TOSHIBA

Document: VF00W104 Rev.3

INSTRUCTION MANUAL

INSTALLATION - OPERATION - MAINTENANCE

HCV-5HA Vacuum Contactor, 7.2kV – 400A – 4.5kA (7.0kA@5.0kV)
HCV-5HAL Vacuum Contactor, 7.2kV – 400A – 4.5kA (7.0kA@5.0kV)
HCV-7HA Vacuum Contactor, 7.2kV – 400A – 7.2kA
HCV-7HAL Vacuum Contactor, 7.2kV – 400A – 7.2kA

Issued: 8/26

Manufactured in the USA with foreign and domestic parts

TOSHIBA

INSTRUCTION MANUAL

For the Installation, Operation and Maintenance of

HCV-5HA Vacuum Contactor, 7.2kV – 400A – 4.5kA (7.0kA@5.0kV)
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HCV-7HA Vacuum Contactor, 7.2kV – 400A – 7.2kA
HCV-7HAL Vacuum Contactor, 7.2kV – 400A – 7.2kA

⚠WARNING **Never attempt to install, operate, maintain or dispose of this equipment until you have first read and understood all of the relevant product warnings and user directions that are contained in this Instruction Manual.**

To contact Toshiba, address all correspondence to:

Field Service Department
Toshiba International Corporation
13131 West Little York Road
Houston, Texas 77041 USA

or call:

Tel (713) 466-0277
US (800) 231-1412
Canada 800/872-2192
Mexico 01/800/527-1204

Please complete the following information for your records and retain with this manual:

Model: _____

Serial Number: _____

Date of Installation: _____

Inspected by: _____

Reference Number: _____

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IMPORTANT MESSAGES

Read this manual and follow its instructions. Signal words such as DANGER, WARNING and CAUTION will be followed by important safety information that must be carefully reviewed.

⚠DANGER	Indicates a situation which will result in death, serious injury, and severe property damage if you do not follow instructions.
⚠WARNING	Means that you might be seriously injured or killed if you do not follow instructions. Severe property damage might also occur.
⚠CAUTION	Means that you might be injured if you do not follow instructions. Equipment damage might also occur.
NOTE	Gives you helpful information

Note: The contents of this manual will not become a part of or modify the warranty policy. The terms of which are set forth at the end of this manual.

READ SAFETY SIGNS

To avoid injury, you must read and follow all safety signs.

Keep the safety signs visible and in good shape. Never remove or cover any safety signs.

Legal Disclaimer:

Prop65 Warning: Use of this product can expose you to chemicals including Lead, which are known to the State of California to cause cancer and birth defects or other reproductive harm. You are receiving this Prop 65 Warning because if you are a California resident, California law requires you to receive it. For more information go to www.P65Warning.ca.gov.

QUALIFIED OPERATORS ONLY

Only qualified persons are to install, operate, or service this equipment according to all applicable codes and established safety practices.

A qualified person must:

1) **Carefully read the entire instruction manual.**
2) Be skilled in the installation, construction or operation of the equipment and aware of the hazards involved.
3) Be trained and authorized to safely energize, de-energize, clear, ground, lockout and tag circuits in accordance with established safety practices.
4) Be trained and authorized to perform the service, maintenance or repair of this equipment.
5) Be trained in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses, face shield, flash clothing, etc. in accordance with established practices.
6) Be trained in rendering first aid.

SAFETY CODES

Toshiba HCV-5HA, HCV-5HAL, HCV-7HA and HCV-7HAL vacuum contactors are designed and built in accordance with NEMA ICS 3, UL347, and CSA 22.2 No. 253 -16. Installations must comply with all applicable state and local codes, adhere to all applicable National Electric Code (NFPA 70) standards and instructions provided in this manual.

PROPOSITION 65 WARNING



WARNING: This product can expose you to chemicals including Lead, which are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov**.**

⚠DANGER **HAZARDOUS VOLTAGE will cause severe injury, death, fire, explosion and property damage.**

- Turn off and lock out Primary and Control Circuit Power before servicing.
- Keep all panels and covers securely in place.
- Never Defeat, Modify, or Bypass any Safety Interlocks
- Qualified Operators only

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It is the intent of this manual to provide a guide for ***safely*** installing, operating and maintaining Toshiba vacuum contactors. This manual consists of a section of general safety instructions and is marked throughout with warning symbols. Read this manual thoroughly before installation, operation and maintenance of this equipment.

This manual and all accompanying drawings should be considered a permanent part of the equipment. They should be readily available for review and reference at all times. This manual is not intended to cover all details, combinations, or variations of the equipment. Always refer to drawings accompanying the equipment for additional details.

All safety warnings must be followed to ensure personal safety. General safety instructions are found on pages 1 through 3. Read and save these instructions for future reference.

Follow all precautions to attain proper equipment performance and longevity.

Dimensions shown in the manual are in metric and/or their English equivalent.

This manual is divided into major sections of interest, as follows:

GENERAL DESCRIPTION – Provides a description of the equipment, information on major components and how they function, plus rating information.

RECEIVING, INSPECTION AND HANDLING – Describes procedures for receiving, unpacking, inspecting, handling, lifting and moving the contactors.

INSTALLATION – Provides information on installing the contactor.

PRE-ENERGIZATION CHECK – Provides a checklist for preparing the equipment for energization.

OPERATION – Provides information on operation of the contactor, circuit diagrams, operating sequence description.

MAINTENANCE – Lists the basic maintenance procedures for this equipment necessary for safe and reliable operation.

DISPOSAL – Lists procedures for the safe disposal of the equipment when the service life has expired.

STORAGE – Provides guidelines for storing new equipment for an extended period of time.

SPECIFICATIONS – Covers ratings and other specifications of the contactor.

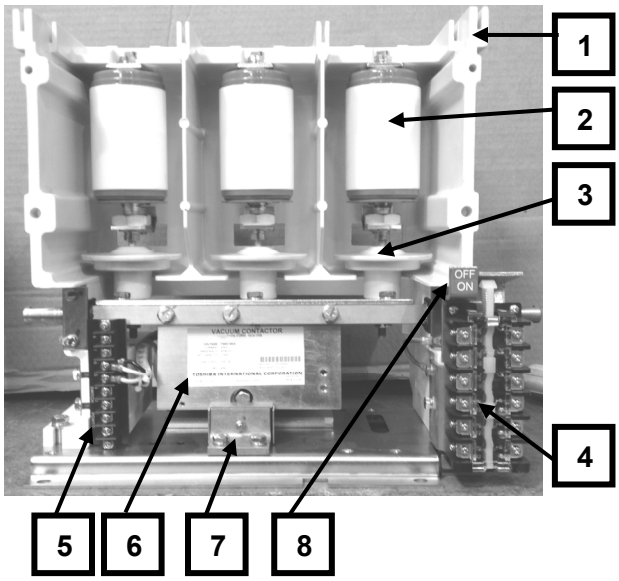
COMPONENTS

The Toshiba vacuum contactors described in this manual are suitable for use on systems up to 7.2kV – 400A.
Arc interruption is accomplished inside sealed vacuum interrupters mounted on track-resistant insulators. Vacuum interrupters use low-surge contact materials, which exhibit low current chopping levels reducing switching over-voltage.

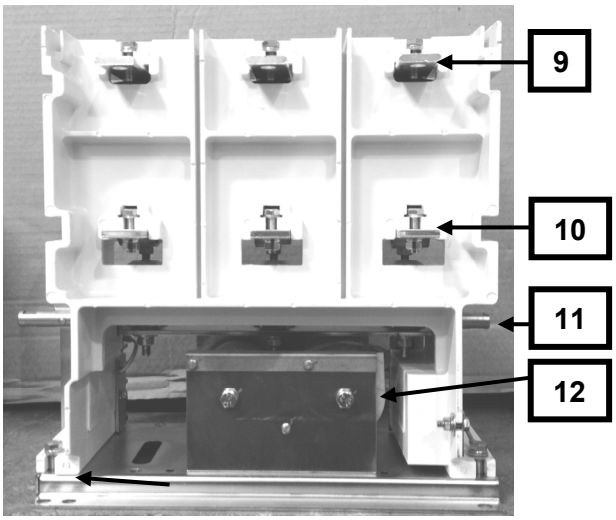
INDICATORS PROVIDED

On-Off Indicator – Located on the front, right side of the contactor. Indicates if the contactor is OFF (Green) or ON (Red). When the indicator reads OFF, the main contacts of the contactor are open. When the indication is ON, the main contacts are closed.

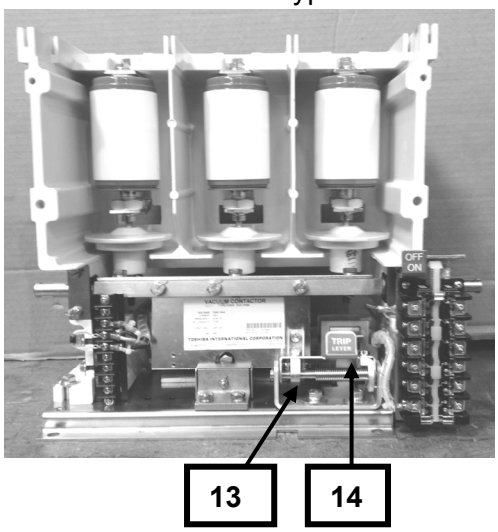
Front view



Back view



Front view – Latched type



1) Insulating frame
2) Vacuum bottle (HCV-7 shown)
3) Insulating flange
4) Auxiliary switch
5) Drive unit
6) Armature
7) Stopper
8) On-Off indicator
9) Stationary contact main terminal
10) Moving contact main terminal
11) Rotating shaft
12) Closing coils
13) Latch mechanism
14) Latch trip lever

Figure 1 – Contactor Structure

RECEIVING AND UNPACKING

The contactor units are subjected to factory production testing prior to being packed and shipped.

ACCEPTANCE INSPECTION

Confirm that the contactor is complete, correct as specified and undamaged from shipment and handling.

Upon receipt of the equipment, do the following:

1. Make an immediate inspection for damage that might have occurred during shipment. If damage is discovered, it should be noted with the carrier prior to accepting the shipment, if possible.
2. Carefully unpack the equipment sufficiently to check for missing parts or concealed damage.
3. Check for the presence of accessories that are shipped with the contactor:
    - Contactor wear gauge (Figure 2).
4. Keep the contactor upright.

⚠CAUTION **Never lay the contactor on its side or upside down. This may cause damage.**

File a claim with the carrier for any damaged or missing items and immediately notify the nearest Toshiba representative.

⚠WARNING **Do not install or energize equipment that has been damaged. Damaged equipment can fail during operation, resulting in fire and explosion.**

HANDLING AND MOVING

Care and caution should be used when handling the contactor to avoid damage to the equipment and personal injury. Always keep the equipment in a generally upright position.

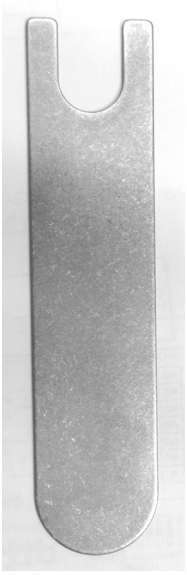


Figure 2 - Wear Gauge

AMBIENT CONDITIONS

⚠WARNING **Do not install this equipment in areas where unusual service conditions exist. Using this equipment in other than usual service conditions can result in equipment failure.**

These Toshiba contactors are intended for use in usual service conditions as defined in NEMA ICS 1. The temperature of the cooling air (ambient air temperature) surrounding the contactor should be between the limits of -5°C (23°F) and +40°C (104°F). The altitude of the equipment installation should not exceed 3300-ft (1000 m).

In particular, avoid the following installation conditions:

- Excessive dust
- Corrosive gases
- Extreme variations in temperature
- Very high or low humidity
- Vibrations
- Inclined locations

If there is a chance that condensation can occur at the installation location, a space heater should be installed inside the contactor enclosure.

NOTE: Temperature, altitude or other conditions outside of the usual limits may require derating or other special equipment. Contact your nearest Toshiba representative for additional information.

MOUNTING THE CONTACTOR

The contactor is designed to mount to a flat, horizontal surface. If there are any noticeable gaps between the contactor and the mounting surface, fill them in using flat washers as spacers.

Fasten the contactor using four (4) M8 hex head bolts. The tightening torque should be 120-150 kgf-cm (9-11 ft-lb). See Table 1 for tightening torque specifications.

MAIN CIRCUIT CABLE CONNECTIONS

Route cables that connect to the contactor to avoid interference with sharp edges and moving parts. Observe minimum bending radius for the type of cable used.

Power cables should be braced and/or laced to withstand short-circuit forces wherever such cables are unsupported. Power cables should be adequately sized to carry the maximum continuous current in accordance with NEC requirements and should have an adequate voltage rating. Cables should be dressed and terminated as appropriate to the voltage class and cable manufacturer's recommendations.

Fasten the cables to the main circuit terminals. Use 35 mm Class 8.8 M10 or M12 hex head bolts, 2 flat washers, a lock washer and a nut. While securely preventing the nut from rotating with a wrench, torque the bolt to 250-315 kgf-cm (18-23 ft-lb) for M10 bolts or 450-565 kgf-cm (32-41 ft-lb) for M12 bolts.

⚠CAUTION **Use two wrenches to torque the connection to prevent applying excessive force to the terminal, which can damage the frame.**

GROUND CONNECTIONS

The contactor must be grounded in accordance with the requirements of the National Electrical Code, Article 250 or applicable local standards.

⚠WARNING **Proper grounding connections must be made to the contactor before incoming power is applied.**

The ground connection should be made to one of the mounting bolt locations.

The ground wire should be no smaller than #10 AWG.

CONTROL CIRCUIT CONNECTIONS

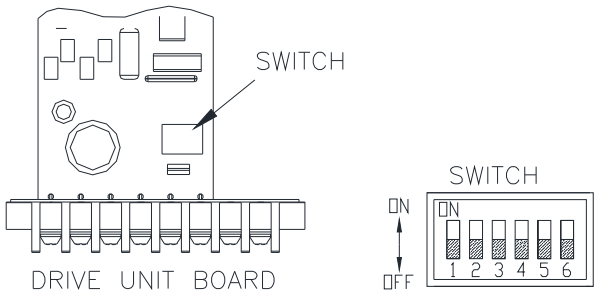
⚠WARNING **Hazardous voltage. Turn off and lock out all primary and control circuit power sources prior to performing this pre-energization check. Applying the specified power to the drive unit will immediately activate the coils and close the contactor.**

Route control cables that connect to the contactor to avoid interference with sharp edges and moving parts. They should also be routed and secured so that they are a sufficient distance from medium voltage circuits and components. Observe minimum bending radius for the type of cable used.

Control cables should be adequately sized to carry the maximum continuous current in accordance with NEC requirements and should have an adequate voltage rating. Cables should be dressed and terminated as appropriate to the voltage class and cable manufacturer's recommendations.

Either AC or DC control supply voltage may be connected to the drive unit for operation of the closing coils. The optional latched trip circuit uses DC as standard power.

The standard control voltage for the closing coils is 120Vac. Other voltages may be used, provided the switch on the drive unit is properly set. See Figure 3 for switch settings:



VOLTAGE AC/DC	SWITCH NO					
	1	2	3	4	5	6
100-110V	ON	ON	OFF	OFF	OFF	OFF
115-120V	OFF	OFF	ON	ON	OFF	OFF
125V	OFF	OFF	OFF	OFF	ON	OFF
200-220V	ON	ON	OFF	OFF	OFF	ON
230-240V	OFF	OFF	ON	ON	OFF	ON
250V	OFF	OFF	OFF	OFF	ON	ON

Figure 3 – Control Voltage Selection for Closing Coils

Trip coils for latched type contactors are available with 24Vdc, 32Vdc, 48Vdc, 125Vdc, and 250Vdc ratings.

Latched contactor installations must these guidelines:

1. The electrical trip-free circuit must be remotely located with respect to the contactor.

2. A stable DC power source such as a battery is recommended for the trip circuit. If DC power is not available, a capacitor trip device should be used.

3. The Auxiliary switch contact corresponding to terminals 11 and 21 should be used for the trip circuit and terminals 16 and 26 for the control relay circuit (Figure 8).

4. The latch mechanism has trip lever for tripping the contactor without trip or control power. Equipment using latched contactors must be provided with an externally operated manual release mechanism to operate this lever.

GENERAL

BEFORE ENERGIZING THE CONTACTOR for the first time, follow the procedure below to verify that the equipment is properly installed and functional.

⚠DANGER **Hazardous Voltage. Turn off and lock out all primary and control circuit power sources prior to performing this pre-energization check.**

⚠WARNING **Do not operate this equipment until a complete safety inspection has been made.**

⚠WARNING **Do not energize damaged equipment that has not been repaired or verified.**

⚠WARNING **Do not remove, cover or destroy any safety signs.**

⚠WARNING **Do not operate this equipment if any panels or covers have been removed.**

- All blocks or other temporary braces used for shipment must be removed.
- Install all panels, guards, and covers if removed.
- Check for any loose connections and confirm that all wiring is correct per wiring diagrams.
- A supply of spare parts should be established.
- Instruction manuals and diagrams should be collected and filed.

ELECTRICAL CHECKS

⚠WARNING **Electrical shock hazard. Do not touch energized components during a test using auxiliary power.**

An electrical insulation resistance test should be performed to verify that the contactor and associated field wiring are free from short circuits and grounds. Refer to the MAINTENANCE Section of this manual for additional information.

⚠WARNING **Hazardous voltages are present during dielectric testing which can result in serious injury or death. High potential tests should be performed only by qualified personnel.**

The operation of all control circuits should be tested with control power only before energizing the main power.

CONTROL CIRCUITS

The HCV-5HA and HCV-7HA are Magnetically Held type contactors. Contactor closing is controlled by the drive unit. The drive unit is a control board that applies a relatively high voltage to the closing coils for a short period of time to close the contactor and then reduces the voltage to the coils for holding the contactor closed.

The HCV-5HAL and HCV-7HAL are HCV-5HA and HCV-7HA contactors with a mechanical latch assembly installed. This is a Mechanically Latched type of contactor. The added latch assembly contains a DC rated trip coil and an auxiliary switch with one delayed b contact and an a contact with magnetic a blowout. For 24VDC~48VDC trip, an RC surge suppressor is supplied separately for external installation across the a contact with the magnetic blowout. See figures 6 and 8.

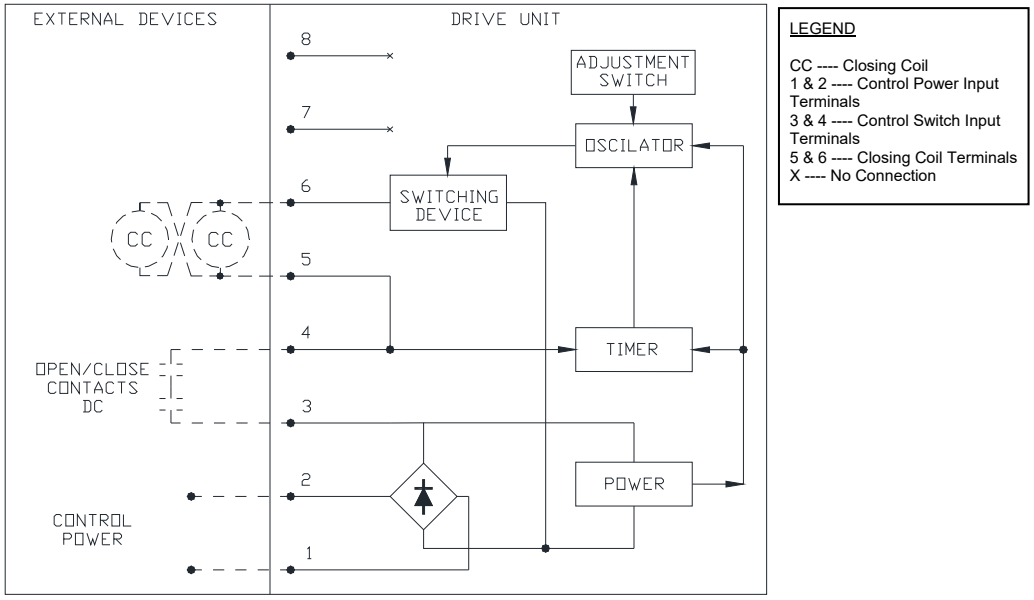


Figure 4 - Drive Unit Block Diagram

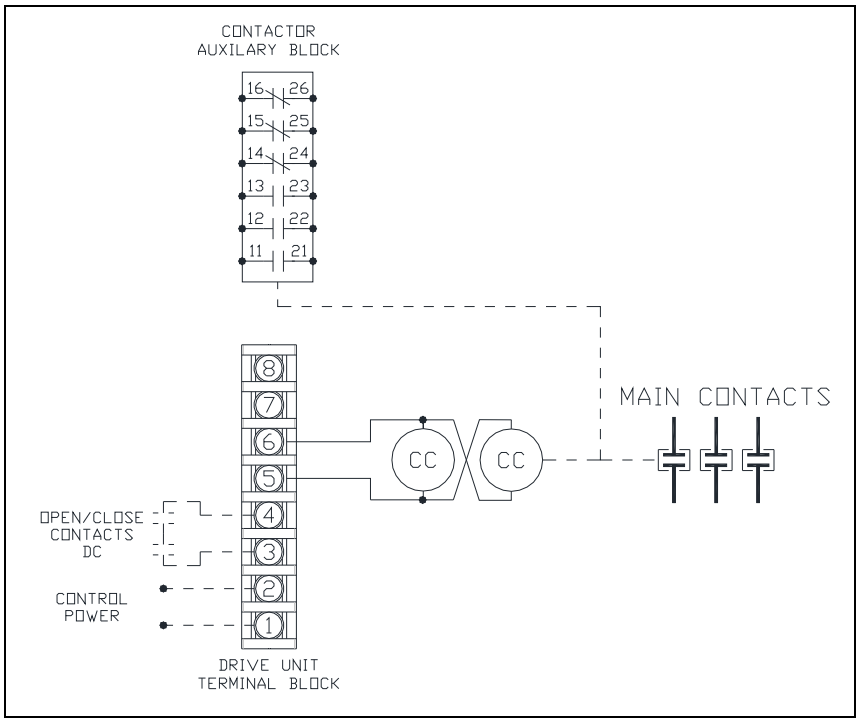


Figure 5 - Internal Connection of the Magnetically Held Type

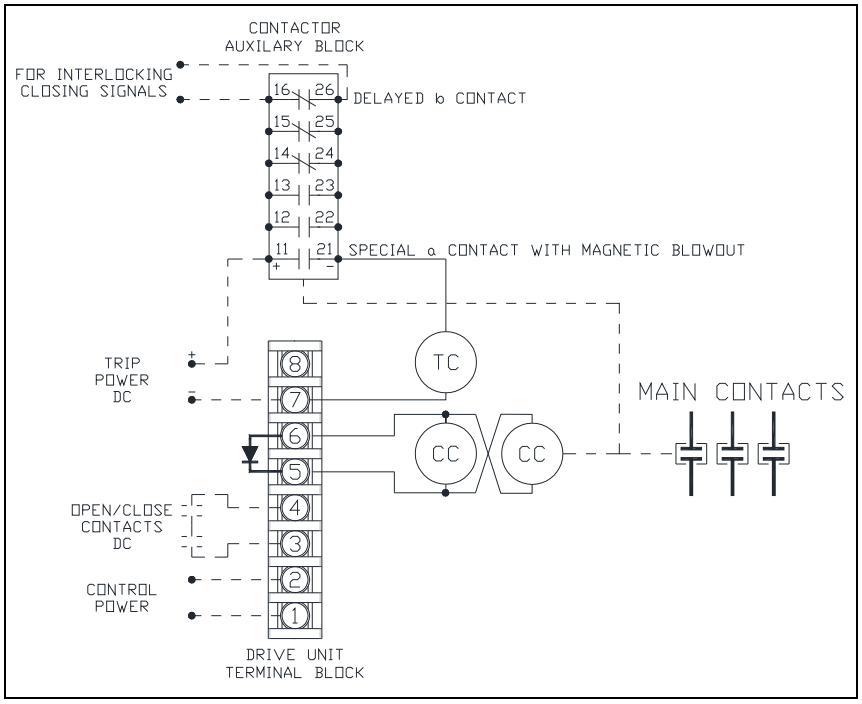


Figure 6 – Internal Connection of the Mechanically Latched Type

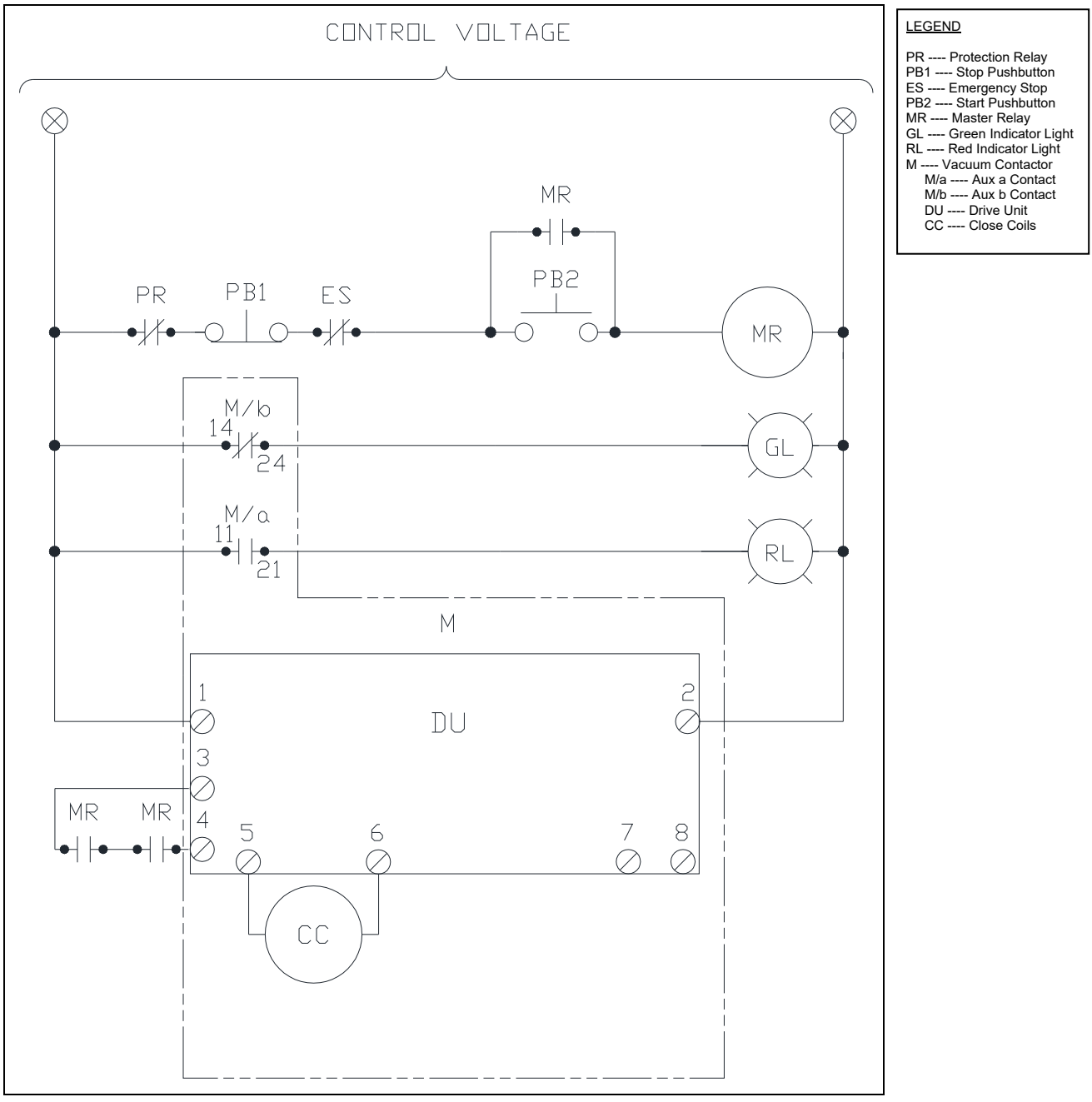


Figure 7 – Typical Control Circuit for Magnetically Held Type

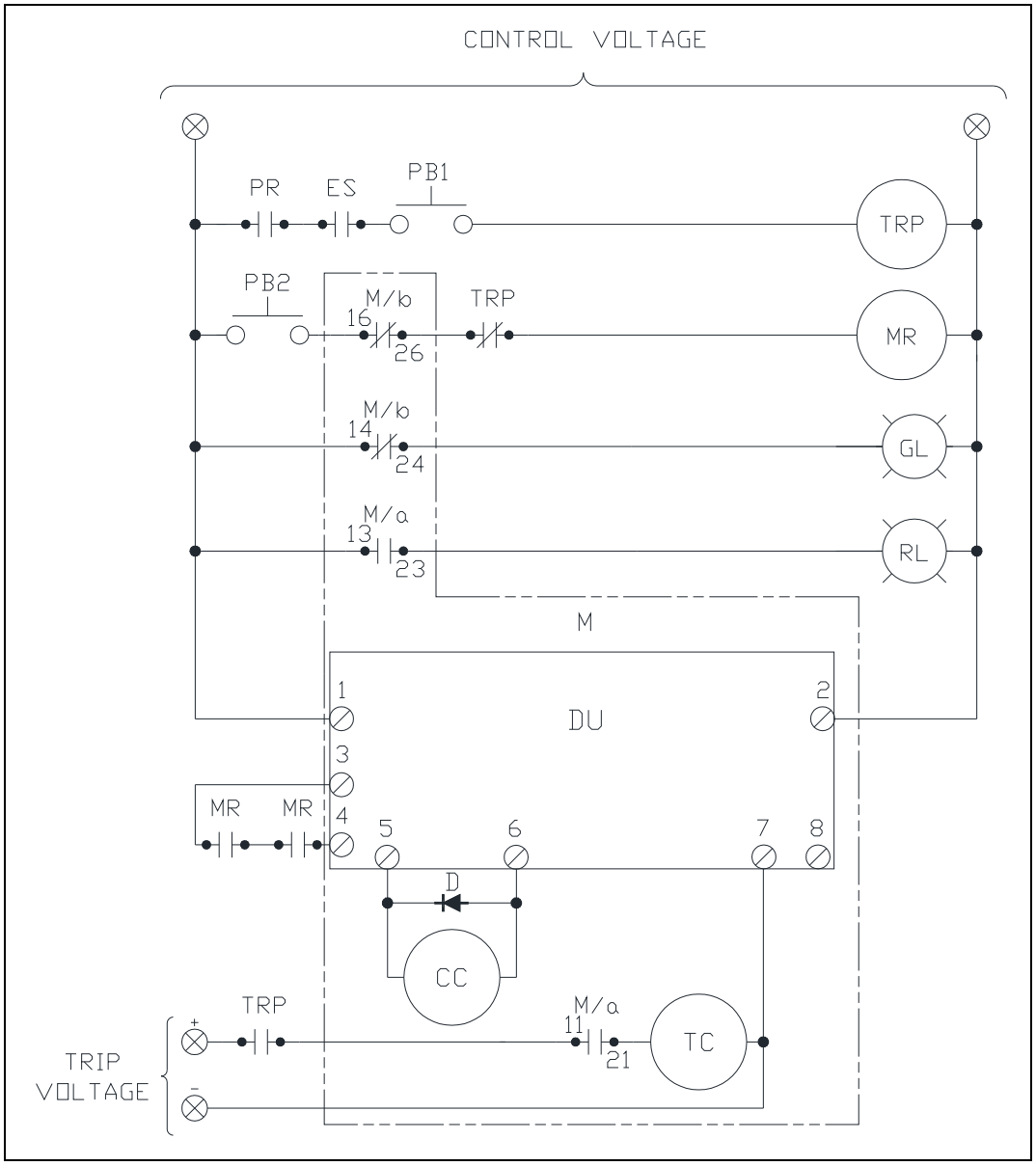
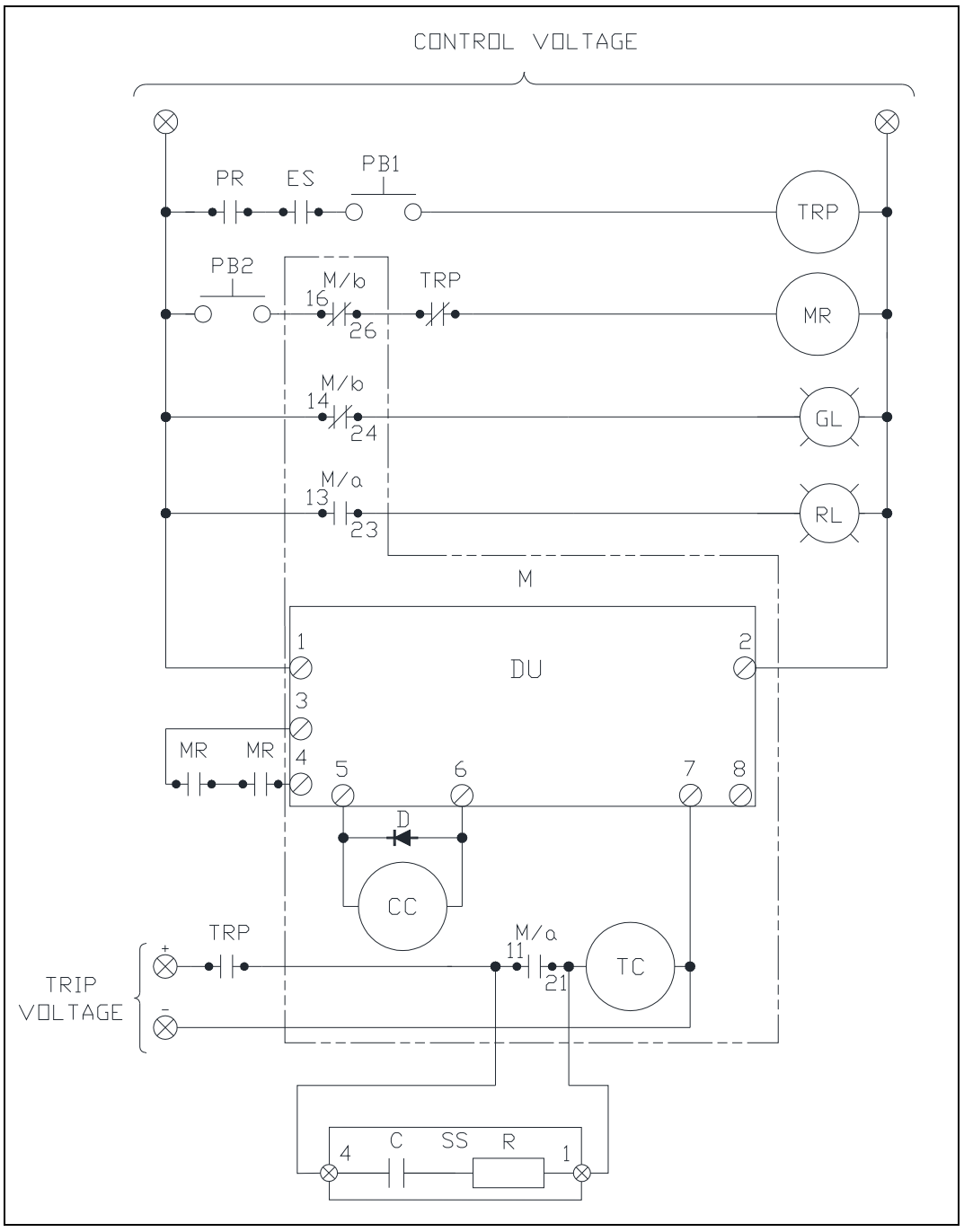


Figure 8 – Typical Control Circuit for Mechanically Latched Type 125~250VDC TRIP



LEGEND

PR ---- Protection Relay
ES ---- Emergency Stop
PB1 ---- Stop Pushbutton
TRP ---- Trip Relay
PB2 ---- Start Pushbutton
MR ---- Master Relay
GL ---- Green Indicator Light
RL ---- Red Indicator Light
M ---- Vacuum Contactor
M/a ---- Aux a Contact
M/b ---- Aux b Contact
DU ---- Drive Unit
CC ---- Close Coils
TC ---- Trip Coil
D ---- Diode
SS ---- Surge Suppressor
C ---- Capacitor
TC ---- Resistor

Figure 9 – Typical Control Circuit for Mechanically Latched Type 24~48VDC TRIP

MAINTENANCE PROGRAM

In order to ensure continued reliable and safe operation of the equipment, a program of periodic maintenance must be established. Operating and environmental conditions will usually dictate the frequency of inspection required. NFPA Publication 70B “Electrical Equipment Maintenance" may be used as a guide for setting up the maintenance program.

⚠DANGER

Contact with energized components can cause severe injury, death and property damage. Turn off and lock out primary and control circuit power before servicing.

⚠WARNING

Improper maintenance can cause severe injury, death and property damage. Only qualified and authorized persons are to install, operate or service this equipment.

⚠WARNING

Grease is conductive. Do not allow grease or any other substances to contaminate insulating materials. Contaminated insulators can allow a short circuit or ground fault to occur.

NOTE: Refer to the SAFETY section of this manual for important information.

MAINTENANCE RECORD

Keep a permanent record of all maintenance work. At a minimum, this record should include information on:

1. Items inspected
2. Reports of any testing
3. Equipment condition
4. Corrective actions or adjustments
5. Date of work
6. Comments

The degree of detail of the record will depend somewhat on the operating conditions.

SERVICING EQUIPMENT

For your safety, turn off and lock out main and control circuit power before servicing the contactor. Certain minimum safety procedures must be followed:

1. Only **qualified personnel** should attempt this service.

2. **Never** perform service on or next to exposed components energized with line voltage.

⚠WARNING

Failure to adhere to these safety procedures can result in severe injury, death and property damage.

RECOMMENDED INSPECTION AND MAINTENANCE TYPES

NOTE: Refer to the SAFETY section of this manual for important information.

1. Acceptance Inspection

   This inspection confirms that the contactor is complete, correct as specified and undamaged from shipment. The procedure for this inspection is outlined in the RECEIVING, INSPECTION AND HANDLING section of this manual.

2. Patrol Inspection

   Inspection is made of the condition of the contactor while it is energized. Check that no unusual sounds or smells exist externally. Check for any abnormal discoloration due to overheating. Inspect for signs of damage to the insulation frame, OPEN/CLOSE indicator and other components.

   Inspection Frequency: Once every 6 months

3. Periodic Inspection

   Inspection is performed with the contactor de-energized. The lubrication of sliding and rotating parts is checked and the mechanism is lubricated if needed.

   Inspection Frequency: Once every 1-2 years or every 20,000 operations (normal).

NOTE: Refer to Table 2 for the schedule of Periodic Inspections.

4. Unscheduled Inspection

   Inspections are implemented as required.

   Inspection Frequency: As needed

NOTE: The inspection frequency and points to be inspected may vary from the above recommendations depending on the status of use, frequency of switching and other factors.

Table 1 - Tightening Torque

Screw Nominal Diameter	Tightening Torque
M4	15-20 kgf-cm (13-17 in-lb)
M5	30-40 kgf-cm (26-34 in-lb)
M6	50-65 kgf-cm (43-56 in-lb)
M8	120-150 kgf-cm (9-11 ft-lb)
M10	250-315 kgf-cm (18-23 ft-lb)
M12	450-565 kgf-cm (32-41 ft-lb)

Table 2 - Check Points for Periodic Inspection

Check Point	Check Item	Check Method	Criteria	Disposition
Operating Mechanism	Loose bolts, nuts or screws	Tighten using screwdriver or wrench.	Make sure all bolts, nuts and screws are tight.	Tighten if loose. See Table 1 for tightening torque specifications.
	Dust or foreign matter inside	Visual inspection.	The contactor should be clean and contain no foreign matter.	Wipe with a clean dry cloth.
	Electro-magnets	Visual inspection.	Check for rust, discoloration, wear, or loose mountings.	Wipe with a clean dry cloth.
	Closing coil	Visual inspection.	Check for discoloration, and burned parts.	Wipe with a clean dry cloth.
	Spring	Visual inspection.	Check for rust, deformation, discoloration, or damage.	Wipe with clean dry cloth. Lubricate wipe surface if needed or every 20,000 operations. (Toshiba B9 grease)
	Smooth operation	Visual inspection or touch. Check lubrication.	Make sure moving parts operate smoothly.	Apply a small amount of lubrication. (Toshiba B9 grease)
Main Circuit	Terminals and movable conductors.	Visual inspection. Tighten using screwdriver or wrench.	Make sure there is no discoloration or loose fasteners.	Check the cause and repair. Tighten connections to the contactor. See Table 1 for tightening torque specifications.
	Loose bolts, nuts or screws	Tighten using a wrench.	Make sure all bolts, nuts and screws are tight.	See Table 1 for tightening torque specifications.
	Vacuum contact wear.	See Electrical Service Life (Page 23).	Check contact wear and wipe.	If wipe is too small contact Toshiba.
	Vacuum level.	Apply 10kV AC for 1 minute.	Check vacuum level by withstand voltage test.	If breakdown occurs, contact Toshiba.
	Dust on surface of vacuum interrupter	Visual inspection.	Make sure there is no dust on the surface.	Wipe with a clean, dry cloth.
Insulating Frame and Flanges	Dust, foreign matter or damage	Visual inspection.	Make sure there is no dust, foreign matter or breakage.	Wipe with a clean, dry cloth. If damaged, contact Toshiba.
Control Circuits	Auxiliary Switch	See Table 3.	Contact wear and wipe. Make sure there is no dust.	Replace if wear or damage is excessive. See Table 1 for tightening torque specifications
	Drive unit	Visual inspection.	Check for overheating and discoloration.	Replace if damaged.
	Wiring	Visual inspection. Tighten using a screwdriver.	Check for discoloration and tightness.	Repair if disconnected. Tighten if loose. See Table 1 for tightening torque specifications.

Table 2 – Check Points for Periodic Inspection (cont.)

Check Point	Check Item	Check Method	Criteria	What to do
Insulation Resistance Measurement	Resistance from main circuit to ground	Measure insulation resistance between phases, between electrodes, and between circuits and ground. Megger test at 1000V.	Resistance should be 50MΩ or greater.	If the insulation resistance is low, wipe off the vacuum interrupter and other insulation surfaces with a clean dry cloth and then repeat the test. If necessary, replace faulty parts.
	Resistance from control circuits to ground	Measure insulation resistance between circuits and ground. Megger test at 500V.	Resistance should be 1MΩ or greater.	
Dielectric Strength	Measure main circuit	Measure dielectric strength between phases and between circuits and ground.	14kV AC or 19.8kV DC for 1 minute	If breakdown occurs, contact Toshiba.
Open/Close Operation	----	Perform open/close operation by electric operation test to confirm the correct operation.	----	If not normal, check and repair. If necessary, replace faulty parts.

Table 3 - Gap/Wipe Standard Values (contactor in new condition)

Location	Type	Gap (mm)	Wipe (mm)	Allowable Wear	Remaining Overtravel
Vacuum Interrupter	Magnetically Held	4.0-4.2	≥2.3	1.7 mm	----
	Mechanically Latched	4.0-4.2	≥2.0	1.5 mm	
Auxiliary Switch	a-contact	4±0.4	3±0.3	----	2.2±0.3 mm
	b-contact	4±0.4	3±0.3		
	Delayed b-contact	2.5±0.3	4.5±0.5		

VACUUM CHECK

A sufficient level of vacuum is necessary for proper performance of the vacuum interrupters. Although vacuum leaks are rare, the vacuum integrity should be checked periodically. The relationship between dielectric breakdown voltage of the contact gap and internal vacuum interrupter pressure has been found to be generally predictable. Therefore, vacuum interrupter integrity is checked by performing a high potential test across the open gap of the interrupter.

TEST EQUIPMENT:

Toshiba offers a compact vacuum checker (Type CI35-1D, Figure 10) which enables a quick and easy check on vacuum interrupter internal pressure. Alternatively, any commercially available AC high potential tester may be used which is capable of delivering at least 25 milliamperes at 10 kV for a period of one minute.

PRECAUTIONS:

Applying abnormally high voltage across a pair of contacts in vacuum may produce X-rays. The radiation may increase with the increase in voltage and/or decrease in contact spacing. X-radiation produced during this test with recommended voltage and normal contact spacing is extremely low and well below the maximum permitted by standards. As an additional safety measure, however, it is recommended that all personnel keep at least 1 meter (3.3 ft) away from the vacuum contactor while this test is performed.

⚠WARNING **Radiation exposure hazard. X-rays may cause illness or injury. Stay at least 1 meter (3.3 ft) away from the contactor during the vacuum check test.**

⚠WARNING **Hazardous voltages are present during dielectric testing which can result in severe injury or death. Only qualified personnel should conduct this testing.**

TEST PROCEDURE:

1. The contactor should be disconnected from the main circuit and be in the OFF position.
2. Connect all the line side primary terminals together and to the output of the vacuum checker or AC hi-pot machine. Connect all the load side primary terminals together and to the ground terminal of the vacuum checker or AC hi-pot machine.
3. Increase the voltage from zero to 10kV AC at a rate of approximately 1kV per second. Hold the voltage at this value for 1 minute and observe the current drawn by the interrupter (Figure 11).
4. Decrease the voltage back to zero.

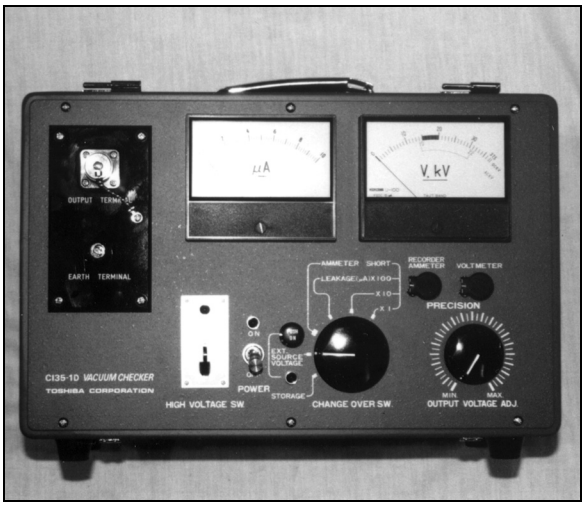


Figure 10 - Toshiba Portable Vacuum Checker

CRITERIA:

1. If a current flow above 5 milliamperes is observed or if breakdown occurs, one or more of the interrupters has insufficient vacuum and must be replaced.

   Exception: If the current exceeds 5 milliamperes the first time the voltage is brought up, reduce the voltage to zero and increase it again. It may be necessary to repeat this procedure a few times.

2. If the contactor fails to meet criteria 1, then repeat the test on each pole separately to identify the damaged interrupter or interrupters.

3. If the voltage can be held for 1 minute and the current flow does not exceed 5 milliamperes, the interrupter has a sufficient vacuum level.

After the test is complete, discharge any residual static charge from the primary terminals of the contactor.

If a vacuum checker or AC hi-pot tester is not available, a DC hi potential test may be conducted. If a DC test is conducted, the test voltage must be increased to 14kV DC. The test duration for DC tests and the criteria for acceptance remain the same as for AC tests.

⚠WARNING

Do not use DC hi-pot testers which employ unfiltered half-wave rectifiers. The peak voltages produced by these testers may exceed the recommended value of 14kV. This can result in the production of harmful X-rays and may invalidate the test results.

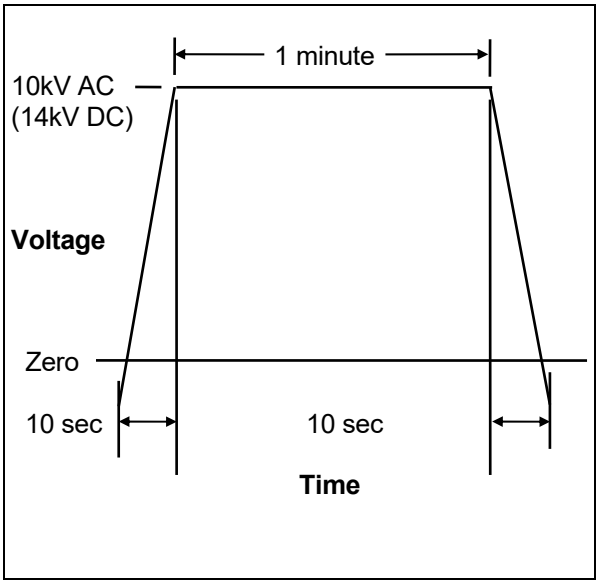


Figure 11 - Application of Test Voltage for Vacuum Check

ELECTRICAL SERVICE LIFE

The electrical service life of the vacuum interrupter is defined by the electrode wear and the number of open/close operations (mechanical life).

To determine the electrode wear, measure dimension A between the lever and washer in the closed (ON) state, as shown in Figure 12. This dimension is called the “wipe”. If the 1.0mm contact wear gauge cannot be inserted, then the end of the service life has been reached. The wipe surfaces must be lubricated with contact grease if dry or every 20,000 operations.

The drive unit and the closing coils also have an electrical service life of 250,000 operations. As a result, these parts should be replaced around 250,000 operations.

MECHANICAL SERVICE LIFE

The magnetically held type has a mechanical service life of 1 million operations and the mechanically latch type 250,000 operations. The mechanical service life of the vacuum interrupters is 250,000 operations.

For the components in Table 4, replacement or detailed inspection and cleaning are recommended after the indicated number of operations.

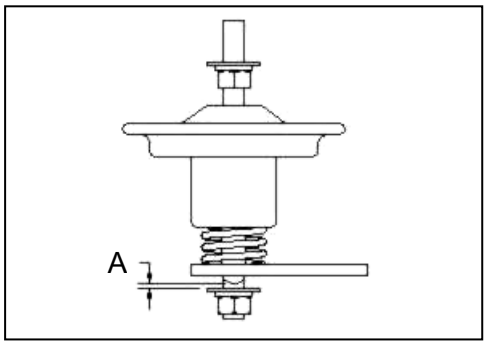


Figure 12 - Wipe Measurement

SERVICE LIFE – CAPACITOR SWITCHING

Switching of capacitor loads produces severe conditions for contactors, such as high frequency inrush current and phase-to-phase recovery voltage more than twice the normal voltage.

The criterion for the maximum number of capacitor current switching operations is shown in the graph below. The vacuum interrupter should be replaced when the number of switching operations in the graph is reached.

Table 4 - Recommended Part Replacement Intervals

Part Name	Number of Operations for Replacement
Vacuum Interrupter	250,000
Auxiliary Switch	250,000
Moveable Core	Detailed inspection and cleaning every 250,000 operations.
Stationary Core	Detailed inspection and cleaning every 250,000 operations.
Closing/Trip Coil	250,000
Flexible Conductor	250,000

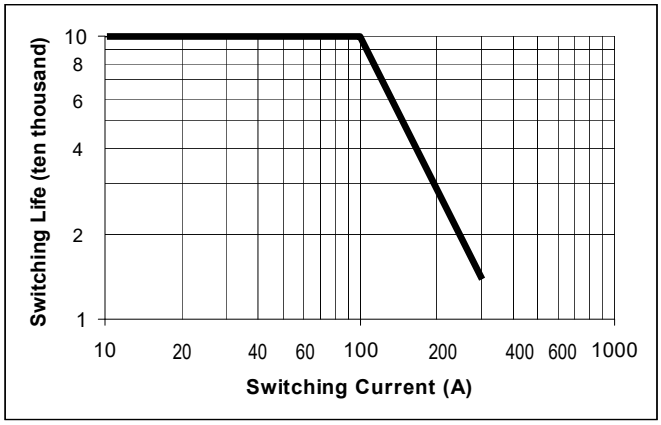


Figure 13 - Capacitor Switching Life (With 6% reactor)

STORAGE

If the contactor is to be stored for any length of time prior to installation, the following precautions should be taken.

1. The original packing should be restored, if possible.
2. Do not subject the equipment to moisture or sunrays. Store in cool, clean, and dry location.
3. Place a dust cover over the contactor packaging to protect against dirt and moisture.
4. Store in an upright position.

INSPECTION DURING STORAGE

Routine scheduled inspection is necessary if storage is for an extended period. The unit should be checked for condensation, moisture, corrosion, and vermin.

Prior to installation, the contactor should be carefully examined for evidence of physical damage, corrosion, or other deterioration. Refer to the PRE-ENERGIZATION Section of this manual.

The MAINTENANCE section of this manual describes various types of inspections recommended for this contactor during the operation period.

DISPOSAL

Contact your state environmental agency for details on disposal of electrical components and packaging in your particular area.

Table 5 – Ratings

Items		HCV-5HA HCV-7HA	HCV-5HAL HCV-7HAL
Rated Maximum Voltage	kV	7.2	
Rated Operation Voltage	V	1501-6900	
Rated Current	A	400	
Rated Frequency	Hz	50/60	
Interrupting Capacity	kA	HCV-5: 4.5 (7kA@5kV) HCV-7: 7.2	
Rated Insulation Level (BIL)	kV	60	
Rated Insulation Level (Power-frequency withstand)	kV	18.2	
Rated Short-Time Current	kA	6.0 – 1 sec., 2.4 – 30 sec.	
Control Voltages*	Vac	100-240	
Control Voltages*	Vdc	125-250	
Available Rated Trip Voltages	Vdc	N/A	24, 32, 48, 125, 250
Pick-Up Voltage AC or DC (Max.) **		85% Rated (Hot) - 70% Rated (Cold)	
Drop-Out Voltage AC or DC (Max.) **		70% Rated (Hot) - 60% Rated (Cold)	
Closing time**, ***	msec	50-90	
Opening time**, ***	msec	15-40	
Arcing time	msec	≤10	
Rated Trip Voltages	Vdc	N/A	24, 32, 48, 125, 250
Minimum Trip Voltages	Vdc	N/A	40-60% Rating
Maximum Trip Current	Adc	N/A	4.8
Method of Operation		Non-latched	Latched
Mechanical Operation	Million	1	0.25
Electrical Operation	Million	0.25	
Auxiliary Switch		3 N.O – 3 N.C.	2 N.O. – 2 N.C.
Auxiliary Contact Rating		10 A, 600 V (NEMA Class A600)	
Switching Frequency	Times/h	1200	300

* Adjustable via switch settings on the drive unit

** These are typical values measured under the following conditions:
- a) No external devices connected to the mechanism.
- b) At sea level.
- c) 120Vac control power applied to terminals 1 & 2.
- d) Contactor controlled (open/close) via terminals 3 & 4.

*** Typically, when controlled via terminals 1 & 2, closing time increases by approximately 8~15 msec and opening time increases by approximately 200~250msec.

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