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IE270VB

27kV CIRCUIT BREAKERS WITH
VISUAL DISCONNECT SWITCHES
P/N 1040-0010 & 1040-0011



Operation / Installation Manual



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Important Notice

This document contains information intended to aid in the proper installation and operation of the product described. Although this information will prove useful to the properly trained and qualified user, it is not practical to cover every possible situation, installation contingency, or other detail.

It is imperative that proper engineering and techniques are adhered to in the installation, operation, and maintenance of this product. It is the responsibility of the user to ensure that any system utilizing this product is safe, and that all personnel involved with the selection, installation, maintenance, and use of this product are properly qualified. This product must not be used in situations where its ratings are exceeded.

While every effort has been made to make sure the information in this document is accurate, IE cannot guarantee that there are no errors. Users of this product should verify any aspects of the product's design or performance that are critical to their application, and in particular, any aspects that may affect the safety of the overall system or installation.

Product design and specifications may change without notice.

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I: GENERAL INFORMATION



The IE270VB breakers combine a specially designed Intermountain Electronics Visual Disconnect Switch (VDS), with an industry standard Vacuum Circuit Breaker (VCB) integrated into a single compact unit rated for 27 kV operation at 600A.

These units replace older 27 kV designs with a cutting edge, globally accepted breaker and a high quality grounding VDS.

Two models are available, designated IE270VB-000 and IE270VB-001. Both models are identical, except that the IE270VB-001 incorporates an Under-Voltage Relay (UVR) function, while the IE270VB-000 does not. Table 1 provides details for both models.

The VDS can be opened or closed using an ergonomically designed operating lever on the front panel. When this lever is placed in the fully open position, all three phases (load side) are securely grounded by virtue of the “knife blade” switch arms being engaged onto grounding contacts. The grounding contacts and the switch arms are visible from the front of the unit, allowing for easy verification. When the VDS is in the open position, a mechanical safety interlock ensures that the VCB remains open as well. In

addition to this mechanical interlock, VDS auxiliary switches are used for electrical interlocking and monitoring of the position of the operating lever.

The VCB can be opened (tripped) or closed manually, using pushbutton switches on the front panel, or remotely, via electrical connections provided for this purpose. In addition, the VCB in the IE270VB-001 can be opened by de-energizing the UVR. Operating the VCB using these methods will not open the VDS, or move the operating lever on the IE270VB.

To close the VCB/VDS, the operating lever must be placed in the fully closed position. Then the VCB can be set, so long as the ready light is lit, by pushing the close pushbutton on the front panel.

The IE270VB breakers include indicators to show the status of the VDS as well as whether the VCB is open or closed. VCB & VDS auxiliary switches are provided for indication and electrical interlocking functions. Refer to the VCB documentation for proper operation of the VCB, as well as for descriptions of its various indicators and features.

When opening or closing the lever switch of the IE270VB, it is important to make sure that the contacts are firmly closed. The lever should be moved from one position all the way to the other swiftly and firmly to ensure proper contact engagement. Pushing the lever slowly may result in an intermediate position of the lever and switch arms, which could (as it should) prevent the VCB from being able to be set. **Note: The VCB should always be opened prior to opening the VDS. The VDS interlocking feature is a safety feature (only) and should not be used for normal operation.**

The operating handle of the IE270VB products is designed to allow a padlock or a “Kirk-lock” to be added to lock the handle in the open position.

The IE270VB VDS auxiliary switches sense when the operating lever is set to either the fully open or fully closed position. When the lever is in an intermediate position, neither switch will be activated. These switches have both NO and NC contacts.

Table 1: IE270VB Model Matrix

Model	IE Part Number	Description
IE270VB-000	1040-0010	IE270VB circuit breaker, without UVR
IE270VB-001	1040-0011	IE270VB circuit breaker, with UVR



II. OPERATION & SPECIFICATIONS

Theory of Operation:

The IE270VB functions through communication between the control module (CM) and the VCB. The CM is powered by 120 VAC, and is responsible for sending trip and close commands to the VCB as well as providing ready and error indications.

The VCB uses mono-stable magnetic actuators to achieve opening and closing. When a trip or close command is sent to the VCB from the CM, a pulse is sent to the magnetic actuators. Since the actuators are mono-stable the CM does not need to provide a constant signal to keep the VCB open or closed.

The CM has six major sets of connections. First are the 120VAC connections used to attach control power to the CM. Second are the Ready contacts, which prevent any command from being sent to the VCB until the CM is ready. Third are the Close contacts, which allow the breaker to be set when they are shorted together. Fourth are the Trip contacts, which act in the same manner as the close contacts, allowing the breaker to be tripped when shorted. Fifth are the Error contacts, which provide indication of the error status. Under normal operation these contacts should not be activated. Lastly are the VCB connections, which provide the status of the breaker to the CM.

Intermountain Electronics has added extra safety features such as electrical and mechanical interlocks. The electrical interlock works through the use of auxiliary switches that are activated depending on the position of the operating handle. The breaker is not allowed to be set unless the VDS aux switch indicates that the VDS is in the fully closed position. In case of electrical interlock failure, a mechanical interlock will also block the closing of the breaker unless the operating handle is in the correct position.

If, for any reason, the electrical interlock function fails and the breaker is tripped manually, by cycling the operating handle, the error light will activate. If the error light does not deactivate, and the ready light activate, upon cycling the operating handle again, another error may be present. It is possible to diagnose errors by removing the front cover and interpreting the blinking error light on the CM by using the VCB users manual, however it is recommended that a representative of Intermountain Electronics be contacted before making any changes to control wiring or if the error persists.

Control of the VCB can be achieved by operating the pushbuttons on the IE270VB front panel, or by using the remote control functions. The remote control functionality allows the breaker to be operated from anywhere, eliminating the need to be in front of the actual unit while maintaining all safety features.

Three expansion module ports are provided inside the CM compartment which are compatible with optional Intermountain Electronics expansion modules. Two ports are reserved for the type 2000-7110 expansion modules, and one is reserved for the 2000-7100.

The 2000-7110 modules consolidate the various VCB remote control and VDS indicator signals into a convenient access point for external connections. The 2000-7100 module provides VCB, CM, and VDS status signals, on a mini D-Sub connector for external monitoring purposes. Refer to spec sheets and manuals for the 2000-7110 and 2000-7100 for more information on these modules, including details about the inputs/outputs they provide when installed in IE270VB breakers.

One 2000-7110 gives access to the remote pushbutton functionality, and the other 2000-7110 connects to the VDS auxiliary switch contacts. If these expansion modules are not used, these signals can also be accessed from terminal strip J4 on the IE270VB circuit board.

The 2000-7100 expansion module may be used to remotely monitor all the IE270VB indicators. The expansion module is attached to J9 through the use of a special ribbon cable. Signals accessible through this module include VCB open and closed indicators, VDS open and closed indicators, and ready and malfunction indicators from the CM. These signals are only accessible for external connections when the 2000-7100 expansion module has been installed.

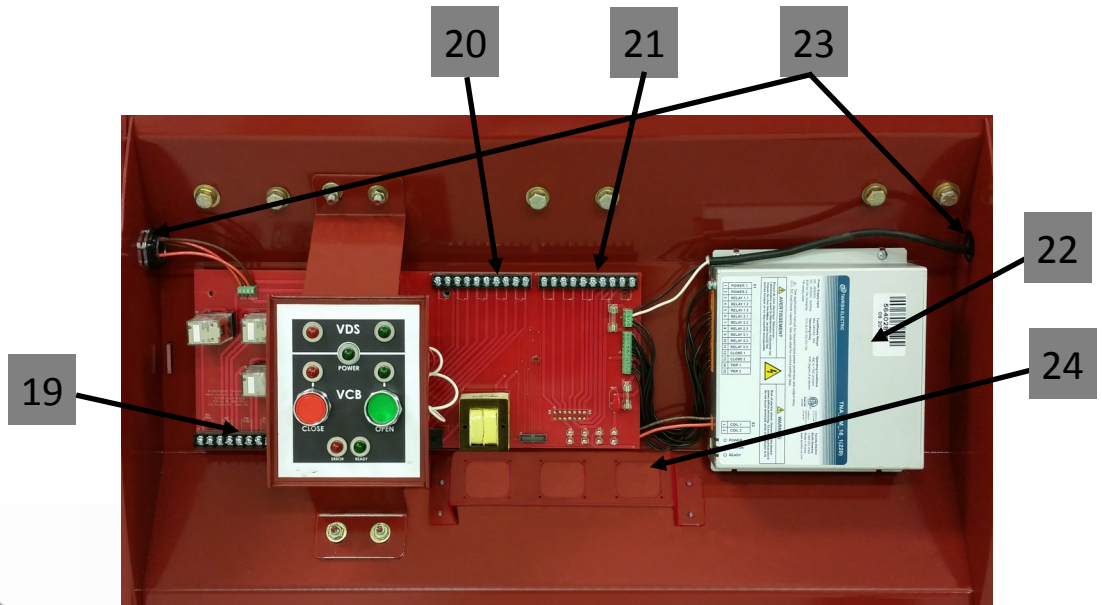
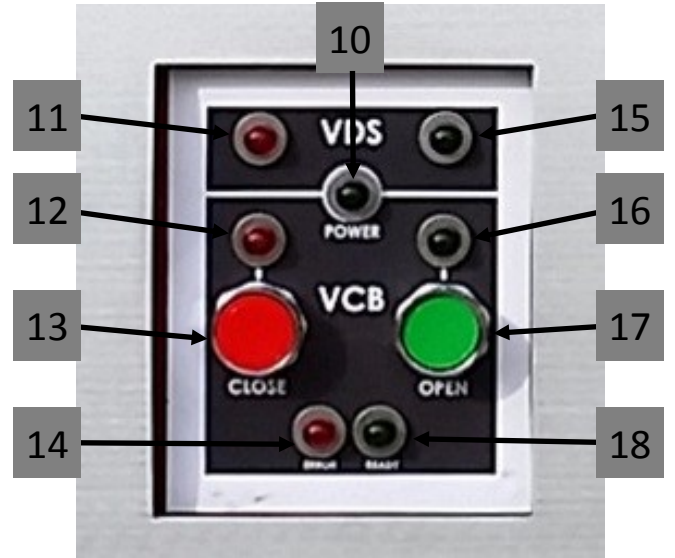
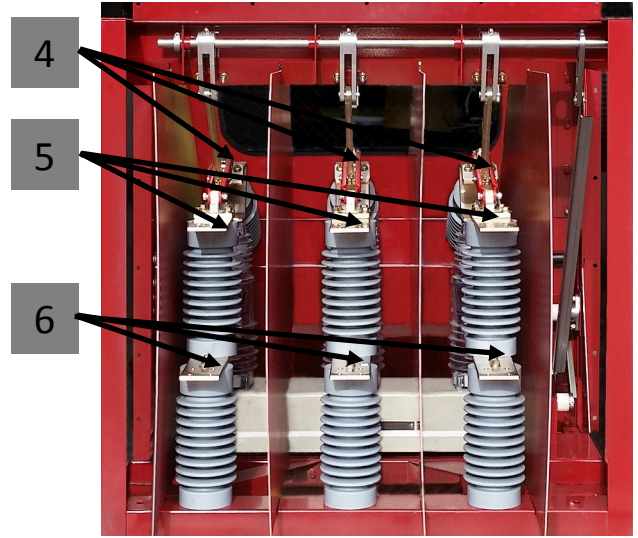
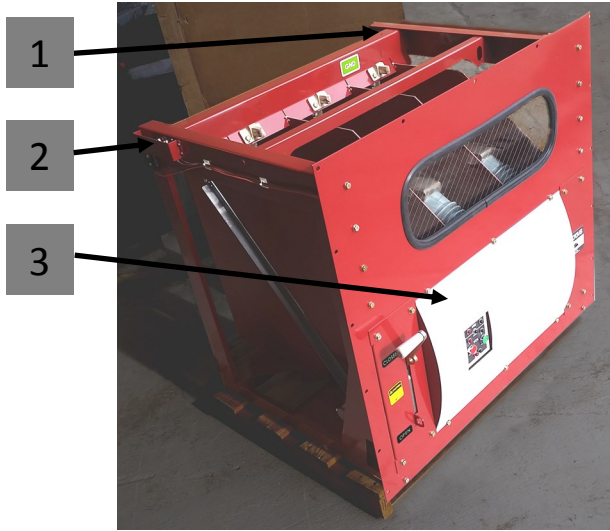
Repairs:

Repairs to the IE270VB, including replacement of various components (including the VCB), should only be carried out by qualified Intermountain Electronics personnel.

Any trouble-shooting, repair, disassembly, or similar operations should be done with appropriate safety precautions in place to make sure power has been removed from the breaker, and that it cannot be restored accidentally. Only qualified personnel should attempt such operations



II. OPERATION & SPECIFICATIONS



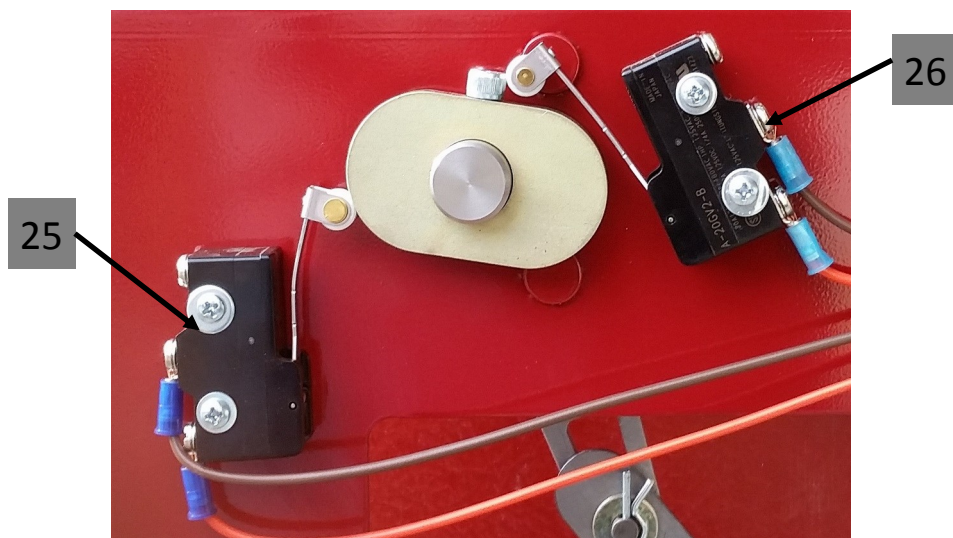


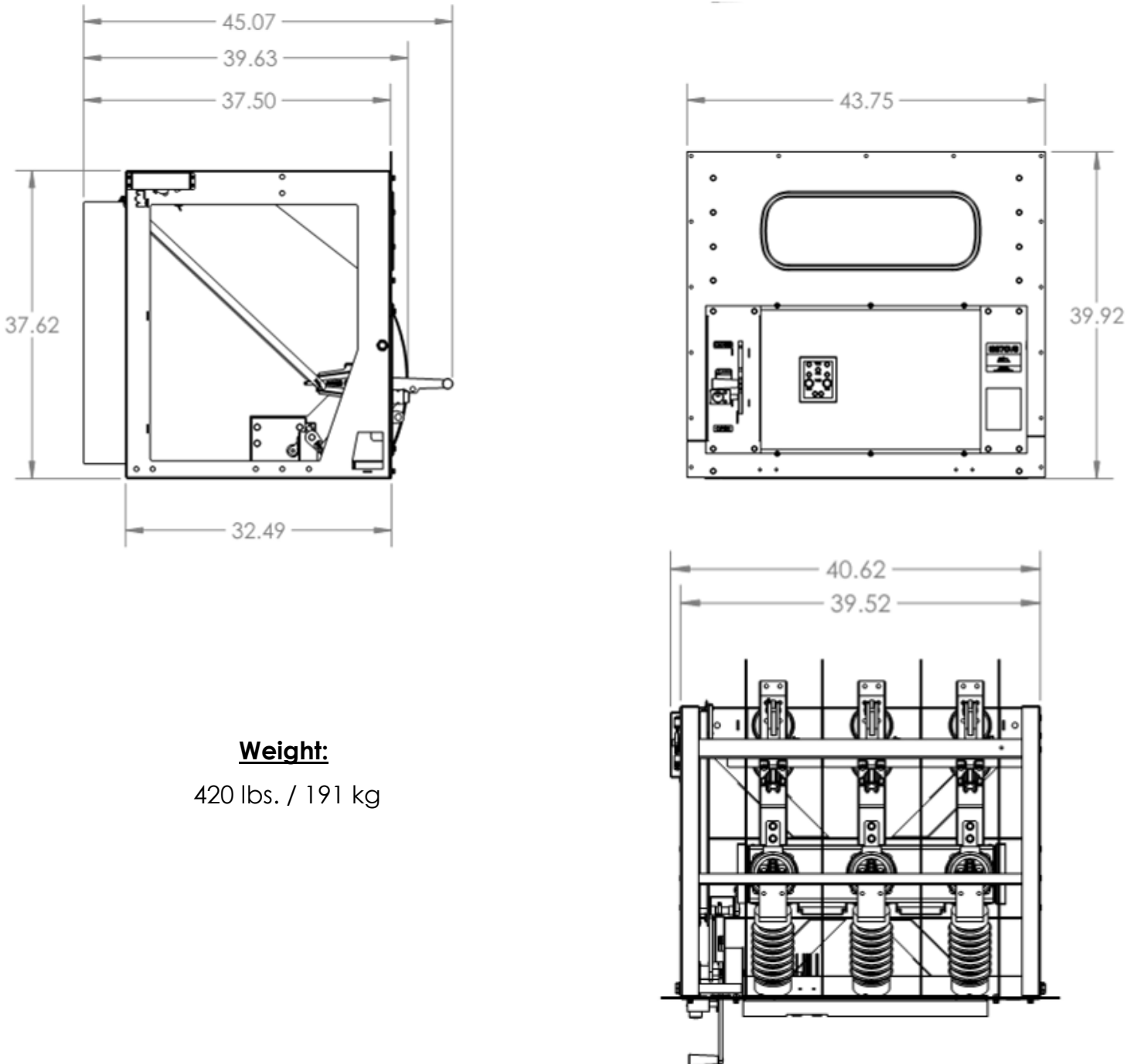
Figure 1: Controls & Components

- | | |
|---|---|
| 1) Chassis grounding/earthing point | 16) VCB open indicator |
| 2) VDS auxiliary switches (fully open, fully closed) | 17) VCB open pushbutton |
| 3) Front cover | 18) Ready indicator |
| 4) VDS knife-blades | 19) J4: VCB/VDS remote connections (customer connections) |
| 5) Load-side terminals | 20) J8: VCB NO contacts (customer connections) |
| 6) Source-side terminals | 21) J7: VCB NC contacts (customer connections) |
| 7) Operating lever arm & handle | 22) VCB control module |
| 8) VCB controls and VCB/VDS indicators | 23) Conduit for external control wiring |
| 9) Electrical Ratings / Model Number / Serial Number labels | 24) Expansion module ports |
| 10) Power indicator | 25) VDS closed auxiliary switch |
| 11) VDS closed indicator | 26) VDS open auxiliary switch |
| 12) VCB closed indicator | |
| 13) VCB close pushbutton | |
| 14) Error indicator | |
| 15) VDS open indicator | |

II. OPERATION & SPECIFICATIONS

Specifications and ratings for the IE270VB are as follows:

Physical Characteristics:



Weight:

420 lbs. / 191 kg

Figure 2: IE270VB Physical Characteristics

Electrical Ratings (See VCB data for additional specifications):

Continuous Current:	600A
Voltage:	27 kV (60Hz)
Momentary Current (1s):	16kA
Impulse Withstand (BIL):	125kV BIL
Interrupt Rating*:	16kA

*Interrupt rating is for VCB. The VDS is a non-load break switch, and is interlocked with the VCB to ensure that it does not interrupt current.

These electrical ratings are based upon the following environmental conditions:

Environmental Specifications (See VCB data for additional specifications):

Max Ambient Temperature:	+55 °C
Max Average over 24 hrs:	+35 °C
Minimum Temperature:	-40 °C
Altitude**:	1000m
Humidity:	Refer to VCB data
Vapor Pressure:	Refer to VCB data

**Above altitude specified above, electrical specifications must be appropriately derated. Refer to VCB data for details.

Control Circuit Specifications:

VCB Auxiliary Contacts, Rated Load:

<u>Voltage</u>	<u>Resistive</u>	<u>Inductive</u>
30 VDC	5A	3A
125 VAC	5A	5A
250 VAC	5A	5A

VDS Open/Close Auxiliary Contacts, Rated Load:

<u>Voltage</u>	<u>Resistive</u>	<u>Inductive</u>
30 VDC	3A	1.5A
250 VAC	3A	0.8A

Max Switching Voltage: 250 VAC / 125 VDC
 Max Switching Current: 5A



III: HANDLING, INSTALLATION & MOUNTING

Shipping/Handling:

The IE270VB comes from the Intermountain Electronics factory as a fully assembled, tested, and ready to install unit.

The unit is palletized at the factory for convenient handling and shipping. Appropriate storage, shipping, and handling precautions should be taken when moving or storing the IE-270VB. Nothing should be stacked on top of the unit, and care should be taken to prevent excessive stresses (dropping, vibration) during shipment. The unit should be kept dry, and free from harmful contaminants.

The VCB/VDS should be carefully inspected when received to make sure that no damage has occurred to the unit during shipping. If the unit has been damaged it should not be used. The operating lever should always be set to the “open” position when moving or otherwise handling the VCB/VDS.

Installation:

The IE270VB is intended for installation within an enclosure designed to protect the operator from access to dangerous voltage levels, and to meet any applicable safety standards and regulations. It is the responsibility of the installer to ensure that the enclosure is designed in a safe and compliant manner. The installation/enclosure should guarantee a minimum degree of ingress protection (IP2X) from all live parts.

The IE270VB can be mounted in front of or behind the enclosure wall. In situations where vertical limitations are present it is recommended that the IE270VB be mounted in front of the enclosure wall in order to provide a “draw out” type method of removal. ***Note: removing the breaker with this method does not ensure that electrical connections are broken. It is still required to disconnect all electrical connections before removing the breaker.***

Where vertical limitations are not an issue, and access to an overhead crane or other method to remove the breaker through the top of the enclosure is present, it is recommended to mount the breaker behind the enclosure wall.

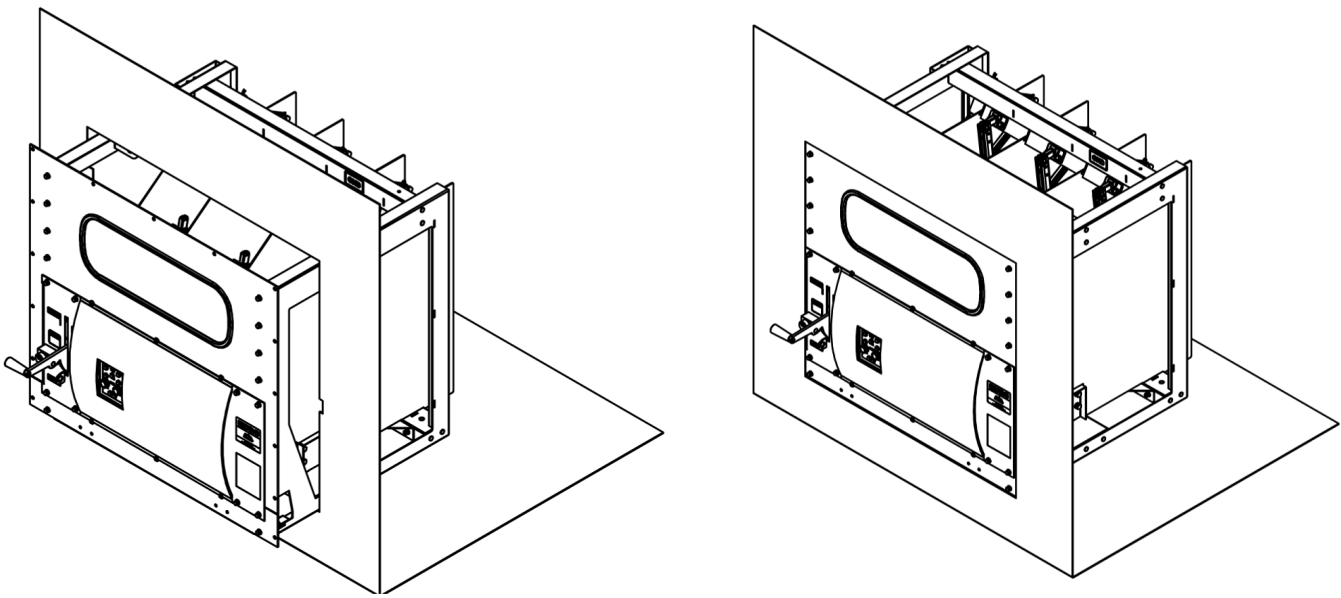


Figure 3: Suggested Mounting Methods

Left: Mounted in front of panel

Right: Mounted behind panel

The IE270VB is designed to be mounted using the hole pattern shown below. The mounting surface for the breaker should be flat. Selected fasteners should be adequate for the size and weight of the device. Electrical connections to the VCB/VDS should only be made once it has been properly and securely mounted.

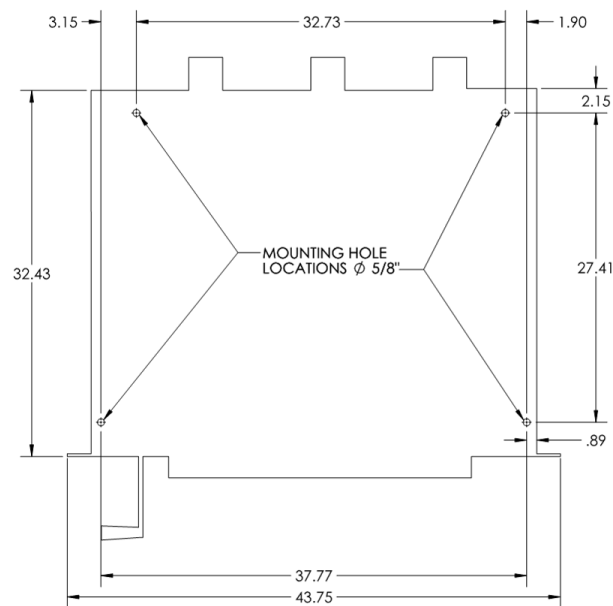


Figure 4: Mounting Hole Pattern



III: HANDLING, INSTALLATION & MOUNTING

Electrical Connections

Electrical connections to the IE270VB are made through the load-side and source-side terminals and Chassis grounding/earthing point (See figure 2 above). Hole patterns/sizes for these connection points are shown below. Care must be taken to ensure that electrical connections to the VCB/ VDS are specified and installed in accordance with sound engineering practices. Specific areas of concern include (among others) proper conductor ampacity, insulation and support.

The IE270VB should be properly grounded in accordance with proper engineering procedures.

When making electrical connections to the IE270VB, make sure that all contact surfaces are flat and free of burrs or oxidation. When copper bus bar is used, silver plating is recommended for most applications,

Electrical conductors attached to the IE270VB should be properly positioned and supported to prevent mechanical stress on the contact terminals of the unit.

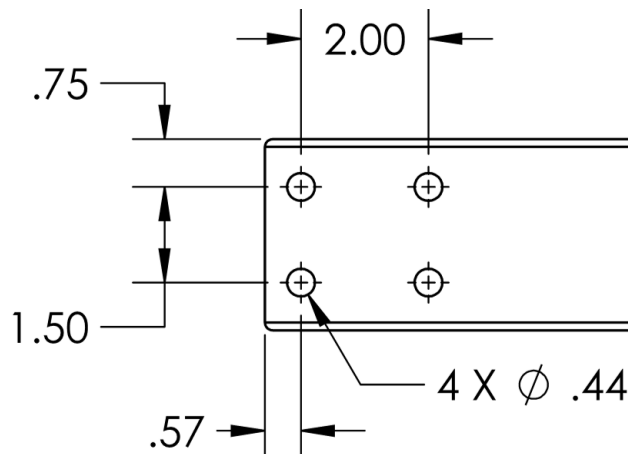


Figure 5: Electrical Connection Hole Patterns

Control Connections:

The VDS of the IE270VB includes two sets of normally open auxiliary contacts available on the terminal strip J4 on the circuit board (see figure 2). VDS Aux 1 closes when the VDS switch is fully closed, and VDS Aux 2 closes when the VDS is fully open. These signals may also be accessed via an optional 2000-7110 expansion module, as described above. The wiring diagram for these VDS auxiliary connections is included in Figure 6.

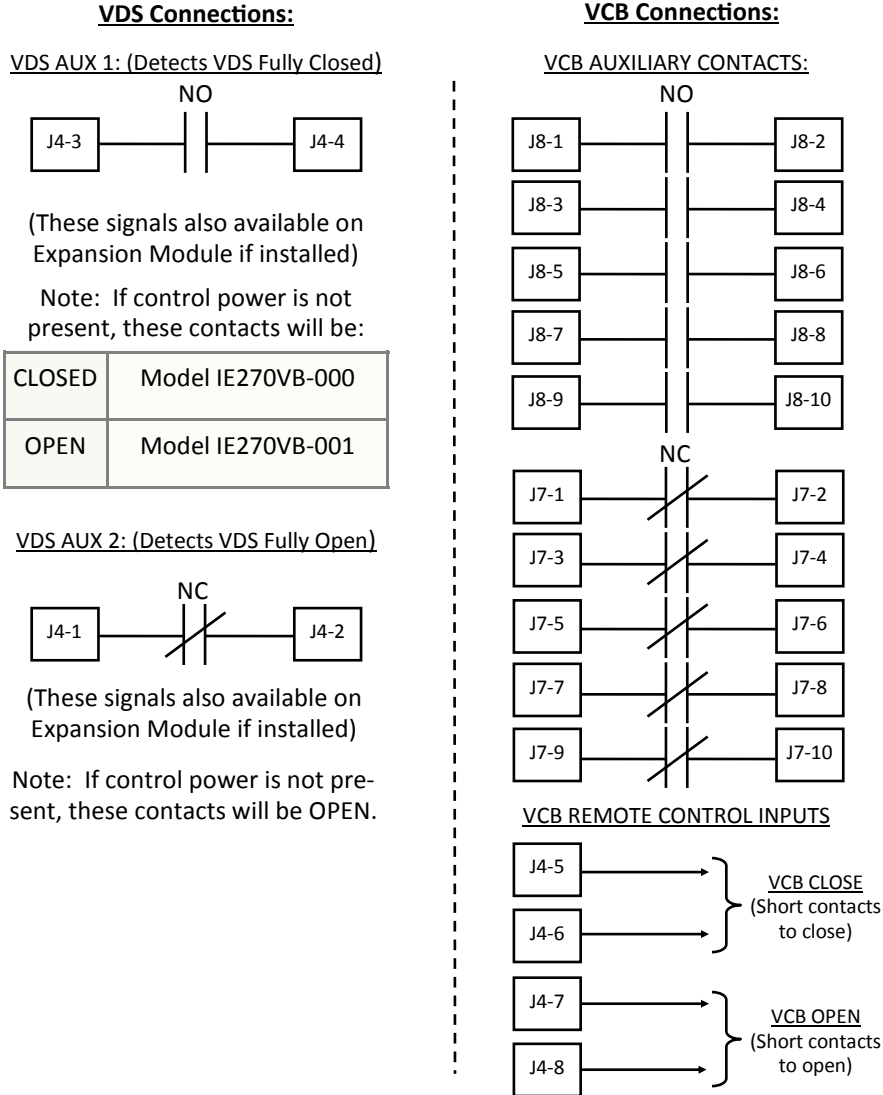


Figure 6: IE270VB Wiring Diagram

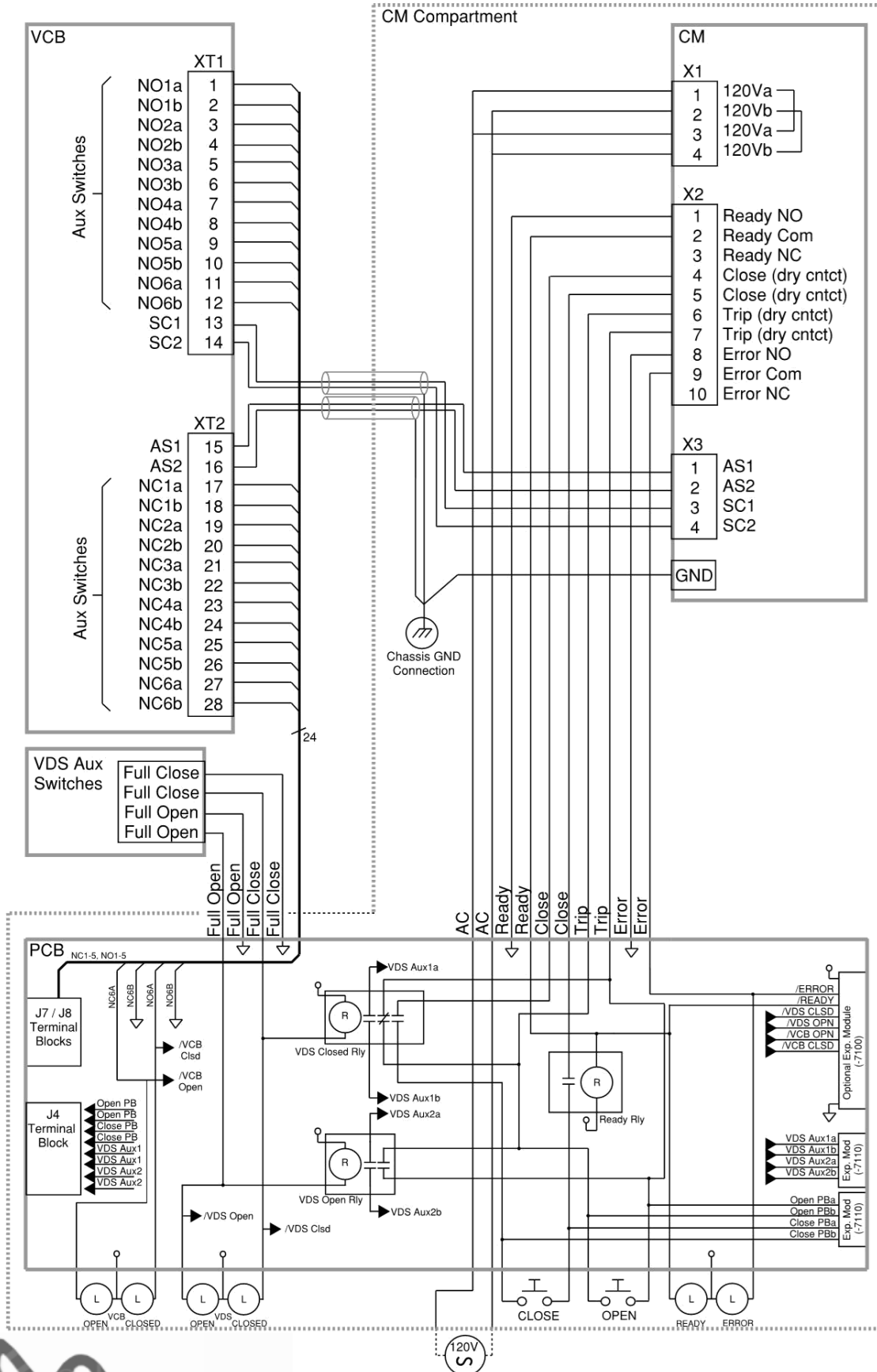
The control connections for the IE270VB's VCB includes five each of normally open and normally closed sets of auxiliary contacts. These auxiliary contacts are accessible on terminal blocks J8 and J7, respectively.

In addition to the VCB auxiliary contacts, the IE270VB also provides control connections for remotely opening or closing the breaker. These connections are included on J4. Opening or closing the VCB is accomplished by shorting the two "open" or the two "close" signals together (e.g. through the use of pushbuttons, etc.).

The wiring diagram for VCB related signals is shown in Figure 6.



Figure 7: IE270VB Block Diagram



IV: MAINTENANCE

The IE270VB VCB/VDS has been designed to provide long life and reliable service with very little maintenance. However, periodic inspections and preventative maintenance are needed to help ensure continued safe and trouble free operation.

Intermountain Electronics recommends that the VCB/VDS should be inspected and maintained at least once every 6 months. However, this schedule should be increased in applications where the VCB/VDS is operated frequently, or where the unit is used under unusual conditions (high/low temperatures, heavy contamination, caustic atmosphere, etc.)

Appropriate safety precautions should be taken while the IE270VB is being inspected or maintained to make sure power has been removed from the breaker, and that it cannot be restored accidentally. Inspections should only be carried out by qualified personnel.

VCB Maintenance, Inspections, and Servicing:

Refer to the VCB Installation and Service Instructions for maintenance and inspection instructions for the VCB.

It is very important to follow the procedures in the VCB documentation related to the VCB in addition to the procedures in this document.

When inspecting the IE270VB, a visual check should be made for any traces of electrical discharge such as arcing or corona damage. Also, any contamination that may have built up on or around the VCB/VDS should be removed.

Screws and other fasteners should be checked to ensure that they have not become loose. This is especially important for all fasteners on electrical contacts or at electrical connection points.

During inspection, the VDS should be mechanically opened and closed (without power applied) several times to ensure that knife blades are fully engaging the contacts, and that all mechanisms are operating smoothly and properly. (The VCB must be closed prior to opening the VDS for this test.)

Operation of the VDS Aux switches should be verified by moving the operating lever into the fully open and fully closed positions several times to ensure that the corresponding lights activate when in the fully open and fully closed position.



IV: MAINTENANCE

VDS Maintenance, Inspections, and Servicing:

During inspection, the knife blade assembly and contacts for the VDS should be checked for excessive wear or erosion. It is normal for contacts to show signs of use; however, the contacts should be replaced if their surface has been worn to the point that there is no longer a tight fit with the knife blades, or if excessive wear or pitting is observed.

The figure below shows a contact with a normal wear pattern. This contact is in good condition and does not need to be replaced. Note that the contact in the figure has been cleaned (and lubrication removed) to illustrate the wear pattern, it will need to be re-lubricated.



Figure 8: Contact with Normal Wear

As part of the inspection process, conductive electrical contact lubricant (Toshiba B9 or equivalent) should be lightly applied to the fixed contacts (3 fixed load contacts, 3 fixed grounding contacts) and the moving contacts (3 “pivot” contacts). See below for the position of these contacts.

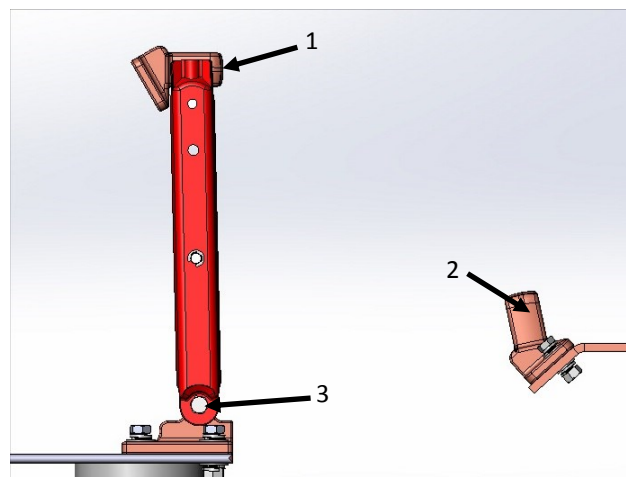


Figure 9: Contact Lubrication Points



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Price, Utah facility

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