O & M Manual for 2-Position Contactor
Based Non-Automatic Transfer Switch
Instruction Booklet

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Section 1: Introduction

1.1 Preliminary Comments and Safety Precautions

This technical document is intended to cover most aspects associated with the installation, application, operation, and maintenance of the contactor based 2-position non-automatic transfer switch with ratings from 40 through 400 amperes (A). It is provided as a guide for authorized and qualified personnel only. Please refer to the specific WARNING and CAUTION in Section 1.1.2 before proceeding. If further information is required by the purchaser regarding a particular installation, application, or maintenance activity, please contact an authorized Eaton sales representative or the installing contractor.

1.1.1 Warranty and Liability Information

No warranties, expressed or implied, including warranties of fitness for a particular purpose of merchantability, or warranties arising from course of dealing or usage of trade, are made regarding the information, recommendations and descriptions contained herein. In no event will Eaton be responsible to the purchaser or user in contract, in tort (including negligence), strict liability or otherwise for any special, indirect, incidental or consequential damage or loss whatsoever, including but not limited to damage or loss of use of equipment, plant or power system, cost of capital, loss of power, additional expenses in the use of existing power facilities, or claims against the purchaser or user by its customers resulting from the use of the information and descriptions contained herein.

1.1.2 Safety Precautions

All safety codes, safety standards, and/or regulations must be strictly observed in the installation, operation, and maintenance of this device.

THE WARNINGS AND CAUTIONS INCLUDED AS PART OF THE PROCEDURAL STEPS IN THIS DOCUMENT ARE FOR PERSONAL SAFETY AND PROTECTION OF EQUIPMENT FROM DAMAGE. AN EXAMPLE OF A TYPICAL WARNING LABEL HEADING IS SHOWN ABOVE TO FAMILIARIZE PERSONNEL WITH THE STYLE OF PRESENTATION. THIS WILL HELP TO INSURE THAT PERSONNEL ARE ALERT TO WARNINGS, WHICH APPEAR THROUGHOUT THE DOCUMENT. IN ADDITION, WARNINGS AND CAUTIONS ARE ALL UPPER CASE AND BOLDFACE.

CAUTION

COMpletely read and understand the material presented in this document before attempting installation, operation, or application of the equipment. In addition, only qualified persons should be permitted to perform any work associated with this equipment. Any wiring instructions presented in this document must be followed precisely. Failure to do so could cause permanent equipment damage.
1.2 General Information

Transfer switches are used to protect critical electrical loads against loss of power. The load's Source 1 power source is backed up by a Source 2 power source. A transfer switch is connected to both the Source 1 and Source 2 power sources and supplies the load with power from one of the two sources. In the event that power is lost from Source 1, the transfer switch transfers the load to the Source 2 power source. This transfer is non-automatic (electrically operated). Once Source 1 power is restored, the transfer back to the Source 1 power source is non-automatic (electrically operated). See Figure 2.

Non-automatic transfer switches perform the transfer function and include three basic elements:

1. A power contactor to connect and disconnect the load to and from either power source.
2. Solenoids to make the transfer of the main contacts from source to source.
3. Supervisory circuits constantly monitor sources available and source to which the transfer switch is connected.

1.2.1 Design Configuration

The Eaton contactor based non-automatic transfer switch is a compact design that uses a power contactor to transfer essential loads from one power source to another (Figure 3 [100A]).
Each panel is independently mounted with interconnecting wiring terminated connector plugs to permit individual panel removal without disturbing critical connections.

Mounting the enclosure is simple using top and bottom mounting flanges with elongated (teardrop) mounting holes. These mounting holes, along with power panel positioning bolts and pre-tapped inserts, insure proper power panel mounting after the initial enclosure installation. Refer to Section 4 for specific mounting and modification details.

### Table 1. Withstand Ratings.

<table>
<thead>
<tr>
<th>UL 1008 Ampere Rating</th>
<th>480 Volts</th>
<th>600 Volts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Any Breaker</td>
<td>Specific Breaker</td>
</tr>
<tr>
<td>100</td>
<td>10,000</td>
<td>30,000</td>
</tr>
<tr>
<td>200</td>
<td>10,000</td>
<td>30,000</td>
</tr>
<tr>
<td>280</td>
<td>30,000</td>
<td>50,000</td>
</tr>
<tr>
<td>320</td>
<td>30,000</td>
<td>50,000</td>
</tr>
<tr>
<td>400</td>
<td>30,000</td>
<td>50,000</td>
</tr>
</tbody>
</table>

### 1.3 Non-Automatic Transfer Switch Catalog Number Identification

Transfer switch equipment catalog numbers provide a significant amount of relevant information that pertains to a particular piece of equipment. The Catalog Number Identification Table (Table 2) provides the required interpretation information. An example is offered here to initially simplify the process.

**Example:** Catalog Number (circled numbers correspond to position headings in Table 2).

```
1to2  3  4  5 to 6  7  8  9to10  11  12
```

The catalog number NTCEC2X20400WRU describes a non-automatic transfer switch with a 2 pole, 2 position Power Contactor mounted on a baseplate within the enclosure. The intelligence represented by the logic panel is Electromechanical. The continuous current rating of this equipment is 400A and applicable at 240 Vac, 60 Hz. The transfer switch equipment is enclosed in a NEMA 3R enclosure and is listed for UL applications.

For more information visit: [www.eaton.com](http://www.eaton.com)
### Table 2. Transfer Switch Catalog Number Explanation

<table>
<thead>
<tr>
<th>POSITIONS 1 TO 2</th>
<th>POSITION 3</th>
<th>POSITION 4</th>
<th>POSITIONS 5 TO 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>BASIC DEVICE</td>
<td>SWITCHING DEVICE</td>
<td>CONTROL PANEL</td>
<td>SWITCING DEVICE</td>
</tr>
<tr>
<td>Non-Automatic Transfer Switch</td>
<td>NT</td>
<td>Contactor</td>
<td>Electromechanical</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SWITCHING DEVICE</th>
<th>NUMBER OF POLES</th>
<th>AMPERE RATING</th>
<th>VOLTAGE/FREQUENCY</th>
<th>ENCLOSURE</th>
<th>LISTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed Mount</td>
<td>X</td>
<td>40A – 0040</td>
<td>208 Vac/60 Hz</td>
<td>B</td>
<td>Type 1 S UL/CSA Listing U</td>
</tr>
<tr>
<td>Three (3)</td>
<td>80A – 0080</td>
<td>220 Vac/50 Hz</td>
<td>G</td>
<td>Type 12 J No Listing X</td>
<td></td>
</tr>
<tr>
<td>Four (4)</td>
<td>100A – 0100</td>
<td>240 Vac/60 Hz</td>
<td>W</td>
<td>Type 3R R</td>
<td></td>
</tr>
<tr>
<td></td>
<td>150A – 0150</td>
<td>380 Vac/50 Hz</td>
<td>H</td>
<td>Open K</td>
<td></td>
</tr>
<tr>
<td></td>
<td>200A – 0200</td>
<td>415 Vac/50 Hz</td>
<td>O</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>*225A – 0225</td>
<td>480 Vac/60 Hz</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>*260A – 0260</td>
<td>600 Vac/60 Hz</td>
<td>E</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>*400A – 0400</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*For 225A to 400A, 600 Vac application, please refer to IB01602047E

### 1.4 Environmental Conditions

#### 1.4.1 Operational Conditions

Normally, a non-automatic transfer switch is applied indoors in an electrical equipment room. In the appropriate enclosure, it can be used for outdoor applications where the equipment is subject to falling rain, freezing temperatures, and no greater than 90% humidity (non-condensing). The ambient temperature range for operation is between -20 and 70°C (-4 to 158°F).

### 1.5 Glossary

With respect to their use within this document and as they relate to transfer switch and controller operation, the following terminology is defined.

**Available**

A source is defined as “available” when it is within its undervoltage/overvoltage/underfrequency/overfrequency (if applicable) setpoint ranges for the nominal voltage and frequency setting.

**Connected**

Connected is defined as when the input is shorted by an external contact or connection.

**Re-Transfer**

Re-transfer is defined as a change of the load connection from the Source 2 to the Source 1.

**Source 1**

Source 1 is the primary source (normal source, normal power source, or normal).

**Source 2**

Source 2 is the secondary source (emergency source, emergency power source, emergency, standby, or backup source).

**Transfer**

Transfer is defined as a change of the load connection from the Source 1 to the Source 2 power source.

**Unconnected**

Unconnected is defined as when the input is not shorted by an external contact or connection.
Section 2: Receiving, Handling, and Storage

2.1 Receiving

Every effort is made to ensure that the non-automatic transfer switch equipment arrives at its destination undamaged and ready for installation. Packing is designed to protect internal components as well as the enclosure. Care should be exercised, however, to protect the equipment from impact at all times. Do not remove the protective packaging until the equipment is ready for installation.

When the non-automatic transfer switch equipment reaches its destination, the customer should inspect the shipping container for any obvious signs of rough handling and/or external damage that occurred during transportation. Record any external and internal damage for reporting to the transportation carrier and Eaton, once a thorough inspection is complete. All claims should be as specific as possible and include the catalog and General Order numbers.

A shipping label affixed to the shipping container includes a variety of equipment and customer information, such as General Order Number and catalog numbers. Make certain that this information matches other shipping paper information.

Each transfer switch is packed securely with appropriate shipping materials to prevent damage during shipment. Do not remove or discard the packing material until the equipment is ready for installation.

Once the top packaging is removed from the shipment, the enclosure door can be opened. A plastic bag of documents will be found in the enclosure, usually attached to the inside of the enclosure. Important documents, such as test reports, wiring diagrams, and appropriate instruction leaflets, are enclosed within the bag and should be filed in a safe place.

2.2 Handling

As previously mentioned, non-automatic transfer switch equipment is packaged for forklift movement. Protect the equipment from impact at all times and DO NOT double stack.

Once the equipment is at the installation location and ready to be installed, packaging material can be removed and discarded. Once the enclosure is unbolted from the wooden pallet, it can be hand moved to its installation position. Be careful not to damage the top or bottom enclosure mounting flanges. Refer to Section 4 of this manual for specific installation instructions.

2.3 Storage

Although well packaged, this equipment is not suitable for outdoor storage. The equipment warranty will not be applicable if there is evidence of outdoor storage. If the equipment is to be stored indoors for any period of time, it should be stored with its protective packaging material in place. Protect the equipment at all times from excessive moisture, construction dirt, corrosive conditions, and other contaminants.

It is strongly suggested that the package-protected equipment be stored in a climate-controlled environment with temperatures from -30 to 85°C (-22 to 185°F) and with a relative humidity of 80% or less. DO NOT, under any circumstance, stack other equipment on top of a transfer switch equipment enclosure, whether packaged or not.
Section 3: Equipment Description

3.1 General

The non-automatic transfer switch consists of three basic panels:

1. The power panel;
2. The voltage selection and transformer panel (if required); and
3. The electromechanical logic panel.

These panels are interconnected via connector plugs and mounted in an enclosure (Figure 5).

3.2 Power Panel

The power panel is used for making load, power, and neutral connections. The power contactor is mounted on a steel baseplate (Figure 6).

3.2.1 Main Contacts

This non-automatic transfer switch incorporates a power contactor. The main contacts connect and disconnect the load to and from the different power sources. The power contactor is mechanically and electrically interlocked to prevent the two sets of main contacts from being closed simultaneously.

3.3 Voltage Selection

3.3.1 Standard Voltage Selection (208, 240, 480, 600 V, 60 Hz and 220, 380, 415 V, 50 Hz)

The standard voltage selection panel consists of multi-tap transformers, contained in a steel case mounted in the enclosure (Figure 7). The voltage is selected by simply removing the wires from the default primary taps of both transformers and installing them on the primary taps for the desired voltage. Taps are provided for 208 to 600 Vac to satisfy required application voltage. The factory default position is 600 Vac.

CAUTION

WHEN CHANGING THE SELECTED VOLTAGE, THE POWER MUST BE REMOVED FROM THE NON-AUTOMATIC TRANSFER SWITCH AND THE WIRES MUST BE MOVED ON THE TAPS OF BOTH TRANSFORMERS.
3.4 Logic Panel

The logic panel provides ability to transfer from Source 1 to Source 2 when Source 2 is at sufficient voltage and frequency. Conversely it also provides ability to transfer from Source 2 to Source 1 when Source 1 is at sufficient voltage and frequency. It also provides indication for source availability and switch position.
3.5 Features

A variety of standard and optional features are available for Eaton non-automatic transfer switches. All features or combinations of features may not be available on specific non-automatic transfer switches. All features and/or accessories are Underwriters Laboratories (UL) listed unless noted.

3.5.1 Standard Features

The following is a list of the standard features for the non-automatic transfer switch.

12. Power Source Annunciation
   This feature provides light indication for switch position and power source availability indications.

Switch Position
   Provides light to indicate the switch position.

12C. Source 1 - Source Connected
   This feature provides a green light that, when lit, indicates the load is connected to Source 1.

12D. Source 2 - Source Connected
   This feature provides a red light that, when lit, indicates the load is connected to Source 2.

Power Source Availability
   Provides light to indicate if a power source is available.

12G. Source 1 - Available
   This feature provides a white light that, when lit, indicates Source 1 is available.

12H. Source 2 - Available
   This feature provides an amber light that, when lit, indicates Source 2 is available.

14. Relay Auxiliary Contacts

14G. Source 1 Present: Provides two (2) normally open and two (2) normally closed contacts. The relay is energized when Source 1 is available.

14H. Source 2 Present: Provides two (2) normally open and two (2) normally closed contacts. The relay is energized when Source 2 is available.

15. Switch Position Indication Contact
   This feature provides a contact that indicates if the power switching device is in the “Open” or “Closed” position.

15E. Source 1 Position Indication Contact
   This feature provides 1 dry form “C” contact that indicates the position of the Source 1 power switching device.

15F. Source 2 Position Indication Contact
   This feature provides 1 dry form “C” contact that indicates the position of the Source 2 power switching device.

42. Seismic Withstand Capability
   Provides transfer switch with seismic capability exceeding the worst case Zone 4 required per both the Uniform Building Code and the California Building Code.

3.5.2 Optional Features

The following is a list of the optional features for the non-automatic transfer switch. All features or combinations of features may not be available on specific non-automatic transfer switches.

14. Relay Auxiliary Contacts
   This feature provides form “C” relay auxiliary contacts.

14C. Source 1 Present
   Provides four (4) normally open and four (4) normally closed contacts. They relay is energized when Source 1 is available.

14D. Source 2 Present
   Provides four (4) normally open and four (4) normally closed contacts. They relay is energized when Source 2 is available.

15. Switch Position Indication Contact
   This feature provides a contact that indicates if the power switching device is in the “Open” or “Closed” position.

15G. Source 1 Position Indication Contact
   This feature provides 3 dry Form “C” contacts that indicate the position of the Source 1 power-switching device.

15H. Source 2 Position Indication Contact
   This feature provides 3 dry Form “C” contacts that indicate the position of the Source 2 power-switching device.

18. Metering
   This feature includes all required external devices (CTs, shorting blocks, fuses, etc.) for a fully functional metering system.

18O IQ Analyzer Normal (S1) Only
18P IQ Analyzer Emergency (S2) Only
18Q IQ Analyzer Normal (S1) & Emergency (S2) Switch Selectable
18V IQ Analyzer Load
18R IQ DP-4000 Normal (S1) Only
18S IQ DP-4000 Emergency (S2) Only
18T IQ DP-4000 Normal (S1) & Emergency (S2) Switch Selectable
18U IQ DP-4000 Load
18AN IQ 250/260 Normal (S1) Only
18AE IQ 250/260 Emergency (S2) Only
18AL IQ 250/260 Load
38. Stainless Steel Logic Cover

38A. Stainless Steel Cover for Device Panel

Provides an added level of security by providing a pad lockable stainless steel cover for use with standard transfer switch device panel. The cover is designed for NEMA 1, 3R, 4X, and 12 applications.

41. Space Heater With Thermostat

This feature provides a space heater and non-adjustable thermostat. External control power is not required.

41A. Space Heater With Thermostat - 100 Watt

This feature provides a 100 watt (W) space heater with a non-adjustable thermostat.

51D1. 50kA CVX Surge Device

This feature gives protection for surge current capacity rating 50kA, upto 480VAC by providing a low impedance surge path to ground while supporting rated voltage. It provides LED indication.

51F1. 100kA CVX Surge Device

This feature gives protection for surge current capacity rating 100kA, upto 480VAC by providing a low impedance surge path to ground while supporting rated voltage. It provides LED indication.

3.6 Enclosure

The rugged steel non-automatic transfer switch enclosure is supplied with three door hinges, regardless of enclosure size. They ensure proper support of the door and door mounted devices (Figure 9). The hinges have removable hinge pins to facilitate door removal. Certain procedures, such as switch mounting, are simplified with the door removed. The doors are supplied as standard with pad-lockable latches.

![Figure 9. Typical Type 1 Enclosure (Door Closed).](image)

The door is used to mount a variety of lights, switches, and push-buttons, depending upon the options required for a particular non-automatic transfer switch. All lights and switches are mounted in the plastic door-mounted panel.

The rear of the enclosure is supplied with teardrop shaped holes in the top and bottom mounting flanges to facilitate mounting. It is also supplied with two positioning bolts and various pre-tapped inserts to insure proper positioning of the power panel anytime the power panel must be repositioned to accommodate a different cable entry position. Cable entry holes are the responsibility of the customer.
Non-automatic transfer switch enclosures and all internal steel mounting plates, such as the power panel mounting plate, go through a pretreatment cleaning system prior to painting to ensure a durable finish.

The standard non-automatic transfer switch enclosure is NEMA 1 Type for general use. However, a variety of enclosures are available to address almost any environmental circumstance (see Table 3).

Table 3. Transfer Switch Equipment Enclosures

<table>
<thead>
<tr>
<th>NEMA TYPE</th>
<th>DESIGN</th>
<th>PROTECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open</td>
<td>Indoor</td>
<td>Enclosed Equipment</td>
</tr>
<tr>
<td>1</td>
<td>Indoor</td>
<td>Rain, Ice Formation</td>
</tr>
<tr>
<td>3R</td>
<td>Indoor</td>
<td>Dust, Dirt, and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-Corrosive Liquids</td>
</tr>
</tbody>
</table>

3.7 Standards

Eaton non-automatic transfer switch equipment, enclosed in any of the enclosures listed in Table 3, is listed for application by UL and ULC. In addition, Eaton non-automatic transfer switches are listed in File E38116 by Underwriters Laboratories, Inc. under Standard UL 1008. This standard covers requirements for automatic and non-automatic transfer switches intended for use in ordinary locations to provide lighting and power as follows:

a. In emergency systems, in accordance with articles 517 and 700 in the National Electrical Code, ANSI/ NFPA 70, and the National Fire Protection Association No. 76A; and/or
b. In standby systems, in accordance with article 702 of the National Electrical Code; and/or
c. In legally required standby systems in accordance with article 701 of the National Electrical Code.

Eaton non-automatic transfer switches are available to meet NFPA 110 for emergency and standby power systems, and NFPA 99 for health care facilities when ordered with the appropriate options.

Standard UL 1008 for automatic and non-automatic transfer switches lists devices under the reexamination program which only require a continual physical reexamination of the components used in the product to ensure consistency with the originally submitted device. Follow-up testing is not required by UL 1008.

Section 4: Installation and Wiring

4.1 General

Eaton non-automatic transfer switches are factory wired and tested. Installation requires solidly mounting the enclosed unit and connecting power cables and auxiliary pilot circuits. Physical mounting procedures and power cable connections are covered in this section. All other required wiring or electrical connection references are covered in a separate Customer Wiring Booklet packaged with the non-automatic transfer switch.

Locate the wiring schematic, review it, and keep it readily available for reference purposes during installation and testing. Once a non-automatic transfer switch is properly installed and wired, it should be mechanically and electrically checked for proper installation and operation. The procedures for these initial mechanical and electrical checks are outlined in Section 6 of this instruction manual.

4.2 Mounting Location

Choose a location that offers a flat, rigid mounting surface capable of supporting the weight of the enclosed non-automatic transfer switch equipment. For standard non-automatic transfer switches, avoid locations that are moist, hot, or dusty. However, Eaton offers optional enclosure designs that can be used in special environments. If there are any doubts as to a location’s suitability, discuss them with your Eaton representative.

Check to make certain that there are no pipes, wires, or other mounting hazards in the immediate mounting area that could create a problem.

Carefully remove all packing material from the non-automatic transfer switch at the mounting location. Even though an equipment inspection should have been made when the equipment was received, make another careful inspection of the enclosure and the enclosed non-automatic transfer switch components as the packing material is removed and the enclosure readied for mounting. Be especially alert for distorted metal, loose wires, or damaged components.
4.3 Mounting Procedure

CAUTION

SINCE THE ENCLOSED NON-AUTOMATIC TRANSFER SWITCH MUST BE LIFTED INTO PLACE FOR MOUNTING, BE CERTAIN THAT ADEQUATE RESOURCES ARE AVAILABLE FOR LIFTING TO AVOID PERSONNEL INJURIES OR EQUIPMENT DAMAGE.

All equipment enclosures and power panels are of the same design. Only the overall physical dimensions change. Note that the enclosure is provided with four teardrop (elongated) mounting holes, two in the top mounting flange and two in the bottom. Cable entry holes are not part of the enclosure when shipped from the factory and must be provided in the field, either before or after mounting the enclosure. Cable access may be from the top, bottom, and/or side.

CAUTION

EXTREME CARE SHOULD BE TAKEN TO PROTECT THE TRANSFER SWITCH FROM DRILL CHIPS, FILINGS, AND OTHER CONTAMINANTS WHEN MAKING THE CABLE ENTRY HOLES. EXTREME CARE SHOULD ALSO BE TAKEN WHEN MOUNTING THE ENCLOSURE TO PREVENT COMPONENT DAMAGE OR A FUTURE MALFUNCTION.

With the enclosed non-automatic transfer switch equipment unpacked and ready for mounting, proceed with the following steps.

Step 1: The non-automatic transfer switch enclosure door is hinge mounted with removable hinge pins. To simplify the mounting procedure and avoid damaging the door-mounted logic panel, it is strongly suggested that the door be carefully removed and put in a safe place until mounting is complete. To remove the door, open the door and label and disconnect the wiring at the back of the logic panel. Remove the wire ties securing the harness to the inside of the door. Carefully remove the hinge pins then the door from the enclosure.

Step 2: Install the required upper and lower mounting bolt anchors and the two upper mounting bolts in the mounting surface.

Step 3: Gently lift the enclosure and guide the teardrop holes in the upper mounting flange over the upper mounting bolts. Do not completely tighten the bolts at this time.

Step 4: While still supporting the enclosure, install the two lower mounting bolts in the lower mounting flange. Again, do not completely tighten the bolts at this time. Use shims, if required, to prevent deformation of the enclosure if the mounting surface is distorted.

Step 5: Tighten all four mounting bolts after any required shimming is completed.

Figure 10. Typical (40A-400A) Contactor Based Non-Automatic Transfer Switch Equipment (Door Open).

Figure 11. Typical Mounting of the Non-Automatic Transfer Switch to a Mounting Surface.

Step 6: Double check to ensure that all packing and shipping materials have been removed.
4.4 Power Cable Connections

**WARNING**

POWER CONDUCTORS MAY HAVE VOLTAGE PRESENT THAT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. DE-ENERGIZE ALL POWER OR CONTROL CIRCUIT CONDUCTORS BEFORE BEGINNING TO WORK WITH THE CONDUCTORS AND/OR TERMINATING THEM TO THE EQUIPMENT.

**CAUTION**

USE OF CABLE LUGS NOT DESIGNED FOR THE NON-AUTOMATIC TRANSFER SWITCH MAY CAUSE HEATING PROBLEMS.

**CAUTION**

TO HELP PREVENT COMPONENT DAMAGE OR FUTURE MALFUNCTIONS, USE EXTREME CARE TO KEEP CONTAMINANTS OUT OF THE NON-AUTOMATIC TRANSFER SWITCH EQUIPMENT WHEN MAKING POWER CABLE CONNECTIONS.

**CAUTION**

RUN THE POWER CABLE THROUGH THE GUTTER SPACE PROVIDED TO THE RIGHT OR LEFT OF POWER PANEL.

Test all power cables prior to connection to the unit to ensure that the conductors or cable insulation have not been damaged while being pulled into position.

Power cables are to be connected to solderless screw type lugs located on the non-automatic transfer switch switching devices. Refer to the separate Customer Wiring Booklet supplied with the non-automatic transfer switch equipment for power termination. Verify that the lugs supplied will accommodate the power cables being used. Also verify that the cables comply with local electrical codes. Standard non-automatic transfer switch equipment, as supplied from the factory, will accommodate the wire sizes shown in Table 4.

<table>
<thead>
<tr>
<th>TRANSFER SWITCH AMPERE RATING</th>
<th>WIRE SIZE RANGES</th>
<th>NUMBER OF CABLES PER PHASE</th>
<th>TERMINAL TEMPERATURE RATING °C (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>#14 2/0</td>
<td>1</td>
<td>75 (167)</td>
</tr>
<tr>
<td>200</td>
<td>#6 250 KCMIL</td>
<td>1</td>
<td>75 (167)</td>
</tr>
<tr>
<td>320</td>
<td>#4 600 KCMIL or (2) 1/0-250 KCMIL</td>
<td>1 or 2 - depending on wire size used</td>
<td>75 (167)</td>
</tr>
<tr>
<td>400</td>
<td>#4 600 KCMIL or (2) 1/0-250 KCMIL</td>
<td>1 or 2 - depending on wire size used</td>
<td>75 (167)</td>
</tr>
<tr>
<td>600</td>
<td>#2 600 KCMIL</td>
<td>2</td>
<td>75 (167)</td>
</tr>
</tbody>
</table>

Carefully strip the insulation from the power cables to avoid nicking or ringing of the conductor strands. Prepare the stripped conductor termination end by cleaning it with a wire brush. If aluminum conductors are used, apply an appropriate joint compound to the clean conductor surface area.

**WARNING**

IMPROPER POWER CABLE CONNECTIONS CAN CAUSE EXCESSIVE HEAT AND SUBSEQUENT EQUIPMENT FAILURE.

Tighten the cable lugs to the torque identified on the label affixed to the door of the unit.

4.5 Wiring

**WARNING**

POWER CONDUCTORS AND CONTROL WIRING MAY HAVE VOLTAGE PRESENT THAT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. DE-ENERGIZE ALL POWER OR CONTROL CIRCUIT CONDUCTORS BEFORE BEGINNING TO PERFORM ANY WIRING ACTIVITY TO OR WITHIN THE NON-AUTOMATIC TRANSFER SWITCH EQUIPMENT.

Power sources, load conductors, and control wiring should be connected to locations as indicated in the Customer Wiring Booklet supplied with the non-automatic transfer switch equipment.

**CAUTION**

ENSURE THE NON-AUTOMATIC TRANSFER SWITCH VOLTAGE IS SET CORRECTLY. IT SHOULD BE THE SAME AS THE SOURCE 1 AND SOURCE 2 LINE VOLTAGES. OPERATING THE EQUIPMENT ON IMPROPER VOLTAGE CAN CAUSE EQUIPMENT DAMAGE.

Once the non-automatic transfer switch equipment has been installed and wired, perform the initial mechanical and electrical procedures as outlined in Section 6 to verify that the equipment is installed and operating properly.
4.6 Voltage Selection Adjustments

Certain devices, such as the Voltage Selection Panel, sensing relays, and timers, need to be set and/or calibrated prior to placing the non-automatic transfer switch equipment in service. Adjustments for logic devices are described in the separate instructional document dedicated to the specific logic being used. Voltage selection adjustments are described in this section.

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**CAUTION**

BE SURE THAT THE CORRECT VOLTAGE IS SELECTED TO MATCH THE SYSTEM VOLTAGE. AN IMPROPER SELECTION AND/OR CONNECTION COULD RESULT IN EQUIPMENT DAMAGE.

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4.6.1 Standard Voltage Selection Panels (208, 240, 480, 600 V, - 60 Hz & 220, 380, 415 V, -50 Hz)

The standard voltage selection panel consists of multi-tap transformers, contained in a steel case mounted in the enclosure. To change the voltage from the factory default 600 Vac, follow the steps detailed below.

**Step 1:** Loosen the six screws securing the cover of the Voltage Selection Transformer case. Slide the cover up, then away from the case.

**Step 2:** Remove the wires from the primary taps of both transformers and installed them on the taps for the desired voltage (Figure 12B). Note that only one wire per transformer is moved since the second wire is the zero reference.

**Step 3:** Reinstall the cover and tighten the six screws.

---

**CAUTION**

WHEN CHANGING THE VOLTAGE, ONE WIRE MUST BE MOVED ON THE PRIMARY TAPS OF BOTH TRANSFORMERS.
4.7 Terminal Block Wire Installation and Removal

Proceed with the following steps and associated figures to install or remove terminal block wiring.

Step 1: Figure 13 shows two tension clamp terminal blocks. There is a large one and small one, but the operation is the same for both. A small tool, such as a screwdriver, will be pushed into the square hole next to the wire hole and a wire will be inserted into the larger circular hole on the outer edge.

![Figure 13. Tension Clamp Terminal Blocks.](image)

Step 2: Begin by inserting a small, flathead screwdriver into the square (tool) hole with the flat surface of the screwdriver against the back wall of the hole. With a little bit of force, push the screwdriver in on a slight angle toward the center of the clamp. Be sure to slide it in until it clicks. You will then see the clamp open in the wire hole.

![Figure 14. Screwdriver Inserted in the “Tool” Hole.](image)

Step 3: Once the screwdriver is in place, obtain a stripped wire (strip about 1/4 in.) and insert it into the larger circular wire hole. Push the wire in until it can go no further.

![Figure 15. Wire Inserted in the “Wire” Hole.](image)

Step 4: While holding the wire in place, pull the screwdriver out. The wire will now be held securely in the terminal block. Pull on the wire to insure that it is correctly inserted into the clamp.

![Figure 16. Wire Securely Installed in the Terminal Block.](image)
Section 5: Operation

5.1 General
A non-automatic transfer switch provides a power contactor to connect and disconnect the load to and from the Source 1 and Source 2 power sources (Section 3.2.1).

5.2 Manual Operation

1. Disconnect all sources of power.
2. Locate the manual lever on the left side of the contactor.
3. Locate the handle used to manually transfer the switch.
4. Attach the handle to the manual lever.
5. Rotate the lever down to go to Source 1.
6. Rotate the lever down again to go to Source 2.

7. Once the manual operation is complete and non-automatic (electrical) operation is desired, connect the sources of power.
8. Follow the testing procedure in Section 6 to ensure proper non-automatic (electrical) operation.

5.3 Non-Automatic Operation (Electrically Operated)
A non-automatic (electrically operated) transfer switch functions similarly to the non-automatic (manually operated) transfer switch except for the addition of an electrical operating device panel on the door. This permits the main contacts to be opened and closed electrically. There is, however, no intelligence associated with this design.

Electrical operation is accomplished by adding required indication lights and push buttons (located on the front device panel) to the operating mechanism of the 2-position contactor.

With the transfer switch connected to Source 1, to transfer from Source 1 to Source 2 turn the 2-position selector switch to “Source-2” position. Conversely, with the transfer switch connected to Source 2, to transfer from Source 2 to Source 1 turn the 2-position selector switch to “Source-1” position. The switch’s operating position and source availability can be visually indicated via indication lights installed on the front device panel without opening the door (Figure 18).

WARNING
DO NOT ATTEMPT TO MANUALLY OPERATE THE NON-AUTOMATIC TRANSFER SWITCH WITH SOURCE 1 OR SOURCE 2 AVAILABLE.

WARNING
HIGH VOLTAGES ARE PRESENT IN AND AROUND TRANSFER SWITCH EQUIPMENT. BEFORE ATTEMPTING TO MANUALLY TRANSFER, DISCONNECT THE LINE POWER FROM THE EQUIPMENT BEING SERVICED BY OPENING AND LOCKING OUT, IF POSSIBLE, THE NEXT HIGHEST DISCONNECT DEVICE. FAILURE TO FOLLOW THIS PROCEDURE COULD CAUSE SEVERE PERSONAL INJURY AND/OR DEATH.

ALWAYS TURN THE SOURCE 1 POWER OFF AND TURN THE SOURCE 2 (IF A GENERATOR) CONTROL SELECTOR SWITCH TO THE “OFF” POSITION BEFORE ATTEMPTING A MANUAL TRANSFER.

To manually operate:
1. Disconnect all sources of power.
2. Locate the manual lever on the left side of the contactor.
3. Locate the handle used to manually transfer the switch.
4. Attach the handle to the manual lever.
5. Rotate the lever down to go to Source 1.
6. Rotate the lever down again to go to Source 2.
Section 6: Testing and Problem Solving

6.1 Testing

After the non-automatic transfer switch equipment is initially installed or during planned outages, the installation should be tested to ensure that all equipment operates properly. This attention to detail will help avoid unexpected malfunctions. Mechanical and/or electrical tests should be performed as described in this section.

The frequency of subsequent testing should be based on recommendations of the Genset manufacturer.

**WARNING**

HIGH VOLTAGES ASSOCIATED WITH OPERATIONAL TRANSFER SWITCH EQUIPMENT PRESENT A SHOCK HAZARD THAT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. USE EXTREME CAUTION TO AVOID TOUCHING ELECTRICAL CONNECTIONS WHENEVER INSPECTING OR TESTING THE EQUIPMENT.

IN ADDITION, IMPROPER OPERATION OF THE GENERATOR SET PRESENTS A HAZARD THAT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. OBSERVE ALL SAFETY PRECAUTIONS IN YOUR GENERATOR SET OPERATIONS AND INSTALLATION MANUALS.

For manual and non-automatic (electrical) operation of the transfer switch refer to Section 5 in this instruction booklet.

6.2 Problem Solving

**WARNING**

HAZARDOUS VOLTAGES IN AND AROUND NON-AUTOMATIC TRANSFER SWITCH EQUIPMENT DURING THE PROBLEM SOLVING PROCESS CAN CAUSE SEVERE PERSONAL INJURY AND/OR DEATH. AVOID CONTACT WITH ANY VOLTAGE SOURCE WHILE PROBLEM SOLVING.

**WARNING**

ONLY PROPERLY TRAINED PERSONNEL, FAMILIAR WITH THE NON-AUTOMATIC TRANSFER SWITCH EQUIPMENT AND ITS ASSOCIATED EQUIPMENT, SHOULD BE PERMITTED TO PERFORM THE PROBLEM SOLVING FUNCTION. IF AN INDIVIDUAL IS NOT QUALIFIED TO PERFORM THE PROBLEM SOLVING FUNCTION, THE INDIVIDUAL SHOULD NOT ATTEMPT ANY OF THESE PROCEDURES.

A basic problem solving effort is the first step to take prior to calling for assistance. Frequently, the effort will successfully address most problems encountered. In addition, several problem solving procedures are presented here which are specific to the type of switches or circuit breakers used in this equipment.

If a problem persists after having completed the problem solving procedure, contact an Eaton representative for further assistance. When calling for assistance, the following is the minimum information required to properly address the need:

1. General Order Number (GO#) of transfer switch, plus related Item Number.
2. Catalog and/or Style Number of transfer switch.
3. Actual location of transfer switch (type of facility, address, etc.).
4. Company name.
5. Name and position of individual representing company.
6. Basic description of situation as it exists.
7. Any results of problem solving steps taken and/or readings taken.

**Section 6.2.1 Transfer Switch Appears Inoperative (Manual Operation)**

**Step 1:** Initially verify that there is no voltage on any source (Source 1 or Source 2) inside the transfer switch.

**Step 2:** Attach the handle to the manual lever (see Figure 19) and rotate the lever down to go to Source 1.

**Step 3:** Rotate the lever down again to go to Source 2.

Following above steps, if the transfer switch does not transfer between two sources, contact factory personnel.

![Figure 19. Troubleshooting Manual Operation of the Transfer Switch](image-url)
### 7.2 Procedures

A suggested maintenance procedure is outlined in Table 5.

#### Table 5. Periodic Maintenance Procedures

<table>
<thead>
<tr>
<th>STEP</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Make the non-automatic transfer switch equipment safe for inspection and/or maintenance.</td>
<td>Disconnect the line power from equipment being serviced by opening the next highest disconnect device. Make certain that any accessory control power is switched off by disconnecting all logic plugs.</td>
</tr>
<tr>
<td>b. Inspect the structure area for safety hazards or potential maintenance problems.</td>
<td>Inspect the area, especially where switching device is installed, for any safety hazards, including personnel safety and fire hazards. Exposure to certain chemical vapors can cause deterioration of electrical connections. Inspect for accumulated dirt, loose hardware, or physical damage. Examine the primary insulation for evidence of cracking or overheating. Overheating will show as discoloration, melting, or blistering of conductor insulation, or as pitting or melting of conductor surfaces due to arcing. Inspect the secondary control connections for damage and the control wiring for insulation integrity.</td>
</tr>
<tr>
<td>c. Inspect the power contactor for dust, dirt, soot, grease, moisture, or corrosion.</td>
<td>Remove dust, dirt, soot, grease, moisture, and corrosion contamination from the surface of the switching device using a dry soft lint-free cloth, dry soft bristle brush, and vacuum cleaner. Do not blow debris into the power contactor. If contamination is found, look for the source and fix the problem.</td>
</tr>
<tr>
<td>d. Check for material integrity, uneven wear, discoloration, or loose hardware.</td>
<td>Severe material cracking will require replacement and loose hardware will need to be tightened.</td>
</tr>
<tr>
<td>e. Check the terminals and connectors for looseness or signs of overheating.</td>
<td>Overheating will show as discoloration, melting, or blistering of the conductor insulation. Connections that do not have signs of looseness or overheating should not be disturbed.</td>
</tr>
<tr>
<td>f. Contact Inspection Procedure</td>
<td>Carefully remove the arc chute clips using needle nose pliers. Remove the arc chutes to inspect the contacts. Contact Eaton Care (1-877-ETN-CARE, Option-2) if the contacts have excessive wear. Reinstall the arc chutes and arc chute clips, making sure the ends of the clips are fully seated in the grooves on the barriers.</td>
</tr>
<tr>
<td>g. Exercise the power contactor if it is not often exercised while in operation. This will permit a “wiping” action by the contacts.</td>
<td>If the power contactor is used for frequent switching during normal operation, this step can be disregarded.</td>
</tr>
<tr>
<td>h. Return the non-automatic transfer switch equipment to service.</td>
<td>Make certain all barriers are in place and doors closed. Reapply secondary and primary power.</td>
</tr>
</tbody>
</table>
Section 8: Renewal Parts Guide

8.1 General

Refer to Figure 20 for assistance with selecting and ordering selected non-automatic transfer switch renewal parts. For more information, please see Renewal Parts Publication (RP01603002E).

Example: To order the transformer pack for an NTCEC2X20400WRU transfer switch, order Catalog Number as shown in Figure 20, below.

Figure 20. Typical Non-Automatic 2-Position Contactor Based Transfer Switch.
Section 9: Non-Automatic Transfer Switch
Quick Start Instructions

**WARNING**

THESE QUICK START INSTRUCTIONS ARE NOT A COMPLETE SOURCE OF INFORMATION ON THE NON-AUTOMATIC TRANSFER SWITCH EQUIPMENT. INSTALLATION SHOULD NOT BE STARTED UNTIL THE ENTIRE INSTRUCTION BOOK HAS BEEN REVIEWED AND UNDERSTOOD. FAILURE TO FOLLOW THE FULL INSTRUCTIONS CAN RESULT IN DEATH, SEVERE PERSONAL INJURY, OR PROPERTY DAMAGE.

**WARNING**

THESE QUICK START INSTRUCTIONS ARE PROVIDED FOR USE ONLY BY TECHNICIANS HIGHLY FAMILIAR AND EXPERIENCED WITH NON-AUTOMATIC TRANSFER SWITCH EQUIPMENT INSTALLATION, SET UP, AND TESTING. IT IS STRONGLY SUGGESTED THAT THE FULL INSTRUCTIONS BE FOLLOWED FOR ALL INSTALLATIONS, SET UP, AND TESTING.

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**Step 1:** Mount the non-automatic transfer switch on a flat rigid surface (Figure 21). Shim if necessary.

**Step 2:** Install the power cables. Cables must be sized and installed per National Electrical Code, refer to NFPA70. The cables must be sized within the specified cable size range on the side of the cable connectors.

Connect the cables and torque to the correct value indicated on the label on the door in the following order:

1. Load Cables* (T1, T2, T3);
2. Source 1 or Utility Supply (N1, N2, N3); and
3. Source 2 or Generator Supply (E1, E2, E3).

For 4 pole transfer switches, connect the load cables (TN), Source 1 or utility supply (NN), and Source 2 or generator supply (EN). Refer to Figure 22 for the location of all parts discussed in this document.

*Load cables MUST be connected and torqued BEFORE installing the SUPPLY cables (Figures 22).
Step 3: Turn the generator OFF at the generator control panel.

Step 4: Apply Utility (Source 1) power. If the switch is properly applied for system voltage and frequency, "Source-1 Available" light should turn ON. Using a voltmeter, check for proper system voltage on Source 1. Voltage measurements should be taken phase to phase and phase to neutral. If the transfer switch is connected to Source-2 (not connected to Source-1), there should not be any voltage on load terminals.

Step 5: Turn 2-position selector switch to "Source-1" position and verify that "Source 1 ON" light should turn ON.

Step 6: Turn the Utility (Source 1) power OFF.

Step 7: Start the generator and apply generator (Source 2) power. If the switch is properly applied for system voltage and frequency, "Source-2 Available" light should turn ON. Using a voltmeter, check for proper system voltage on Source 2. Voltage measurements should be taken phase to phase and phase to neutral. If the transfer switch is connected to Source-1 (not connected to Source-2), there should not be any voltage on load terminals.

Step 8: Turn 2-position selector switch to "Source-2" position and verify that "Source 2 ON" light should turn ON.
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