unchanging pressure reading indicates a defective gauge or a pressure leak. A pressure leak must be corrected to avoid “breathing” of external moist air.

Over a period of time, this condition can destroy the dielectric strength or insulating properties of the liquid coolant. Refer to “Locating Pressure Leaks Above the Liquid Level” on page 33 for information on locating and correcting a pressure leak. Pressure in excess of ±5 psi can be lowered by releasing the pressure relief valve.

Pressure Relief Valve

The pressure relief valve is located near the top above the liquid level (see Figure 2 on page 5). The device is threaded into the tank wall for easy installation or removal. The valve automatically opens when the internal gas pressure increases by 9–11 psi. Once the pressure is relieved, the device automatically reseals. To manually relieve internal pressure, apply a hook stick to the valve pull ring and gently pull.

Drain Valve With Sampler

A one- or two-inch drain valve and drain plug with a side-mounted 3/8 in. sampler fitting is located at the bottom of the tank wall (see Figure 2 on page 5). Replacement or addition of this valve to a tank filled with liquid is possible, although not recommended. Consult your Schneider Electric field sales representative for this procedure. See “Sampling the Liquid” on page 34 and “Draining and Filling the Tank” on page 35 for the liquid sampling and draining procedure.

Surge Arrestors

Surge arrestors intercept and divert to ground various overvoltage transients (such as lightning surges) which occur on the distribution system. On transformers with surge arrestors, the arrestors must be disconnected whenever high potential or induced potential tests are made.

NOTE: Surge arrestors will not operate for high frequency overvoltages.

Current Transformers

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Current transformer secondaries must be connected to a load or short-circuited before the transformer is energized to avoid hazardous voltage at the terminals.

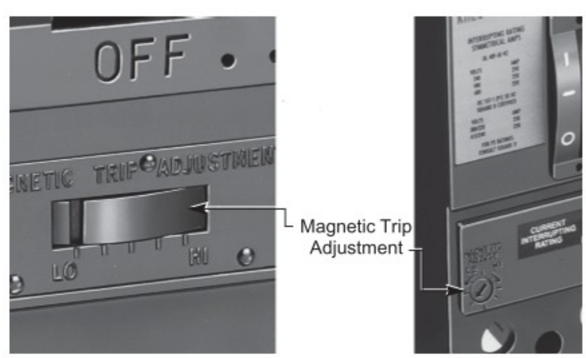
Failure to follow this instruction will result in death or serious injury and equipment damage.

If current transformers are provided, their secondary leads are wired to terminal blocks in the low voltage compartment. Refer to the transformer wiring diagram to identify the location of current transformer secondary leads. Current transformer leads are shorted and grounded for transformer shipment. If the current transformers are not connected to a load, they must remain shorted and grounded to avoid hazardous voltage at the secondary terminations.

Molded Case Circuit Breakers

Factory-installed molded case circuit breakers, 250 A frames or larger, have an adjustable magnetic trip, which is shipped on the “LO” setting. The markings between “LO” and “HI” settings represent a range of instantaneous magnetic trip values of 5–10 times the circuit breaker’s continuous current rating. To provide coordinated operation during a fault, adjust the magnetic trip as outlined in the respective instruction manual. All poles are adjusted simultaneously, using a screwdriver, by the single setting (see Figure 13).

Figure 13: Instantaneous Trip Setting



SECTION 7—START-UP TESTING

NOTE: Complete start-up services are available from Square D Services. They can provide assistance in a variety of areas, from installation to comprehensive testing and verification of the new equipment. Contact Square D Services at 1-800-634-2003, 24-hours a day.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only qualified personnel should perform these tests.
- Disconnect ALL high voltage, low voltage, and neutral connections.
- Disconnect auxiliary equipment such as lightning arrestors, the fan and temperature control system, meters, or any other low voltage control system connected to the windings involved in these tests.
- DO NOT disconnect the ground connection to the transformer frame.

Failure to follow these instructions will result in death or serious injury.

Pre-energization Tests

Before energizing the transformer and placing it in service, perform the following tests at the installation site:

- **Insulation Resistance:** Measures the resistance of the insulation between the primary and secondary windings and from each winding to ground.
- **Turns Ratio:** Measures the ratio of the primary to secondary turns to check for possible insulation degradation in the windings.

Wye-Wye Transformers With HOXO Bushing

Transformers with a wye-wye connection and an HOXO bushing have the neutral of the high and low voltage windings connected together inside the tank. Before the insulation resistance or megger test is performed, separate the two neutrals by following steps 1–7:

1. Open the transformer hand hole cover following the procedure in “Opening the Transformer Tank” on page 36.
2. Locate the HO disconnect inside the tank approximately 10 in. (254 mm) below the tank cover. This is approximately 4 in. (102 mm) under the liquid.
3. Remove the nut securing the HO terminal, being careful not to drop it in the tank.
4. Remove the HO lead and bend it away from the connection point and away from any metal parts.
5. Perform the insulation resistance (megger) tests.
6. Replace the HO lead and tighten the nut.
7. Replace the hand hole cover following the procedure in “Closing the Transformer Tank” on page 37.

Insulation Resistance Testing

Measure the resistance of each winding to ground using a megohm meter. Do not apply greater than 2500 Vdc to any winding.

Turns Ratio Test

Perform the turns ratio test at each tap position and for the full winding.

1. Use a Transformer Turns Ratio (TTR) to measure the ratio between the primary and secondary windings. Follow the manufacturer's instructions for the TTR.
2. Compare these measurements to the transformer nameplate voltage ratio. The measurements should be within .5% of the nameplate voltage ratio. Refer to ANSI C57.12.91 for additional information.

NOTE: A High-Potential (Hi-Pot) test is not recommended. If this test is performed, it must be done with a 60 Hz ac voltage at approximately 75% of the factory-applied test. A dc voltage must not be used for this test without first contacting your Schneider Electric field sales representative.

Pre-Energizing Procedure Checklist

Conduct a complete inspection before the transformer is energized to ensure that all components function and operate properly. **Complete steps 1–22 before energizing the transformer.**

1. Check all field-installed electrical connections. Torque values are listed in Table 1 on page 15.
2. Check all accessible connections for tightness.
3. Check all factory and field-installed lug terminations for tightness.
4. Check the rigidity of all bushing and cable supports.
5. Check the enclosure for dents or other damage that reduce electrical clearances inside the compartment.
6. Remove all foam blocks, or other temporary cushioning or retaining material, from the electrical devices.
7. Manually open and close all switches, circuit breakers, and other operating mechanisms, checking for correct alignment and free operation.
8. Check all relays, meters, and instrumentation to verify that all field installed wiring connections are made properly and that the devices function properly.
9. Current transformers (CTs) supplied require connection to a metering device load before energizing. Verify that the metering device load is properly connected.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Current transformer secondaries must be connected to a load or short-circuited before the transformer is energized to avoid hazardous voltage at the terminals.

Failure to follow this instruction will result in death or serious injury and equipment damage.

10. All CT circuits supplied by Schneider Electric for metering use are shorted for shipment. Remove shorting terminal screws on shorting terminal blocks or jumpers and store in the block.
11. On transformers with an electronic trip circuit breaker, set the tripping characteristic curve of the adjustable electronic trip unit as outlined in the respective instruction manual.

    NOTE: For molded case circuit breakers, Schneider Electric manual number 0600PD9602, Field Testing Industrial Molded Case Circuit Breakers, provides more in-depth information. Contact your Schneider Electric field sales representative to obtain this manual.

ENGLISH

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- If circuit breaker settings are adjusted, do not set the long time trip rating at a higher ampacity than the rating of the bus bar or load cables it supplies; overheating can occur.
- Before energizing the transformer, all unused I-Line® circuit breaker mounting spaces must be filled with blank fillers and/or extensions as listed in Table 4.

Failure to follow these instructions will result in death or serious injury.

Table 4: Blank Fillers and Extensions

	Height	Catalog No.
Blank Fillers	1.5 in. (38 mm) 4.5 in. (114 mm)	HNM1BL HNM4BL
Blank Extensions	1.5 in. (38 mm) 4.5 in. (114 mm)	HLW1BL HLW4BL

⚠ CAUTION

HAZARD OF EQUIPMENT DAMAGE

Do not remove the protective lubricant on the plug-on connectors.

Failure to follow this instruction can result in injury or equipment damage.

NOTE: If additional lubrication is required, apply a coating of electrical joint compound, catalog number PJC7201, to the plug-on connectors' contact surfaces.

12. Check all control wiring (when present) with the wiring diagrams to ensure that connections are properly made.
13. Inspect all insulation surfaces for dirt and moisture, including the primary support insulators and isolation barriers. If necessary, wipe with a clean cloth.
14. Fasten all barriers and covers in place.
15. Insert the proper keys in the interlocks, when used.
16. Verify that all grounding connections are correctly made.

⚠ CAUTION

HAZARD OF EQUIPMENT DAMAGE

Do not pry open or spread the fuse mounting clips. This can cause a loose connection, resulting in overheating.

Failure to follow this instruction can result in injury or equipment damage.

17. Conduct an electrical insulation resistance (megger) test to ensure that the transformer is free from short circuits and undesirable grounds.

18. After completing the electrical insulation resistance test, replace all control power fuses that may have been removed and close power disconnects that have been opened.
19. Check all field-installed wiring. Make certain it is clear of all live parts and secured to withstand fault currents.
20. Verify that all control wiring is properly connected.
21. Verify the position of the tap changer against the transformer nameplate information.
22. Remove all hand tools, equipment, or any other foreign materials from inside the compartment.

Verifying the Voltage is Correct

Do not energize the transformer with single phase switching and do not operate the transformers with any phases open. Use only ganged three phase switches to energize or de-energize the transformer. When steps 1 through 22 above have been completed, energize the transformer and follow steps 1–2 below to verify the voltage is correct.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Do not energize or de-energize the transformer with single phase switches.
- Do not operate the transformer with any phases open.
- Only qualified personnel with appropriate measurement devices should measure the voltages on the transformer.

Failure to follow these instructions will result in death, personal injury, or damage to the equipment.

1. Verify that the rating of the voltmeter is adequate for measuring the high voltage and low voltage rating of the transformer as listed on the transformer nameplate.
2. Using the voltmeter, verify the voltages on the transformer secondary. If the voltages are not as required, verify the primary voltage. Use the tap changer to adjust the voltage. See “Tap Changer” on page 16.

Inspection Following Energizing

After energizing the transformer, check the following:

- ❑ Inspect the dial-type thermometer and confirm the proper liquid temperature (see “Dial Thermometer” on page 23).
- ❑ Confirm that there are no leaks around bushing parts or weld seams.
- ❑ Confirm that there is no blue glow or partial discharge effect at the high voltage or low voltage terminations.
- ❑ When it is first energized, keep the transformer under observation during the first few hours.
- ❑ Make a periodic check of the load to ensure the transformer is not being subjected to excessive overload. Planned overloading should be in accordance with the ANSI Loading Guide (C57.91).

Sound Level

All transformers have an inherent sound level that varies with the size of the units. Sound waves may be amplified by means of reflected waves and/or radiated waves via walls, floors, ceilings, mechanical vibrations of air ducts, conduits, and mounting bases. For average expected sound levels, refer to NEMA ST-20.

To meet NEMA listed average sound levels, each unit should be installed in a location which provides a 10-foot clearance on all sides except floor or ground. Units located in close proximity to hard surfaces may produce higher than average sound levels. When transformers must be located in noise sensitive areas, precautions should be taken to avoid amplification of the transformer sound.

Install the unit in an area where the noise will be least objectionable. Avoid areas where hard surfaces are in close proximity to the transformer.

If the unit is installed indoors, use acoustic absorbing materials on walls, floors, and ceilings. Avoid installation of units in corners, hallways, and stairways, and near heating and air conditioning ducts.

Cabinet Security

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Properly secure the cabinet to prevent access by unauthorized personnel.

Failure to follow this instruction will result in death or serious injury or damage to equipment.

Before leaving the site of an energized transformer, make sure any protective or insulating barriers are in place, the cabinet is completely closed, and all locking provisions are properly installed.

Follow these procedures to help ensure cabinet security:

1. Close the high voltage (left) door and secure it in place with the captive bolts supplied (pentahead or hexhead).
2. Close the low voltage (right) door and secure it in place by rotating the handle in a clockwise direction until seated (the handle should then be in a vertical orientation).
3. Tighten the safety bolt (pentahead or hexhead) located in the locking tube until it is fully seated.
4. Install a padlock through the door handle and locking tube and secure it in place.
5. Check both the high and low voltage doors for proper fit and security.

SECTION 8—MAINTENANCE

Complete maintenance services are available from Square D Services. They can provide assistance in a variety of areas, from installation to comprehensive testing and verification of the new equipment. Contact Square D Services at 1-800-634-2003, 24-hours a day.

Scheduled Maintenance

Inspect the transformer regularly. The frequency of inspection depends on operating conditions. If the transformer is operating in usual service conditions as defined in ANSI/IEEE C57.12.00, an inspection every year may be sufficient. However, for unusual locations where the air is contaminated with particles such as dust or chemical fumes, inspect the transformer every three months or sooner. After the first few inspections, determine a more definite schedule based on the existing conditions. Complete the following maintenance checks.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Before performing these checks, review “Section 3— Safety Precautions”.
- Before servicing the transformer, ensure all static charge has been discharged by grounding the coils with an appropriate grounding device.

Failure to follow these instructions will result in death or serious injury.

- ❑ De-energize the transformer following the safety messages above and your facility’s lock-out/tag-out procedures.
- ❑ Check the transformer tank, radiators, and bushings for leaks and repair any leaks found (see “Liquid Leaks” on page 33).
- ❑ Check the liquid temperature and level. Add the proper liquid as required.
- ❑ Check and clean dirty bushings and surge arrestors with a clean, dry cloth, and replace any corroded hardware.
- ❑ Repair and repaint any damaged or corroded areas on the tank (see “Exterior Finish” on page 33).
- ❑ Check the torque values on all electrical connections, including the ground connections and tighten as necessary (see Table 1 on page 15).
- ❑ Ensure that all accessories (fans, gauges, relays, etc.) are operational.
- ❑ Replace any damaged or unreadable safety labels.
- ❑ Check enclosure integrity (hinges, locking provisions, corrosion, etc.)
- ❑ Check transformer tilt.

Maintenance Testing

The following tests are recommended to determine the condition of the transformer:

1. Insulation resistance (see page 26).
2. Insulation power factor.
3. Transformer Turns Ratio (TTR) (see page 27).
4. Dielectric strength, power factor, moisture content, and combustible gas analysis of the insulating liquid.

Maintenance for Accessories

Accessories such as the liquid temperature and level indicators, pressure vacuum gauge, pressure relief valve and pressure relief diaphragm, and drain and sampler valve require no maintenance except to be replaced in the event of accidental damage. Monitor each gauge on a regular basis to ensure internal pressures, liquid level, and temperature are within design limits.

Molded Case Circuit Breakers Inspection and Maintenance

Molded case circuit breakers manufactured by Schneider Electric are designed as totally sealed units requiring minimal periodic maintenance.

Exercise circuit breakers at least once a year to ensure proper operation. For general maintenance:

- Trip the circuit breaker by pushing the Push to Trip button located on the face of the circuit breaker. (On most molded case circuit breakers this button will be yellow). This procedure tests alarm switches if they are built into the circuit breaker, or electrical interlocks between two circuit breakers. This also exercises the trip mechanism.
- Manually open and close the circuit breaker two to three times.

ENGLISH

Refer to individual circuit breaker instruction manuals shipped with the transformer for additional maintenance information, such as changing rating columns or adjustable settings and removing circuit breakers. If the instruction manual is not available, see “Section 10—Reference Publications” on page 38 of this manual for the appropriate number, and contact your Schneider Electric field sales representative to obtain this manual.

The universal test set, catalog number UTS3, is available to test all Schneider Electric circuit breakers equipped with Micrologic® trip units. It runs trip unit tests automatically, with prompts to the user for initial information. Test modules for each circuit breaker frame are used to store data necessary for automatic tests. Series B MICROLOGIC trip units require test module CBTMB, which is included in UTS3.

NOTE: Tests may be conducted with a circuit breaker installed; circuit breaker removal is not required. The transformer must be de-energized.

Ground Fault Protection Systems

Check the terminal connections on the ground fault protection system at least once a year for tightness and corrosion. If the system can be tested with or without tripping the main or branch device, directions for testing the system are in the device manual. Otherwise, testing the ground fault protection system will trip the main or branch device to which it is connected. If the ground fault sensor or relay is physically or electrically damaged, replace it.

If the ground fault protection system does not operate properly and additional equipment has been connected to the installation since the last maintenance test/check, de-energize the entire system and check for grounds on the neutral downstream from the main bonding jumper. If no downstream grounds are detected and the ground fault system is not operating properly, contact Square D Services at 1-800-634-2003. Likewise, if no additions have been made to the installation, and the ground fault protector does not operate properly, contact Square D Services.

Refer to the ground fault field test instruction manual for additional testing information. If the manual is not available, refer to “Section 10—Reference Publications” on page 38 to obtain the appropriate number. Contact your Schneider Electric field sales representative to obtain this manual.

Maintenance After a Major Fault

To perform maintenance after a major fault, follow steps 1–3:

1. If the transformer is not de-energized, de-energize the transformer following the safety messages on page 7 and your facility’s lock-out/tag-out procedures.
2. Inspect the transformer for any evidence of damage (broken and/or leaking bushings, operation of pressure relief device or valve, etc.).

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Do not re-energize the transformer if it has been damaged.

Failure to follow this instruction will result in death or serious injury.

3. Perform the tests described in “Scheduled Maintenance” on page 30. DO NOT re-energize the transformer if the test results are not acceptable. If no damage has occurred and all test results are acceptable, perform maintenance by following the procedures in “Scheduled Maintenance” on page 30.

Exterior Finish

The standard outside finish for liquid insulated transformers is satisfactory for widely diverse atmospheric conditions. However if the paint is damaged, the tank exterior metal is susceptible to rusting. All exposed metal surfaces must be thoroughly cleaned and prepared for the application of touch-up paint since the proper preparation of surfaces to be finished is an important factor in securing a satisfactory and lasting finish and maximizing the tank wall and radiator cooling effectiveness. Touch-up paint may be ordered from Schneider Electric. See "Section 9—Replacement Parts" on page 38.

Regardless of how good the paint may be, it will fail as a protector if applied over a wet, dirty, rusty, or greasy surface. Rust and scale will absorb and hold moisture. Therefore, to obtain a durable finish, it is absolutely essential that no moisture be sealed in by the application of paint. For large areas, to obtain a clean, dry surface with sufficient roughness for good adhesion of the priming coat, shot- or sand-blast the exposed surfaces of the transformer tank.

Locating Pressure Leaks Above the Liquid Level

Each transformer is pressure tested at the factory to ensure a pressure-tight seal, preventing moisture contamination of the liquid coolant. Review "Receiving" on page 8 for initial inspection and methods of verifying the pressure seal. If the seal is broken due to mishandling or other adverse conditions, locate and repair the leak point as follows:

Apply dry air or nitrogen with a dew point of -50 °C (-58 °F) through the Schraeder valve in the tank wall. Do not apply through the pressure-vacuum bleeder valve. Apply a solution of soap and glycerin to all seams and joints above the liquid level. As the pressure rises to 5 psi, any bubbling of the soap solution will pinpoint the location of a pressure leak. Patch the leak by tightening devices at the point of the leak, applying epoxy patches, or welding.

Liquid Leaks

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

De-energize the transformer before performing any maintenance procedures.

Failure to follow this instruction will result in death or serious injury.

Liquid coolant leaks are rare, but if detected, repair them at once to avoid the liquid level dropping below energized parts, creating a possibility of flashover or transformer overheating. To repair a weld leak in a tank seam or around one of the fittings, follow steps 1–9:

1. De-energize the transformer following the safety precautions listed on page 7 and your facility's lock-out/tag-out procedures. Check the liquid level in relation to the area to be welded. It should be 4 in. (102 mm) or more above the area to be welded. Should the area to be welded be above the liquid or if the liquid has been removed from the tank, blanket the transformer with dry nitrogen.
2. If the liquid has not been removed, pull a vacuum of several psi above the liquid to stop the liquid leak. This may be done with a vacuum pump or by sealing all fittings on the tank and draining sufficient liquid to obtain the necessary vacuum.

   NOTE: Vacuum is not always required, especially when a sweating leak is to be repaired and the tank wall is relatively thick.
3. Peen the weld leak closed, if possible, with the ball end of a ball-peen hammer or with a blunt or round-nosed chisel.
4. Grind or scrape the paint from the area to be welded and prepare a suitable point for attaching the ground lead to the arc welding machine.
5. Select a 1/8 in. diameter all-purpose coated electrode. Either ac or dc welding current may be used. When dc current is used, straight polarity (the electrode is negative) is preferred. Adjust the welding machine to supply the desired welding current. Depending on the welding operator's

ability and the individual task at hand, set the welding current between 115 and 125 A.

6. Apply a string bead sealing weld over the weld defect in a single, quick pass. This weld may be deposited horizontally or vertically depending upon circumstances. If the weld is deposited vertically, make it downward to drive any liquid seepage ahead of the weld. Remove the slag from the deposited weld before depositing each successive weld pass.

   Liquid interferes with the welding operation and the quality of the deposited metal. Wipe off any liquid with a dry cloth. Deposit all welds in a sequence as described above to prevent any liquid seepage from interfering with the welding operation other than the final sealing at the lowest point of the weld leak.
7. Clean the repaired area and check with a suitable leak detector to be sure the leak has been stopped.
8. After testing for leaks, reclean the area and apply touch-up paint.
9. If required, refill the transformer to its proper operating level (see “Draining and Filling the Tank” on page 35).

Small Pin-Hole Leaks

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

De-energize the transformer before performing any maintenance procedures.

Failure to follow this instruction will result in death or serious injury.

Small pin-hole leaks in the exterior metal, weld seam, etc., resulting in slow dripping, can be repaired with a durable epoxy patch kit. First de-energize the transformer following the safety precautions listed on page 7 and your facility’s lock-out/tag-out procedures, then apply a temporary liquid stick before the epoxy. In most cases this eliminates the need for a vacuum pump to stop the liquid leak while the epoxy is curing. Larger leaks may require the use of a vacuum pump. Detailed instructions are included with the epoxy repair kit.

Welding of small leaks can also be accomplished in the field on de-energized transformers, however avoid penetrating the metal and creating a more serious leak. **Welding on radiator metal is not recommended due to the thinner gauge material. See “Liquid Leaks” on page 33**.

Bushing Leaks

Some bushing leaks at the bushing connector may be corrected by tightening the metal terminator part of the bushing. Leaks between the bushing and the tank wall may be corrected by tightening the bushing clamp bolts.

NOTE: Do not exceed 40–60 lb-in. (5–7 N•m) torque on the bushing clamp bolts or terminals to avoid cracking the bushing material.

Maintenance of Internal Features

The transformer normally does not require internal maintenance throughout its life except for periodic sampling of the liquid coolant. The unit is shipped from the factory with the tank sealed.If inspection or repair of the internal tank parts is necessary, be careful to reseal the openings properly on completion of the work.

Sampling the Liquid

The dielectric strength of liquid is affected by the most minute traces of certain impurities, particularly water. To avoid contamination, use great care in obtaining and handling the samples. When sampling the liquid, use a clean, dry, dark glass bottle or jar with a cork stopper. Do not use a rubber stopper or a sealing lid with a rubber gasket since the sulfur in natural rubber can easily contaminate the liquid. Clean the bottle by washing it with non-leaded gasoline followed by strong soap, and rinsing it with distilled water before drying. Be careful to procure a sample that fairly represents the liquid at the bottom of the tank by drawing off a sufficient amount of liquid before taking the sample. This ensures that the sample is not liquid that was stored in the sampling pipe.

Open the drain valve or plug and release a small amount of the liquid coolant to flush out the valve and plug opening. The valve and drain pipe should be small enough to be emptied conveniently and large enough to give an even flow of liquid and avoid clogging by sediment. Take a quart sample, leaving space in the jar for expansion. Seal the jar and send it to the nearest testing facility for testing in accordance with ANSI standards. Testing must include as a minimum dielectric strength, power factor, and moisture content.

It is essential that the sample of insulating liquid represent the actual condition of the liquid in the transformer. Take every precaution to keep the sample and container free from foreign impurities or moisture. If the transformer is installed outdoors, be careful to prevent contamination of the sample by rain, snow, etc.

Receiving, Storing, and Handling the Liquid

If liquid is received in drums, as soon as they are unloaded, examine the bungs for damage or leaks. Store the drums in a closed room. Do not store the liquid outdoors since it is hazardous to the liquid. Store the drums with the bung down so the bung is under positive pressure. Do not open a drum until the liquid is needed. Tightly reseal any partially emptied containers and store them the same as new drums.

Like liquid purchased in drums, do not expose one- and five-gallon cans of liquid to the weather. Keep the seal intact until the liquid is needed. It is not necessary to perform dielectric tests on liquid in sealed cans. If a can is not completely emptied, use the provided screw cap to prevent contamination by moisture and dirt. The liquid in a partially used can must be tested before using it.

Draining and Filling the Tank

De-energize the transformer following the safety message on page 7 and your facility’s lock-out/tag-out procedures.

⚠ DANGER

FLAMMABLE LIQUID. RISK OF FIRE OR EXPLOSION

- Purge the gas space with nitrogen before adding/filling the transformer with liquid.
- Ground the transformer, transformer bushings, and all liquid-handling equipment.

Failure to follow this instruction will result in death or serious injury and damage to equipment.

Transformer liquid should be considered and handled as a flammable liquid. Under certain conditions, the closed transformer tank may contain combustible gases, and filling procedures may generate static electricity. Purge the gas space with nitrogen and ground all equipment following the safety message above.

When adding liquid to the transformer, take the precautions necessary to prevent PCB contamination. When draining or filling the tank, be careful to avoid contamination of the stored liquid. Use chemically cleaned and dry barrels or storage containers. Before opening the storage containers, allow them to reach the ambient temperature to avoid condensation. Use hoses and fittings that are liquid-resistant to avoid sulfur contamination. Remove the fill plug to equalize the tank pressure while draining. Drain the tank from the drain valve and plug location into the storage containers. When filled, properly seal the storage containers.

ENGLISH

Before filling the tank, tightly seal all fittings. Fill the tank through the upper fill plug. Use of a filter press is recommended when filling to ensure the liquid is free from moisture, air, or solid contamination. After filling the tank, test the liquid quality and tank seal.

NOTE: Never fill or add liquid to the transformer through the drain valve.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Do not re-energize the transformer before draining or adding liquid.

Failure to follow this instruction will result in death or serious injury and damage to equipment.

Reconditioning the liquid consists of removing water, carbon gases, and sludge. Four types of equipment are generally used: centrifuge, blotter filter press, and a combination of fullers earth and vacuum dehydration process.

In general, when large quantities of liquid have been contaminated, it is preferable to replace the liquid rather than attempt to reclaim it. When small quantities of liquid have been contaminated, the reclamation process depends on the kind and degree of contamination. Contact your local Schneider Electric field sales representative for recommendations and instructions.

Opening the Transformer Tank

Transformers are shipped sealed and in most cases need not be opened. If it should become necessary to open the tank to gain internal access, follow steps 1–7:

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

De-energize the transformer before opening the transformer.

Failure to follow this instruction will result in death or serious injury and damage to equipment.

1. De-energize the transformer following the safety message above and on page 7, and your facility's lock-out/tag-out procedures.

⚠ DANGER

HAZARDOUS PRESSURE. RISK OF FLYING OBJECTS.

Release the internal pressure before removing accessories or hand-hole inspection covers.

Failure to follow this instruction will result in death or serious injury and damage to equipment.

2. Release the internal pressure by operating the pressure relief valve, or by slowly removing the filling plug a thread at a time until the pressure starts to relieve itself.
3. Do not open the transformer in an area that is unprotected from the weather if there is a possibility of precipitation, or in an area where the air contains dirt or other particles. When the transformer is opened, protect the opening from foreign matter. Do not permit anyone on the tank cover until they have emptied all pockets of loose objects, and removed watches, rings, etc.

ENGLISH

4. Clean off the cover of the transformer to prevent the entrance of any dirt or foreign material when the cover is opened.
5. Remove the tamper-proof cover over the hand hole cover by removing the nuts holding it in place. These nuts are located inside the high- and low-voltage compartments. Slide the tamper-proof cover back and lift it off.
6. Remove the hand hole cover by removing the nuts holding it in place and lifting it off.

⚠ DANGER

HAZARD OF SUFFOCATION

Purge the gas space with dry air before entering the transformer tank.

Failure to follow this instruction will result in death or serious injury.

7. Purge the gas space with dry air. Never enter the transformer tank until an analysis of the air in the tank shows at least 19.5% oxygen.
8. To ventilate the inside of the tank while it is open, use dry air with a dew point of -50 °C (-58 °F) or lower. If dry air is not available, outside air may be used to ventilate the transformer as long as the outside relative humidity is less than 60% and the temperature of the transformer is at least 10 °C higher than the dew point of the outside air.
9. Tie off all tools outside the cover opening before using them inside the tank. Air hoses may be placed inside the transformer tank if they are clean and are made of material resistant to the liquid in the transformer.
10. If it is necessary to lower the liquid level, see “Draining and Filling the Tank” on page 35.

The maximum time that the transformer can be open is 12 hours. If this time must be exceeded, contact your local Schneider Electric field sales representative for instructions.

Entering the Transformer Tank

If it is necessary to enter the tank, first make sure an analysis of the air in the tank shows at least 19.5% oxygen. Use clean drop cloths under the working area to prevent objects from falling into the core and coil assembly. Wear clean cloth covers over shoes and never stand on any electrical insulation. Whenever anyone is inside the tank, station a second person at the opening in the cover of the tank to ensure the safety of the person inside. Follow all OSHA “confined space” entry rules and regulations.

Closing the Transformer Tank

After completing work inside the transformer tank, follow steps 1–3:

1. Clean the contact surfaces of the hand hole gasket and cover. If the gasket has been damaged in any way, replace the gasket.
2. Replace the transformer hand-hole cover and tighten the nuts evenly around the cover. Refill the transformer with any liquid that was removed. See “Draining and Filling the Tank” on page 35.
3. Perform the tests described in “Scheduled Maintenance” on page 30.
4. Pressure test the transformer for leaks as described in “Locating Pressure Leaks Above the Liquid Level” on page 33.
5. Replace the tamper-proof cover over the hand hole cover.

Repairs

It is the responsibility of the owner to inspect and maintain the transformer and keep it in good repair.

Report all problems during the warranty period to your Schneider Electric field sales representative. All warranty repairs must be made by Schneider Electric or an approved service facility.

ENGLISH

To assure proper operation, use only Schneider Electric approved replacement parts.

Schneider Electric recommends that the owner limit repairs to replacing broken parts, unless the owner has well-trained repair personnel.

Some internal parts can be replaced without completely draining the tank. In such cases, only the liquid necessary to expose the part should be drained. There may be occasions when complete draining of the transformer tank is required.

The core and coil assembly can be repaired or replaced by Schneider Electric personnel at either the factory, or at an authorized repair facility. For details, contact Schneider Electric.

SECTION 9—REPLACEMENT PARTS

The following parts are possible field-replaceable parts. Because of the wide variety of sizes, ratings, types, and styles used on different ratings and types of transformers, it is not possible to give a part number that will match your specific transformer. If a replacement or spare is needed, order by its name, along with the serial number, voltage ratings, and kVA size of the transformer, and any other information that will enable us to locate the original records on a specific transformer. Order from your local Schneider Electric representative.

- Thermometer
- Pressure/vacuum gauge
- Pressure relief valve
- Liquid level gauge
- Pressure relief device
- Drain valve
- Touch-up paint
- Fill valve
- Current transformer
- Safety labels
- Circuit breaker
- Terminal or ground lugs
- High voltage bushing
- Low voltage bushing
- Neutral bushing
- Tap changer

SECTION 10—REFERENCE PUBLICATIONS

The following Schneider Electric publications are available through your Schneider Electric field sales representative. These include device replacement procedures and spare parts listings to make ordering and servicing of replacement parts quick and convenient. Any maintenance procedure or device not listed, such as an I-Line® panel, is not customer serviceable. Contact your field sales representative for information.

Table 5: Installation Instructions

Title	Publication Number
FA, FH, FC, SFH Circuit Breakers	48940-158-02
NA, NC, SL 1200 I-Line® Circuit Breakers	48040-797-04
LI, LC I-LINE Circuit Breakers	48040-732-03
KA, KH, KC, KI, SKC, SKI Instructions	48049-031-02
FI Instructions	48049-033-01
LA, LH, SLA, Q4 Instructions	48049-034-02
Q2 Instruction Sheet	48040-008-08
MA, MH, SMA, SMH Instructions	48049-032-02
PA, PH Instruction Sheet	48040-189-05
FA-M01 and KA-M01 Motor Operator	48049-085-01
LA-M01 and MA-M01 Motor Operator	48049-086-01

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Table 5: Installation Instructions

Title	Publication Number
PA-M02 Motor Operator	48040-884-06
SE Electronic Trip Circuit Breaker with Micrologic® Trip System	48040-495-07
Ground Fault Module (GFM)	48040-756-05
Ground Fault Protection System–Type GC	40268-292-01
Masterpact® Universal Power Circuit Breaker	48049-071-02
QMB Fusible Switches	40268-525-02

Table 6: Instruction and Maintenance Bulletins

Title	Publication Number
LE/LX Manual	48049-027-02
ME, MX Electronic Trip Circuit Breakers	48049-028-02
NE, NX Drawout Circuit Breakers	48049-029-01
PE/PX Manual	48040-940-03
SE Electronic Trip Circuit Breaker	48040-495-06

Table 7: Ground Fault Field Test Instructions

Title	Publication Number
Ground Fault Module (GFM) Field Test Procedure	48040-757-04
ME/NE/PE and MX/NX/PX Electronic Trip Circuit Breakers	63020-271-01
Type GC–Ground Fault Protection System	80043-054-01

Table 8: Distribution Reference Catalogs

Title	Section Number
Molded Case Circuit Breakers	600
QMB Fusible Switches	4620
QMB Circuit Breaker Adapter Units	4620

Table 9: Other Reference Literature

Title	Publication Number
Application Guide for Ground Fault Protective Devices for Equipment	NEMA Publication PB2.2
Circuit Breakers	NEMA Publication AB-4
Enclosed and Miscellaneous Distribution Switches	NEMA Publication KS-1
Electrical Equipment Maintenance	NFPA 70B-1999
Molded Case Circuit Breakers Field Test and Maintenance	Schneider Electric Bulletin No. 0600PD9602

For information about obtaining NEMA documents, write to:

National Electrical Manufacturers Association (NEMA)
Attention: Customer Service
1300 North 17th Street
Suite 1847
Rosslyn, VA 22209

You can also visit the NEMA web site at www.nema.org.

MAINTENANCE LOG

DATE	INITIALS	ACTIONS

ENGLISH

DATE	INITIALS	ACTIONS

Schneider Electric

1010 Airpark Center Drive
Nashville, TN 37217 USA
1-888-SquareD
(1-888-778-2733)
www.SquareD.com

Replaces 43500-054-03R1 dated June 2002

05/2004

SQUARE D COMPANY
CERTIFIED TRANSFORMER TEST REPORT

Serial Number : 36419323-003-01

Shop Order : JC781280001

Customer Name : SHELLEY ELECTRIC

Project Name : WASTEWATER TREATMENT PLANT #2

Purchase Order : 36419323

Sub/Phase Polarity: N/A

3PH 60 Hertz Coolant - MINERAL OIL

K Factor: NA

Winding High Voltage

75 KVA PAD

12470 Volts

Winding Low Voltage

75 KVA

208Y/120 Volts

Taps : 13095 12785 12470 12160 11850

Resistance, losses, impedance and regulation corrected to 85 degree C and are based on wattmeter reading unless otherwise stated. The resistance for 3 phase transformers is the sum of the 3 phases in series.

	Resistance(Ohms)			Losses						
Test Date	**H.V**	**L.V**	**%Exc Amps**	**No Load**	**Load**	**Total**	**%Imp**	**%R**	**%X**	**X/R**
08/31/2015	120.78285	.01186	0.27	164	1,041	1,206	3.65	1.39	3.37	2.43
	Guarantee						3.50			

Regulation					
PF	**100%**	**90%**	**85%**	**80%**	**75%**
	1.44	2.76	2.99	3.15	3.28

Temperature rise calculated from basic design data which has been verified by test results of similar unit (Serial Number = 07J772161, KVA = 75.0, High Voltage = 12470, Date = 05/04/2007)

Winding Rise by Resistance in degree C				
Load	H.V	L.V	Guarantee	Top Fluid
Base	27.4	44.1	65	22.5

Insulation Test			
Applied Potential Test			
Winding	Rated Volts	Test Volts applied	Duration of test
H.V	12470	34000	60 Sec
L.V	208	10000	60 Sec

Induced Potential test:
Voltage = 416
(Applied to the secondary)

Efficiency				
125%	100%	75%	50%	25%
98.13	98.42	98.69	98.88	98.81

Sound Test : Test result from a similar unit

(Serial Number = 07J857263, High Voltage = 12470, Date = 9/11/2007)

ONAN(db)	ONAF(db)
45.2	N/A

Ratio Test Results

DV Position	Tap Position	Tap	Phase A	Phase B	Phase C	Vector
A	1	13090	109.01100	109.01400	109.01400	DY1
A	2	12780	106.45900	106.46000	106.46000	DY1
A	3	12470	103.84800	103.84900	103.84900	DY1
A	4	12160	101.29200	101.29300	101.29300	DY1
A	5	11850	98.67960	98.68090	98.68120	DY1

Pressure Test Results:

Unit was leak tested and no detectable leaks were found.

Unit contained less than 1PPM PCB at the time of manufacture.

Unit Successfully Passed Lightning Impulse Test.

I hereby certify that this is a true report based on factory tests made in accordance with the latest IEEE/ANSI C57.12.90 and C57.12.00 and that each transformer withstood the insulation tests.

STATE OF MISSOURI
SUSMITHA TARLAPALLY
NUMBER PE-2015000613
PROFESSIONAL ENGINEER

T. Susmitha

Susmitha Tarlapally
Electrical Engineering Manager
Distribution Transformers Division
2015-09-01

SQUARE D COMPANY
CERTIFIED TRANSFORMER TEST REPORT

Serial Number : 36419323-003-02

Shop Order : JC781280002

Customer Name : SHELLEY ELECTRIC

Project Name : WASTEWATER TREATMENT PLANT #2

Purchase Order : 36419323

Sub/Phase Polarity: N/A

3PH 60 Hertz Coolant - MINERAL OIL

K Factor: NA

Winding High Voltage

75 KVA PAD

12470 Volts

Taps : 13095 12785 12470 12160 11850

Winding Low Voltage

75 KVA

208Y/120 Volts

Resistance, losses, impedance and regulation corrected to 85 degree C and are based on wattmeter reading unless otherwise stated. The resistance for 3 phase transformers is the sum of the 3 phases in series.

	Resistance(Ohms)			Losses						
Test Date	**H.V**	**L.V**	**%Exc Amps**	**No Load**	**Load**	**Total**	**%Imp**	**%R**	**%X**	**X/R**
09/01/2015	121.79565	.01197	0.26	161	1,052	1,213	3.64	1.40	3.36	2.40
	Guarantee						3.50			

Regulation					
PF	**100%**	**90%**	**85%**	**80%**	**75%**
	1.46	2.77	2.99	3.15	3.28

Temperature rise calculated from basic design data which has been verified by test results of similar unit (Serial Number = 07J772161, KVA = 75.0, High Voltage = 12470, Date = 05/04/2007)

Winding Rise by Resistance in degree C				
Load	H.V	L.V	Guarantee	Top Fluid
Base	27.4	44.1	65	22.5

Insulation Test			
Applied Potential Test			
Winding	Rated Volts	Test Volts applied	Duration of test
H.V	12470	34000	60 Sec
L.V	208	10000	60 Sec

Induced Potential test:
Voltage = 416
(Applied to the secondary)

Efficiency				
125%	100%	75%	50%	25%
98.11	98.41	98.68	98.88	98.82

Sound Test : Test result from a similar unit

(Serial Number = 07J857263, High Voltage = 12470, Date = 9/11/2007)

ONAN(db)	ONAF(db)
45.2	N/A

Ratio Test Results

DV Position	Tap Position	Tap	Phase A	Phase B	Phase C	Vector
A	1	13090	109.01100	109.01400	109.01500	DY1
A	2	12780	106.45600	106.46000	106.46000	DY1
A	3	12470	103.84600	103.84900	103.84900	DY1
A	4	12160	101.28900	101.29400	101.29300	DY1
A	5	11850	98.67870	98.68400	98.68400	DY1

Pressure Test Results:

Unit was leak tested and no detectable leaks were found.

Unit contained less than 1PPM PCB at the time of manufacture.

Unit Successfully Passed Lightning Impulse Test.

I hereby certify that this is a true report based on factory tests made in accordance with the latest IEEE/ANSI C57.12.90 and C57.12.00 and that each transformer withstood the insulation tests.

STATE OF MISSOURI
SUSMITHA
TARLAPALLY
NUMBER
PE-2015000613
PROFESSIONAL ENGINEER

T. Susmitha

Susmitha Tarlapally
Electrical Engineering Manager
Distribution Transformers Division
2015-09-02

PANELBOARD

THIS SECTION CONTAINS DETAILED DRAWINGS ON THE FOLLOWING PANELS:

DESIGNATION	*TYPE*	*VOLTAGE*	*AIC*	*MOUNTING*	*PBA*	*NOTES AND REMARKS*
PG-LV	NQ	208Y/120V 3Ph 4W 60Hz	22kA	Top Trim w/ Box	711SS	Standard Panel (Box Ahead),Standard Solid Neutral,Standard Ground Bar Group User Placement

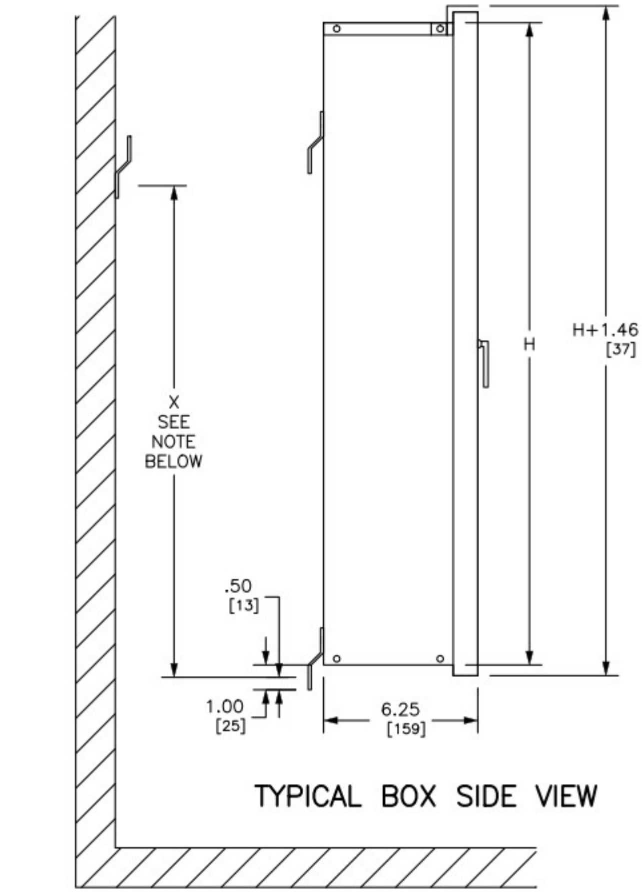
PLEASE CONFIRM THAT THE PANEL DETAILS MATCHES THE PLANS AND SPECIFICATIONS.

ALL LUGS ON PANELBOARDS AND CIRCUIT BREAKERS ARE RATED AT 75 DEGR C.

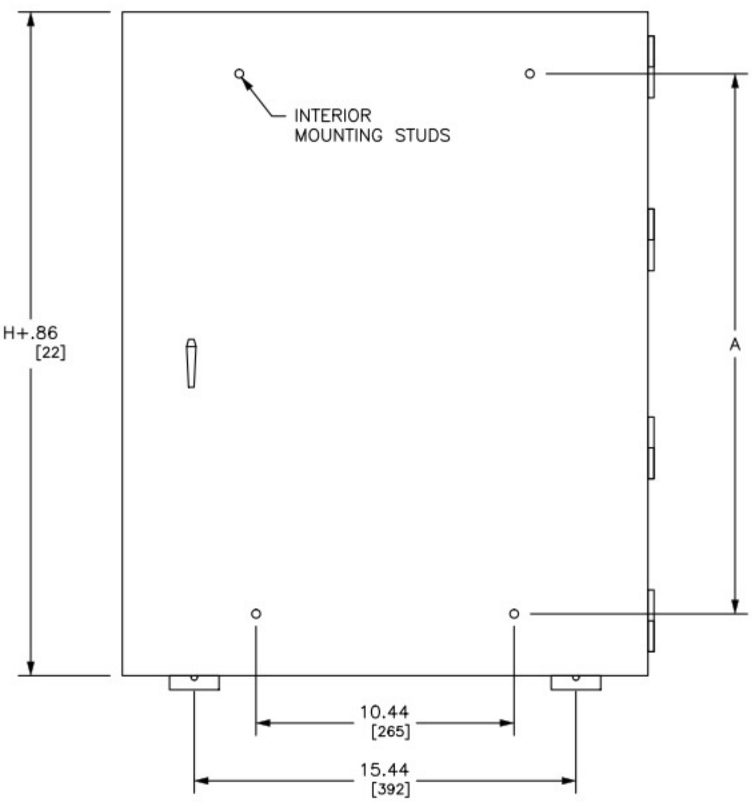
ALL LUGS ARE SIZED PER UL STANDARDS. PLEASE CONFIRM THAT THEY ARE APPROPRIATE FOR THE QUANTITY AND SIZE OF THE CABLE BEING CONNECTED.

PLEASE CONFIRM TOP OR BOTTOM FEED, AND SURFACE OR FLUSH COVERS.

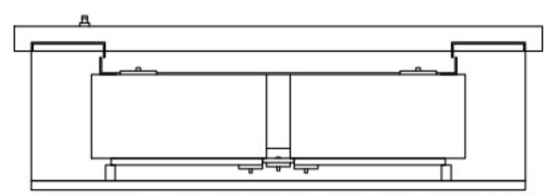
REV	DESCRIPTION	BY	DATE	-	----	--	--/--/--
-	----	--	--/--/--	-	----	--	--/--/--



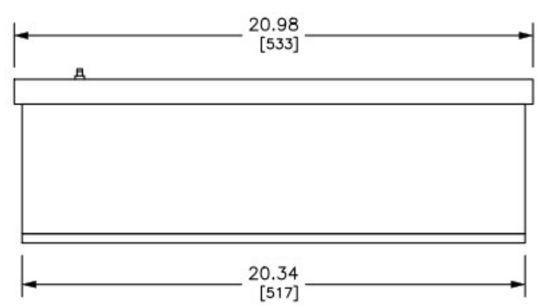
TYPICAL BOX SIDE VIEW



TYPICAL FRONT VIEW



TYPICAL MOUNTING OF QO,QOB BREAKERS



TYPICAL ENDWALL

DUAL DIMENSIONS: INCHES / MILLIMETERS

BOX HEIGHT		MOUNTING INTERIOR HEIGHT	
H		A	
IN	MM	IN	MM
26.00	660	21.00	533
32.00	813	27.00	686
38.00	965	33.00	838
44.00	1118	39.00	991
50.00	1270	45.00	1143
56.00	1422	51.00	1295
62.00	1575	57.00	1448
68.00	1727	63.00	1600
74.00	1880	69.00	1753
80.00	2032	75.00	1905
86.00	2184	81.00	2057

NOTE: FOR "X" DIMENSION, SUBTRACT 6.60/[168] FROM THE BOX HEIGHT.

REFER TO DP CATALOG CLASS 1640 FOR ADDITIONAL INFORMATION

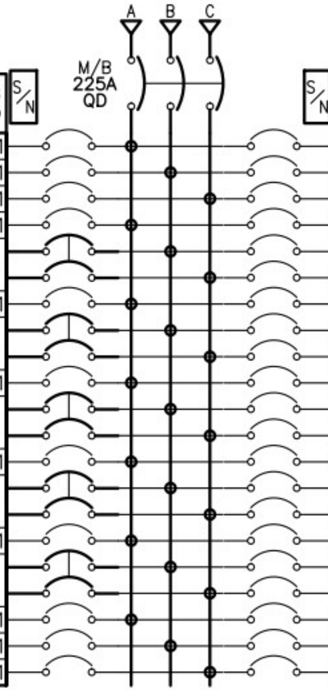
NQ PANELBOARDS MEET THE APPLICABLE REQUIREMENTS OF UL AND CSA.

BOX: STAINLESS STEEL INCLUDES HINGED COVER. MOUNTS TO WALL WITH MOUNTING BRACKETS.

LOCK: CHROME-PLATED HANDLE LOCK. NSR 251 KEY. NOT PROVISIONS FOR PADLOCK.

JOB NAME:	WASTEWATER TREATMENT PLANT #2	EQUIPMENT DESIGNATION:	PG-LV
JOB LOCATION:	WICHITA KS	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	PAD DRAWiNG
ENGR:		SQUARE D by Schneider Electric	
DATE:	July 15 2015		
DRAWING STATUS:	RECORD	DWG# A36419323-711-01	PG 1 OF 1 REV -

REV	DESCRIPTION	BY	DATE	–	----	--	--/--/--
–	----	--	--/--/--	–	----	--	--/--/--



CKT NO	ACCESSORIES	TYPE	RATING AMP/P	RATING AMP/P	TYPE	ACCESSORIES	CKT NO
1		QOB	20/1	20/1	QOB		2
3		QOB	20/1	20/1	QOB		4
5		QOB	20/1	20/1	QOB		6
7		QOB	20/1	20/1	QOB		8
9		QOB	35/2	20/1	QOB		10
11				20/1	QOB		12
13		QOB	20/1	20/1	QOB		14
15		QOB	35/2	20/1	QOB		16
17				20/1	QOB		18
19		QOB	20/1	20/1	QOB		20
21		QOB	35/2	20/1	QOB		22
23				20/1	QOB		24
25		QOB	20/1	20/1	QOB		26
27		QOB	35/2	20/1	QOB		28
29				20/1	QOB		30
31		QOB	20/1	20/1	QOB		32
33		QOB	20/2	20/1	QOB		34
35				20/1	QOB		36
37		QOB	20/1	20/1	QOB		38
39		QOB	20/1	20/1	QOB		40
41		QOB	20/1	20/1	QOB		42

PHYSICAL DATA

UL Service Entrance
ENCLOSURE Type 3R/4/4X/5/12 StainlessStl
FRONT CAT#: Trim w/Box
BOX CAT#: MH50WPSSULNF
DIMENSIONS:
50''H x 20''W x 6.5''D
WIRE BENDING SPACE:
TOP – 9.26
BOTTOM – 5
SIDE – 6.13
PBA: 711SS
BUSSING: Aluminum
Tin Plated
OPTIONAL FEATURES:
GROUP USER PLACEMENT
ALUMINUM SOLID NEUTRAL
ALUMINUM GROUND BAR

ELECTRICAL DATA

SYSTEM: 208Y/120V 3Ph 4W 60Hz
System Ampacity: 225A
22kA SYMS. SCCR
MAIN: MAIN BREAKER QD 225A
Feeders Series Rated w/ QD
Top FEED
25kA AIR
INCOMING CONDUCTORS(S) PER NEC:
#4 – 300 kcmil
BRANCH MOUNTING TYPE: BOLT–ON
-----------BRANCH SUMMATION-----------
32 – 20A/1P QOB   4 – 35A/2P QOB
1 – 20A/2P QOB

JOB NAME:	WASTEWATER TREATMENT PLANT #2	EQUIPMENT DESIGNATION:	PG-LV
JOB LOCATION:	WICHITA KS	EQUIPMENT TYPE:	NQ (Circuit Breaker Type)
DRAWN BY:	CAD	DRAWING TYPE:	ONE LINE DIAGRAM
ENGR:		SQUARE D by Schneider Electric	
DATE:	July 15 2015		
DRAWING STATUS:	RECORD	DWG# 036419323-001-01	PG 1 OF 1 REV –

NQ/NQM Panelboards and QONQ Load Centers

Information Manual
Class 1640

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Instruction Bulletin

80043-712-06 Rev. 01

02/2015

Retain for future use.

SQUARE D™

by Schneider Electric

Hazard Categories and Special Symbols

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER
DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING
WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

⚠ CAUTION
CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

NOTICE
NOTICE is used to address practices not related to physical injury. The safety alert symbol is not used with this signal word.

NOTE: Provides additional information to clarify or simplify a procedure.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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Introduction

This bulletin contains instructions for installing Square D™ brand NQ circuit breaker panelboards and QONQ load centers. These panelboards and load centers are Underwriters Laboratories (cULus) listed and accept QO™ and QOB branch circuit breakers.

For technical support on the installation of this panelboard, contact the Square D/Schneider Electric Customer Information Center at (1-888-778-2733).

See the labels on the equipment for rating and safety information. Additional equipment labels are provided with this document.

Safety Precautions

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462 or NOM-029-STPS.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn OFF all power supplying this equipment before working on or inside the equipment.
- Always use a properly-rated voltage sensing device to confirm all power is OFF.
- Read and understand this entire instruction bulletin and the included NEMA PB 1.1 standards publication before installing, operating, or maintaining this equipment.
- Local codes vary, but are adopted and enforced to promote safe electrical installations. A permit may be needed to do electrical work, and some codes may require an inspection of the electrical work.
- Replace all devices, doors and covers before turning ON power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Installation

This section provides instructions for the following NQ panelboard and QONQ load center procedures:

Interior Mounting for Square D Brand Enclosures

A separate standards publication, titled "General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less" (NEMA PB1.1), has been provided with this equipment. Familiarize yourself with the content of this document before proceeding with any of the following procedures.

If you did not receive a copy of this document, or if you have any questions regarding this equipment, contact your local distributor or Schneider Electric representative.

NOTICE

HAZARD OF EQUIPMENT DAMAGE DUE TO LOOSE CONNECTIONS

- Ensure all connections are properly tightened.
- Refer to the torque information label provided on the panelboard before tightening the connections.

Failure to follow these instructions can result in equipment damage.

To properly mount and install the NQ panelboard or QONQ load center interior, please refer to the NEMA PB 1.1 standards publication, and follow the instructions below for either ""Surface Mounting (Enclosure Mounted on Wall)" on page 7" or ""Flush Mounting (Enclosure Recessed in Wall)" on page 7."

Surface Mounting (Enclosure Mounted on Wall)

1. Mount the enclosure as instructed in the NEMA PB 1.1 standards publication.
2. Remove the interior trim from the trim brackets.
3. Install the interior as described below:
    a. Set the interior on the enclosure studs. An elevating screw is not required (See Figure 1 on 8).
    b. Tighten the keps nuts against the interior side rails until the rails are against the back of the enclosure.
    c. Remount the interior trim after wiring.
4. If used as service entrance equipment, neutral bonding is required. See the “Neutral Bonding Strap/Cable Installation” instructions on page 9.
5. Apply equipment labels (located in the bag assembly) as directed by the instructions on the back of the equipment label sheet.

Flush Mounting (Enclosure Recessed in Wall)

1. Mount the enclosure as instructed in the NEMA PB 1.1 standards publication.
2. Remove the interior trim from the trim brackets.
3. Install the interior as described below:
    a. Thread the (4) 10-32 x .875 in. self-tapping, elevating screws provided with the flush trim into the side rails.
    b. Set the interior on the enclosure studs (see Figure 1 on 8). Place the keps nuts onto the enclosure studs, but do not tighten.
    c. Adjust the screws so that the lip of the interior trim is approximately 0.25 inches (6.35 mm) from wall line.
    d. Tighten the keps nuts against the side rails.
    e. Remount the interior trim after wiring.
4. If used as service entrance equipment, neutral bonding is required. See the “Neutral Bonding Strap/Cable Installation” instructions on page 9.
5. Apply equipment labels (located in the bag assembly) as directed by the instructions on the back of the equipment label sheet.

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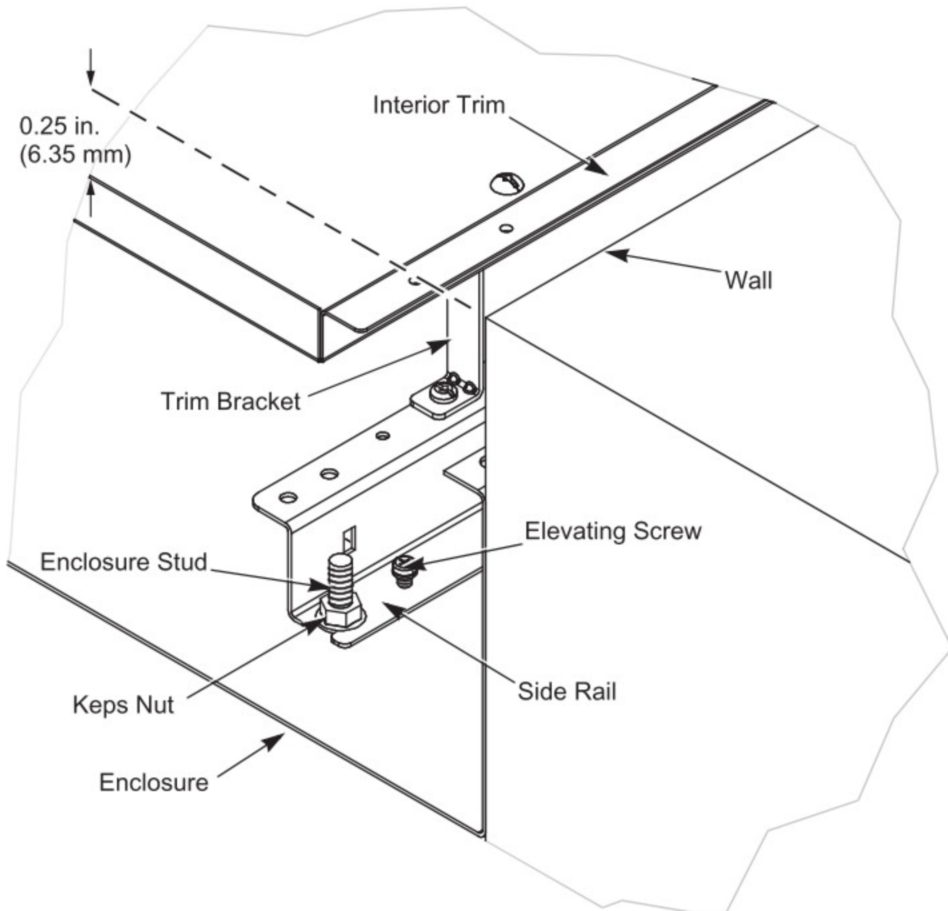
Figure 1: Interior Mounting of Square D Brand Enclosures



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Neutral Bonding Strap/Cable Installation

The neutral bonding strap/cable should be used only when the panelboard is **installed** as service entrance equipment.

To properly bond the neutral to the panelboard, follow the instructions for either “100 or 250 A Maximum NQ Panelboards” or “400 or 600 A Maximum NQ Panelboards and QONQ Load Centers” below and on page 11, respectively.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462 or NOM-029-STPS.
- Turn OFF all power supplying this equipment before working on or inside the equipment.
- The main bonding strap/cable should be used only when the panelboard is installed as service entrance equipment.
- Do not mix the mounting screws with the interior trim screws.

Failure to follow these instructions will result in death or serious injury.

NOTE: The bonding strap/cable parts are found in the bag assembly provided with the interior.

100 or 250 A Maximum NQ Panelboards

To install a neutral bonding strap on a 100 or 250 A maximum NQ panelboard, refer to Figure 2 and follow the instructions below.

1. Align the bonding strap on the side rail, as pictured.

   NOTE: For some applications, it may be necessary to remove the lug (not pictured) before installing the bonding strap.

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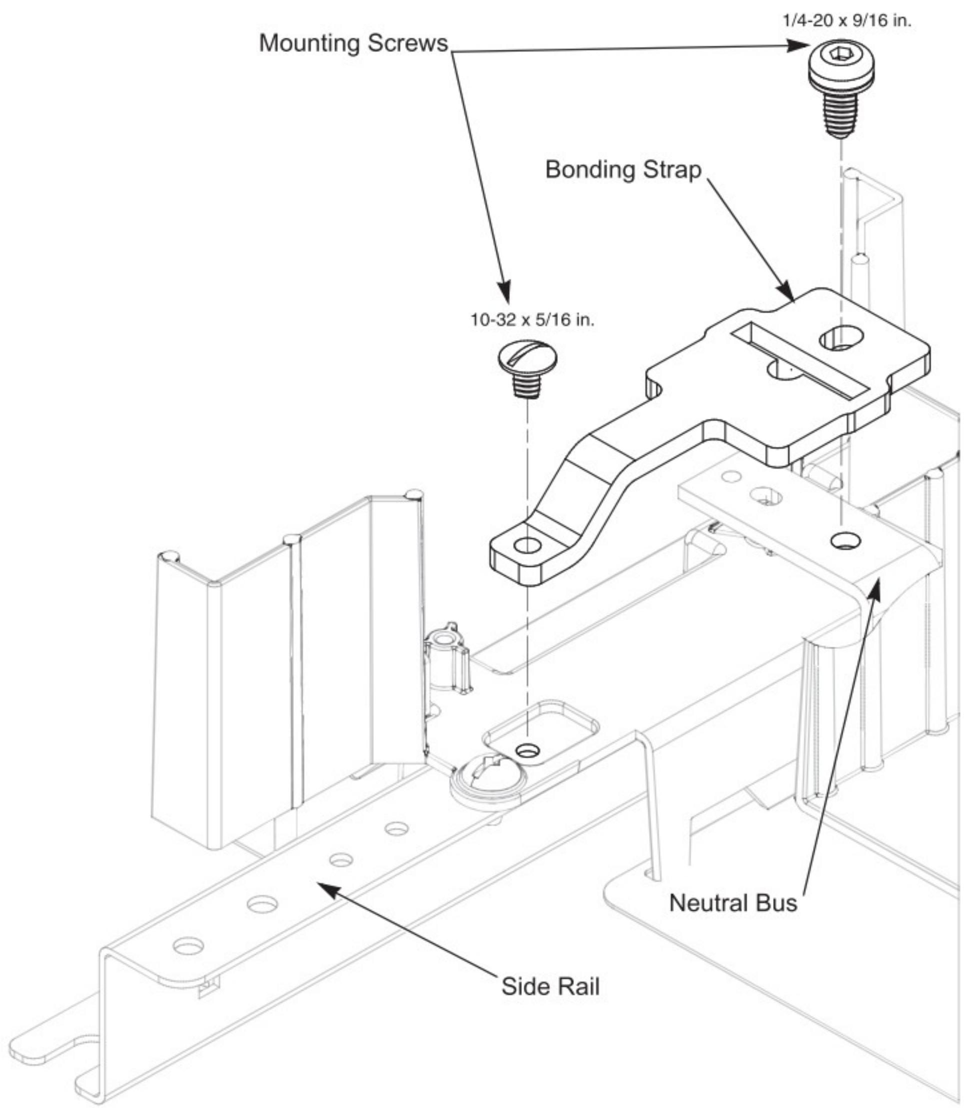
2. Insert the two mounting screws, as pictured. Tighten the 10-32 screw to 10–12 lb-in (1.1–1.4 N•m) and the 1/4-20 to 25–30 lb-in (2.8–3.4 N•m).

   NOTE: If the lug was removed in Step 1 above, reinstall it on top of the bonding strap. Use the 1/4-20 x 11/16 in. mounting screw with feed-through lug, sub-feed lug, sub-feed breaker, or 200% neutral applications. Use the 1/4-20 x 7/8 in. lug mounting screw with 200% neutral on 225 A applications with feed-through lug, sub-feed lug, or sub-feed circuit breaker applications. Lug mounting screws are provided in the bonding strap bag assembly.

Figure 2: Bonding Strap Installation — 100 or 250 A Maximum NQ Panelboards



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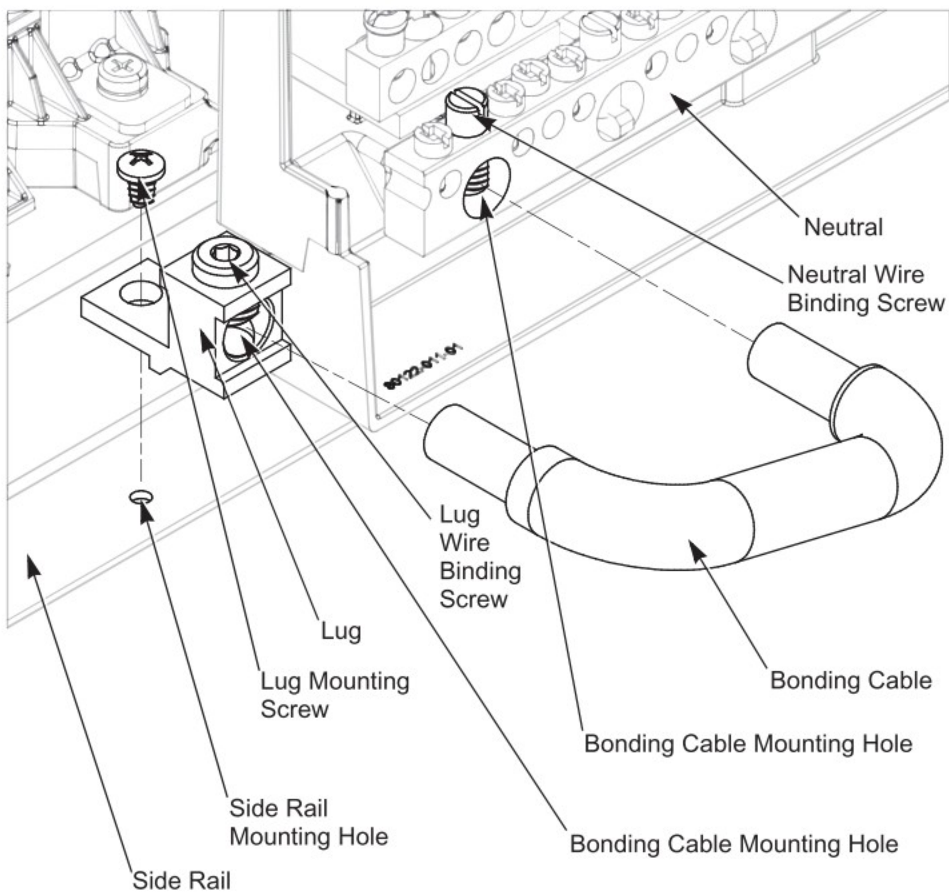
400 or 600 A Maximum NQ Panelboards and QONQ Load Centers

To install a neutral bonding cable on a 400 or 600 A maximum NQ panelboard and QONQ load center, refer to Figure 3 and follow the instructions below.

1. Align the lug on the side rail mounting hole, as pictured.
2. Tighten the lug mounting screw against the side rail to 10–12 lb-in (1.1–1.4 N•m).
3. Align the bonding cable, as pictured, and insert it into the lug and neutral mounting holes.
4. Tighten both the lug wire binding screw and the neutral wire binding screw to 45–50 lb-in (5.1–5.6 N•m).

Figure 3: Bonding Cable Installation — 400 or 600 A Maximum NQ Panelboards and QONQ Load Centers



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QO and QOB Circuit Breaker Installation and Removal

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462 or NOM-029-STPS.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn OFF all power supplying this equipment before working on or inside equipment.
- Always use a properly-rated voltage sensing device to confirm that all power is OFF.
- All unused spaces must be filled with blank fillers.
- Replace all devices, doors and covers before turning ON power to this equipment.

Failure to follow these instructions will result in death or serious injury.

QO and QOB Breaker Installation

Refer to Figure 4 on 14 for the following instructions:

1. Turn OFF all power to the panelboard.
2. Turn the breaker OFF.
3. Remove the interior trim.
4. Snap the wire terminal end of the circuit breaker onto the mounting rail.
5. Engage the branch connector.

   For QO Circuit Breakers:

   a. Push inward until the plug-on jaws fully engage the branch connector.

   For QOB Circuit Breakers:

   a. Push inward until the breaker connector is centered on the branch connector mounting hole. Engage the screw into the branch connector hole and tighten it to the torque values shown on the interior wiring and torque diagram.

6. Install the load wire.
7. Reinstall the interior trim.

QO and QOB Breaker Removal

Refer to Figure 4 on 14 for the following instructions:

1. Turn OFF all power to the panelboard.
2. Remove the interior trim.
3. Remove the load wire.
4. Disengage the branch connector.

   For QO Circuit Breakers:

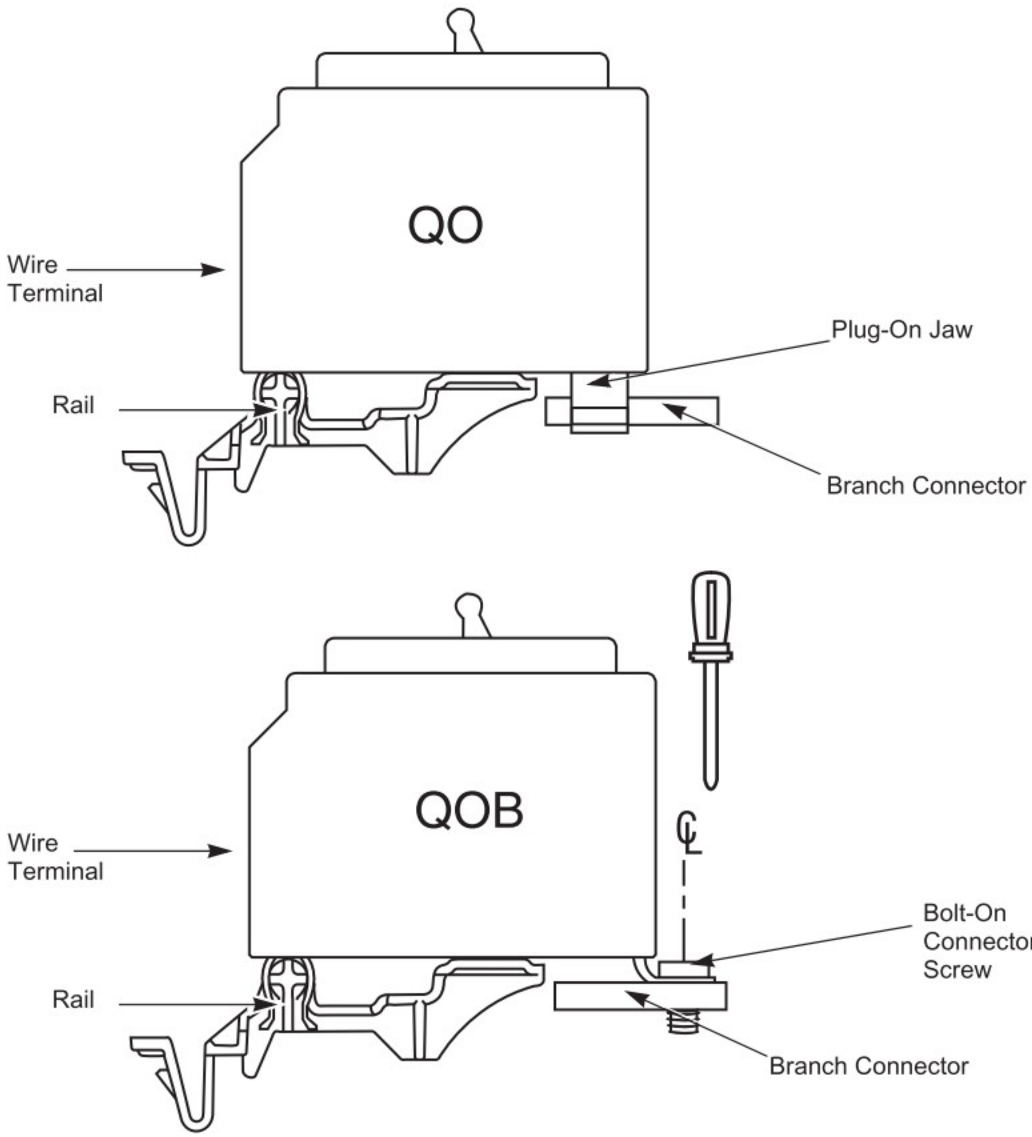
   a. Pull outward until the plug-on jaws fully disengage the branch connector.

   For QOB Circuit Breakers:

   a. Loosen the screw in the breaker connector and pull the breaker off of the branch connector.

5. Snap the wire terminal end of the circuit breaker off of the mounting rail.
6. Reinstall the interior trim.

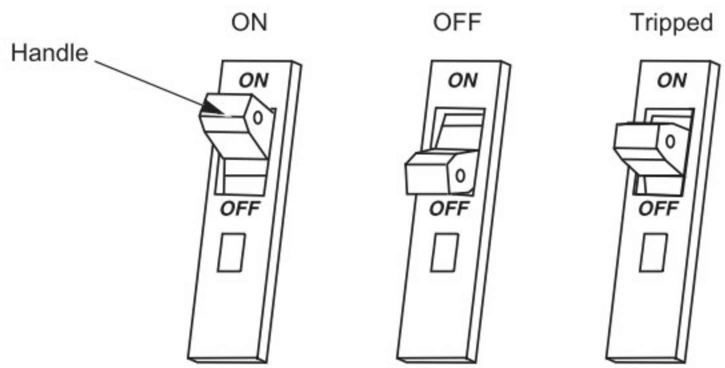
Figure 4: QO and QOB Circuit Breaker Installation and Removal



Circuit Breaker Reset Instructions

If the circuit breaker is tripped, the handle will be at the mid-position between ON and OFF. To reset the circuit breaker, push the handle to the OFF position, then to the ON position.

Figure 5: Circuit Breaker Handle Positions



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Interior Trim Preparation

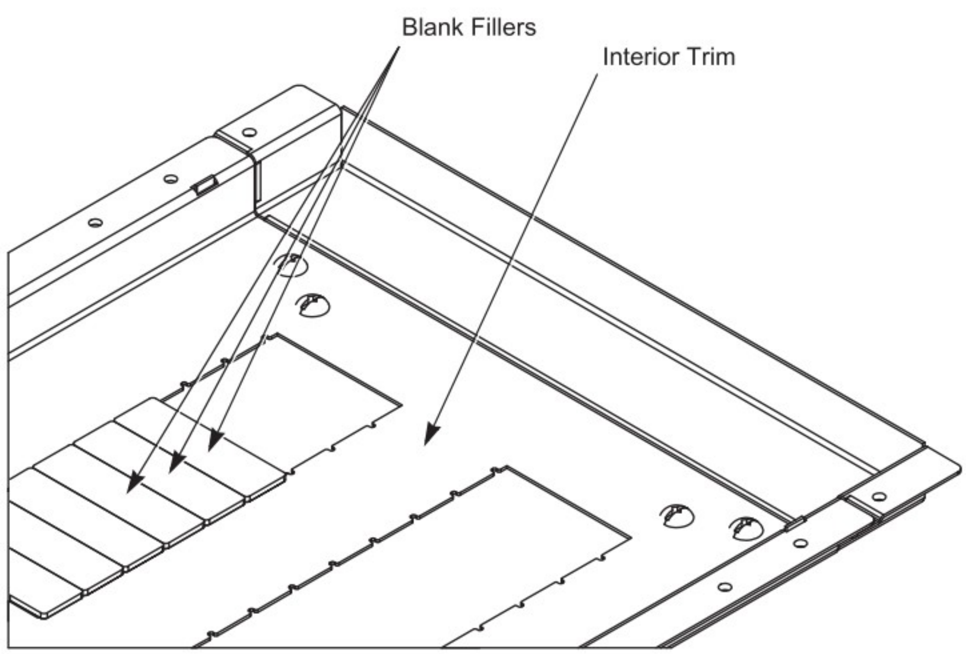
⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462 or NOM-029-STPS.
- Before energizing the panelboard, all unused spaces must be filled with blank fillers.
- Replace all devices, doors, and covers before energizing this equipment.

Failure to follow this instruction will result in death or serious injury.

Figure 6: Interior Trim Diagram



NOTE: The back of the interior trim lists the catalog number for its corresponding compatible blank fillers.

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Appendix 1: Specifications

Typical Wiring

Table 1: Panelboard Typical Wiring[1]

Voltage AC	1-Phase Panelboards		3-Phase Panelboards	
	Phase	Wires	Phase	Wires
208Y/120	—	—	3	4
120/240	1	3	—	—
240[2]	1	2	3	3
240[3]	1	3	—	—
240/120[4]	—	—	3	4 Delta

1 Additional information is provided on the panelboard. See the main circuit breaker rating, if used.

2 For this system, the neutral is not used and only circuit breakers rated 240 V AC minimum should be used. Do not use circuit breakers rated 120 V or 120/240 V AC.

3 For a grounded “B” phase system, only circuit breakers rated 240 V AC minimum should be used. Do not use circuit breakers rated 120 V or 120/240 V AC.

4 When wiring for a delta system, phases “A” and “C” must be 120 V to neutral, phase “B” 208 V to neutral. Connect only circuit breakers rated 240 V AC minimum. Do not use circuit breakers rated 120 V or 120/240 V to “B” phase.

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Integral Main or Sub-Feed:
DJ, FI, KI, H, J, LA, LC, LH, QB, QD, QG, QJ, QO(B)VH

Figure 7: NQ/NQM 100–225 A Main Lugs or 100–250 A Main Breaker Diagram

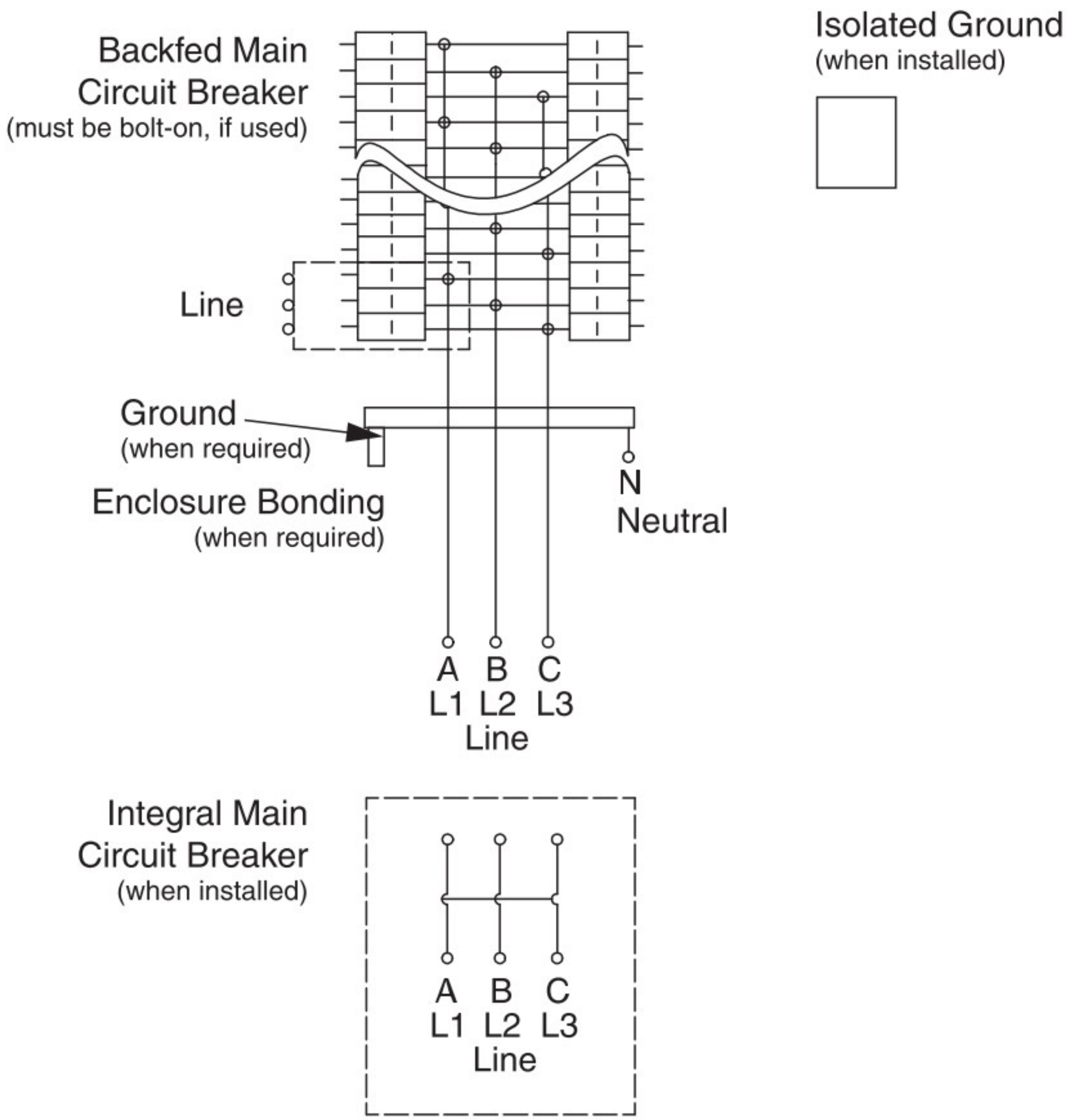

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Figure 8: NQ Panelboard or QONQ Load Center 400–600 A Main Lugs or Main Circuit Breaker with or without Feed-Through Lugs Diagram

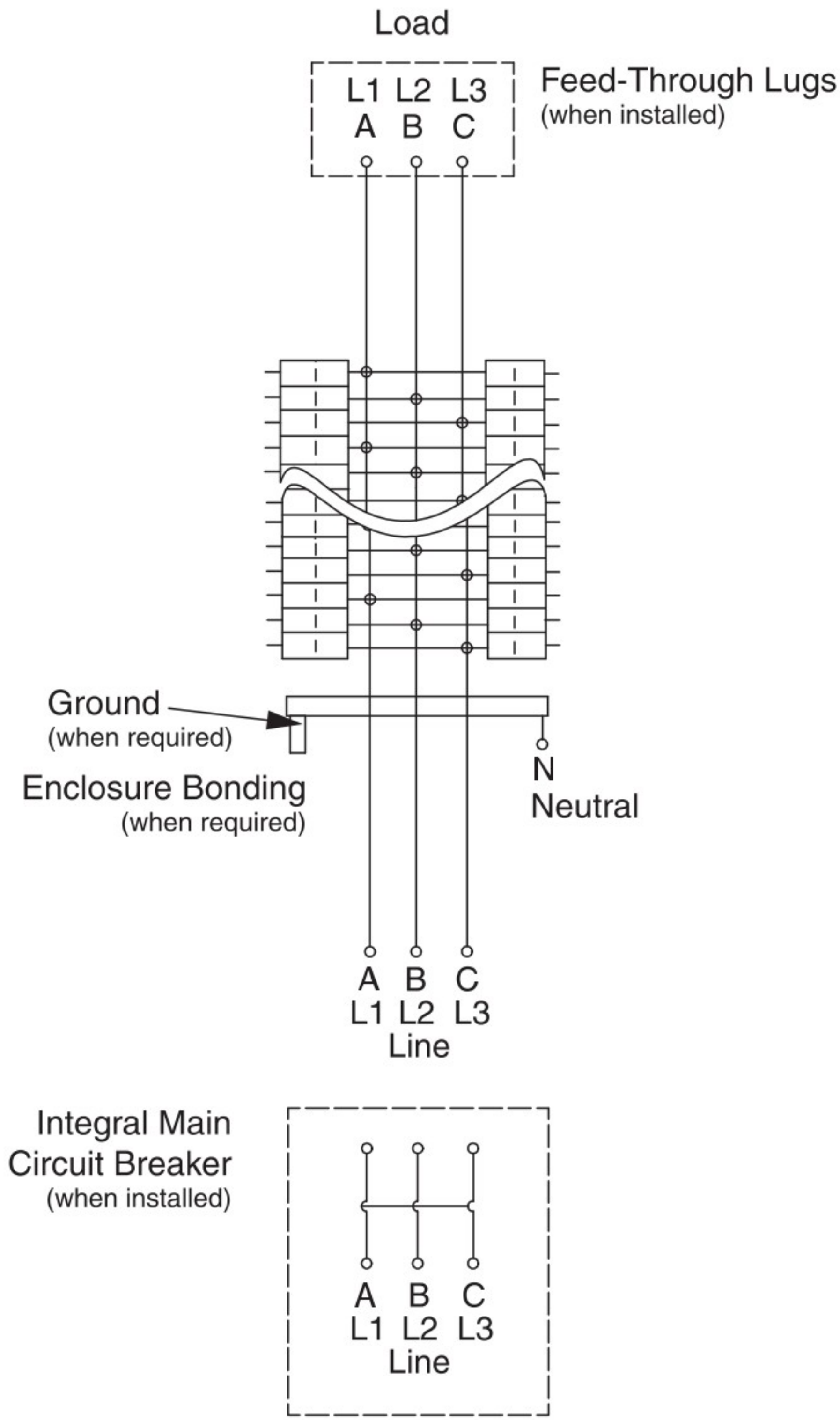

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Figure 9: NQ Panelboard or QONQ Load Center 400–600 A Main Circuit Breaker with Feed-Through Lugs or Sub-Feed Circuit Breakers Diagram

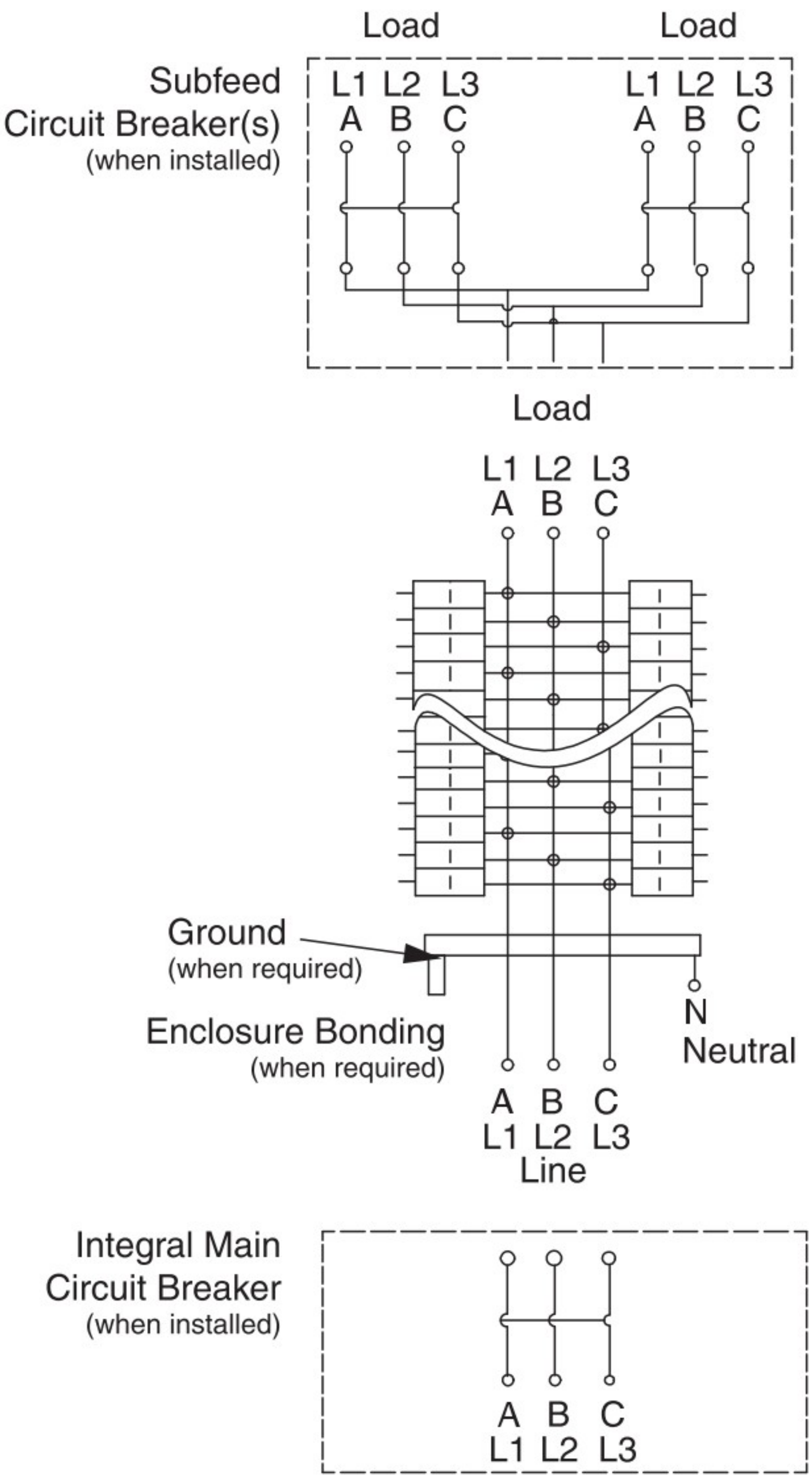
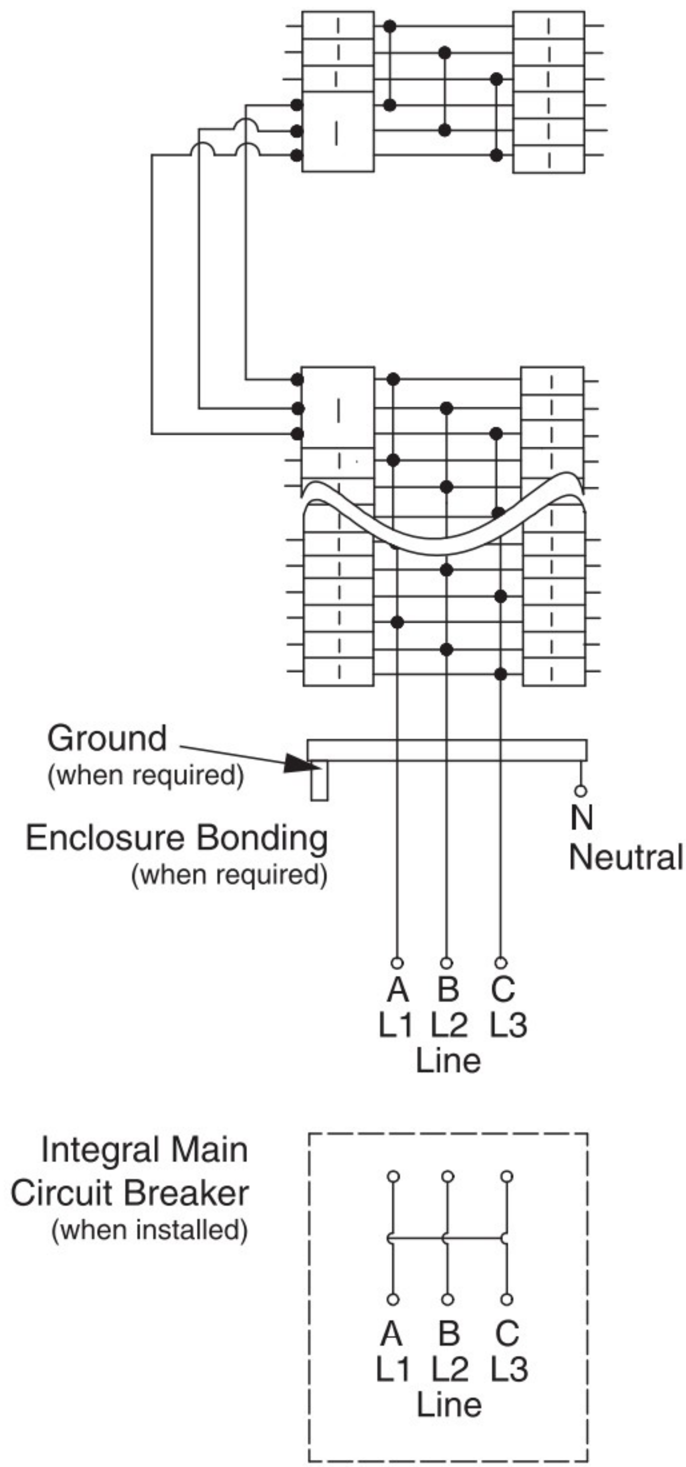


Figure 10: Typical NQ Panelboard with Split Bus Diagram



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Panelboard Ratings

Refer to NEC section 110-22 and CEC rule 14-014 for more information. The series rated system label is located in the bag assembly.

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical)

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
120/240 1P/3W	22,000	MG	QO (B)	15–30 A	—	—
	25,000	LD, HD, JD	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	65,000	HG, JG	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LG	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LJ	QO (B) GFI	15–30 A	40–60 A	—
			QO (B) EPD	15–30 A	40–60 A	—
	100,000	HJ, JJ	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
120/240 1P/3W	100,000	LJ	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) H	—	15–100 A	—
			QO (B) GFI	—	15–30 A	—
			QO (B) EPD	—	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		DJ 400 A	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	—	150 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		QJ	QO (B)	15–70 A	15–125 A	—
			QO (B) AS	15–30 A	15–30 A	—
			QO (B) VH	—	150 A	—
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	125,000	HL, JL	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	—
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
208Y/120 3P/4W	18,000	LA/LH (L) 34200MC	QO (B)	15–30 A	15–30 A	15–30 A
		LA/LH (L) 34225MC				
		LA/LH (L) 34250MC				
		LA/LH (L) 34400MC				

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
208Y/120 3P/4W	25,000	LD	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–30 A	15–125 A	15–150 A
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) EPD	15–30 A	15–60 A	15–30 A
			QO (B) EPE	—	—	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	30,000	DJ-W 150 A MC[7]	QO (B)	15–70 A	15–100 A	—
			QO (B) VH	—	15–125 A	15–150 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
		DJ-W 250 A MC[7]	QO (B)	15–70 A	15–100 A	—
			QO (B) VH	—	—	15–100 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
		DJ-W 600 A MC[7]	QO (B)	15–70 A	15–100 A	—
			QO (B) VH	—	—	15–150 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
	65,000	LG	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) EPD	15–30 A	15–60 A	15–30 A
			QO (B) EPE	—	—	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
208Y/120 3P/4W	65,000	LJ	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) EPD	15–30 A	15–60 A	15–30 A
			QO (B) EPE	—	—	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LL	QO (B) GFI	—	—	15–30 A
			QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
	100,000	DJ 400 A	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	—	—	15–150 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		QJ	QO (B)	15–70 A	15–125 A	15–30 A
			QO (B) VH	—	—	15–150 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	15–30 A	15–60 A	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LJ	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	—	15–30 A	—
			QO (B) EPD	—	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	22,000	QO (B) VH	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) PL	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	25,000	QD	QO (B)	15–70 A	15–125 A	15–30 A
			QO (B) VH	—	—	35–150 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		ED, FD	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		KD	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) AS	15–30 A	15–30 A	15–30 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
		HD, JD	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) VH	—	—	35–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	25,000	LD	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–30 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) EPD	15–30 A	15–60 A	15–30 A
			QO (B) EPE	—	—	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	42,000	LA, MA	Q2L-H	—	100–225 A	100–225 A
			QDL	—	70–225 A	70–225 A
		LC 400 A	QO (B)	15–70 A	15–70 A	—
			QO (B) VH	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LC 600 A	QO (B) VH	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		MG	QO (B) VH	15–30 A	15–30 A	15–30 A
	65,000	LC 400 A	QO (B)	15–30 A	15–30 A	—
			QO (B) VH	15–30 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LC 600 A	QO (B) VH	15–30 A	15–125 A	15–150 A
			QO (B) GFI	—	—	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		DJ 400 A	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	—	—	15–150 A
			QO (B) H	—	15–100 A	—

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	65,000	DJ_W	QO (B)	15–70 A	15–150 A	—
			QO (B)-VH	—	110–125 A	15–150 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		DJ, DG, DL 150–600 A	QO (B) EPD	—	—	15–30 A
		EG, FG, KG	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		QG	QO (B)	15–70 A	15–125 A	15–30 A
			QO (B) VH	—	—	35–150 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		HG, JG	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) VH	—	—	35–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		FC_ or KC_22___	QO (B)	15–70 A	15–100 A	15–100 A
		FC_ or KC_34___	QO (B) AS	15–30 A	15–30 A	15–30 A

Continued on next page

Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	65,000	LG	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	15–30 A	15–60 A	15–30 A
			QO (B) EPD	15–30 A	15–60 A	15–30 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		LJ	QO (B)	15–70 A	15–125 A	—
			QO (B) GFI	15–30 A	40–60 A	—
			QO (B) EPD	15–30 A	40–60 A	15–30 A
			QO (B) EPE	—	—	15–30 A
		LL	QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
	100,000	FC_ or KC_22___	QO (B) GFI	15–30 A	15–30 A	—
		FC_ or KC_34___	QO (B) AFI	15–20 A	—	—
		DJ 400 A	QO (B)	15–70 A	15–125 A	—
			QO (B) H	—	15–100 A	—
			QO (B) VH	—	—	15–150 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		EJ	QO (B)	15–70 A	15–125 A	15–100 A
		LJ	QO (B)	15–70 A	15–125 A	—
			QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	—	15–30 A	—
			QO (B) EPD	—	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	100,000	HJ, JJ	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) H	—	15–100 A	—
			QO (B) VH	—	—	35–150 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	125,000	HL, JL	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) H	—	15–100 A	—
			QO (B) VH	—	—	35–150 A
			QO (B) PL	15–30 A	15–60 A	15–30 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	200,000	FI, KI, HR, JR	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
240 3P/3W or 240 1P/2W (two pole only)	22,000	QO (B) VH	QO (B)	—	—	15–100 A
			QO (B) GFI	—	—	15–50 A
			QO (B) PL	—	15–30 A	—
		Q2-H	QO (B)	—	—	15–30 A

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
240 3P/3W or 240 1P/2W (two pole only)	25,000	QD	QO (B)	—	—	15–30 A
			QO (B) VH	—	—	35–150 A
			QO (B) H	—	15–100 A	—
			QO (B) PL	—	15–60 A	15–30 A
			QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) GFI	—	—	15–50 A
		ED, FD	QO (B)	—	—	15–100 A
			QO (B) GFI	—	—	15–50 A
		KD	QO (B)	—	—	15–100 A
		HD, JD	QO (B)	—	—	15–100 A
			QO (B) VH	—	—	35–150 A
			QO (B) H	—	15–100 A	—
			QO (B) GFI	—	—	15–50 A
	25,000	LD	QO (B) VH	—	—	15–150 A
			QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
	42,000	LA, MA	QDL	—	70–225 A	70–225 A
		LC 400 A	QO (B) VH	—	—	15–100 A
		LC 600 A	QO (B) VH	—	—	15–100 A
		MG	QO (B) VH	—	—	150 A
	65,000	LC 400 A	QO (B) VH	—	—	15–100 A
		LC 600 A	QO (B) VH	—	—	15–30 A
		DJ 400 A	QO (B) VH	—	—	15–150 A
			QO (B) H	—	15–100 A	—
		DJ, DG, DL 150–600 A	QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
		EG, FG, KG	QO (B)	—	—	15–100 A
			QO (B) GFI	—	—	15–50 A

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

<table>
<tr><th rowspan="2">Max. System Voltage AC [1, 2]</th><th rowspan="2">Max. Short Circuit Current Rating</th><th rowspan="2">Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses</th><th colspan="4">Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]</th></tr>
<tr><th>Type</th><th>1 Pole</th><th>2 Pole</th><th>3 Pole</th></tr>
<tr><td rowspan="30">240 3P/3W or 240 1P/2W (two pole only)</td><td rowspan="17">65,000</td><td rowspan="3">QG</td><td>QO (B)</td><td>—</td><td>—</td><td>15–30 A</td></tr>
<tr><td>QO (B) VH</td><td>—</td><td>—</td><td>35–150 A</td></tr>
<tr><td>QO (B) H</td><td>—</td><td>15–100 A</td><td>—</td></tr>
<tr><td>QG, HG, JG</td><td>QO (B) PL</td><td>—</td><td>—</td><td>15–30 A</td></tr>
<tr><td rowspan="3">HG, JG</td><td>QO (B)</td><td>—</td><td>—</td><td>15–100 A</td></tr>
<tr><td>QO (B) VH</td><td>—</td><td>—</td><td>35–150 A</td></tr>
<tr><td>QO (B) H</td><td>—</td><td>15–100 A</td><td>—</td></tr>
<tr><td>FC_ or KC_22___</td><td>QO (B)</td><td>—</td><td>—</td><td>15–100 A</td></tr>
<tr><td>FC_ or KC_34___</td><td>QO (B) AS</td><td>—</td><td>15–30 A</td><td>15–30 A</td></tr>
<tr><td rowspan="4">LG</td><td>QO (B) VH</td><td>—</td><td>—</td><td>15–150 A</td></tr>
<tr><td>QO (B) H</td><td>—</td><td>15–100 A</td><td>—</td></tr>
<tr><td>QO (B) EPD</td><td>—</td><td>—</td><td>15–30 A</td></tr>
<tr><td>QO (B) EPE</td><td>—</td><td>—</td><td>15–30 A</td></tr>
<tr><td rowspan="2">LJ</td><td>QO (B) EPD</td><td>—</td><td>—</td><td>15–30 A</td></tr>
<tr><td>QO (B) EPE</td><td>—</td><td>—</td><td>15–30 A</td></tr>
<tr><td rowspan="2">LL</td><td>QO (B) EPD</td><td>—</td><td>—</td><td>15–30 A</td></tr>
<tr><td>QO (B) EPE</td><td>—</td><td>—</td><td>15–30 A</td></tr>
<tr><td rowspan="3">100,000</td><td>FC_ or KC_24___</td><td rowspan="2">QO (B) GFI</td><td rowspan="2">—</td><td rowspan="2">15–30 A</td><td rowspan="2">—</td></tr>
<tr><td>FC_ or KC_34___</td></tr>
<tr><td>DJ 400 A</td><td>QO (B) H</td><td>—</td><td>15–100 A</td><td>—</td></tr>
<tr><td rowspan="8">100,000</td><td>EJ, FJ</td><td>QO (B)</td><td>—</td><td>—</td><td>15–100 A</td></tr>
<tr><td rowspan="2">LJ</td><td>QO (B) VH</td><td>—</td><td>—</td><td>15–100 A</td></tr>
<tr><td>QO (B) H</td><td>—</td><td>15–100 A</td><td>—</td></tr>
<tr><td rowspan="5">HJ, JJ</td><td>QO (B)</td><td>—</td><td>—</td><td>15–100 A</td></tr>
<tr><td>QO (B) H</td><td>—</td><td>15–100 A</td><td>—</td></tr>
<tr><td>QO (B) VH</td><td>—</td><td>—</td><td>35–150 A</td></tr>
<tr><td>QO (B) EPD</td><td>—</td><td>—</td><td>15–30 A</td></tr>
<tr><td>QO (B) EPE</td><td>—</td><td>—</td><td>15–30 A</td></tr>
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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
240 3P/3W or 240 1P/2W (two pole only)	125,000	HL, JL	QO (B)	—	—	15–100 A
			QO (B) H	—	15–100 A	—
			QO (B) VH	—	—	35–150 A
			QO (B) EPD	—	—	15–30 A
			QO (B) EPE	—	—	15–30 A
	200,000	FI, KI, HR, JR	QO (B)	—	—	15–100 A
120/240 1P/3W	42,000	400 A Max. Class T3 Fuses	QO (B) VH	15–70 A	15–125 A	—
	65,000	400 A Max. Class J Fuses	QO (B) VH	15–70 A	15–150 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		400 A Max. Class T6 Fuses	QO (B) VH	15–70 A	15–150 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	100,000	200 A Max. Class T3 Fuses	QO (B)	15–70 A	15–125 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
	200,000	400 A Max. Class T3 Fuses	QO (B)	15–70 A	15–125 A	—
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	—
208Y/120 3P/4W	200,000	200 A Max. Class T6, J Fuses	QO (B)	15–70 A	15–125 A	—
			QO (B) GFI	—	—	15–50 A
			QO (B) EPD	—	—	15–50 A
		400 A Max. Class T3 Fuses	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) EPD	15–30 A	15–60 A	15–50 A

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
240/120 3P/4W	42,000	400 A Max. Class T3 Fuses	QO (B) VH	15–30 A	15–125 A	—
	50,000	400 A Max. Class T3 Fuses	QO (B) VH	—	—	15–30 A
	65,000	400 A Max. Class J Fuses	QO (B) VH	15–70 A	15–125 A	—
			QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
		400 A Max. Class T6 Fuses	QO (B) VH	15–70 A	15–125 A	15–150 A
			QO (B) AFI	15–20 A	—	—
	100,000	200 A Max. Class T3 Fuses	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) VH	—	—	15–30 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A
			QO (B) AFI	15–20 A	—	—
			QO (B) CAFI	15–20 A	—	—
			QOT	15–30 A	15–30 A	—
	200,000	200 A Max. Class J or T6 Fuses	QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A
		400 A Max. Class T3 Fuses	QO (B)	15–70 A	15–125 A	15–100 A
			QO (B) GFI	15–30 A	15–60 A	—
			QO (B) EPD	15–30 A	15–60 A	15–50 A
			QO (B) EPE	—	—	15–50 A

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Table 2: Series Connected Breaker Ratings (RMS Symmetrical) *(continued)*

Max. System Voltage AC [1, 2]	Max. Short Circuit Current Rating	Square D Brand Integral or Remote Main Circuit Breakers and Remote Main Fuses	Square D Brand Branch Circuit Breaker Catalog Designation and Allowable Ampere Ranges [3, 4, 5, 6]			
			Type	1 Pole	2 Pole	3 Pole
240 3P/3W or 240 1P/2W (two pole only)	50,000	400 A Max. Class J or T6 Fuses	QO (B) VH	—	—	15–30 A
	65,000	400 A Max. Class J Fuses	QO (B) VH	—	—	15–30 A
			QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A
		400 A Max. Class T6 Fuses	QO (B) VH	—	—	15–150 A
			QOB VH 1φ, 2W only	—	150 A	—
	100,000	200 A Max. Class T3 Fuses	QO (B)	—	—	15–100 A
			QO (B) VH	—	—	15–30 A
240 3P/3W or 240 1P/2W (two pole only)	200,000	200 A Max. Class J or T6 Fuses	QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A
		400 A Max. Class T3 Fuses	QO (B)	—	—	15–100 A
			QO (B) EPD	—	—	15–50 A
			QO (B) EPE	—	—	15–50 A

1 For shown circuit breakers rated less than this maximum voltage, the indicated short circuit current rating also applies, but at the voltage rating of the circuit breaker.

2 Short circuit tests are conducted at 100–105% of the maximum rated voltage of the panelboard.

3 Suffixes HID, SWD, and SWN may also be applied to the applicable branch circuit breakers shown above. Suffix SWN may **not** be applied in combination with LC main breakers.

4 Where QO (B) circuit breakers are shown above, QO (B) H, QO (B) VH, and QH (B) circuit breakers may also be used.

5 Where QO (B) GFI circuit breakers are shown above, QO (B) EPD and/or QO (B) EPE circuit breakers may also be used. QO-EPE only comes in 3 pole construction.

6 Where QO (B) AFI circuit breakers are shown above, QO (B) CAFI circuit breakers may also be used.

7 To achieve selective coordination, the rating of the DJ main circuit breaker must be at least two times greater than the ampere rating of any branch circuit breaker.

Table 3: NQ Panel Mission Critical Breaker Selectivity

Maximum SCCR (RMS Symmetrical)	Integral or Remote Main Circuit Breakers	Branch Circuit Breakers			
		Type	1-pole	2-pole	3-pole
Fully Rated and Selective to 10kA at 208Y/120 Vac or at 240/120 Vac	J-W, 250 A L-W, 250 A	QO(B) QO(B)-H QO(B)-VH QH	10–70	10–125	10–125
Series Rated and Selective to 12kA at 208Y/120 Vac or at 240/120 Vac	J-W, 250 A	QO(B) QO(B)-H QO(B)-VH QH	10–70	10–125	10–60
Series Rated and Selective to 15kA at 208Y/120 Vac or at 240/120 Vac	J-W, 250 A	QO(B) QO(B)-H QO(B)-VH QH	10–60	10–60	10–30
Series Rated and Selective to 18kA at 208Y/120 Vac or at 240/120 Vac	J-W, 250 A	QO(B) QO(B)-H QO(B)-VH QH	10–30	10–30	—
	L-W, 250 A	QO(B) QO(B)-H QO(B)-VH QH	10–60	10–60	10–60
Series Rated and Selective to 30kA at 208Y/120 Vac or at 240/120 Vac	L-W, 400 A L-W, 600 A	QO(B) QO(B)-H QO(B)-VH QH	15–70	15–150	15–150

Including AFI, CAFI, EPD and GFI Circuit Breakers

Table 4: Short Circuit Current Rating[1] for Main Lug Interiors with Sub-Feed or Feed-Through Lugs

Maximum System Voltage AC	Maximum Current Rating	Branch Circuits	Application	Adder[2]	Maximum Short Circuit Current Rating[3]
240	100	18, 30	SFL and FTL	—	10,000
	225	30, 42, 54, 72, 84	SFL	6 inches (152.4 mm)	
		42	FTL	—	
		30, 54, 72, 84		6 inches (152.4 mm)	
	400	30, 42, 54, 72, 84	SFL	—	25,000
		30, 84	FTL	—	
		42, 54, 72		6 inches (152.4 mm)	
	600	30, 42, 54, 72, 84	FTL	12 inches (304.8 mm)	

1 This rating applies to main lug interiors, equipped with sub-feed or feed-through lugs, where the device feeding the interior is unknown or not a Square D brand device. Use of a Square D brand main circuit breaker ahead of these lugs will result in a rating equal to the rating of the breaker. Short circuit tests are conducted at 100–105% of the maximum rated voltage of the panelboard.

2 The adder is the additional length of the enclosure.

3 RMS symmetrical amperes, for three cycles.

CE Marking

Interiors with the "CE" mark meet the IEC 61439-1 and IEC 61439-2 standards.
Main lug interiors with the "CE" mark have been tested to withstand 10,000 RMS symmetrical amperes for 30 cycles.
Interiors with the "CE" mark are only approved for use with QOXD or QOBXD branch circuit breakers which carry the "CE" mark.

Appendix 2: Accessory Kits

An assortment of field-installable accessory kits are available for NQ panelboards:

- Equipment Ground Bar Kits
- Oversized Lug Kits for 100–250 A Panelboards
- Sub-Feed Lug Kits for 100–400 A Panelboards
- Main Lug Kits
  - — Mechanical Lug Kits—Aluminum
  - — Mechanical Lug Kits—Copper
  - — Versa-Crimp® Compression Lug Kits—Aluminum
  - — Versa-Crimp Compression Lug Kits—Copper

Equipment Ground Bar Kits

Equipment ground bar kits, suitable for copper or aluminum wire, meet the grounding needs of NQ panelboards and QONQ load centers.

Table 5: Equipment Ground Bar Kits Specifications

Panelboard		Use Ground Bar Kit Catalog Number	
Branch Circuit	**Mains Rating**	**Aluminum[1]**	**Copper[2]**
1–42	600 A Maximum	(1) PK27GTA	(1) PK27GTACU
54–84		(2) PK27GTA	(2) PK27GTACU

1 Aluminum bars suitable for 60° C or 75° C Copper or Aluminum conductors.

2 Copper bars suitable for 60° C or 75° C Copper conductors.

NOTE: Ground bar mounting locations are identified by the ground symbol ⏚ stamped into the backwall of the enclosure.

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Oversized Lug Kits for 100–250 A Panelboards

Oversized lug kits are available for applications where termination conductors of 3 AWG or larger are required for the neutral.

Table 6: Oversized Lug Kits for 100–250 A Panelboards Specifications

Circuit Breaker Rating	Kit Catalog Number	Wire Range
70 A	QO70AN	(1) 10–2 Al ([1] 5.76–33.6 mm^2) (1)14–4 Cu ([1] 2.08–21.1 mm^2)
80–125 A	Q1100AN	(1) 4–1/0 Al/Cu ([1] 42.4–53.5 mm^2)
125–150 A	Q1150AN	(1) 1–4/0 Al/Cu ([1] 42.4–107 mm^2)

Sub-Feed Lug Kits for 100–400 A Panelboards

Sub-feed main lugs are available for 100, 225, or 400 A applications.

Table 7: Sub-Feed Lug Kits for 100–400 A Panelboards Specifications

Main Amps	Kit Catalog Number	Maximum Circuits
100	NQSFL1	18, 30
225	NQSFL2	30[1], 42[1], 54[1], 72[1], 84[1]
400	NQSFL4	30, 42, 54, 72, 84

[1] These panels require an additional 6 inches (152.4 mm) for the box and trim, for proper wire bending space.

Main Lug Kits

Table 8: Mechanical Lug Kits — Aluminum

Panelboard Amps	Kit Catalog Number	Wire Range
100	Standard	#6–2/0 AWG (13.3–67.43 mm²)
225	Standard	#6–350 kcmil (13.3–177.3 mm²)
400	Standard	(1) 1/0–750 kcmil (2) 1/0–350 kcmil ([1] 53.48–380 mm²) ([2] 53.48–177.3 mm²)
600	Standard	(2) 1/0–750 kcmil ([2] 53.48–380 mm²)
	NQALM6A	(3) #6–250 kcmil ([3] 13.3–127 mm²)

Table 9: Mechanical Lug Kits — Copper

Panelboard Amps	Kit Catalog Number	Wire Range
100	NQCUM1	#6–2/0 AWG (13.3–67.43 mm²)
225	NQCUM2	#6–250 kcmil (13.3–127 mm²)
400	NQCUM4	(1) 1/0–750 kcmil (2) 1/0–350 kcmil ([1] 53.48–380 mm²) ([2] 53.48–177.3 mm²)
600	NQCUM6	

Table 10: Versa-Crimp® Compression Lug Kits — Aluminum

Panelboard Amps	Kit Catalog Number	Wire Range	Crimp Tool
100	NQALV1	#8–1/0 AWG (8.36–53.48 mm²)	VC6 (All)
225	NQALV2	#4–300 kcmil (21.15–152 mm²)	
400	NQALV4	(2) 2/0–500 kcmil ([2] 67.43–253.4 mm²)	VC6-3, VC6-FT
600	NQALV6		

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Table 11: Versa-Crimp® Compression Lug Kits — Copper

Panelboard Amps	Kit Catalog Number	Wire Range	Crimp Tool
100	NQCUV1	#6–1/0 AWG (13.30–53.48 mm^2)	VC6 (All), VC7 (All)
225	NQCUV2	2/0–300 kcmil (67.43–152 mm^2)	VC6-3, VC7, VC6-FT, VC7-FT
400	NQCUV4	400–750 kcmil (202.7–380 mm^2)	VC6-FT, VC7-FT, VC8
600	NQCUV6	(2) 250–500 kcmil ([2] 126.7–253.4 mm^2)	VC6-3, VC7, VC6-FT, VC7-FT

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General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less

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NOTICE AND DISCLAIMER
(ANSI Accredited Standards Committee)

TABLE OF CONTENTS

Figures

Foreword

This publication is a guide of practical information containing instructions for the proper installation, operation, and maintenance of panelboards rated 600 volts or less.

These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency regarding installation, operation, or maintenance.

It is recommended that work described in this set of instructions be performed only by qualified personnel familiar with the construction and operation of panelboards and that such work be performed only after reading this complete set of instructions. For specific information not covered by these instructions, you are urged to contact the manufacturer of the panelboard directly.

In the preparation of this standards publication input of users and other interested parties has been sought and evaluated. Inquiries, comments, and proposed or recommended revisions should be submitted to the concerned NEMA product section by contacting the following: These recommendations will be reviewed periodically and updated as necessary.

Senior Technical Director, Operations
National Electrical Manufacturers Association
1300 North 17th Street, Suite 900
Rosslyn, Virginia 22209

Publication PB 1.1- 2013 revises and supersedes PB 1.1-2007.

This standards publication was developed by the Panelboard and Distribution Board Product Group of the LVDE Section. Product Group approval of the standard does not necessarily imply that all Product Group members voted for its approval or participated in its development. At the time it was approved, the Product Group was composed of the following members:

Eaton Corporation.—Pittsburgh, PA
GE Industrial Solutions—Plainville, CT
Hubbell, Inc.—Orange, CT
Milbank Manufacturing Company—Kansas City, MO
Penn Panel & Box Company—Collingdale, PA
Reliance Controls Corporation—Racine, WI
Siemens Industry, Inc.—Norcross, GA
Schneider Electric —Palatine, IL

Section 1
SCOPE

This publication covers single panelboards or groups of panel units suitable for assembly in the form of single panelboards, including buses, and with or without switches or automatic overload protective devices (fuses or circuit breakers), or both. These units are used in the distribution of electricity at 600 volts and less with:

1600—ampere mains or less
1200—ampere branch circuits or less

Specifically excluded are live-front panelboards, panelboards employing cast enclosures for special service conditions, and panelboards designed primarily for residential and light commercial service equipment.

Section 2
REFERENCES

National Fire Protection Association (NFPA)
Batterymarch Park
Quincy, MA 02269

NFPA 70	*National Electrical Code®*
NFPA 70E	*Standard for Electrical Safety in the Workplace*

National Electrical Manufacturers Association (NEMA)
1300 North 17th Street, Suite 900
Rosslyn, Virginia 22209

AB 4	*Guidelines for Inspection and Preventative Maintenance of Molded Case Circuit Breakers Used in Commercial and Industrial Applications*
PB 2.2	*Application Guide for Ground Fault Protective Devices for Equipment*
	Guidelines for Handling Water Damaged Electrical Products

Section 3
GENERAL

WARNING—HAZARDOUS VOLTAGES IN ELECTRICAL EQUIPMENT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. UNLESS OTHERWISE SPECIFIED, INSPECTION AND MAINTENANCE SHOULD ONLY BE PERFORMED ON PANELBOARDS AND EQUIPMENT TO WHICH POWER HAS BEEN TURNED OFF, DISCONNECTED AND ELECTRICALLY ISOLATED SO THAT NO ACCIDENTAL CONTACT CAN BE MADE WITH ENERGIZED PARTS. FOLLOW ALL MANUFACTURER'S WARNINGS AND INSTRUCTIONS.

Safety-related work practices, as described in NFPA 70E, should be followed at all times.
All requirements of the *National Electrical Code*® NFPA 70 should be followed.

CAUTION—HYDROCARBON SPRAY PROPELLANTS AND HYDROCARBON BASED SPRAYS OR COMPOUNDS WILL CAUSE DEGRADATION OF CERTAIN PLASTICS. CONTACT THE PANELBOARD MANUFACTURER BEFORE USING THESE PRODUCTS TO CLEAN, DRY, OR LUBRICATE COMPONENTS DURING INSTALLATION OR MAINTENANCE.

3.1 SUCCESSFUL OPERATION OF PANELBOARDS

The successful operation of panelboards is dependent upon proper installation, operation, and maintenance. Neglecting fundamental installation and maintenance requirements may lead to personal injury, death, or damage to electrical equipment or other property.

3.2 QUALIFIED PERSONNEL

Installation, operation, and maintenance of panelboards should be conducted only by qualified personnel.

3.3 DEFINITION OF QUALIFIED PERSONNEL

For purposes of these guidelines, a qualified person is one who is familiar with the installation, construction, and operation of the equipment and the hazards involved. In addition, the person is:

3.3.1 Requirements

Knowledgeable of the requirements of the *National Electrical Code*® and of all other applicable codes, laws, and standards.

3.3.2 Established Safety Practices

Trained and authorized to test, energize, clear, ground, tag, and lockout circuits and equipment in accordance with established safety practices.

3.3.3 Protective Equipment

Trained in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses or face shields, and flash resistant clothing in accordance with established safety practices.

3.3.4 First Aid

Trained in rendering first aid.

3.4 SUITABLE RATINGS

Verify that all equipment being installed has ratings suitable for the installation.

Section 4
INSTALLATION OF PANELBOARD CABINETS (BOXES)

4.1 INSTALLATION INSTRUCTIONS

Installation of the cabinet in a neat and workmanlike manner. Follow the manufacturer's installation instructions.

4.2 LOCATION IN BUILDING

Locate the cabinet so that it is readily accessible and not exposed to physical damage.

4.3 FLAMMABLE MATERIAL

Locate the cabinet well away from flammable material.

4.4 UNUSUAL SERVICE CONDITIONS

Do not locate the cabinet where it will be exposed to ambient temperatures above 40°C (104°F), corrosive or explosive fumes, dust, vapors, dripping or standing water, abnormal vibration, mechanical shock, high humidity, tilting, or unusual operating conditions, unless the cabinet/panelboard combination has been designed and so identified by the manufacturer for these conditions.

4.5 INDOOR DAMP LOCATIONS

Locate or shield the cabinet so as to prevent moisture and water from entering and accumulating therein. Mount the cabinet so that there is at least 1/4 inch of air space between the cabinet and the wall or other supporting surface.

4.6 WET LOCATIONS

Cabinets should be specifically approved for wet locations. Mount the cabinet so that there is at least 1/4 inch of air space between the cabinet and the wall or other supporting surface.

4.7 CLEARANCE FROM CEILING

Do not locate the cabinet against a non-fireproof ceiling; allow a space of 3 feet between the ceiling and cabinet unless an adequate fireproof shield is provided.

4.8 SPACE AROUND THE CABINET

When selecting a location, provide sufficient access and working space around the cabinet (see Section 110.26 of the *National Electrical Code*®). The width of the working space in front of the panelboard should be at least 30 inches, or the width of the cabinet, whichever is greater, and this space should not be used as storage. The working space should have adequate lighting and a minimum head room of 6 feet 6 inches.

4.9 MOUNTING OF CABINET

The cabinet should be reliably secured to the mounting surface. Do not depend on wooden plugs driven into holes in masonry, concrete, plaster, or similar materials. (See Section 110.13 of the *National Electrical Code*®.)

4.10 FLUSH MOUNTING IN WALL

In walls of concrete, tile, or other noncombustible material, install the cabinet so that its front edge will not set back more than 1/4 inch from the finished surface. In walls of wood or other combustible material, cabinets should be flush with or project beyond the finished surface. (See Section 312.3 of the *National Electrical Code®*.)

4.11 UNUSED OPENINGS IN CABINET

Effectively close unused openings in the cabinet to provide protection which is substantially equivalent to that afforded by the wall of the cabinet.

4.12 GROUNDING OF PANELBOARD CABINETS

Ground the cabinet as specified in Article 250 of the *National Electrical Code®*. When the cabinet contains service equipment, it is necessary to bond the cabinet to the grounded (neutral) service conductor.

Section 5
INSTALLATION OF CONDUIT AND CONDUCTORS

5.1 CONDUITS INSTALLATION

Conduits should be installed so as to prevent moisture or water from entering and accumulating within the enclosure. Provision should be made to protect conductors from abrasion in accordance with Article 312 of the *National Electrical Code®*.

5.2 KNOCKOUTS REMOVAL

Knockouts should be removed as follows:

IMPORTANT—Remove knockouts, ONE AT A TIME, alternating INWARD and OUTWARD.

5.2.1 First Step—Remove Center Knockout

Remove center knockout INWARD.

5.2.1.1 Screwdriver Blade

Place screwdriver blade against point farthest from tie and strike INWARD (Figure 1). Bend back and forth to break tie.

5.2.2 Next Step—Remove Rings

Remove rings ONE AT A TIME without straining remaining rings.

5.2.2.1 Pry First Ring

Pry first ring OUTWARD with screwdriver midway between ties, using pliers flat against box under screwdriver (Figure 2). Bend ring sections OUTWARD with pliers, then back and forth to break ties (Figure 5-3).

5.2.2.2 Second Ring

Remove second ring INWARD by striking screwdriver (with blade against point midway between ties) then breaking ring sections inward and back and forth to break ties.

5.3 *NATIONAL ELECTRICAL CODE®*, ARTICLE 300

Refer to the *National Electrical Code®*, Article 300 for proper wiring methods. See 6.7 for making proper connections.

5.4 CONDUCTOR LENGTH

Keep conductor length to a minimum within the wiring gutter. Excessive conductor length will result in additional heating and may result in overheating. However, conductors should be long enough to reach the terminal location in a manner that avoids strain on the terminal.

5.5 EXERCISE CARE

Exercise care to maintain the largest practical bending radius of conductors; otherwise the insulation may be damaged and terminal connections may become loosened. Deflection of conductors shall comply with *NEC®* Section 312.6.

5.6 *NATIONAL ELECTRICAL CODE®*, SECTION 725.136

Refer to the *National Electrical Code®*, Section 725.136 for the separation requirements for conductors of Class 2 and Class 3 remote-control, signaling and power-limited circuits.

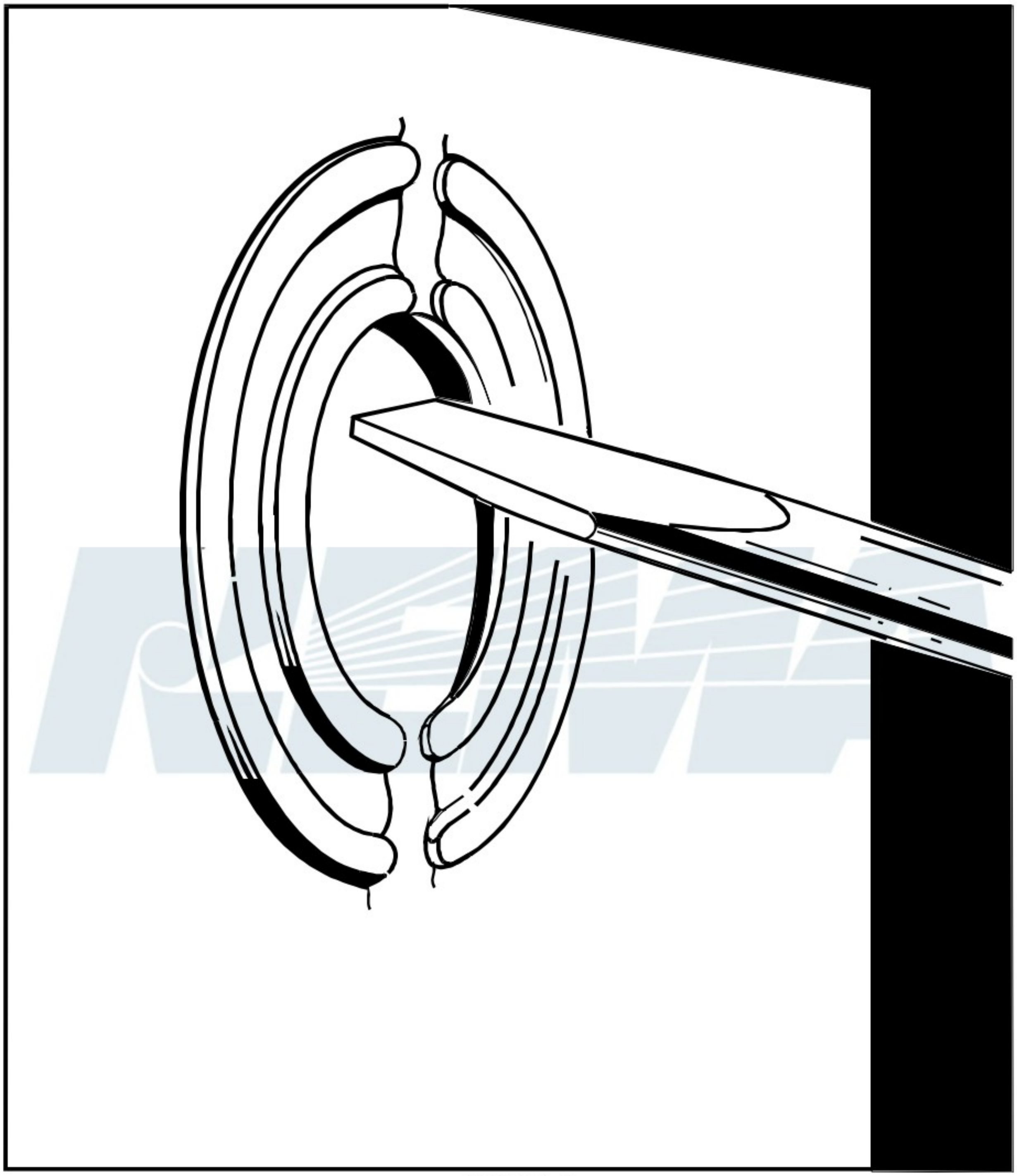

Figure 5–1
KNOCKOUT REMOVAL—STEP 1

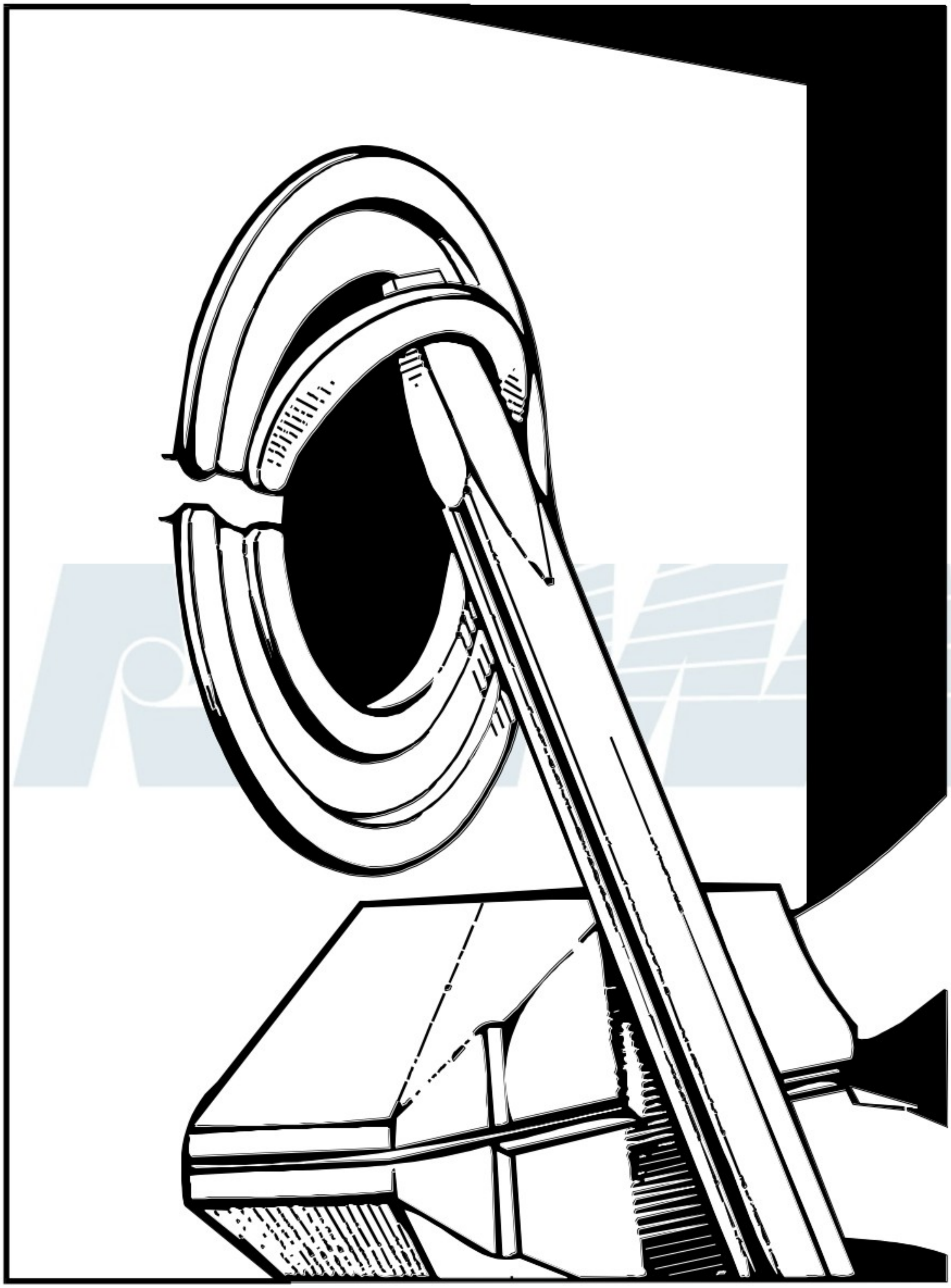

Figure 5–2
KNOCKOUT REMOVAL—STEP 2

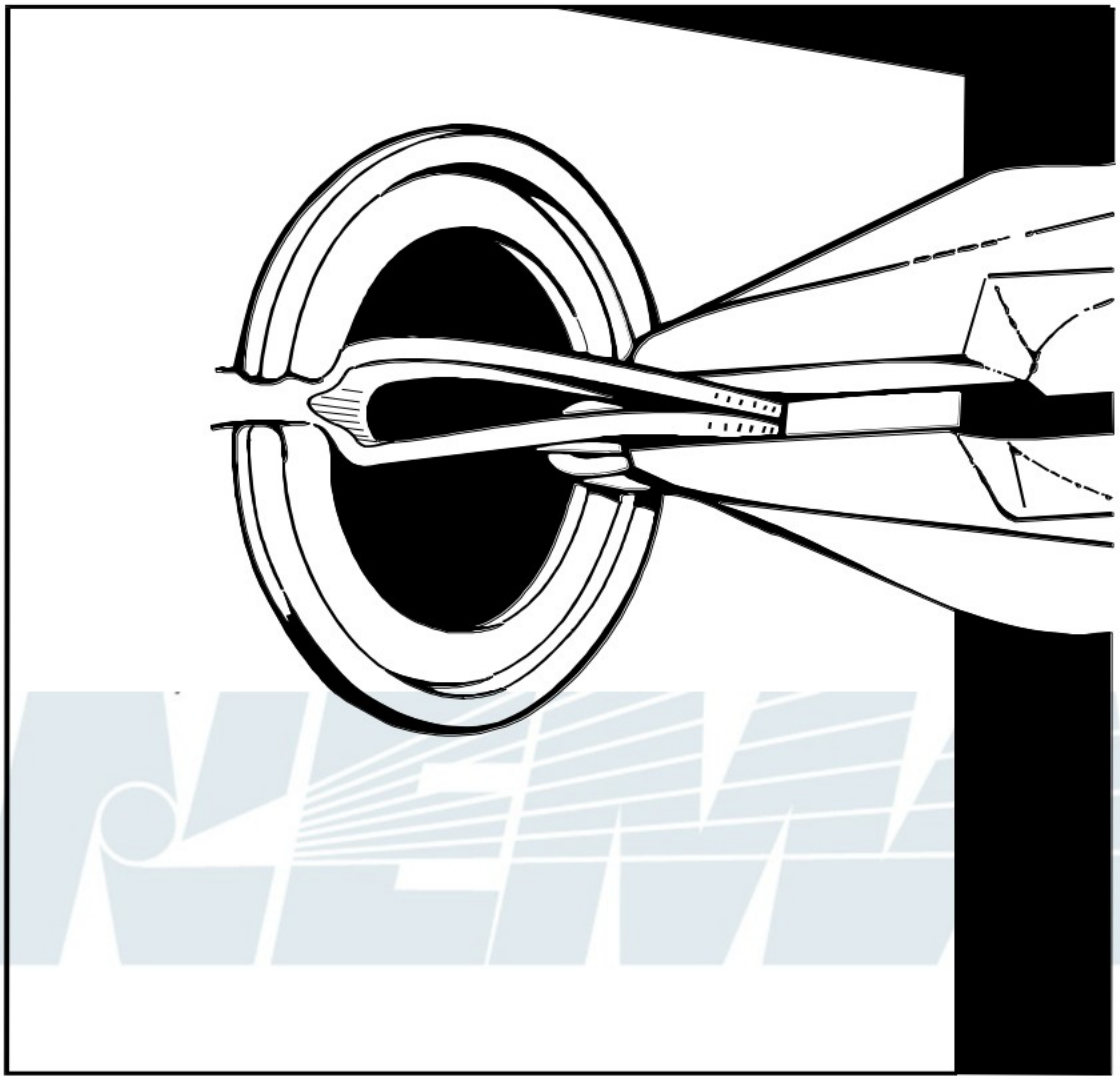

Figure 5–3
KNOCKOUT REMOVAL—STEP 3

Section 6
INSTALLATION OF PANELBOARD

6.1 PROPER STORAGE

Store the panelboard in a clean, dry place located so that mechanical damage from work personnel in the area is not likely to happen.

6.2 UNPACKING

Care should be exercised in unpacking the panelboard to prevent damage and loss of instruction materials and loose parts.

6.3 INSPECTION

Check for shipping damage and check to make sure that the panelboard is the correct one for installation in the cabinet.

6.4 CARE

Care should be taken to protect the panelboard internal parts from contamination during the installation process.

6.4.1 Cleaning

Clean the cabinet of all foreign materials. If parts at connection points are spattered with cement, plaster, paint, or other foreign material, remove the foreign materials with great care to avoid damage to the plating.

CAUTION—HYDROCARBON SPRAY PROPELLANTS AND HYDROCARBON BASED SPRAYS OR COMPOUNDS WILL CAUSE DEGRADATION OF CERTAIN PLASTICS. CONTACT THE PANELBOARD MANUFACTURER BEFORE USING THESE PRODUCTS TO CLEAN, DRY, OR LUBRICATE PANELBOARD COMPONENTS DURING INSTALLATION OR MAINTENANCE.

6.5 MANUFACTURER'S INSTRUCTIONS

Carefully follow the manufacturer's instructions and labels.

6.6 INSTALLATION

6.6.1 Alignment Devices

Adjust the alignment devices where provided.

6.6.2 Panelboard

Install the panelboard, finalize its alignment, and tighten it securely in the cabinet.

6.6.3 Flange of Deadfront Shield

Unless otherwise instructed by the manufacturer, adjust the panelboard so that the flange of the deadfront shield is no more than 3/16 inch from (1) the front of the cabinet for surface mounting or (2) the surrounding wall surfaces for flush mounting.

6.7 LINE AND BRANCH CONDUCTORS

Connect Line and Branch Conductors

6.7.1 Conductors

Use care in stripping insulation from conductors so as not to nick or ring the conductor. For aluminum, clean all oxide from the stripped portion and apply an antioxide compound.

6.7.1.1 Wiring Gutters

Distribute and arrange conductors neatly in the wiring gutters. (See Section 5.)

6.7.1.2 Types and Temperature Ratings

Care should be exercised to ensure that the types and temperature ratings of conductors being installed in the panelboard are suitable for use with the terminals, which have been provided.

6.7.1.3 Tighten All Terminals

Use the manufacturer's torque values. (See 7.1).

6.8 PANELBOARD GROUNDING AND BONDING

Ground the panelboard cabinet in accordance with 4.12. (See Section 408.40 of the *National Electrical Code*®.)

6.8.1 Equipment Grounding Conductors

Where separate equipment grounding conductors are used, prepare equipment grounding conductors in accordance with 6.7.1 and connect them to the equipment grounding terminal bar. Check to be sure that the terminal bar is securely bonded to the cabinet or panelboard frame and that it is not connected to the neutral bar except at service equipment (as permitted in Section 250.28 of the *National Electrical Code*®) or at separately derived systems (as permitted in Section 250.30 of the *National Electrical Code*®).

NOTE—An equipment grounding terminal bar is not always required. For example, when a properly installed metallic raceway is used as the equipment grounding path or when the grounded conductor terminals (neutral bar) complies with the conditions of the last sentence of Section 408.40 of the *National Electrical Code*®.

6.9 PROPER TYPE OR CLASS AND RATING

When installing circuit breakers or fuses, ensure that they are of the proper type or class and rating.

6.10 DEBRIS

Clean the cabinet of all debris, which has accumulated during the panelboard installation Ensure that all foreign materials, including cement, plaster and paint (overspray) are cleaned and removed. Remove all such materials with great care to avoid damage to conductors, plating, etc. (see 6.4.1).

6.11 STEPS IN SECTION 7

If the job is complete, perform the steps in Section 7 and then install the cabinet front (see Section 8).

Section 7
STEPS TO BE TAKEN BEFORE ENERGIZING

7.1 ACCESSIBLE ELECTRICAL CONNECTIONS

Tighten all accessible electrical connections to the manufacturer's torque specifications. If such information is not provided with the equipment, consult the manufacturer.

7.2 BLOCKS AND PACKING MATERIALS

Make certain that all blocks and packing materials used for shipment have been removed from all component devices and the panelboard.

7.3 SWITCHES, CIRCUIT BREAKERS, AND OTHER OPERATING MECHANISMS

Manually exercise all switches, circuit breakers, and other operating mechanisms to make certain they operate freely. If devices with self-test function are installed, perform test and verify proper operation per the manufacturer's instructions.

Check the integrity of all electrical and mechanical interlocks and padlocking mechanisms. For key interlocked systems, assure that only the required number of keys are accessible to the operator.

7.4 SHORT CIRCUITS AND GROUND FAULTS

To make sure that the system is free from short circuits and ground faults, conduct an insulation resistance test phase to ground and phase to phase with the switches or circuit breakers in both the open and closed positions. If the resistance reads less than 1 megohm while testing with the branch circuit devices in the open position, the system may be unsafe and should be investigated. If after investigation and possible correction, low readings are still observed, the manufacturer should be contacted. Some electronic equipment (metering, SPD, etc.) may be damaged by this testing. Refer to the manufacturers equipment markings for guidelines.

7.5 GROUND FAULT PROTECTION SYSTEM

Test the ground fault protection system (if furnished) in accordance with the manufacturer's instructions. See Section 230.95 of the *National Electrical Code®* and NEMA PB 2.2, *Application Guide for Ground Fault Protective Devices for Equipment*.

7.6 ADJUSTABLE TIME CURRENT TRIP DEVICE SETTINGS

Set any adjustable time current trip device settings to the proper values.

NOTE—Experience has indicated that damage from overcurrent can be reduced if the devices used for overload and short-circuit protection are set to operate instantaneously (that is, without intentional time delay) at 115 percent of the highest value of phase current which is likely to occur as the result of any anticipated motor starting or welding currents.

7.7 GROUNDING CONNECTIONS

Check to determine that all grounding connections are properly made. If the panelboard is used as service equipment, make certain that the neutral, if present, is properly bonded to the cabinet.

7.8 FOREIGN MATERIAL

Remove all foreign material from the panelboard and cabinet before installing the cabinet front. Make certain that all deadfront shields are properly aligned and tightened. Install the cabinet front in accordance with Section 8.

Section 8
INSTALLATION OF CABINET FRONT

8.1 CABINET FRONT OR TRIM PACKAGE

The cabinet front or trim package is designed to prevent damage to the front during shipment and handling.

8.2 UNPACKING

Care should be used when unpacking and handling the cabinet front.

8.3 COVERS AND DOORS

Install covers, close doors, and make certain that no conductors are pinched and that all enclosure parts are properly aligned and tightened. Hinged covers or doors must open a minimum of 90 degrees when installed.

8.4 TOUCH-UP

A suitable paint or other corrosion-resistant finish should be applied to those places where the finish is damaged.

8.5 FRONT ALIGNMENT

The cabinet front may be provided with an adjusting means to align it squarely with the building even though the cabinet may be slightly out of plumb with the building.

Section 9
ENERGIZING EQUIPMENT

WARNING—HAZARDOUS VOLTAGES IN ELECTRICAL EQUIPMENT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. ENERGIZING A PANELBOARD FOR THE FIRST TIME AFTER INITIAL INSTALLATION OR MAINTENANCE IS POTENTIALLY DANGEROUS.

9.1 QUALIFIED PERSONNEL

Only qualified personnel should energize equipment for the first time. If short circuit conditions caused by damage or poor installation practices have not been detected in the procedures specified in Section 7, serious personal injury and damage can occur when the power is turned on.

9.2 LOAD ON THE PANELBOARD

There should be no load on the panelboard when it is energized. Turn off all of the downstream loads.

9.3 ENERGIZED IN SEQUENCE

The equipment should be energized in sequence by starting at the source end of the system and working towards the load end. In other words, energize the main devices, then the feeder devices, and then the branch-circuit devices. Turn the devices on with a firm positive motion.

9.4 LOADS SUCH AS LIGHTING CIRCUITS, CONTACTORS, HEATERS, AND MOTORS

After all main, feeder, and branch circuit devices have been closed, loads such as lighting circuits, contactors, heaters, and motors may be turned on.

Section 10
MAINTENANCE

10.1 MAINTENANCE PROGRAM

A maintenance program for panelboards should be conducted on a regularly scheduled basis in accordance with the following:

10.2 PANELBOARD WHICH HAS BEEN CARRYING ITS REGULAR LOAD FOR AT LEAST 3 HOURS

A panelboard which has been carrying its regular load for at least 3 hours just prior to inspection should be field tested by feeling the deadfront surfaces of circuit breakers, switches, interior trims, doors, and enclosure sides with the palm of the hand. If the temperature of these surfaces does not permit you to maintain contact for at least 3 seconds, this may be an indication of trouble and investigation is necessary. Thermographic (infrared) scanning has become a useful method of investigating thermal performance.

WARNING—HAZARDOUS VOLTAGES IN ELECTRICAL EQUIPMENT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. UNLESS OTHERWISE SPECIFIED, INSPECTION AND MAINTENANCE SHOULD ONLY BE PERFORMED ON PANELBOARDS TO WHICH POWER HAS BEEN TURNED OFF, DISCONNECTED AND ELECTRICALLY ISOLATED SO THAT NO ACCIDENTAL CONTACT CAN BE MADE WITH ENERGIZED PARTS. FOLLOW ALL MANUFACTURER'S WARNINGS AND INSTRUCTIONS.

Safety related work practices, as described in NFPA 70E, should be followed at all times.

CAUTION—HYDROCARBON SPRAY PROPELLANTS AND HYDROCARBON BASED SPRAYS OR COMPOUNDS WILL CAUSE DEGRADATION OF CERTAIN PLASTICS. CONTACT THE PANELBOARD MANUFACTURER BEFORE USING THESE PRODUCTS TO CLEAN, DRY, OR LUBRICATE PANELBOARD COMPONENTS DURING INSTALLATION OR MAINTENANCE.

10.3 INSPECT PANELBOARD ONCE EACH YEAR

Inspect the panelboard once each year or after any severe short circuit.

10.4 ACCUMULATION OF DUST AND DIRT

If there is an accumulation of dust and dirt, clean out the panelboard by using a brush, vacuum cleaner, or clean lint-free rags. Avoid blowing dust into circuit breakers or other components. Do not use a blower or compressed air.

10.4.1 Visible Electrical Joints and Terminals

Carefully inspect all visible electrical joints and terminals in the bus and wiring system.

10.4.2 Conductors and Connections

Visually check all conductors and connections to be certain that they are clean and secure. Loose and/or contaminated connections increase electrical resistance which can cause overheating. Such overheating is indicated by discoloration or flaking of insulation and/or metal parts. Pitting or melting of connecting surfaces is a sign of arcing due to a loose or otherwise poor connection. Parts which show evidence of overheating or looseness should be cleaned and re-torqued or replaced if damaged. Tighten bolts and nuts at bus joints to manufacturer's torque specifications.

CAUTION—DO NOT REMOVE PLATING FROM ALUMINUM PARTS IN JOINTS OR TERMINATIONS. DAMAGE TO PLATING CAN RESULT IN OVERHEATING. REPLACE DAMAGED ALUMINUM PARTS.

10.4.3 Fuse Clip Contact Pressure and Contact Means

Examine fuse clip contact pressure and contact means. If there is any sign of overheating or looseness, follow the manufacturer's maintenance instructions or replace the fuse clips. Loose fuse clips can result in overheating.

10.4.4 Plug Fuses

Re-tighten plug fuses.

10.4.5 Conditions Which Caused Overheating

Be sure that all conditions which caused the overheating have been corrected.

10.5 PROPER AMPERE, VOLTAGE, AND INTERRUPTING RATINGS

Check circuit breakers, switches, and fuses to ensure they have the proper ampere, voltage, and interrupting ratings. Ensure that non-current-limiting devices are not used as replacements for current-limiting devices. Never attempt to defeat rejection mechanisms which are provided to prevent the installation of the incorrect class of fuse.

10.5.1 Mechanisms Free and in Proper Working Order

Operate each switch or circuit breaker several times to ensure that all mechanisms are free and in proper working order. Replace as required. See NEMA AB-4 for maintenance of molded case circuit breakers.

10.6 OPERATION OF ALL MECHANICAL COMPONENTS

Check the operation of all mechanical components. Replace as required.

10.6.1 Switch Operating Mechanisms

Exercise switch operating mechanisms and external operators for circuit breakers to determine that they operate freely to their full on and off positions.

10.6.2 Integrity of Electrical and Mechanical Interlocks

Check the integrity of all electrical and mechanical interlocks and padlocking mechanisms. For key interlocked systems, assure that only the required number of keys are accessible to the operator.

10.6.3 Missing or Broken Parts

Whenever practical, check all devices for missing or broken parts, proper spring tension, free movement, corrosion, dirt, and excessive wear.

10.6.4 Manufacturer's Instructions

Adjust, clean, and lubricate or replace parts according to the manufacturer's instructions.

10.6.4.1 Clean Nonmetallic Light Grease or Oil

Use *clean* nonmetallic light grease or oil as instructed.

10.6.4.2 Molded Case Circuit Breakers

Do *not* oil or grease parts of molded case circuit breakers.

10.6.4.3 Clean, Light Grease

If no instructions are given on the devices, sliding copper contacts, operating mechanisms, and interlocks may be lubricated with clean, light grease.

10.6.4.4 Excess Lubrication

Wipe off excess lubrication to avoid contamination.

CAUTION—HYDROCARBON SPRAY PROPELLANTS AND HYDROCARBON BASED SPRAYS OR COMPOUNDS WILL CAUSE DEGRADATION OF CERTAIN PLASTICS. CONTACT THE PANELBOARD MANUFACTURER BEFORE USING THESE PRODUCTS TO CLEAN, DRY, OR LUBRICATE PANELBOARD COMPONENTS DURING INSTALLATION OR MAINTENANCE.

10.6.5 Accessible Copper Electrical Contacts, Blades, and Jaws

Clean and dress readily accessible copper electrical contacts, blades, and jaws according to the manufacturer's instructions when inspection indicates the need.

10.7 DAMAGED INSULATING MATERIAL AND ASSEMBLIES

Look for and replace damaged insulating material and assemblies where sealing compounds have deteriorated.

10.8 MOISTURE OR SIGNS OF PREVIOUS WETNESS OR DRIPPING

Look for any moisture or signs of previous wetness or dripping inside the cabinet.

NOTE—Condensation in conduits or dripping from outside sources is one known cause of panelboard malfunction.

10.8.1 Conduits Which Have Dripped Condensate

Seal off any conduits which have dripped condensate, and provide means for further condensate to drain away from the panelboard.

10.8.2 Cracks or Openings

Seal off any cracks or openings which have allowed moisture to enter the enclosure. Eliminate the source of any dripping on the enclosure and any other source of moisture.

10.8.3 Insulating Material Which is Damp or Wet

Replace or thoroughly dry and clean any insulating material, which is damp or wet or shows an accumulation of deposited material from previous wettings.

10.8.4 Component Devices Which Show Evidence of Moisture Damage

Inspect all component devices. Replace any component device which shows evidence of moisture damage or has been subjected to water damage or flooding. Additional information may be found in the NEMA document “Guidelines for Handling Water Damaged Electrical Products.”

10.9 BEFORE CLEANUP AND CORRECTIVE ACTION IS ATTEMPTED

In the event of water damage, e.g., flooding or sprinkler discharge, the manufacturer should be consulted before clean up and corrective action is attempted.

10.10 SEVERE ELECTRICAL SHORT CIRCUIT

If a severe electrical short circuit has occurred, the excessive currents may have resulted in structural component and/or bus and conductor damage due to mechanical distortion, thermal damage, metal deposits, or smoke. Examine all devices and bus supports for cracks or breakage. The manufacturer should be consulted before cleanup and correction is attempted.

10.11 GROUND FAULT PROTECTION SYSTEM

Test the ground fault protection system (if furnished) in accordance with the manufacturer's instructions. See Section 230.95 of the *National Electrical Code®* and NEMA PB 2.2 *Application Guide for Ground Fault Protective Devices for Equipment*.

10.12 INSULATION RESISTANCE

Check insulation resistance (see 7.4) under any of the following conditions:

10.12.1 Severe Short Circuit

If a severe short circuit has occurred (see 10.10);

10.12.2 Parts Replaced

If it has been necessary to replace parts or clean insulating surfaces;

10.12.3 Panelboard Exposed to High Humidity

If the panelboard has been exposed to high humidity, condensation, or dripping moisture.

Section 11
PERMISSIBLE LOADING OF PANELBOARDS

11.1 *NATIONAL ELECTRICAL CODE®*

In compliance with the *National Electrical Code®*, the normal continuous loads (3 hours or more) of panelboard circuits should be not more than 80 percent of the rating of the overcurrent protective device, unless the marking of the device indicates that it is suitable for continuous duty at 100 percent of its rating.

11.2 HARMONICS IN ELECTRICAL SYSTEM

Some types of electrical equipment cause harmonics in the electrical system, which may result in overheating. This condition should be considered when determining panelboard loading.

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