PATENT PENDING



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IE175VB

17.5kV/1250A VACUUM CIRCUIT BREAKER/ VISUAL DISCONNECT SWITCH



Operation and Service Manual

IMPORTANT NOTICE

This document contains information intended to aid in the proper installation, operation, and maintenance of the product described. Although this document includes a great deal of information that will prove useful to the properly trained/qualified user, it is not possible to cover every possible situation, product variation, 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 design, installation, maintenance, and use of this product are properly qualified and trained. This product must not be used in situations where its electrical ratings are exceeded.

If additional information is needed, please contact Intermountain Electronics, Inc.

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 that are critical to their application, and in particular, to 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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TABLE OF CONTENTS

l:	General Information	•	4
II:	Specifications and Reference Information	•	6
III:	Handling, Installation and Mounting	.1	0
IV:	Maintenance	.1	4

LIST OF FIGURES & TABLES

Figure 1: IE175VB Dimensions
Figure 2: Controls & Components
Figure 3: Suggested Mounting Method & Windowed Trim Strip
Figure 4: Mounting Hole Pattern
Figure 5: Electrical Connection Hole Patterns 12
Figure 6: VDS Aux Schematic
Figure 7: Wiring Diagram
Figure 8: Contact with Normal Wear
Figure 9: Contacts Requiring Lubrication
Table 1: VCB Control Connections



I: GENERAL INFORMATION



The IE175VB series is a family of products, each encompassing a 3-phase Vacuum Circuit Breaker (VCB) and a Visual Disconnect Switch (VDS).

These products combine a specially designed Intermountain Electronics Visual Disconnect Switch, along with an industry standard Vacuum Circuit Breaker integrated into a single compact unit rated for 17.5 kV operation at 1250A.

The IE175VB replaces traditional 600A and 1200A designs with a globally accepted breaker and a high quality grounding VDS, while offering higher voltage and current ratings.

The VDS can be opened or closed using an ergonomically designed open/close lever on the front panel of the IE175VB. 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 interlock ensures that the VCB remains open as well. VCB Aux switches may be used for electrical interlocking or monitoring of the position of the open/close lever.

The VCB can be opened (tripped) manually, using a switch on the front panel, or remotely, via the energization of a 120V trip coil, or the de-energization of the UVR coil (if so equipped). VCB tripping in this fashion will not open the VDS, or move the open/close lever on the IE175VB.

To close the VCB/VDS, the open/close lever must be returned to fully closed position, and then the VCB can be set by charging its closing spring (manually, or with the spring-charging motor) and then by closing the breaker by either using the Push On button on the front of the VCB, or by remotely energizing the closing coil.

The VCB includes indicators to show the status of the closing spring, and whether the breaker is on or off. VCB auxiliary switches are also available for remote indication and control functions.

Refer to the VCB documentation for proper operation of the VCB, as well as for description of its various indicators and features.

When opening or closing the lever switch of the IE175VB, 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 open/close handle of the IE175VB products is equipped with provisions for locking the VDS/ VCB in the open position, using either a standard padlock or a "Kirk" type lock. In the case of the Kirk lock, the lock cannot be closed unless the open/close lever is fully in the open position.

The VCB includes a counting device to indicate how many times the breaker has been operated. (Note: The counting device will not be set to zero operations when the IE175VB is first received. This is because the breaker will have been operated several times at the Intermountain Electronics factory to ensure proper operation with the VDS.)

The IE175VB VDS auxiliary switches sense when the open/close lever is set to either the fully open or closed position. When the lever is in an intermediate position, neither switch will be activated. These switches have both NO and NC contacts.



II: SPECIFICATIONS AND REFERENCE INFO

Specifications and ratings for the IE175VB are as follows:

Physical Characteristics:

Overall dimensions for the IE175VB are shown below.





Figure 1: IE175VB Dimensions

Weight: 375 lbs

Location of Controls & Components:

Refer to the figure below for the position of controls and other key components of the IE175VB.





Figure 2: Controls & Components

- 1) VDS Auxiliary switch (switch open)
- 2) VDS Auxiliary switch (switch closed)
- 3) Conduit for VCB wiring
- 4) Chassis grounding/earthing point
- 5) VDS knife-blades
- 6) Load-side terminals
- 7) Source-side terminals
- 8) VCB Lever for manual closing spring charging
- 9) IE175VB Electrical Ratings / Model Number / Serial Number labels
- 10) Mounting location for "Kirk" style lock and safety padlock location
- 11) Open/Close Lever arm & Handle
- 12) VCB Push Off button
- 13) VCB Push On button
- 14) VCB Signaling device for circuit-breaker open/closed
- 15) VCB Signaling device for closing springs charged/discharged
- 16) VCB Operation Counter
- 17) VCB Control Wiring Terminal Block*
- 18) VCB Auxiliary Contacts*
- *Note: Remove the VCB cover to access items 17 and 18



Electrical Ratings (See VCB data for additional specifications):

Note: These specifications can change, depending on version of VCB being used. Refer to VCB data for the actual unit installed—if differences exist, VCB specifications should be considered correct.

Continuous Current:	1250A	
Voltage:	17.5 kV (60Hz)	
Momentary Current:	25 kA	
Impulse Withstand (BIL)	95 kV BIL	
Interrupt Rating:	25 kA*	

*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*	+40 degrees C
Max Average Maximum over 24 hrs	+35 degrees C
Minimum temperature	-5 degrees C
Altitude**	1000m / 3281 feet
Humidity	Refer to VCB data

* Above ambient temperature specified above, continuous current rating must be appropriately derated. Refer to VCB information for details.

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

Other Electrical / Environmental Specifications:

Refer to the VCB documentation for other specifications and ratings for the VCB.

Control Circuit Specifications:

VDS Aux Switches:

15A @ 120VAC, 250VAC resistive load 0.5A @ 125VDC resistive load

VCB Aux Contacts:	Refer to VCB documentation		
Shunt Trip Opening Coil:	120VAC. Refer to VCB documentation		
Closing Coil:	120VAC. Refer to VCB documentation		
Spring Charging Motor	120VAC. Refer to VCB documentation		
UVR	120VAC. Refer to VCB documentation		

Model Names:

Model names for the IE175VB are as follows:

Accessory Options:

IE175VB-100: IE specially designed VDS with VCB. Includes accessories:

VDS aux switches indicating position of open/close lever (fully open or fully closed) VCB Shunt Trip Opening Coil VCB Spring Charging Motor VCB Closing Coil 10 VCB Auxiliary Contacts

IE175VB-101: Same as above, plus UVR option

For other possible options, please contact Intermountain Electronics.



III: HANDLING, INSTALLATION & MOUNTING

Shipping / handling:

The IE175VB 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 IE175VB. 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 open/close lever should be always be set to the "open" position, and the closing spring of the VCB should be discharged when moving or otherwise handling the VCB/VDS.

Installation:

The IE175VB 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.

A suggested mounting method is illustrated below. In this example, the IE175VB is positioned behind the panel of an enclosure with a cut-out to allow the breaker to be removed through the panel wall. A trim strip with a window allows for visual confirmation of the VDS knife blade positions, while providing ingress protection, including for the situation where the VCB cover is removed. Suggested dimensions for this trim strip are shown below. Note: This windowed trim strip (as shown) may be purchased from Intermountain Electronics (Part Number 1040-0100).

It is the user's responsibility to ensure that the method of installation of the IE175VB meets any applicable safety, regulatory, or other requirements.



Figure 3: Suggested Mounting Method & Windowed Trim Strip

The IE175VB 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



Electrical Connections:

Electrical connections to the IE175VB 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 IE175VB should be properly grounded in accordance with proper engineering procedures.

When making electrical connections to the IE175VB, make sure that all contact surfaces are flat and free of burrs or oxidation. When copper busbar is used, silver plating is recommended for most applications.

Electrical conductors attached to the IE175VB 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 portion of the IE175VB includes 2 aux switches located on the left side panel of the unit (see figure 2). Both switches have one Normally Open (NO) and one Normally Closed (NC), contact. The switch located at the top of the unit is activated when the open/close lever is fully set to the open position. The other switch is activated when the open/close lever is fully in the closed position.



Figure 6: VDS Aux Schematic

Control circuitry from the VCB includes connection points for the shunt trip opening coil, the closing coil, the charging motor terminals, the VCB aux contacts, and the Under-Voltage Release coil (if so equipped).

The connection points for these items are located inside the VCB (refer to Figure 2), and are located by removing the front cover from the VCB.

Connection points for the closing coil, the UVR, and the spring charging motor are located on the control wiring terminal block. VCB auxiliary switches are located on a separate set of terminal blocks, as shown in Figure 2.

The shunt trip opening coil has one connection point on the control wiring terminal block, and the other connection point is pre-wired to one of the auxiliary switch contacts. This allows for the typical usage of the shunt trip coil being wired in series with an auxiliary switch to prevent continuous current flow to the coil after the breaker has been tripped. See the table below.

Control Signal	Control Wiring Terminal Block	VCB Auxiliary Contacts	Notes
Spring Charging Motor	Pins 1 & 2		
Closing Coil	Pins 5 & 6		
UVR (if equipped)	Pins 9 & 10		
Shunt Trip Opening coil	Pin 8	Pin 13	Includes Aux. See explanation above
Auxiliary Contacts		Various	Refer to VCB documentation

Table 1: VCB Control Connections:



For additional information regarding connection to the VCB Auxiliary circuits or other VCB control wiring, refer to the VCB data.



Figure 7: Wiring Diagram

It is recommended that the VDS auxiliary switch (see Figure 2) that detects when the VDS is fully closed (the lower of the two) be utilized to provide an electrical interlock to the VCB to increase safety. This may be done by using this auxiliary to open the VCB with its opening coil as soon as the VDS is no longer fully closed. Note that this electrical interconnect must operate from a reliable power source (e.g. such that its power is not interrupted by opening this VCB/VDS).

In connecting to the VCB or VDS control wiring, make sure that the relevant electrical specifications are not violated. Also ensure that conductors used are selected/specified according to proper engineering standards.

After completing initial installation of the IE175VB (prior to placing the unit in service), perform the inspection procedure (described in section IV below) to ensure that the unit is working properly.

IV: MAINTENANCE

The IE175VB 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 IE175VB 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. Various models in the IE175VB family use different VCB breakers, so it is important to make sure the documentation being referred to matches the actual VCB being used.

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



VDS Inspections & routine maintenance:

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. In practice, contacts will not look like this unless they are also cleaned off. If a contact is cleaned to inspect the wear pattern, it will need to be re-lubricated.



Figure 8: Contact with normal wear (This contact does not need to be replaced)

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 (contact area on knife blades, 3 "pivot" contacts). See below for the position of these contacts.



Figure 9: Contacts Requiring Lubrication

When inspecting the IE175VB, 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.)

In particular, the mechanical safety interlock between the VDS and the VCB should be tested by ensuring that the VCB opens (trips) before the knife blade switches disengage from the contacts (items 1 and 2 in figure 9) when opening the VDS.

Operation of the VDS Aux switches (see figure 1) should be verified by moving the open/close lever into the fully open and fully closed positions several times and using an ohm meter (or equivalent method) to verify that the switches electrically open and close reliably. The switches should be set to switch only when the open/close lever is <u>fully</u> open/closed. This is particularly important for the fully closed switch, if it is being used (as recommended) for electrical interlocking with the VCB. If the switches are set incorrectly, they can be adjusted by setting the locking nuts that attach them to the unit.

Repairs:

Repairs to the IE175VB, 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.



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