

# VarCom® 950P

SWITCHED CAPACITOR CONTROLS

*with Paging Receiver*

Operating & Instruction Manual



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## SWITCHED CAPACITOR CONTROLS

### *with Paging Receiver*

## Operating & Instruction Manual

Overview .....	4
Installation .....	5
Control Set Up .....	6-7
Display Messages .....	8-9
Fusing .....	9
Operation .....	10
LED Indicators .....	11
Automatic Operations .....	12-14
Specifications .....	15
Limitation of Warranty & Liability .....	16




## OVERVIEW

The VarCom 950P Series switched bank capacitor control utilizes user selectable functions and parameters to control switched capacitor banks with local time and/or voltage control, and in remote mode using the integral Paging Receiver.

**VOLTAGE** – The control will close the capacitor bank when the sensed line voltage drops below the user selected close volts setting. The control will open the capacitor bank when the sensed line voltage rises above the user selected open volts setting.

**TIME** – The control will close the capacitor bank when the user selected close time occurs. The control will open the capacitor bank when the user selected open time occurs. Both settings are subject to the weekend settings.

**TIME/VOLT** – The control will function according to the time mode, except the time mode operating conditions will be overridden by voltage conditions according to the volt mode function.

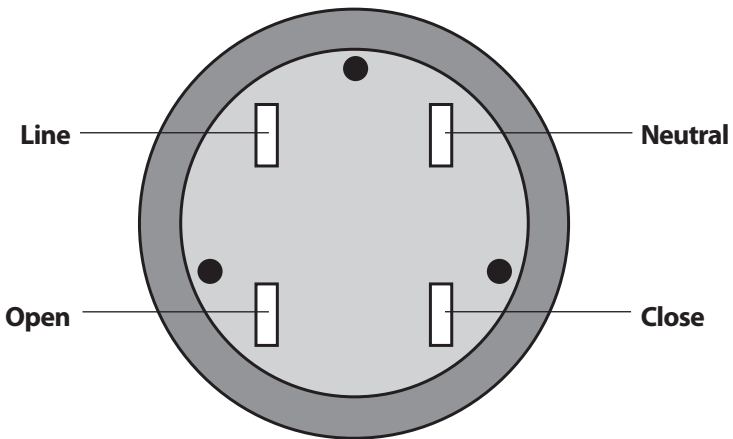
 **WARNING:** Prior to installing, operating, maintaining, or testing this equipment, read and understand the material in this manual. Failure to comply can result in death, severe injury or equipment damage. These instructions are intended to supplement, not replace, local safety practices and procedures.

## INSTALLATION

The VarCom 950P Series Controls is supplied ready for 4 jaw meter socket mounting, see Figure 1.

**INSTALLING INTO A METER SOCKET** – Align the terminals on the back of the control and press firmly into the meter socket. Use the supplied ring to complete the installation. Attach a ground wire to the external ground lug. Seal or lock the ring only after the entire system has been verified.

**⚠ WARNING:** Before plugging the control into a live circuit, rotate the main switch out of the “AUTO” position or remove the front panel fuse, and observe all safety procedures for working with live circuits. Failure to comply can result in death, personal injury or equipment damage.



**Figure 1 – Wiring diagram for a standard 4-stab, 4-lead meter socket**

## CONTROL SET UP

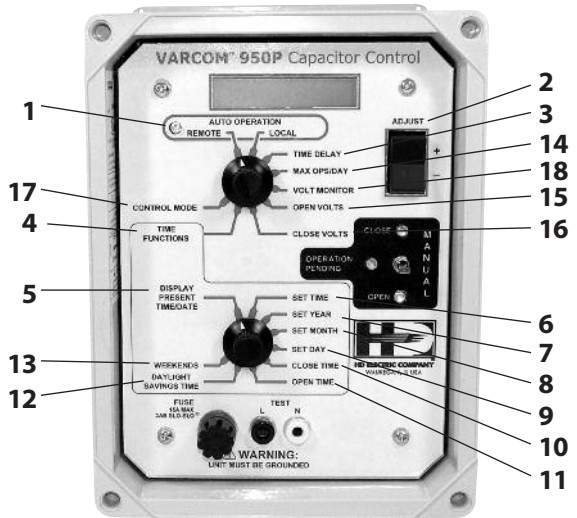
The following section describes the switch positions used to set up the VarCom 950P Control. Please refer to Figure 2.

### VarCom 950P Functions

1) **AUTO OPERATION** – This places the control in either remote or local automatic operation allowing it to control the capacitor bank according to the selected control mode and other settings.

2) **ADJUST-/+** – This switch is used to decrease or increase the selected setting. Pushing and releasing adjusts the setting by its smallest adjustment value. Pushing and holding the ADJUST switch increases or decreases the setting at a faster rate. Continuing to hold the switch increases the adjustment rate.

Figure 2 – VarCom 950P Unit



**NOTE:** All of the settings rollover when the maximum or minimum value is exceeded.

3) **TIME DELAY** – This sets the Operation Time Delay period. This delay is the amount of time, in seconds, the control will wait between determining the bank needs to switch states, and actually energizing the Capacitor Bank Relay. This delay is active for Open and Close operations, and Automatic or Manual operations. The minimum value is 3 seconds. The maximum value is 600 seconds (10 minutes).

4) **TIME FUNCTIONS** – When the upper rotary switch is placed in this position the lower rotary switch becomes active.

5) **DISPLAY PRESENT TIME/DATE** – The present time and date of the control clock will be displayed.

6) **SET TIME** – Adjusts the time of the control clock. The time is incremented in 5-minute intervals and the rate of change will increase if the adjust switch is held for several seconds.

7) **SET YEAR** – Adjusts the year of the control clock.

8) **SET MONTH** – Adjusts the month of the control clock.

9) **SET DAY** – Adjusts the day of the control clock.

10) **CLOSE TIME** – The time setting threshold for closing the capacitor bank.

11) **OPEN TIME** – The time setting threshold for opening the capacitor bank.

12) **DAYLIGHT SAVINGS TIME** – When enabled, the control clock will automatically adjust for daylight savings time (i.e. Move ahead 1 hour at 2am on the second Sunday in March and move back 1 hour at 2 am on the first Sunday in November).

13) **WEEKENDS** – Weekend settings are active in all control modes. If Saturday and/or Sunday is off, the bank will open on a weekend. If Saturday, Sunday, or both are on, the bank will operate per the control mode. If there is a clock error and the control is set for Voltage Only, it will operate in this mode all the time. If there is a clock error and the control is set for Time/Volt, the control will operate in the selected mode without time.

**NOTE:** Automatic time control is always active Monday through Friday if a time control mode is active

14) **MAX OPS/DAY** - The number of Automatic Close operations allowed by the control in a 24-hour period. The minimum value is two operations. The maximum value is 24 operations.

**NOTE:** “Manual” Close operations, and “Aborted” Automatic Close pending operations, are not counted against the Max Ops/Day setting.

15) **OPEN VOLTS** - The level of the line voltage which increments the Volts Open counter. The minimum value is the CLOSE VOLTS setting plus 3.0 volts. The maximum value is 130.0 volts.

16) **CLOSE VOLTS** - The level of the line voltage which increments the Volts Close counter. The minimum value is 105.0 volts. The maximum value is the OPEN VOLTS setting minus 3 volts.

17) **CONTROL MODE** - This sets the control mode that will be used to automatically control the capacitor bank.

18) **VOLT MONITOR** - The display will show the sensed line voltage.

## DISPLAY MESSAGES

The following describes the messages the user can expect to see on the Liquid Crystal Display.

- "Remote Active" The control will respond to Open and Close commands received from the paging receiver.
- "Total Ops xxxxxx" The total number of Close operations since installation
- "24Hr Auto Ops xx" The number of Automatic Close operations today
- "Close Inh. xx:xx" The remaining time Close Inhibit is active
- "Auto In xx:xx" The remaining time a Manual Open or Manual Close maintenance operation is active before the control returns to automatic operation
- "Opening In xx:xx" The remaining time until an Automatic Open Operation occurs
- "Closing In xx:xx" The remaining time until an Automatic Close Operation occurs
- "Bank Switching!" Indicates an IMMEDIATE operation is in progress
- "Bank Volts x.x" The Delta Volts measurement
- "Line Volts xxx.x" The Line Volts measurement
- "Time xx:xx:xx" The present control clock time
- "Date xx/xx/xx" The present control clock date
- "Sunday" (or other day) The present control clock day

**NOTE:** All messages which include an equality sign "=" indicates the user is accessing a set point.

- "Seconds = xxx" The OPERATION TIME DELAY setting
- "Max. Ops./24 Hr. = xx" The MAX OPS/DAY setting
- "Open V = xxx.x" The OPEN VOLTS setting
- "Close V = xxx.x" The CLOSE VOLTS setting
- "Mode = Time" The CONTROL MODE is Time only
- "Mode = Time/Volt" The CONTROL MODE is Time with Voltage Override
- "Mode = Voltage" The CONTROL MODE is Voltage Only
- "Time = xx:xx:xx" The control clock time setting
- "Year = xxxx" The control clock year setting
- "Month = xx" The control clock month setting
- "Day = xx" The control clock day setting
- "Close = xx:xx" The CLOSE TIME setting
- "Open = xx:xx" The OPEN TIME setting
- "DST = xxxxxxxx" Daylight Savings Time Enabled/Disabled

## DISPLAY MESSAGES *continued*

- "Wkend = xxxxxxxx"      Weekend Enabled/Disabled
- "Volt Sensor Err."      The control has determined the Voltage Sensor has failed
- "Clock Error"      The internal back-up battery for the clock has failed

**NOTE 1:** Each time the control is turned on the control will energize ALL LEDS and the LCD will display "HD Electric Co" followed by the control type and firmware version.

**NOTE 2:** If the Voltage Sensor fails, the control will initiate an Open operation.

**NOTE 3:** While in a failure Mode (see Note 2) Manual Close, while in AUTO, is disabled. Manual Close, when NOT in AUTO, is still enabled.

## FUSING

The VarCom 950P Control is supplied with a 15 Amp Slo-Blo® fuse, accessible from the front panel. This fuse disables the control and protects the capacitor bank switches. If it was removed before installation, the fuse should be reinstalled after installation is complete.

The control circuitry is also protected by an internal fuse which is not replaceable. All repairs should be referred to the factory.

## OPERATION

The following settings and features are common to all control modes:

**Time Delay** – Sets the operation time delay period. Using the Adjust switch, select the desired time delay, in seconds, from 3 to 600. This will delay both Open and Close operations in both Manual and Automatic operation mode by the time selected. The Operation Pending light flashes before every Open or Close operation for the period of time selected for the time delay. If in AUTOMATIC operation, the LCD displays the operation type (Close or Open) and time until the operation will occur.

If initiated by a MANUAL OPEN or MANUAL CLOSE command, the pending operation can be aborted by switching to AUTO.

If initiated by a MANUAL OPEN command, and the Capacitor Bank is Closed, the pending Open operation can be aborted by operating the MANUAL CLOSE switch.

If initiated by a MANUAL CLOSE command, and the Capacitor Bank is Open, the pending Close operation can be aborted by operating the MANUAL OPEN switch.

**MAX OPS/DAY** – Sets the maximum allowable number of automatic capacitor bank close operations per 24 hour period. This can be set from 2 to 24 operations using the Adjust switch. This setting overrides all other automatic operation settings. Manual operations do not count against the limit set by Max Ops/Day.

**FIVE MINUTE CLOSE INHIBIT** – The controls use a built-in time delay to prevent the line from closing into a charged Capacitor Bank. This “Close Inhibit” delay begins after every Open operation and is active for 5 minutes. Neither Automatic nor Manual Close operations will take place while “Close Inhibit” is active.

**OTHER OPERATIONAL FEATURES** – If the control loses power while the Capacitor Bank Motorized Switch is operating (either Open or Close Direction), an IMMEDIATE operation occurs upon restoration of power, bypassing the OPERATION TIME DELAY. This insures the Motorized Switch finishes it’s travel.

If the control loses power while Close Inhibit is active, an IMMEDIATE OPEN operation occurs upon restoration of power, bypassing the OPERATION TIME DELAY.

If the user switches from AUTO to any of the rotary switch Setup positions, and an operation is pending, the operation is suspended.

If the user switches from any of the rotary switch Setup positions to AUTO, and an operation is pending, the operation is suspended.

**VOLTAGE MONITOR** – When the front panel rotary switch is set to VOLT MONITOR, the display will show the sensed line voltage.

## LED INDICATORS

**REMOTE AUTO (BLINKING)** – Indicates the Control will respond to commands received through the paging receiver.

**LOCAL AUTO** – Indicates the Control is in Automatic mode and is using the operator settings to control the Capacitor Bank state.

**OPERATION PENDING** – Flashes to warn the operator an operation is about to occur. In Automatic mode, the LCD displays the type of operation about to occur (i.e. Close or Open), and the amount of time before it occurs. The OPERATION TIME DELAY setting determines OPERATION PENDING period.

**CLOSE** – When flashing, the CLOSE LED indicates the Close Motor Relay is energized. When solid, the CLOSE LED indicates the Capacitor Bank is connected to the line.

**OPEN** – When flashing, the OPEN LED indicates the Open Motor Relay is energized. When solid, the OPEN LED indicates the Capacitor Bank is NOT connected to the line.

**NOTE:** Both OPEN and CLOSE LEDs off indicates the Control has recently powered on and the Line Voltage is within the Open and Close settings. There is not a preferred Capacitor Bank state on the VarCom 950P; the operator settings and Manual operations control the Capacitor Bank state.

**MANUAL BANK CONTROL** – The MANUAL OPEN and MANUAL CLOSE toggle switch is used to “Manually” Open or Close the Capacitor Bank. To manually CLOSE or OPEN the capacitor bank:

Switch the control out of the AUTO mode, verify the red LED is off, and select TIME DELAY. Using the ADJUST switch, select the desired time delay, in seconds, from 3 to 600.

Use the toggle switch to OPEN or CLOSE the capacitor bank. The OPERATION PENDING LED will flash for the duration of the selected time delay. The CLOSE or OPEN LED will flash during the time the output is energized and will remain on.

**NOTE 1:** Pending manual operations can be cancelled by turning the control to AUTO.

**NOTE 2:** The capacitor bank cannot be closed within less than 5 minutes from the previous open operation to allow discharge of the capacitor bank. See Five Minute Close Inhibit section, page 10.

**NOTE 3:** Manual operations are counted by the operations counter (close operations only), but manual operations do not count against the preset daily limit set by 24Hr Auto Ops. See Automatic Operation section, page 12.

**MANUAL MAINTENANCE OPERATION** – When the rotary switch is in the Local AUTO position, a Manual Open or Close is considered a maintenance operation. The Manual operation completes and the Control suspends its Automatic testing for ten minutes. At the end of ten minutes, the Control reverts to Automatic operation and will automatically Open or Close the capacitor bank based upon the Automatic Operation programmed settings. While in Local AUTO, the amount of time remaining before Automatic testing resumes is cycled on the LCD.

**WARNING:** The Control will revert to Automatic operation after 10 minutes following a Manual Maintenance Operation. The control will then automatically Open or Close the capacitor bank based upon the Automatic Operation programmed settings.

## AUTOMATIC OPERATIONS

### AUTOMATIC VOLTAGE

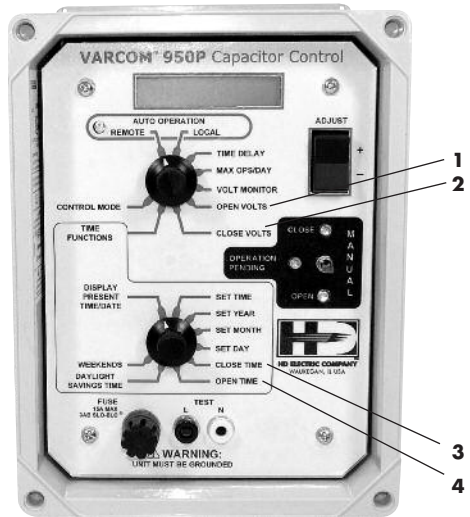
**OPERATION** – Automatic Voltage Control Mode is active when the front panel rotary switch position is set to AUTO, and the Control Mode is set to Voltage. The AUTO LED will also light. When Automatic Voltage Control Mode is active, the control tests the Voltage against the programmed Open and Close settings. To adjust the set points for automatic voltage operation, use the front panel rotary switch to select the parameter. Please refer to Figure 3.

- 1) OPEN VOLTS is the set point for opening the capacitor bank based upon sensed line voltage. When the sensed line voltage rises above this set point for one minute continuous, the control will open the capacitor bank after the preset time delay. Use the Adjust switch to select the desired value. The minimum value is the Close Volts setting plus 3 volts. The maximum value is 130 volts.
- 2) CLOSE VOLTS is the set point for closing the capacitor bank based upon sensed line voltage. When the sensed line voltage drops below this set point for one minute continuous, the control will close the capacitor bank after the preset time delay. Use the Adjust switch to select the desired value. The minimum value is 105 volts. The maximum value is the Open Volts setting minus 3 volts.

The Line Voltage is tested at one-second intervals. The Line Voltage is averaged over eight cycles per interval.

The control also incorporates an Adaptive Trip feature utilizing the Delta Volt measurement. The Delta Volt measurement is the voltage contribution of the Capacitor Bank. If the next close operation would cause the control voltage to be above the open voltage set point, the close operation is not performed until the voltage falls below the open voltage set point minus Delta

**Figure 3 – VarCom 950P Unit**



Volts. Similarly, if the next open operation would cause the control voltage to be below the close voltage set point, the operation is not performed until the voltage rises above the close voltage set point plus Delta Volts. Upon power on, Delta Volts is preset to 0.5 volts. At the first Automatic Close operation, Delta Volts is set to the difference measured just before the Bank Closes and one-minute later. From that point on every four Automatic Close operations are averaged. This average is used as the Delta Volts measurement.

#### **AUTOMATIC VOLTAGE OPERATION CONTROL PRIORITY –**

The OPEN VOLTS setting has priority over the CLOSE VOLTS setting.

**CAPACITOR BANK SWITCHING COORDINATION FEATURE –** The OPERATION TIME DELAY feature can be used to have the control automatically abort Voltage Open or Close operations, thus allowing Capacitor Bank switching coordination.

If a Volt Open operation is pending, and the Line Voltage drops below the OPEN VOLTS setting (minus 1 Volt) for 50% of the OPERATION TIME DELAY setting, the Volt Open operation will be aborted.

Likewise, if a Volts Close operation is pending, and the Line Voltage increases above the CLOSE VOLTS setting ( plus 1 volt) for 50% of the OPERATION TIME DELAY setting, the Volt Close operation will be aborted.

#### **Example:**

Two sites are controlled by a VarCom 950P Control. The Cap Bank Voltage contribution is 2.2 Volts (i.e. Delta Volts is 2.2 volts).

Site 1 CLOSE VOLTS setting is 118.0 and the OPERATION TIME DELAY setting is 60 seconds.

Site 2 CLOSE VOLTS setting is 118.0 and the OPERATION TIME DELAY setting is 180 seconds.

The Line Voltage drops below 118.0 for more than 60 seconds, both Site 1 & 2 initiate pending Close operations (i.e. the Close Event counters exceed 60).

After another 60 seconds, Site 1's Close Motor Relay energizes (i.e. the OPERATION TIME DELAY for Site 1 is 60). Shortly thereafter, the Line Voltage increases to 120.2 volts (118.0 + 2.2 Volts Delta). Site 2 is 60 seconds into its Operation Time Delay.

90 seconds later Site 2's Close operation automatically aborts (i.e. the OPERATION TIME DELAY for Site 2 is 180) approximately 30 seconds before its Close Motor Relays would have energized.

**NOTE:** If a pending operation aborts, the Voltage condition counter which initiated the operation, resets to zero.

While in Automatic Voltage Control Mode, the control will cycle through several different status messages. The messages include the Total Operations counter, the number of 24 hour Auto operations, the Line Voltage, the Present Time and either the Delta Volts or any activated timer (i.e. the "Close Inhibit" timer, or the Manual Open/Close maintenance timer).

If the control powers on into a high Line Voltage condition ( $> 130.0$  volts) an IMMEDIATE OPEN operation occurs, bypassing the OPERATION TIME DELAY time.

**AUTOMATIC TIME OPERATION** – Automatic Time Control Mode is active when the front panel rotary switch position is set to AUTO and the Control Mode is set to "Time". The AUTO LED will also light. When Automatic Time Control Mode is active, the control will open the capacitor bank when the control clock reaches the "Open" set point and the control will close the capacitor bank when the control clock reaches the "Close" set point, subject to the weekend settings. To adjust the set points for automatic time operation, use the front panel rotary switches to select the parameter. Please refer to Figure 3.

- 3) CLOSE TIME is the set point for closing the capacitor bank based upon the control clock. To adjust this setting, the upper rotary switch must be set to TIME FUNCTIONS and the lower rotary switch set to CLOSE TIME. Use the Adjust switch to select the desired time.
- 4) OPEN TIME is the set point for opening the capacitor bank based upon the control clock. To adjust this setting, the upper rotary switch must be set to TIME FUNCTIONS and the lower rotary switch set to OPEN TIME. Use the Adjust switch to select the desired time.

While in Automatic Time Control Mode, the control will cycle through several different status messages. The messages include the Total Operation counter, the number of 24 hour Auto operations and the present time.

**AUTOMATIC TIME OPERATION WITH VOLTAGE OVERRIDE OPERATION** –

Automatic Time with Voltage Override Control Mode is active when the front panel rotary switch is set to Auto and the Control Mode is set to "Time/Volt". The Auto LED will also light. When this mode is active, the control will operate as described for Automatic Time Operation as long as the sensed voltage is in the "non-Voltage Control Range" (below the OPEN VOLT setting and above the CLOSE VOLT setting). Automatic Voltage Override will occur when the sensed voltage crosses either the OPEN VOLT or CLOSE VOLT setting with the following priority:

The OPEN VOLT setting has priority over the CLOSE VOLT setting, the CLOSE TIME setting and the OPEN TIME setting.

The CLOSE VOLT setting has priority over the CLOSE TIME setting and the OPEN TIME setting.

## SPECIFICATIONS

- 16 bit High Performance in-circuit re-programmable Flash Processor
- 16 Character x 1 Line Liquid Crystal Display
- Front Panel Voltage Test points
- Enclosure – NEMA 4x, Dimensions 6" x 8"
- Mounting – 4 Jaw Meter Socket or Direct Pole Mount
- Environmental – -22° to +185° F (-30° to +85°C) 5-95% non-condensing humidity
- Voltage Sensor is True RMS and Transformer Isolated (Galvanic isolation)
- Voltage Input accuracy – +/- 1% Full Scale -22° to +176° F (-30° to +80°C)
- Voltage Input resolution – .15 VRMS internal, .1 VRMS displayed
- Voltage range – 80 to 145 VRMS
- Motor Relays – Rated 30 Amps, fused 15Amp SloBlo®, 15 Second ON duration
- Relay Protection – MOV and Snubbers across contacts
- Control Protection – MOV and Snubbers Line 1 to Neutral, Neutral to Ground, Line 1 to Ground Fused at 1 amp
- Remote Communication – Paging Receiver

## LIMITED WARRANTY AND LIMITATION OF LIABILITY

This warranty applies to all products sold by HD Electric Company (the "Products"); provided, however, that the term Products does not include any third party products purchased through HD Electric Company, for which no warranties are made (the "Third Party Products"). Third Party Products may be subject to a separate manufacturer's warranty; [should you have any question regarding whether a separate warranty applies, please contact HD Electric Company].

NOTICE: READ THIS LIMITATION OF WARRANTY AND LIABILITY BEFORE BUYING OR USING THE PRODUCTS CONTAINED HEREIN.

It is impossible to eliminate all risks associated with the use of the Products. Risks of serious injury or death, including risks associated with electrocution, arcing and thermal burns, are inherent in work in and around energized electrical systems. Such risks arise from the wide variety of electrical systems and equipment to which Products may be applied, the manner of use or application, weather and environmental conditions or other unknown factors, all of which are beyond the control of HD Electric Company.

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Upon notice of your claim, HD Electric Company will provide a return authorization number, and further instructions on how to return the product for service. You must follow HD Electric Company's instruction. You are responsible for all Product removal, handling, re-installation, and shipping (both to and from HD Electric Company). Products returned for repair, as well as repaired or replacement Products shall be sent postage / freight prepaid. After receipt of a product which HD Electric Company determines is defective, HD Electric will, at its option, either (1) repair (or authorize the repair of) the Product or (2) replace the Product, subject to the following: The Products are made using parts sourced from a variety of manufacturers. Due to the rapidly changing technology environment, parts may become obsolete / unavailable over time (end of life). In the event that a Product cannot be repaired or replaced due to unavailability of parts, HD Electric Company will use commercially reasonable efforts to obtain substitute parts or conduct work around design, but cannot guarantee its ability to do so.

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