PowerVac® Direct Acting
Undervoltage Trip Device

for ML-18
Medium Voltage
Vacuum Circuit Breakers
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THESE INSTRUCTIONS ARE INTENDED FOR USE BY QUALIFIED PERSONNEL FOR INSTRUCTION AND MAINTENANCE PURPOSES. REPRODUCTION IN WHOLE OR IN PART IS NOT PERMITTED WITHOUT THE EXPRESS PERMISSION OF GENERAL ELECTRIC.
SECTION 1—Introduction

Introduction
This manual provides information and explanations needed by the user to properly operate and maintain the Undervoltage Trip Device.

The Undervoltage Trip Device is a factory installed unit which is an integral part of the breaker mechanism. Its function is to monitor the trip control voltage and to trip the breaker if that control voltage drops below a certain level. Because a special breaker mechanism containing an extended trip shaft is required, it is not available as an accessory to be added later.

1.1—Safety
Each user must maintain a safety program for the protection of personnel, as well as other equipment, from the potential hazards associated with electrical equipment.

The following requirements are intended to augment the user's safety program, but NOT supplant the user's responsibility for devising a complete safety program. The following basic industry practiced safety requirements are applicable to all major electrical equipment such as switchgear or switchboards. GE neither condones nor assumes any responsibility for practices which deviate from the following:

1. ALL CONDUCTORS MUST BE ASSUMED TO BE ENERGIZED UNLESS THEIR POTENTIAL HAS BEEN MEASURED AS GROUND AND SUITABLE GROUNDING CONDUCTORS HAVE BEEN APPLIED TO PREVENT ENERGIZING. Many accidents have been caused by back feeds from a wide variety of sources.

2. Although interlocks to reduce some of the risks are provided, the individual's actions while performing service or maintenance are essential to prevent accidents. Each person's knowledge; his mental awareness; and his planned and executed actions often determine if an accident will occur. The most important method of avoiding accidents is for all associated personnel to carefully apply a thorough understanding of the specific equipment from the viewpoints of its purpose, its construction, its operation and the situations which could be hazardous.

All personnel associated with installation, operation and maintenance of electrical equipment, such as power circuit breakers and other power handling equipment, must be thoroughly instructed, with periodic retraining, regarding power equipment in general as well as the particular model of equipment with which they are working. Instruction books, actual devices and appropriate safety and maintenance practices such as OSHA publications, National Electric Safety Code (ANSI C2), the National Electric Code, and National Fire Protection Association (NFPA) 70B Electrical Equipment Maintenance must be closely studied and followed. During actual work, supervision should audit practices to assure conformance.

1.2—Maintenance

Excellent maintenance is essential for reliability and safety of any electrical equipment. Maintenance programs must be tuned to the specific application, well planned and carried out consistent with both industry experience and manufacturer's recommendations. Local environment must always be considered in such programs, including such variables as ambient temperatures, extreme moisture, number of operations, corrosive atmosphere or major insect problems and any other unusual or abusive condition of the application.

One of the critical service activities, sometimes neglected, involves the calibration of various control devices. These monitor conditions in the primary and secondary circuits, sometimes initiating emergency corrective action such as opening or closing circuit breakers. In view of the vital role of these devices, it is important that a periodic test program be followed. As was outlined above, it is recognized that the interval between periodic checks will vary depending upon environment, the type of device and the user's experience. It is the GE recommendation that, until the user has accumulated enough experience to select a test interval better suited to his individual requirements, all significant calibrations be checked at an interval of one to two years.

To accomplish this, some devices can be adequately tested using test sets. Specific calibration instructions on particular devices typically are provided by supplied instruction books.

Instruction books supplied by manufacturers address components that would normally require service or maintenance during the useful life of the equipment. However, they can not include every possible part that could require attention, particularly over a very long service period or under adverse environments. Maintenance personnel must be alert to deterioration of any part of the supplied switchgear, taking actions, as necessary to restore it to serviceable status.

Industry publications of recommended maintenance practices such as ANSI/NFPA 70B, Electrical Equipment Maintenance, should be carefully studied and applied in each user's formation of planned maintenance.

Some users may require additional assistance from GE in the planning and performance of maintenance. GE can be contracted to either undertake maintenance or to provide technical assistance such as the latest publications.

The performance and safety of all equipment may be compromised by the modification of supplied parts or their replacement by non-identical substitutes. All such design changes must be qualified to ANSI/IEEE Standard C37.59.

The user should methodically keep written maintenance records as an aid in future service planning and equipment reliability improvement. Unusual experiences should be promptly communicated to GE.
All safety precautions contained in the main body of GEK-86132 apply. Special emphasis should be placed on the prohibition against working on the breaker with the test coupler engaged. When it is necessary to work on a closed breaker, the Undervoltage Trip Device should be gagged rather than applying voltage to the device to permit the breaker to close.
The PowerVac Breaker is shipped from the factory with the Undervoltage Trip Device gag bolt installed in the gag position to allow the breaker to be shipped in the closed position. This bolt should be kept in the gagged position during mechanical check-out of and maintenance on the breaker.

**CAUTION:** REMOVE THE GAG BOLT BEFORE PLACING THE BREAKER IN SERVICE. IF THIS IS NOT DONE, THE BREAKER WILL OPERATE AS IF THE UNDervoltage TRip Device WAS NOT INSTALLED. INSTALL THE GAG BOLT ONLY WHEN THE BREAKER IS IN THE TRIPPED (OPEN) POSITION.
SECTION 3—Description and Principles of Operation

The Undervoltage Trip Device is a spring actuated tripping mechanism which monitors the trip control voltage and is actuated by loss or reduction of that voltage to trip the breaker. Fig 1 shows the a bottom view of the breaker.

With the breaker closed, the undervoltage trip coil (1), energized by the breaker trip control voltage, holds the trip plunger (3) in. On loss or reduction of voltage to the undervoltage trip coil (1), the trip plunger spring (9) forces the trip plunger (3) into the hammer assembly (8), releasing trip bar (11) to rotate the trip shaft (5) and open the breaker.

As the breaker opens (Fig. 1), the breaker hex shaft (12) rotates. The reset mechanism (7), mounted on the breaker hex shaft (12), rotates causing two functions to occur simultaneously: (a) the trip hammer assembly (8) is reset (solenoid retracted position) by the motion of trip bar (11), and (b) trip plunger (3) is pushed into the undervoltage trip coil (1) by the reset lever assembly (2).

In this position (breaker is open and Undervoltage Trip Device is cocked) the device is set to perform its function when the breaker is reclosed. If trip control voltage is restored to the undervoltage trip coil (1) before the breaker is closed, the trip plunger (3) will remain in and the breaker will close normally. However, if the trip control voltage has not been restored, the undervoltage trip coil (1) will not hold the trip plunger (3) in as the reset lever assembly (2), moves away during the closing stroke of the breaker, and the breaker will be trip free.

The Undervoltage Trip Device is furnished with a gag bolt (6) to allow the breaker to be operated when trip control voltage is not available. This feature is required for performing maintenance on the breaker or for mechanical check out of the breaker.

CAUTION: GAG OR UNGAG THE DEVICE ONLY WHEN THE BREAKER IS IN THE TRIPPED (OPEN) POSITION, AND THE CLOSING SPRING DISCHARGED OR GAGGED.

SECTION 4—Removing or Installing Gag Bolt

The gag bolt, (6) Fig. 1, has a red head and is accessible from the bottom side of the breaker. Access may be obtained by tipping the breaker gently on its side.

CAUTION: DO NOT WORK UNDER A BREAKER SUSPENDED BY THE BREAKER LIFT TRUCK.

BEFORE TIPPING A BREAKER ON ITS SIDE, ASSURE THAT IT IS OPEN AND DISCHARGED. IF THIS IS NOT DONE, THE INTERLOCK ROLLER ON THE SIDE OF THE BREAKER MAY CAUSE THE MECHANISM TO OPERATE.

GAG OR UNGAG THE DEVICE ONLY WHEN THE BREAKER IS OPEN AND THE CLOSING SPRING DISCHARGED OR GAGGED.

PROCEDURE

1. Check that the breaker closing spring is discharged or gagged and that the breaker is tripped (open).

2. Either tip the breaker on its side or raise the breaker to gain access to the gag bolt.

3. To gag the device, screw the gag bolt (6) into the tapped hole in the trip bar (11).

4. To ungag the device remove the gag bolt (6).
Fig. 2   Typical Wiring Diagram for ML-18 Mechanism with Direct Acting Undervoltage Trip Device (52 UVD)
SECTION 5—Electrical Checks

A typical wiring diagram is shown in Fig. 2 for a ML-18 PowerVac® Breaker containing an Undervoltage Trip Device. Check the wiring diagram supplied with the actual circuit breaker for its wiring.

Electrical checking consists of testing to see that the breaker will close when nominal trip control voltage is applied and that a closed breaker will trip when that voltage is removed.

**NOTE:** The device gag bolt must be removed (ungagged) while performing the electrical tests.

**CLOSING** — Use a test connector or the test position in the metalclad switchgear to apply nominal trip control voltage across the device solenoid. Close the breaker either electrically or manually and check that the breaker closed and stayed closed.

**TRIPPING** — Remove the trip control voltage. The breaker should trip immediately.

**NOTE:** If performing the test in the metalclad switchgear, trip control voltage may be removed by pulling the trip fuse.

SECTION 6—Lubrication

Proper lubrication is important for maintaining reliable operation of the Undervoltage Trip Device. When maintenance is performed on the PowerVac® breaker, apply a few drops of synthetic oil such as Mobil #1 at each pivot pin and to each moving contact surface.
These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.