Instruction Booklet **IB131006EN**

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Instructions for installation, operation, and maintenance of type VCP-W vacuum circuit breakers

Powering Business Worldwide

⚠ WARNING

IMPROPERLY INSTALLING OR MAINTAINING THESE PRODUCTS CAN RESULT IN DEATH, SERIOUS PERSONAL INJURY, OR PROPERTY DAMAGE.

READ AND UNDERSTAND THESE INSTRUCTIONS BEFORE ATTEMPTING ANY UNPACKING, ASSEMBLY, OPERATION OR MAINTENANCE OF THE CIRCUIT BREAKERS.

INSTALLATION OR MAINTENANCE SHOULD BE ATTEMPTED ONLY BY QUALIFIED PERSONNEL. THIS INSTRUCTION BOOK SHOULD NOT BE CONSIDERED ALL INCLUSIVE REGARDING INSTALLATION OR MAINTENANCE PROCEDURES. IF FURTHER INFORMATION IS REQUIRED, YOU SHOULD CONTACT EATON.

⚠ WARNING

THE CIRCUIT BREAKER ELEMENTS DESCRIBED IN THIS BOOK ARE DESIGNED AND TESTED TO OPERATE WITHIN THEIR NAMEPLATE RATINGS. OPERATION OUTSIDE OF THESE RATINGS MAY CAUSE THE EQUIPMENT TO FAIL, RESULTING IN DEATH, SERIOUS PERSONAL INJURY, AND PROPERTY DAMAGE.

ALL SAFETY CODES, SAFETY STANDARDS, AND/OR REGULATIONS AS THEY MAY BE APPLIED TO THIS TYPE OF EQUIPMENT MUST BE STRICTLY ADHERED TO.

THESE CIRCUIT BREAKER ELEMENTS ARE DESIGNED TO BE INSTALLED PURSUANT TO THE AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI). SERIOUS INJURY, INCLUDING DEATH, CAN RESULT FROM FAILURE TO FOLLOW THE PROCEDURES OUTLINED IN THIS MANUAL. THESE CIRCUIT BREAKER ELEMENTS ARE SOLD PURSUANT TO A NON-STANDARD PURCHASING AGREEMENT WHICH LIMITS THE LIABILITY OF THE MANUFACTURER.

These instructions do not purport to cover all possible contingencies, details, and variations which may arise during installation, operation or maintenance. If further information is desired by purchaser regarding his particular installation, operation or maintenance of particular equipment, contact an Eaton representative.

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1. Introduction

1.1 Preliminary comments and safety pre-cautions

This technical document is intended to cover most aspects associated with the installation, operation, and maintenance of Type VCP-W, VCPW-SE, VCP-WC,and VCPWND vacuum circuit breakers. It is provided as a guide for authorized and qualified personnel only. Please refer to the specific WARNING and CAUTION in Paragraph 1.1.2 before proceeding past Section 1. If further information is required by the purchaser regarding a particular installation, application, or maintenance activity, an Eaton representative should be contacted.

1.1.1 Warranty and liability information

NO WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE OF MERCHANTABILITY, OR WARRANTIES ARISING FROM COURSE OF DEALING OR USAGE OF TRADE, ARE MADE REGARDING THE INFORMATION, RECOMMENDATIONS AND DESCRIPTIONS CONTAINED HEREIN. In no event will Eaton be responsible to the purchaser or user in contract, in tort (including negligence), strict liability or otherwise for any special, indirect, incidental, or consequential damage or loss whatsoever, including but not limited to damage or loss of use of equipment, plant or power system, cost of capital, loss of power, additional expenses in the use of existing power facilities, or claims against the purchaser or user by its customers resulting from the use of the information and descriptions contained herein.

1.1.2 Safety precautions

All safety codes, safety standards, and/or regulations must be strictly observed in the installation, operation, and maintenance of this device.

⚠ WARNING

THE WARNINGS AND CAUTIONS INCLUDED AS PART OF THE PROCEDURAL STEPS IN THIS DOCUMENT ARE FOR PERSONNEL SAFETY AND PROTECTION OF EQUIPMENT FROM DAMAGE. AN EXAMPLE OF A TYPICAL WARNING LABEL HEADING IS SHOWN ABOVE TO FAMILIARIZE PERSONNEL WITH THE STYLE OF PRESENTATION. THIS WILL HELP TO INSURE THAT PERSONNEL ARE ALERT TO WARNINGS, WHICH MAY APPEAR THROUGHOUT THE DOCUMENT. IN ADDITION, CAUTIONS ARE ALL UPPER CASE AND BOLDFACE AS SHOWN BELOW.

⚠ CAUTION

COMPLETELY READ AND UNDERSTAND THE MATERIAL PRESENTED IN THIS DOCUMENT BEFORE ATTEMPTING INSTALLATION, OPERATION, OR APPLICATION OF THE EQUIPMENT. IN ADDITION, ONLY QUALIFIED PERSONS SHOULD BE PERMITTED TO PERFORM ANY WORK ASSOCIATED WITH THE EQUIPMENT. ANY WIRING INSTRUCTIONS PRESENTED IN THIS DOCUMENT MUST BE FOLLOWED PRECISELY. FAILURE TO DO SO COULD CAUSE PERMANENT EQUIPMENT DAMAGE.

1.2 General information

The purpose of this book is to provide instructions for unpacking, storage, use, operation, and maintenance of Type VCP-W, VCPW-SE, VCP-WC, and VCPW-ND vacuum circuit breakers. These circuit breakers are horizontal drawout type removable interrupting elements designed for use in VacClad-W Metal-Clad switchgear and appropriate VCP-W modules. They provide reliable control and protection for medium voltage electrical equipment and circuits. All VCP-W circuit breaker elements are designed to ANSI Standards for reliable performance, ease of handling, and simplified maintenance. In addition, some VCP-W circuit breakers have been tested in accordance with IEC Standards for applications around the world.

The VCPW-SE circuit breaker element is a VCP-W circuit breaker designed specifically for special environment applications and operating conditions through 27 kV. The VCPW-ND circuit breaker element is a narrow design VCP-W circuit breaker designed specifically for use in 5 kV applications where floor space requirements would not allow the industry standard 36 in. (914.4 mm) wide switchgear. From this point on, all circuit breaker elements will be referred to as Type VCP-W unless the reference is specific to a particular design. The VCP-WC circuit breaker element is a VCP-W circuit breaker designed and tested for extra capabilities beyond one or more of the preferred ratings of the applicable ANSI Standard.

⚠ WARNING

SATISFACTORY PERFORMANCE OF THESE BREAKERS IS CONTINGENT UPON PROPER APPLICATION, CORRECT INSTALLATION, AND ADEQUATE MAINTENANCE. THIS INSTRUCTION BOOK MUST BE CAREFULLY READ AND FOLLOWED IN ORDER TO OBTAIN OPTIMUM PERFORMANCE FOR LONG USEFUL LIFE OF THE CIRCUIT BREAKER ELEMENTS.

⚠ WARNING

THE CIRCUIT BREAKERS DESCRIBED IN THIS BOOK ARE DESIGNED AND TESTED TO OPERATE WITHIN THEIR NAMEPLATE RATINGS. OPERATION OUTSIDE OF THESE RATINGS MAY CAUSE THE EQUIPMENT TO FAIL, RESULTING IN DEATH, BODILY INJURY, AND PROPERTY DAMAGE.

1.3 Type VCP-W vacuum circuit breaker element ratings (Tables 1, 2, 3, 4, 5, and 6)

Table 1. (ANSI Standards①) type VCP-W vacuum circuit breaker through 15 kV rated symmetrical current basis.

Identification			Rated values											
Circuit breaker type	Nominal voltage class	Nominal 3-phase MVA class	Voltage		Insulation level		Current		Interrupting time ④	Permissible tripping delay	Max. voltage divided by K	Current values		
			Max. voltage	Voltage range factor③	Withstand test voltage		Continuous current at 60 Hz	Short circuit current (at rated max. kV)				Maximum symmetrical interrupting capability	Closing & latching capability	Closing & latching capability momentary
					Power frequency (1 min.)	Impulse						K times rated short circuit current ③⑤	2.7 K times rated short circuit current	1.6 K times rated short circuit current
			E	K				I		Y	E/K			
	kV	MVA	kV rms		kV rms		Amperes	kA rms	Cycles	Seconds	kV rms	kA rms	kA peak	kA rms
50VCPW-ND250	4.16	250	4.76	1.24	19	60	1200	29	5	2	3.85	36	97	58
50VCP-W250	4.16	250	4.76	1.24	19	60	1200 2000 3000	29	5	2	3.85	36	97 132 ②	58 78 ②
50VCP-W350	4.16	350	4.76	1.19	19	60	1200 2000 3000	41	5	2	4.0	49	132	78
50VCP-W63 (500)	4.16	500	4.76	1.00	19	60	1200 2000 3000	63	5	2	4.76	63	173	101
75VCP-W500	7.2	500	8.25	1.25	36	95	1200 2000 3000	33	5	2	6.6	41	111	66
150VCP-W500	13.8	500	15	1.30	36	95	1200 2000 3000	18	5	2	11.5	23	62 97 ②	37 58 ②
150VCP-W750	13.8	750	15	1.30	36	95	1200 2000 3000	28	5	2	11.5	36	97 130 ②	58 77 ②
150VCP-W1000	13.8	1000	15	1.30	36	95	1200 2000 3000	37	5	2	11.5	48	130	77
150VCP-W63(1500)	13.8	1500	15	1.00	36	95	1200 2000 3000	63	5	2	15.0	63	173	101

① All circuit breakers are tested to 60 Hz; however, they can also be applied at 50 Hz with no derating.
② Non-standard circuit breakers with high close and latch (momentary). Rating for special applications.
③ Consult the Consulting Application Guide CA08104001E sections 1 and 5 for further information.
④ Optional interrupting time of 3 cycles is available.
⑤ Also 3-second short time current carrying capability.

Table 2. (ANSI Standards①) type VCP-W vacuum circuit breaker 27 kV rated symmetrical current basis.

Identification	Rated values													
Circuit breaker type	Nominal voltage class	Nominal 3-phase MVA class	Voltage		Insulation level		Current		Interrupting time ④	Permissible tripping delay	Transient recovery voltage		Current values	
			Max. voltage② E	Voltage range factor③ K	Withstand test voltage: Power frequency (1 min.)	Withstand test voltage: Impulse	Continuous current at 60 Hz	Short circuit current 3 Second short time current carrying capability I		Y	E_2	t_2 rise time	Closing & latching capability 2.7 K times rated short circuit current	Capacitor switching & cable charging
	kV	MVA	kV rms		kV rms		Amperes	kA rms	Cycles	Seconds	kV rms	kA rms	kA peak	kA rms
270VCP-W750(16)⑤	27	750	27	1.0	60	125	600 1200 2000	16	5	2	51	105	43	31.5
270VCP-W1000(22)⑤	27	1000	27	1.0	60	125	600 1200 2000	22	5	2	51	105	60	31.5
270VCP-W1250(25)⑤	27	1250	27	1.0	60	125	600 1200 2000	25	5	2	51	105	68	31.5
270VCP-W1600(32)⑥	27	1600	27	1.0	60	125	1200 2000	31.5	5	2	51	105	85	31.5
270VCP-W2000(40)⑥	27	2000	27	1.0	60	125	1200 2000	40	5	2	51	105	106	31.5

① All circuit breakers are tested to 60 Hz; however, they can also be applied at 50 Hz with no derating.
② K=1.0, therefore E = E/K and I = KI. Consult the Consulting Application Guide CA08104001E sections 1 and 5 for further information.
③ Consult the Consulting Application Guide CA08104001E sections 1 and 5 for further information.
④ Optional interrupting time of 3 cycles is available.
⑤ Tested at 28.5 kV RMS.
⑥ Tested at 29.5 kV RMS.

Table 3. (ANSI Standards) type VCP-WC extra capability vacuum circuit breaker 5-27 kV rated symmetrical current basis.

Identification	Rated voltage																		
Circuit breaker type	Voltage		Insulation level withstand test		Continuous current at 60 Hz	Short circuit current					Interrupting time ①	Max. permissible tripping delay	Transient recovery voltage (RRRV) ③	Capacitor switching ratings				Mechanical endurance
	Max. voltage	Voltage range factor				Sym interrupting at V (Isc)	% DC component (Idc)	Asym. interrupting (It)	Closing & latching capability	Short-time current for 3 sec.				General purpose	Definite purpose			
														Isolated shunt capacitor bank current	Back to back capacitor switching			No-load operations
															Capacitor bank current	Inrush current	Inrush frequency	
	V	K	Power frequency (1 min.)	Lightening impulse 1.2x50us														
	KV rms		kV rms	kV peak	A rms	kA rms total	%	kA rms	kA peak	kA rms	Cycles	Sec.	kV / µs	A rms	A rms	kA peak	kHz	
50 VCP-W 40C	5.95	1	24	75	1200 2000 3000	40	75.	58	139	40	3	2	0.9 0.9 0.8		630 ⑤ 1000 ⑤ —	15 18 —	3.5 2.7 —	10,000 10,000 5,000
50 VCP-W 50C	5.95	1	24	75	1200 2000 3000	50	57 57 52	64 64 62	139	50	3	2	0.9 0.9 0.8		630 ⑤ 1000 ⑤ —	15 18 —	3.5 2.7 —	10,000 10,000 5,000
75 VCP-W 50C	10.3	1	42	95	1200 2000 3000	50	57 57 52	64 64 62	139	50	3	2	0.9 0.9 0.8		630 ⑤ 1000 ⑤ —	15 18 —	3.5 2.7 —	10,000 10,000 5,000
150 VCP-W 25C	17.5	1	42	95	1200 2000 3000	25	50 75 75	31 36 36	97 ②	25	3	2	0.95 0.9 0.8		600 ⑥ 1000 ⑤⑥ —	20 18 —	3.5 2.7 —	10,000 10,000 5,000
150 VCP-W 40C	17.5	1	42	95	1200 2000 3000	40	75	58	139	40	3	2	0.9 0.9 0.8	630 ④ 630 ④ 250 ④	630 ⑤⑥ 1000 ⑤⑥ —	15 18 —	3.5 2.7 —	10,000 10,000 5,000
150 VCP-W 50C	17.5	1	42	95	1200 2000 3000	50	57 57 52	64 64 62	139	50	3	2	0.9 0.9 0.8	630 ④ 630 ④ 250 ④	630 ⑤⑥ 1000 ⑤⑥ —	15 18 —	3.5 2.7 —	10,000 10,000 5,000
150 VCP-W 63C	17.5	1	42	95	1200 2000 3000	63	61 61 61	83 83 83	175	63	3	2	1.07 1.07 1.07		200,1600⑨ 200,1600⑨ 200,1600⑨	7.7 7.7 7.7	465 465 465	10,000 10,000 10,000
270 VCP-W 25C	27	1	60	125	1200 1600	25	75	36	85	25 ⑧	3	2	1.1		400	20	4.2	2,500
270 VCP-W 32C	27	1	60	125	1200 1600	31.5	57	40	97	32 ⑦	3	1	1.1		400	20	4.2	2,500
270 VCP-W 40C	27	1	60	125	1200 1600	40	50	49	104	40 ⑦	3	1	1.1		400	20	4.2	2,500

① 3 cycles
② Close & latch current for 1200 A Type 150 VCP-W 25C is proven at 15 kV. For sealed interrupters at high altitudes, switching voltage is not de-rated.
③ For higher RRRV contact Eaton for more information.
④ Breaker tested to 2700 A single bank switching for momentary load (Thermal derating must consider harmonic content of current waveform).
⑤ Breaker tested to 1270 A back-to-back switching for momentary load (Thermal derating must consider harmonic content of current waveform)
⑥ Capacitor switching ratings are proven at 15 kV. For sealed interrupters at high altitudes, switching voltage is not de-rated.
⑦ 1 second
⑧ 2 second
⑨ C37.04a-2003 class C2 @ 15 kV

Table 4. (IEC-56 Standards①) type VCP-W vacuum circuit breaker through 17.5 kV rated symmetrical current basis.

Identification	Rated values							
Circuit breaker type	Voltage class	Insulation level		Normal current	Short circuit breaking current	3 second short time current	Short circuit making current	Cable charging breaking amps
		Power frequency	Impulse withstand					
	kV rms	kV rms	kV peak	Amperes	kA rms	kA rms	kV peak	Amperes
36VCPW-ND25 36VCPW-ND32	3.6 3.6	10 10	40 40	630, 1250 630, 1250	25 31.5	25 31.5	63 79	25 25
72VCPW-ND25 72VCPW-ND32	7.2 7.2	20 20	60 60	630, 1250 630, 1250	25 31.5	25 31.5	63 79	25 25
36VCP-W25 36VCP-W32 36VCP-W40	3.6 3.6 3.6	10 10 10	40 40 40	630, 1250, 2000 1250, 2000 1250, 2000	25 31.5 40	25 31.5 40	63 79 100	25 25 25
72VCP-W25 72VCP-W32 72VCP-W40	7.2 7.2 7.2	20 20 20	60 60 60	630, 1250, 2000 1250, 2000 1250, 2000	25 31.5 40	25 31.5 40	63 79 100	25 25 25
120VCP-W25 120VCP-W32 120VCP-W40	12.0 12.0 12.0	28 28 28	75 75 75	630, 1250, 2000 1250, 2000 1250, 2000	25 31.5 40	25 31.5 40	63 79 100	25 25 25
175VCP-W25 175VCP-W32 175VCP-W40	17.5 17.5 17.5	38 38 38	95 95 95	1250, 2000 1250, 2000 1250, 2000	25 31.5 40	25 31.5 40	63 79 100	31.5 31.5 31.5

① Interrupting time is 3 cycles at 50/60 Hz. Rated operating sequence 0-3 min- CO-3 min-CO.

Table 5. (ANSI Standards①) type VCP-W (K = 1) vacuum circuit breaker through 15 kV rated symmetrical current basis (standard ratings).

Identification			Rated values ①											
Circuit breaker type	Nominal voltage class		Voltage		Insulation level		Current		Interrupting time	Permissible tripping delay	Max. voltage divided by K		Current values	
			Max. voltage	Voltage range factor ②	Withstand test voltage		Continuous current at 60 Hz	Short circuit current (at rated max. kV) ③					Closing & latching capability 2.6 K times rated short	Closing & latching capability momentary 1.6 K times rated short circuit current
					Power frequency (1 min.)	Impulse								
			E	K				I		Y	E/K			
	kV		kV rms		kV rms	kV peak	Amperes	kA rms	Ms	Seconds	kV rms		kA peak	kA rms
50VCP-W 25	4.16		4.76	1.0	19	60	1200 2000 3000	25	3 or 5	2	4.76		65	39
50VCP-W 40	4.16		4.76	1.0	19	60	1200 2000 3000	40	3 or 5	2	4.76		104	62
50VCP-W 50	4.16		4.76	1.0	19	60	1200 2000 3000	50	3 or 5	2	4.76		130	78
50VCP-W 63	4.16		4.76	1.0	19	60	1200 2000 3000	63	3 or 5	2	4.76		164	98
75VCP-W 40	7.2		8.25	1.0	36	95	1200 2000 3000	40	3 or 5	2	11.5		104	62
75VCP-W 50	7.2		15	1.0	36	60	1200 2000 3000	50	3 or 5	2	11.5		130	78
150VCP-W 25	13.8		15	1.0	36	95	1200 2000 3000	25	3 or 5	2	15.0		65	39
150VCP-W 40	13.8		15	1.0	36	95	1200 2000 3000	40	3 or 5	2	15.0		104	62
150VCP-W 50	13.8		15	1.0	36	95	1200 2000 3000	50	3 or 5	2	15.0		130	78
150VCP-W 63	13.8			1.0	36	95	1200 2000 3000	63	3 or 5	2	15.0		164	98

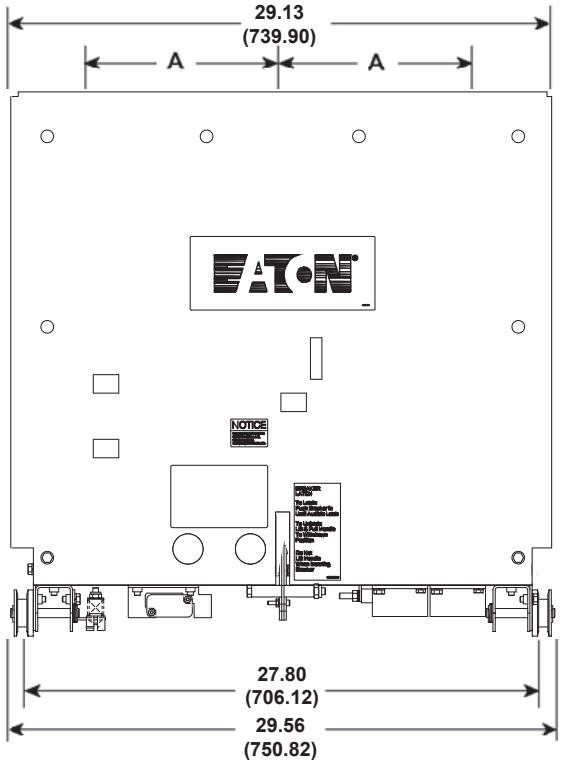
① All circuit breakers are tested to 60 Hz; however, they can also be applied at 50 Hz with no derating.
② Consult the Consulting Application Guide CA08104001E sections 1 and 5 for further information.
③ Also 3-second short time current carrying capability.

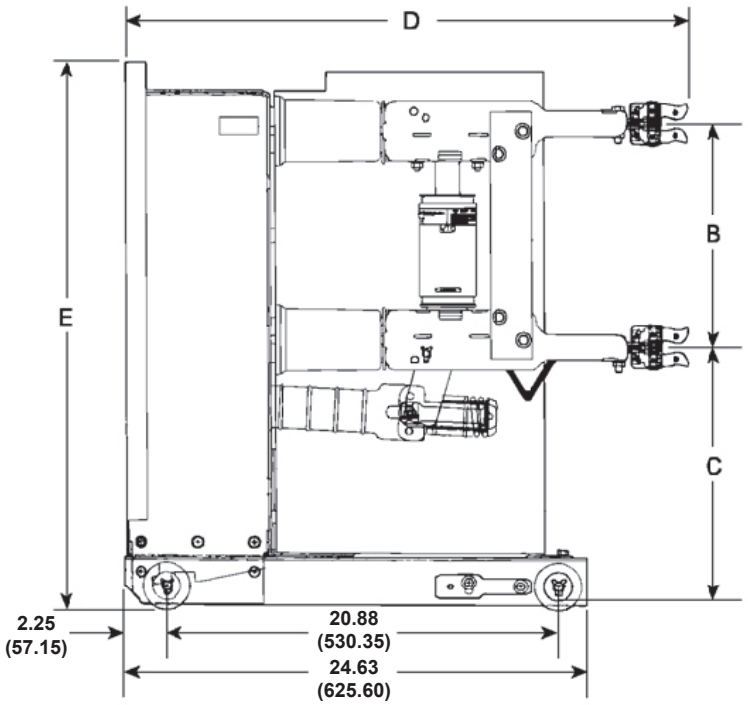
Table 6. (ANSI Standards①) type VCP-WXC circuit breaker through 15 kV rated symmetrical current basis (standard ratings).
See Figure 23 for control schemes and diagram that apply to this breaker. This breaker differs from the standard breaker with the addition of a third motor cut-off switch and addition of two wires.

Identification	Rated voltage																		
Circuit breaker type	Voltage		Insulation level withstand test		Continuous current at 60 Hz	Short circuit current					Interrupting time ②	Max. permissible tripping delay	Transient recovery voltage (RRRV) ③	Capacitor switching ratings					Mechanical endurance
	Max. voltage	Voltage range factor				Sym interrupting at V (Isc)	% DC component (Idc)	Asym. interrupting (It)	Closing & latching capability	Short-time current for 3 sec.				General purpose	Definite purpose				
														Isolated shunt capacitor bank current	Back to back capacitor switching				No-load operations
															capacitor bank current	Inrush current	Inrush frequency		
	V	K	Power frequency (1 min.)	Lightening impulse 1.2x50us															
	kV rms		kV rms	kV peak	A rms	kA rms total	%	kA rms	kA peak	kA rms	Cycles	Sec.	kV / µs	A rms	A rms	kA peak	kHz		
150 VCP-WXC 63	17.5	1	42	95	1200 2000 3000	63	61 61 61	83 83 83	175s	63	5	2	1.07 1.07 1.07		200,1600(9) 200,1600(9) 200,1600(9)	7.7 7.7 7.7	465 465 465	10,000 10,000 5,000

① All circuit breakers are tested to 60 Hz; however, they can also be applied at 50 Hz with no derating.
② Optional interrupting time of 3 cycles is available.
③ For higher RRRV contact Eaton for more information.

1.4 Outlines and dimensions





Breaker Identification	A	B	C	D	E
240 VCP-W, 270 VCP-W & 270 VCP-WC	10 (254.00)	14 (355.60)	16.25 (412.75)	34.80 (883.92)	35.22 (894.59)
50/350, 50/350C, 150/1000, 150/1000C, 150/63, 3000A VCP-W, VCPW-SE,VCP-WC & VCP-W K=1>=50 kA Except those immediately below	10 (254.00)	12 (304.80)	13.63 (346.20)	29.94 (760.48)	31.44 (798.58)
All Other VCP-W,VCPW-SE & VCP-W K=1<=40 kA including 50/25C & 150/25C, 1200 A	10 (254.00)	12 (304.80)	13.63 (346.20)	29.81 (757.17)	29.44 (747.78)

Figure 1. Type VCP-W (K = 1 & MVA), VCPW-SE, and VCP-WC circuit breaker outlines and dimensions in inches (mm).

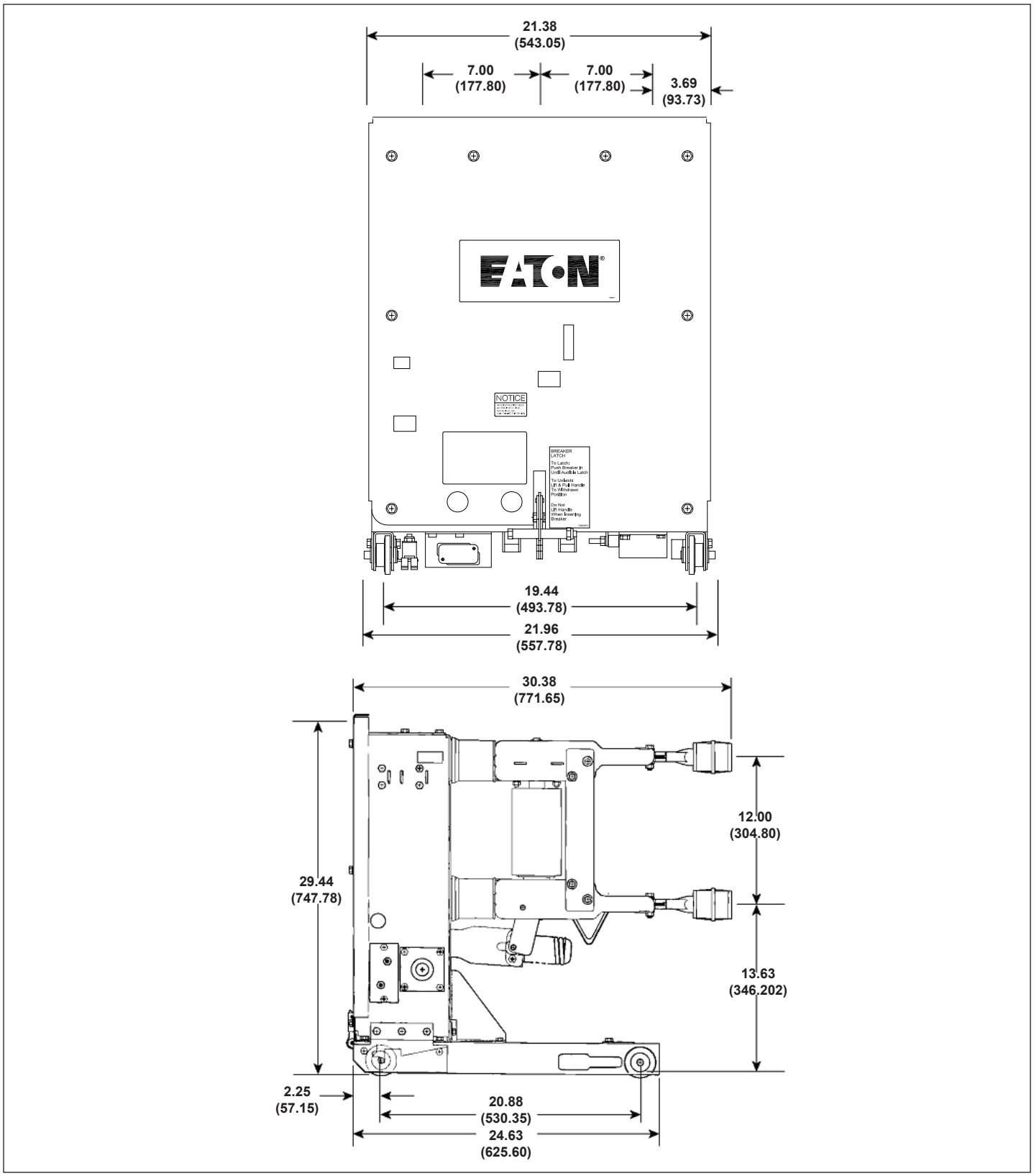


Figure 2. Type VCPW-ND circuit breaker outlines and dimensions in inches (mm).

2. Safe practices

2.1 Recommendations

Type VCP-W vacuum circuit breaker elements are equipped with high speed, high energy operating mechanisms. They are designed with several built-in interlocks and safety features to provide safe and proper operating sequences.

⚠ WARNING

TO PROTECT THE PERSONNEL ASSOCIATED WITH INSTALLATION, OPERATION, AND MAINTENANCE OF THESE CIRCUIT BREAKER ELEMENTS, THE FOLLOWING PRACTICES MUST BE FOLLOWED.

- Only qualified persons as defined in section 6.2.1 and with respect to the local electric code, who are familiar with the installation and maintenance of medium voltage circuits and equipment, should be permitted to work on these circuit breaker elements.
- Read these instructions carefully before attempting any installation, operation or maintenance of these breakers.
- Always remove the breakers from the enclosure before performing any maintenance. Failure to do so could result in electrical shock leading to death, severe personal injury, or property damage.
- BE EXTREMELY CAREFUL while the circuit breaker is on the extension rails. Use provided rail clamps to firmly hold the circuit breaker on the extension rails while performing such activities as charging, closing, and tripping. Carelessness could cause the circuit breaker to fall from the rails resulting in personal injury to those in the area.
- Do not work on a closed breaker or a breaker with closing springs charged. The closing spring should be discharged and the main contacts open before working on the breaker. Failure to do so could result in cutting or crushing injuries.
- Do not use a circuit breaker by itself as the sole means of isolating a high voltage circuit. Remove the breaker to the DISCONNECT position and follow good lockout and tagging rules, as well as all applicable codes, regulations, and work rules.
- Do not leave the breaker in an intermediate position in the cell. Always have the breaker either in the TEST or CONNECTED position. Failure to do so could result in a flash over and possible death, personal injury, or property damage.
- Always remove the maintenance tool from the breaker after charging the closing springs.
- Breakers are equipped with safety interlocks. Do not defeat them. This may result in death, bodily injury, or equipment damage.

3. Receiving, handling, and storage

3.1 General

Type VCP-W vacuum circuit breaker elements are subjected to complete factory production tests and inspection before being packed. They are shipped in packages designed to provide maximum protection to the equipment during shipment and storage and at the same time to provide convenient handling. Tools, such as the maintenance tool, are shipped separately.

3.2 Receiving

If the circuit breaker element is not to be used immediately but is to be placed in storage, maximum protection can be obtained by keeping it packed as shipped.

Upon receipt of the equipment, inspect the containers for any signs of damage or rough handling. Open the containers carefully to avoid any damage to the contents. Use a nail puller rather than a crow bar when required. When opening the containers, be careful to save any loose items or hardware that may be otherwise discarded with the packing material. Check the contents of each package against the packing list.

Examine the circuit breaker element for any signs of shipping damage such as broken, missing, or loose hardware, damaged or deformed insulation, and other components. File claims immediately with the carrier if damage or loss is detected and notify the nearest Eaton office.

3.3 Handling

⚠ CAUTION

DO NOT USE ANY LIFTING DEVICE AS A PLATFORM FOR PERFORMING MAINTENANCE, REPAIR, OR ADJUSTMENT OF THE BREAKER OR FOR OPENING, CLOSING THE CONTACTS OR CHARGING THE SPRINGS. THE CIRCUIT BREAKER ELEMENT MAY SLIP OR FALL CAUSING SEVERE PERSONAL INJURY. ALWAYS PERFORM MAINTENANCE, REPAIR, AND ADJUSTMENTS ON A SOLID WORK SURFACE CAPABLE OF SUPPORTING THE BREAKER ELEMENT.

When a breaker element is ready for installation, a lifting yoke in conjunction with an overhead lifter or portable floor lifter can be used to move a breaker element. When a breaker element is to be lifted, position the lifting yoke over the breaker element and insert lifters into the breaker element side openings with the lifting hole toward the interrupters. Once the lifting yoke is securely seated in the holes, the breaker element can be carefully lifted and moved. Also, a breaker lift pan in conjunction with the portable floor lifter can be used to create a breaker lifter. The breaker can be placed or rolled onto the lift pan with the conductors arms pointing away from the lifter (see IB022015EN for more details).

3.4 Storage

If the circuit breaker element is to be placed in storage, maximum protection can be obtained by keeping it packed as shipped. Before placing it in storage, checks should be made to make sure that the breaker element is free from shipping damage and is in satisfactory operating condition.

The circuit breaker element is shipped with its contacts open and closing springs discharged. The indicators on the front panel should confirm this. Insert the maintenance tool in the manual charge socket opening (Figure 5). Charge the closing springs by pumping the handle up and down approximately 38 times until a crisp metallic "click" is heard. This indicates that the closing springs are charged and is shown by the closing spring "charged" (yellow) indicator. Remove the maintenance tool. Operate the push-to-close button. The breaker element will close as shown by the breaker contacts "closed" (red) indicator. Operate the push-to-open button. The breaker element will trip as shown by the breaker contacts "open" (green) indicator. After completing this initial check, leave the closing springs "discharged" and breaker contacts "open".

Outdoor storage of the breaker element is NOT recommended. If unavoidable, the outdoor location must be well drained and a temporary shelter from sun, rain, snow, corrosive fumes, dirt, falling objects, and excessive moisture must be provided. Containers should be arranged to permit free circulation of air on all sides and temporary heaters should be used to minimize condensation. Moisture can cause rusting of metal parts and deterioration of high voltage insulation. A heat level of approximately 400 watts for each 100 cubic feet (2.83 cubic meters) of volume is recommended with the heaters distributed uniformly throughout the structure near the floor.

Indoor storage should be in a building with sufficient heat and air circulation to prevent condensation. If the building is not heated, the same general rule for heat as for outdoor storage should be applied.

3.5 Tools and accessories

Tools and accessories, both standard and optional, are available for use with the circuit breaker element (Figure 3). If not specified accessories can be used for 36 in. wide and 26 in. wide breakers.

Spin-free levering-in crank: Used to crank breaker between DISCONNECT, TEST, and CONNECTED positions.

Extension rails: Permits breaker to be withdrawn from its compartment.

Rail clamps: Used to secure breaker to extension rails.

Lifting yoke: Used to lift breaker.

Manual charging handle: Used to charge closing springs manually.

Portable lifter: Used to lift breaker to or from extended rails.

Breaker lift pan: This accessory enables the breaker to be lifted from the ground to any height cell without the extension rails. It consists of a portable lifter and a MV breaker lift pan.

- Portable lifter;
- MV breaker lift pan with short extension rail kit for 36”or 26” wide breaker.

Drawout ramp: Used to insert or withdraw breaker from lower compartment without portable lifter.

Docking transport dolly: Used to insert or withdraw breaker from lower compartment without portable lifter or move breaker from one location to another.

Electrical levering-in device:

BPI pan assembly:

Integral Motorized Racking (MR2) used to electrically move breaker between DISCONNECT/TEST, or DISCONNECT, TEST, and CONNECTED positions is available. Specified by description as opposed to a style number.

If the external electric levering-in device which mounts to the door or pan assembly is used, then the breaker can be moved between the DISCONNECT and CONNECTED positions.

The process of levering the breaker from the DISCONNECT to the TEST position would need to be performed manually (approximately 6 turns).

Non-BPI pan assembly:

Used to electrically move the breaker between DISCONNECT/TEST and CONNECTED positions.

Truck operated cell (TOC) switch: Indicates when breaker is in the CONNECT position. Furnished with standard push on wire terminals. Optional ring tongue terminals are available.

Mechanism operated cell (MOC) switch: Provides additional normally open and closed contacts for when control and protection scheme exceeds the available auxiliary contacts in the breaker. Furnished with standard push on wire terminals. Optional ring tongue terminals are available.

This feature is available in two different configurations:

1.) Functions in both the TEST and CONNECT positions, or

2.) Functions only in the CONNECT position.

Eaton strongly recommends use of the TEST and CONNECT position configuration.

Test jumper: Used to operate breaker electrically while breaker is on extension rails or transport dolly.

Test cabinet: Used to provide power to operate breaker outside its compartment for the purpose of testing functionality.

Key provisions with positional interlock: This enables locking of the levering-in cage when the breaker is in the TEST position with a padlock or keyed cylinder lock.

Wheel conversion kit (MG & TD only): Due to how the manual ground and test device is designed this is the best direct roll-in wheel kit to use.

Wheel conversion kit for direct roll-in: This wheel kit can be used to convert a standard breaker or electrical ground and test device to a direct roll-in version.

Conversion kit ROF to non-ROF: This kit is used to convert a direct roll-in cell to a non direct roll-in cell. It provides the teeter totter feature that prevents removing a breaker from the breaker cell when the extension rails or MV breaker lift pan are not in place. Also, the short ramp feature in the front of each rail would need to be removed.

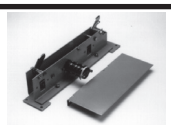
Conversion kit non-ROF to ROF: This kit is used to convert a non-direct roll-in cell to a direct roll-in cell. It provides the ramp feature that goes on the end of each rail to help guide the steel wheels on the side of the breaker up onto the rail rolling surface. This is only to be used in the lower switchgear cells that are level with the floor. The teeter totter feature that keeps the breaker from being rolled out of the cell would need to be removed.

Secondary conversion kit: This kit converts an automatic secondary in a BPI pan assembly to a manual enabled automatic secondary. When the release lever is raised above the stop feature the secondaries will slide forward to automatically connect, see section 8.2 for more details.

Closed door racking guide: This feature can be added to the front of the BPI pan assembly to provide a guide for the manual levering-in tool when the switchgear door is closed to guide the levering-in crank socket onto the levering-in drive screw nut.

Table 7. Accessories for 36-inch wide breaker compartments for 29-inch frame breaker.

5A/5B TOC switch

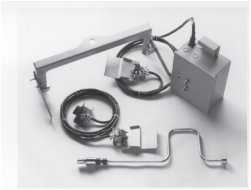


5A/5B MOC switch

Standard set of accessories

Portable lifter

Portable lifter and lift pan

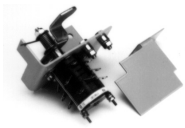


Optional accessories include (clockwise): lifting yoke, test cabinet, spin-free levering crank, and test jumper

Description	Style number
TOC (truck-operated cell) switch 4A/5B contacts	1C20006G12
TOC (truck-operated cell) switch 4A/5B contacts ring-tongue terminals	1C20006G15
MOC (mechanism-operated cell) switch	
5A/4B contacts (test and connect)	1C20007G12
5A/4B contacts (connect only)	1C20007G13
10A/8B contacts (test and connect)	1C20007G14
10A/8B contacts (connect only)	1C20007G15
15A/12B contacts (test and connect)	1C20007G16
15A/12B contacts (connect only)	1C20007G17
5A/4B contacts (test and connect) ring-tongue terminals	1C20007G28
5A/4B contacts (connect only) ring-tongue terminals	1C20007G29
10A/8B contacts (test and connect) ring-tongue terminals	1C20007G30
10A/8B contacts (connect only) ring-tongue terminals	1C20007G31
15A/12B contacts (test and connect) ring-tongue terminals	1C20007G32
15A/12B contacts (connect only) ring-tongue terminals	1C20007G33
Spin-free levering-in crank with clutch	701B601G11
Extension rails (right and left, one set)	7813C41G03
Set of rail clamps	6511C83G11
Lifting yoke	691C607G11
Manual charging handle	8064A02G11
Standard set of accessories Spin-free levering-in crank with clutch Extension rails (right and left, one set) Manual charging handle Set of rail clamps	1A30136G02
Portable lifter (26-/36-inch convertible)	1C19086H01
MV breaker lift pan	1C20220G01
Drawout ramp	1C14163G08
Docking transport dolly	6510C71G21
Electrical levering-in device	1A30257G01
Test jumper	6526C23G11
Test cabinet Any DC close and any trip AC or DC close and DC trip 120 Vac close and capacitor trip 240 Vac close and capacitor trip AC or DC charge, DC close and trip	 8346A28G21 8346A28G22 8346A28G23 8346A28G60 8346A28G24
Key provisions with positional Interlock This allows for key locking the levering-in cage when the breaker is in the TEST position.	6510C48G22
Wheel conversion kit (MG & TD only)	68C5010G41
Wheel conversion kit for direct roll-in	68C5010G42
Conversion kit ROF to NON-ROF	1C19779G101
Conversion kit NON- ROF to ROF	1C19779G102
Secondary conversion kit: to convert automatic secondary to manual operation	1C20335G01
Closed door racking guide	1C20339G02

Table 8. Narrow design accessories for 26-inch-wide breaker compartments.

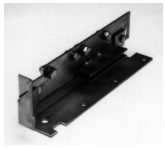
Set of ND accessories



ND 4A/3B TOC switch

ND 4A/3B MOC switch

Electric levering-in device



Padlock/key interlock

Description	Style number
TOC (truck-operated cell) switch 4A/3B contacts	7797C20G01
MOC (mechanism-operated cell) switch	
4A/3B contacts (test and connect)	7797C24G02
4A/3B contacts (connect only)	7797C24G03
8A/6B contacts (test and connect)	7797C24G04
8A/6B contacts (connect only)	7797C24G05
12A/9B contacts (test and connect)	7797C24G06
Spin-free levering-in crank with clutch	701B601G11
Primary contact spanner wrench	502A850G01
Extension rails (right and left, one set)	7813C41G03
Set of rail clamps	6511C83G12
Lifting yoke	691C607G02
Manual charging handle	8064A02G11
Set of ND accessories Spin-free levering-in crank with clutch Primary contact spanner wrench Extension rails (right and left, one set) Manual charging handle Set of rail clamps	1A30136G04
Portable lifter (26-/36-inch convertible)	1C19086H01
MV breaker lift pan and short extension rail kit	1C19086G01
Drawout ramp	1C14163G01
Docking transport dolly	6510C71G02
Electrical levering-in device	1A30257G01
Test jumper	1C15331G01
Test cabinets	
Any DC close and any trip	8346A28G41
AC or DC close and DC trip	8346A28G42
120 Vac close and capacitor trip	8346A28G43
240 Vac close and capacitor trip	8346A28G60
Padlock/key provisions with positional interlock Includes the padlock assembly plus a positional interlock. This allows for key locking the levering-in cage when the breaker is locked in the DISCONNECT position	6510C48G01

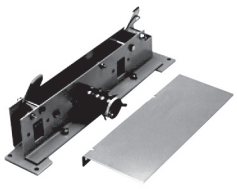
Table 9. 27 kV VCP-W accessories.

Epoxy stand-off insulator

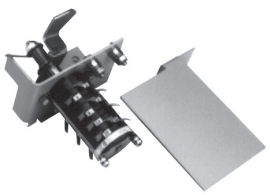
Epoxy cable support

Capacitor trip device

Description		Style number
TOC (truck operated cell) switch	5A/5B contacts	6510C49G12
TOC (direct roll-in)		691C568G06
MOC (mechanism operated cell) switch	5A/4B contacts (test and connect)	6529C58G02
	5A/4B contacts (connect only)	6529C58G03
	10A/8B contacts (test and connect)	6529C58G04
	10A/8B contacts (connect only)	6529C58G05
	15A/12B contacts (test and connect)	6529C58G06
	15A/12B contacts (connect only)	6529C58G07
Spin-free levering-in crank		701B601G11
Standard levering-in crank		701B601G12
Extension rails (right and left—one set)		7813C41G03
Set of rail clamps		6511C83G11
Lifting yoke		691C607G11
Manual charging handle		8064A02G11
Standard set of 27 kV accessories	Levering-in crank with clutch manual charging handle	1A30136G02
	Wheel kit (for direct roll-in)	68C5010G42
Portable lifter		1C19086H01
MV breaker lift pan		1C20220G01
Drawout ramp		1C14163G02
Docking transport dolly		6510C71G11
Electrical levering-in device (120 Vac)		1A30257G01
Test cabinet	Any DC close and any trip	8346A28G21
	AC or DC close and DC trip	8346A28G22
	120 Vac close and capacitor trip	8346A28G23
	240 Vac close and capacitor trip	8346A28G60
Test jumper		6526C23G11
120 Vac capacitor trip device		3A39175G01
240 Vac capacitor trip device		3A39175G02
27 kV epoxy cable support		7799C52H01
8.25 inch epoxy stand-off insulator		1A34286H01



5A/5B TOC switch

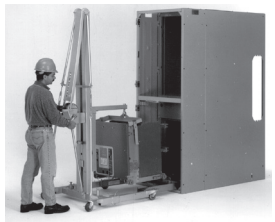


5A/5B MOC switch

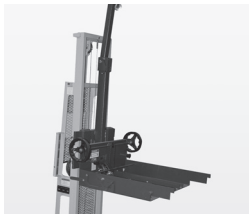
Electrical levering-in device

Standard accessories include (clockwise): Left and right removable extension rails, manual charging handle, and levering crank

Optional accessories include (clockwise): lifting yoke, test cabinet, spin-free levering crank, and test jumper



Portable lifter



Portable lifter and lift pan

Ground and test device (G&TD) accessories: Eaton offers a broad spectrum of manual and electrical G&TDs. All of the manual G&TDs provide access to all the line and load terminals to enable phase checking. Also, they provide the ability to verify operation of the voltage sensing equipment against a live source while verifying that the other connection does not have any voltage present prior to applying the grounds. The simple electrical G&TDs only provide access to line or load terminals. One of the designs provides the ability to perform cable testing as well as grounding the desired circuit.

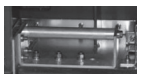
Table 10. Simple manual ground and test devices—bus bar type.

Simple manual ground and test device

Description	25 and 40 kA Style number	50 kA Style number	63 kA Style number
Upper and lower terminals 1200 A (26" narrow design)	4A35130G01	—	—
Upper and lower terminals 1200/2000 A	66A5092G42	66A5092G02	66A5092G12
Upper and lower terminals 3000 A	66A5092G43	66A5092G03	66A5092G13
Upper terminals only 1200/2000 A	66A5092G44	66A5092G04	66A5092G14
Lower terminals only 1200/2000 A	66A5092G45	66A5092G05	66A5092G15
Upper terminals only 3000 A	66A5092G46	66A5092G06	66A5092G16
Lower terminals only 3000 A	66A5092G47	66A5092G07	66A5092G17
Upper and lower terminals 1200/2000 A with ROF wheels installed	66A5092G82	66A5092G62	66A5092G72
Upper and lower terminals 3000 A with ROF wheels installed	66A5092G83	66A5092G63	66A5092G73
Upper terminals only 1200/2000 A with ROF wheels installed	66A5092G84	66A5092G64	66A5092G74
Lower terminals only 1200/2000 A with ROF wheels installed	66A5092G85	66A5092G65	66A5092G75
Upper terminals only 3000 A with ROF wheels installed	66A5092G86	66A5092G66	66A5092G76
Lower terminals only 3000 A with ROF wheels installed	66A5092G87	66A5092G67	66A5092G77

Table 11. 15 kV VCP-W simple manual ground and test device—"bail" and "ball" type ① .

Bail type manual ground and test device

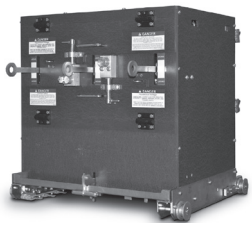


Bail connector

Ball connector

Description	Style number
Bail 1200/2000 A upper/lower	66A5201G01
Bail 3000 A upper/lower	66A5201G02
Ball 1200/2000 A upper/lower	66A5291G01
Ball 3000 A upper/lower	66A5291G02
Bail 1200/2000 A upper/lower with ROF wheels installed	66A5201G11
Bail 3000 A upper/lower with ROF wheels installed	66A5201G12
Ball 1200/2000 A upper/lower with ROF wheels installed	66A5291G11
Ball 3000 A upper/lower with ROF wheels installed	66A5291G12
① Cables are not provided	

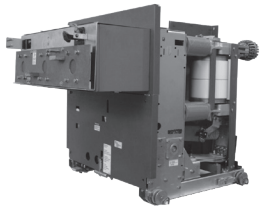
Table 12. Complex manual (selectable) ground and test device.



Ground and test device

Description	Style number
1200/2000/3000 A, 50 kA with ROF	94G7092G712
1200/2000/3000 A, 50 kA (standard, non-ROF)	94G7091G711

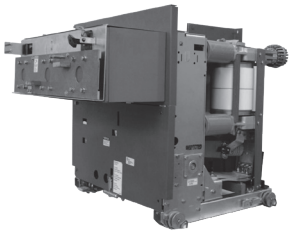
Table 13. Simple electrically operated ground and test device.



Simple electrically operated ground and test device

Description	25 and 40 kA Style number	50 kA Style number	63 kA Style number
Without roll-on-floor wheels (ROF) factory installed			
Upper terminal			
1200/2000 A, 48 Vdc	66A5302G75	—	—
1200/2000 A, 125 Vdc or 120 Vac	66A5302G76	—	—
1200/2000 A, 250 Vdc or 240 Vac	66A5302G77	—	—
1200/2000 A, 48 Vdc	—	66A5302G02	—
1200/2000 A, 125 Vdc or 120 Vac	—	66A5302G03	—
1200/2000 A, 250 Vdc or 240 Vac	—	66A5302G04	—
3000 A, 48 Vdc	—	66A5302G05	—
3000 A, 125 Vdc or 120 Vac	—	66A5302G06	—
3000 A, 250 Vdc or 240 Vac	—	66A5302G07	—
1200/2000/3000 A, 48 Vdc	—	—	66A5302G12
1200/2000/3000 A, 125 Vdc or 120 Vac	—	—	66A5302G13
1200/2000/3000 A, 250 Vdc or 240 Vac	—	—	66A5302G14
Lower terminal			
1200/2000 A, 48 Vdc	66A5302G85	—	—
1200/2000 A, 125 Vdc or 120 Vac	66A5302G86	—	—
1200/2000 A, 250 Vdc or 240 Vac	66A5302G87	—	—
1200/2000 A, 48 Vdc	—	66A5302G22	—
1200/2000 A, 125 Vdc or 120 Vac	—	66A5302G23	—
1200/2000 A, 250 Vdc or 240 Vac	—	66A5302G24	—
3000 A, 48 Vdc	—	66A5302G25	—
3000 A, 125 Vdc or 120 Vac	—	66A5302G26	—
3000 A, 250 Vdc or 240 Vac	—	66A5302G27	—
1200/2000/3000 A, 48 Vdc	—	—	66A5302G32
1200/2000/3000 A, 125 Vdc or 120 Vac	—	—	66A5302G33
1200/2000/3000 A, 250 Vdc or 240 Vac	—	—	66A5302G34
With roll-on-floor wheels (ROF) factory installed			
Upper terminal			
1200/2000 A, 48 Vdc with ROF	66A5302G53	—	—
1200/2000 A, 125 Vdc or 120 Vac with ROF	66A5302G54	—	—
1200/2000 A, 250 Vdc or 240 Vac with ROF	66A5302G55	—	—
1200/2000 A, 48 Vdc with ROF	—	66A5302G35	—
1200/2000 A, 125 Vdc or 120 Vac with ROF	—	66A5302G36	—
1200/2000 A, 250 Vdc or 240 Vac with ROF	—	66A5302G37	—
3000 A, 48 Vdc with ROF	—	66A5302G38	—
3000 A, 125 Vdc or 120 Vac with ROF	—	66A5302G39	—
3000 A, 250 Vdc or 240 Vac with ROF	—	66A5302G40	—
1200/2000/3000 A, 48 Vdc with ROF	—	—	66A5302G41
1200/2000/3000 A, 125 Vdc or 120 Vac with ROF	—	—	66A5302G42
1200/2000/3000 A, 250 Vdc or 240 Vac with ROF	—	—	66A5302G43
Lower terminal			
1200/2000 A, 48 Vdc with ROF	66A5302G57	—	—
1200/2000 A, 125 Vdc or 120 Vac with ROF	66A5302G58	—	—
1200/2000 A, 250 Vdc or 240 Vac with ROF	66A5302G59	—	—
1200/2000 A, 48 Vdc with ROF	—	66A5302G44	—
1200/2000 A, 125 Vdc or 120 Vac with ROF	—	66A5302G45	—
1200/2000 A, 250 Vdc or 240 Vac with ROF	—	66A5302G46	—
3000 A, 48 Vdc with ROF	—	66A5302G47	—
3000 A, 125 Vdc or 120 Vac with ROF	—	66A5302G48	—
3000 A, 250 Vdc or 240 Vac with ROF	—	66A5302G49	—
1200/2000/3000 A, 48 Vdc with ROF	—	—	66A5302G50
1200/2000/3000 A, 125 Vdc or 120 Vac with ROF	—	—	66A5302G51
1200/2000/3000 A, 250 Vdc or 240 Vac with ROF	—	—	66A5302G52

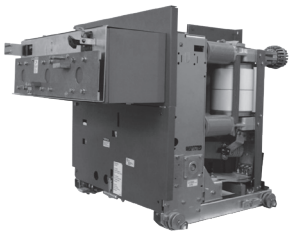
Table 14. Simple electrically operated ground and test device for VCP-W without key interlocks.

	Description	Style number
	Lower terminal	
	1200/2000 A, 125 Vdc or 120 Vac, 50 kA with ROF	66A5312G45

Electrically operated ground and test device

Note: These units are also available as direct-roll-on-the-floor products via a separately purchased wheel kit.

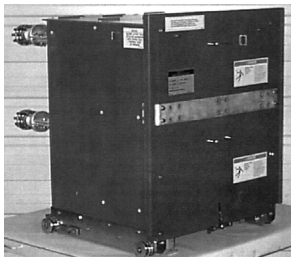
Table 15. Simple electrically operated ground and test device for VCP-WXC.

	Description	Style number
	Upper terminal	
	1200/2000/3000 A, 125 Vdc or 120 Vac, 63 kA	66A5302G83
	Lower terminal	
	1200/2000/3000 A, 125 Vdc or 120 Vac, 63 kA	66A5302G93

Electrically operated ground and test device

Note: These units are also available as direct-roll-on-the-floor products via a separately purchased wheel kit.

Table 16. 27 kV manual ground and test device.

	Description	Style number
	1200/2000 A, bus bar type—top and bottom studs	1C94354G01
	1200/2000 A, bus bar type—top and bottom studs with factory installed wheel kit	1C94354G11
	1200/2000 A, ball type—top and bottom studs	66A5296G01
	1200/2000 A, ball type—top and bottom studs with factory installed wheel kit	66A5296G11

27 kV simple manual ground and test device—bus bar type

Ball type

Ball connector

Table 17. Dummy elements①②

Description	Style number
5 kV, 1200 A (up to 50 kA)	691C605G03
5 kV, 2000 A (up to 50 kA)	691C605G04
5 kV, 3000 A (up to 63 kA)	691C605G05
15 kV, 1200 A (up to 50 kA)	691C605G06
15 kV, 2000 A (up to 50 kA)	691C605G07
15 kV, 3000 A (up to 63 kA) ②	691C605G08

① Dummy elements applicable for breakers rated VCP-W MVA, VCP-W K = 1, and VCP-WSE.

② Dummy element also applicable for VCP-WXC breaker.

3.6 Type VCP-W vacuum circuit breaker element weights (Tables 18, 19, and 20).

Table 18. VCP-W ANSI rated breaker weights①.

Rating	Amperes	Lbs. (kg)
50VCPW-ND250	1200	345 (157)
50VCP-W250 50VCPW-SE250	1200 2000 3000	350 (159) 410 (186) 525 (238)
50VCP-W350 50VCPW-SE350	1200 2000 3000	460 (209) 490 (222) 525 (238)
75VCP-W500 75VCPW-SE500	1200 2000 3000	375 (170) 410 (186) 525 (238)
150VCP-W500 150VCPW-SE500	1200 2000 3000	350 (159) 410 (186) 525 (238)
150VCP-W750 150VCPW-SE750	1200 2000 3000	350 (159) 410 (186) 525 (238)
150VCP-W1000 150VCPW-SE1000	1200 2000 3000	460 (209) 490 (222) 525 (238)
150VCP-W1500(63) 150VCPW-SE1500(63)	1200 2000 3000	525 (238) 530 (241) 550 (250)
270VCP-W750(16)	600 1200 2000	460 (209) 480 (218) 500 (227)
270 VCP-W1000(22)	600 1200 2000	460 (209) 480 (218) 500 (227)
270 VCP-W1250(25)	600 1200 2000	460 (209) 480 (218) 500 (227)
270 VCP-W1600(32)	1200 2000	545 (245) 560 (252)
270VCP-W2000(40)	1200 2000	545 (245) 560 (252)

① Does not include shipping carton.

Table 19. VCP-W IEC rated breaker weights①.

Rating	Normal current amperes	Lbs. (kg)
36VCPW-ND25	630 1250	350 (159) 350 (159)
36VCPW-ND32	630 1250	350 (159) 350 (159)
72VCPW-ND25	630 1250	350 (159) 350 (159)
72VCPW-ND32	630 1250	350 (159) 350 (159)
36VCP-W25	630 1250 2000	350 (159) 350 (159) 410 (186)
36VCP-W32	1250 2000	350 (159) 410 (186)
36VCP-W40	1250 2000	375 (170) 410 (186)
72VCP-W25	630 1250 2000	350 (159) 350 (159) 410 (186)
72VCP-W32	1250 2000	350 (159) 410 (186)
72VCP-W40	1250 2000	375 (170) 410 (186)
120VCP-W25	630 1250 2000	350 (159) 350 (159) 410 (186)
120VCP-W32	1250 2000	350 (159) 410 (186)
120VCP-W40	1250 2000	375 (170) 410 (186)
175VCP-W25	630 1250 2000	350 (159) 350 (159) 410 (186)
175VCP-W32	1250 2000	375 (170) 410 (186)
175VCP-W40	1250 2000	375 (170) 410 (186)
240 VCP-W1 6	630 1250 2000	462 (210) 484 (220) 506 (230)
240 VCP-W20	630 1250 2000	462 (210) 484 (220) 506 (230)
40 VCP-W25	630 1250 2000	462 (210) 484 (220) 506 (230)

① Does not include shipping carton.

Table 20. VCP-W (K = 1) breaker weights①.

Rating	Amperes	Lbs. (kg)
150 VCP-W 25	1200 2000 3000	350 (159) 375 (170) 500 (227))
150 VCP-W 40	1200 2000 3000	375 (170) 375 (170) 500 (227)
150 VCP-W 50	1200 2000 3000	480 (218) 490 (222) 500 (227)
150 VCP-W 63	1200 2000 3000	460 (209) 490 (222) 525 (238)
75 VCP-W 40	1200 2000 3000	375 (170) 375 (170) 500 (227)
75 VCP-W 50	1200 2000 3000	480 (218) 490 (222) 525 (227)
50 VCP-W 25	1200 2000 3000	350 (159) 375 (170) 500 (227)
50 VCP-W 40	1200 2000 3000	375 (170) 375 (170) 500 (227)
50 VCP-W 50	1200 2000 3000	480 (218) 490 (222) 500 (227)
50 VCP-W 63	1200 2000 3000	460 (209) 490 (222) 525 (238)

① Does not include shipping carton.

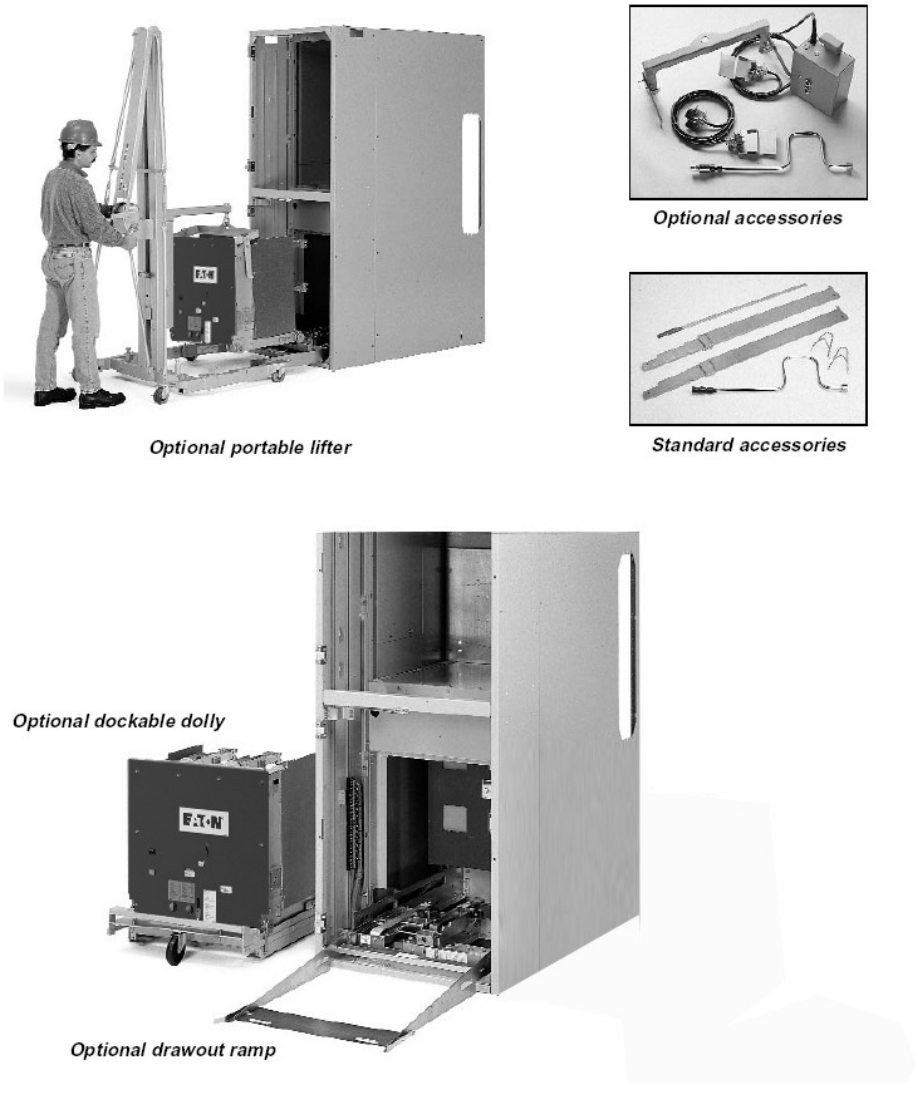
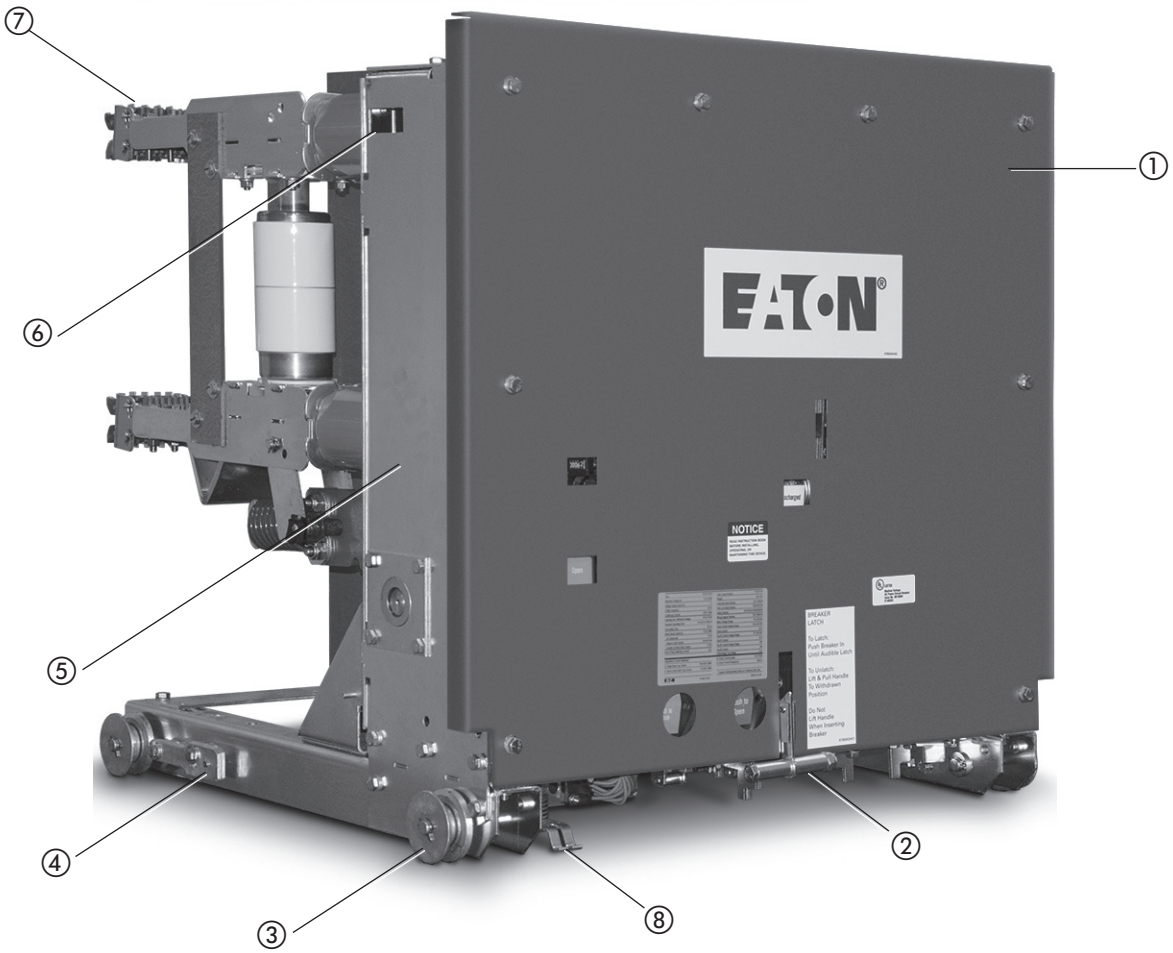
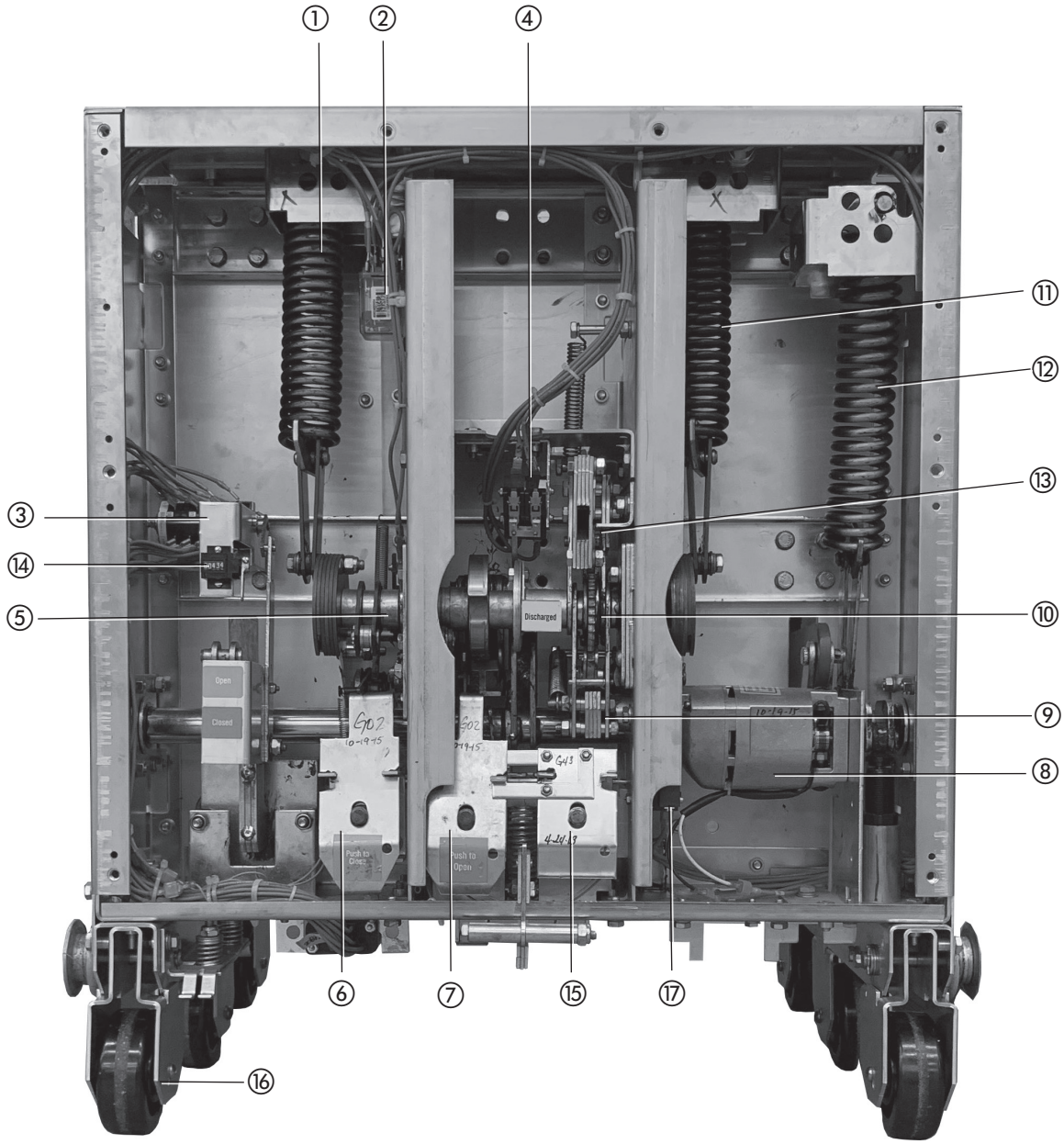


Figure 3. Typical VCP-W tools and accessories. (Note: products shown for representation only. New products may include design improvements and alternate nameplate configurations.)



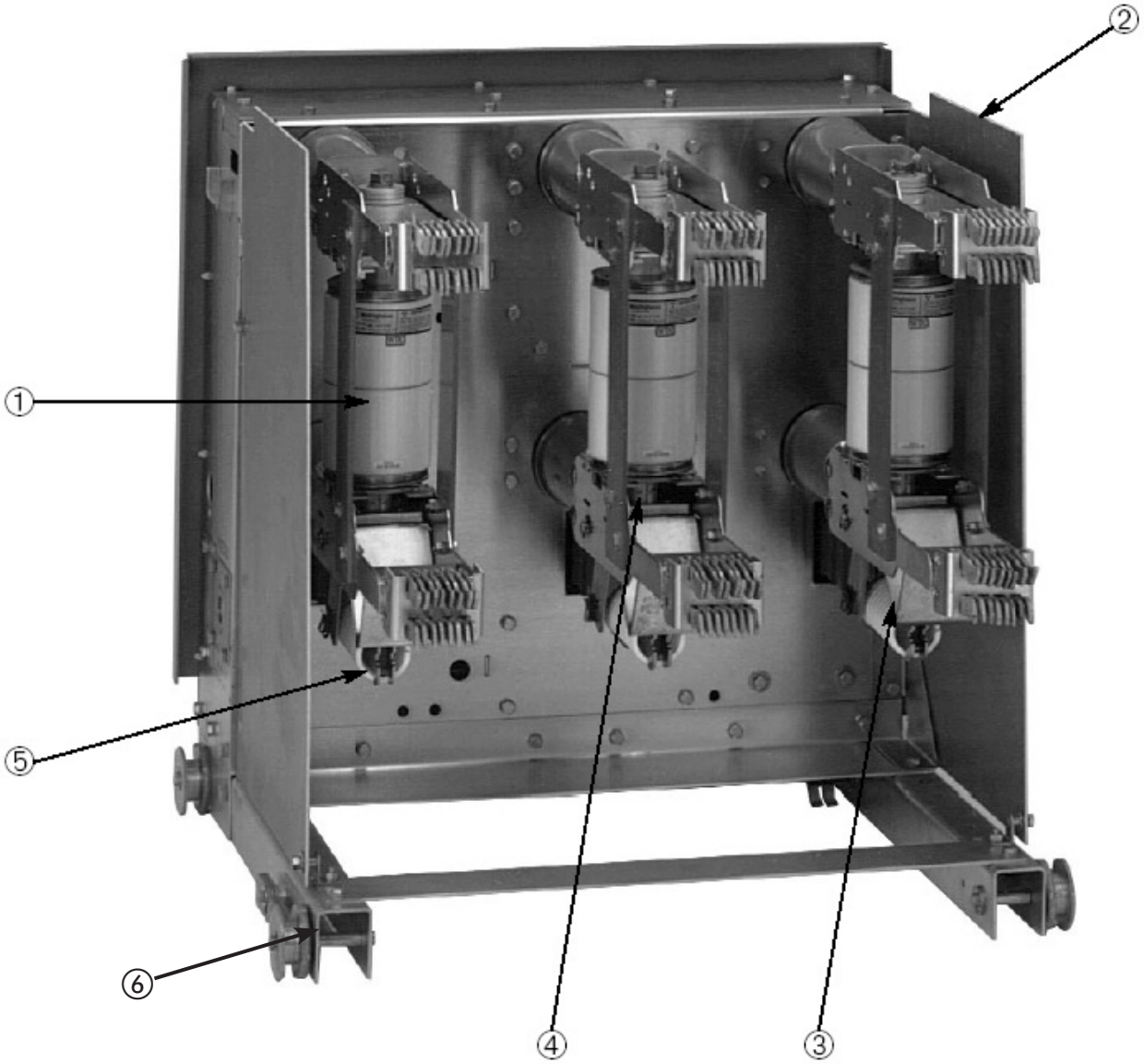
1. Front panel
2. Lift/pull handle
3. Wheel
4. Extension rail interlock
5. Mechanism enclosure
6. Lifting yoke opening
7. Primary disconnect
8. Ground contact

Figure 4. Typical front view VCP-W vacuum circuit breaker. (See Figure 45 for an example of a roll on the floor wheel kit.)



1. L.H. closing spring
2. Anti-pump relay
3. Auxiliary switch
4. Motor cutoff switch
5. Closing cam
6. Spring release (close coil) assembly
7. Shunt trip assembly
8. Charging motor
9. Charging pawl
10. Ratchet wheel
11. R. H. closing spring
12. Opening spring
13. Manual charge socket
14. Operation counter
15. Optional second shunt trip
16. Optional roll on floor wheels
17. Position switches

Figure 5. Typical VCP-W vacuum circuit breaker element with front cover removed.



1. Vacuum interrupter
2. Phase barrier
3. V-flex current transfer system
4. Direct reading contact erosion indicator
5. Contact loading spring (wipe spring)
6. TOC operator (BPI pan assembly)

Figure 6. Typical rear view VCP-W vacuum circuit breaker element.

1. Front panel
2. Nameplate
3. Operation counter
4. Open /closed indicator
5. Manual charge socket
6. Spring charge/discharge indicator
7. Manual open button
8. Manual close button

Figure 7. Typical VCP-W vacuum circuit breaker front cover arrangement.

4. Initial inspection and installation

4.1 Introduction

⚠ WARNING

BEFORE PLACING THE CIRCUIT BREAKER IN SERVICE, CAREFULLY FOLLOW THE INSTALLATION PROCEDURE GIVEN BELOW. NOT FOLLOWING THE PROCEDURE CAN FAIL TO UNCOVER SHIPPING DAMAGE THAT MAY RESULT IN INCORRECT CIRCUIT BREAKER OPERATION LEADING TO DEATH, BODILY INJURY, AND EQUIPMENT DAMAGE.

Before attempting to put a circuit breaker in service, it should be carefully examined and operated manually and electrically. In addition, carefully examine the breaker for loose or obviously damaged parts. The following information is a guide for performing recommended checks and tests.

4.2 Manual operation check

Refer to Figures 7 and 8 and then proceed by placing the maintenance tool into the manual charge socket opening. Charge the closing springs with about 38 up and down strokes of the handle. When charging is complete, the closing crank goes over center with an audible CLICK and the springs Charged/Discharged indicator shows "Charged."

NOTICE

IF THE SPRINGS ARE TO BE CHARGED ON A CLOSED CIRCUIT BREAKER, NO CLICK IS HEARD AT THE END OF CHARGING OPERATION. DISCONTINUE CHARGING AND REMOVE THE MAINTENANCE TOOL AS SOON AS "CHARGED" FLAG IS FULLY VISIBLE. CONTINUED ATTEMPTS TO CHARGE FURTHER MAY RESULT IN DAMAGE TO THE MECHANISM.

Remove the maintenance tool. Close and trip the circuit breaker. Repeat several times.

4.3 Vacuum interrupter integrity

Using a dry, lint free cloth or paper towel, clean all the accessible insulating surfaces of the pole units. Conduct a vacuum interrupter integrity check as described in Section 6.

4.4 Insulation

Check the circuit breaker's primary and secondary insulation as described in Section 6.

4.5 Contact erosion and wipe

Manually charge the closing springs and close the circuit breaker. Check contact erosion and wipe as described in Section 6.

4.6 Primary circuit resistance

Check the primary circuit resistance as described in Section 6. The resistance should not exceed the values specified. Record the values obtained for future reference.

4.7 Nameplate

Compare the circuit breaker nameplate information with switchgear drawings for compatibility.

Figure 8. Type VCP-W circuit breaker manual charging handle in use.

4.8 Electrical operation check

After having completed all previous checks and tests, the circuit breaker is ready to be operated electrically. It is preferred that this check be made with the circuit breaker in a TEST position or by using a test cable, if the circuit breaker is outside the cell structure.

⚠ CAUTION

BEFORE INSERTING THE CIRCUIT BREAKER, EXAMINE THE INSIDE OF THE CELL STRUCTURE FOR EXCESSIVE DIRT OR ANYTHING THAT MIGHT INTERFERE WITH THE CIRCUIT BREAKER MOVEMENT.

⚠ WARNING

EXTREME CAUTION MUST BE EXERCISED TO INSURE THAT PRIMARY CIRCUITS ARE NOT ENERGIZED WHILE CHECKS ARE PERFORMED IN THE CIRCUIT BREAKER COMPARTMENT. FAILURE TO DO SO MAY RESULT IN PERSONAL INJURY OR DEATH.

The circuit breaker is normally tested electrically in its cell structure in the TEST position. To achieve the TEST position, first determine if the breaker cell has a BPI Pan Assembly, Figure 12 or a non-BPI Pan Assembly, Figure 13. Then follow the appropriate instructions in section 4.8.1 to move/lever the circuit breaker into the TEST position.

4.8.1 Circuit breaker insertion and removal

⚠ CAUTION

DO NOT USE ANY TOOL OTHER THAN THE LEVERING-IN CRANK PROVIDED TO LEVER THE CIRCUIT BREAKER FROM TEST OR CONNECTED POSITIONS. CORRECT OPERATION OF SOME OF THE INTERLOCKS IS DEPENDENT ON USE OF THE PROVIDED LEVERING-IN CRANK. PERSONAL INJURY OR EQUIPMENT DAMAGE COULD RESULT FROM THE USE OF A TOOL OTHER THAN THE PROPER LEVERING-IN CRANK.

NOTICE

THE CIRCUIT BREAKER AND INTEGRAL LEVERING MECHANISM INCLUDES ALL NECESSARY INTERLOCKS THAT, WHEN INTERFACED WITH A COMPATIBLE STRUCTURE, WILL RENDER THE CIRCUIT BREAKER MECHANISM MECHANICALLY AND ELECTRICALLY TRIP-FREE DURING THE LEVERING PROCESS. FOR INFORMATION PERTAINING TO INDIVIDUAL INTERLOCKS, REFER TO PARAGRAPH 4.9 IN THIS SECTION.

Inserting breaker:

A. Lower compartment direct roll-in-breaker
Push the breaker into the breaker compartment until the breaker "T" handle latches over the moving block on the levering screw assembly. In this position, the breaker is considered in the DISCONNECT position.

B. Upper compartment or non-direct roll-in-breaker

1. The breaker compartment has an interlock assembly on the compartment levering assembly, located on both the left and right hand rail assemblies. The purpose of the interlock assembly is to prevent the breaker from being removed from the compartment without the extension rails in place.
2. In order to insert or remove a non-direct roll-in breaker, a set of extension rails must be inserted into the left hand and right hand rail assemblies. This is achieved by inserting the appropriate rail, identified with a label, diagonally into the slot such that the extension rail, when lowered, unlocks the interlock allowing an installed circuit breaker to roll forward. The rolling surfaces of the compartment rail and extension rail are flush.
3. In this position, the breaker can be inserted or removed from the breaker compartment (see Figures 9 and 10).

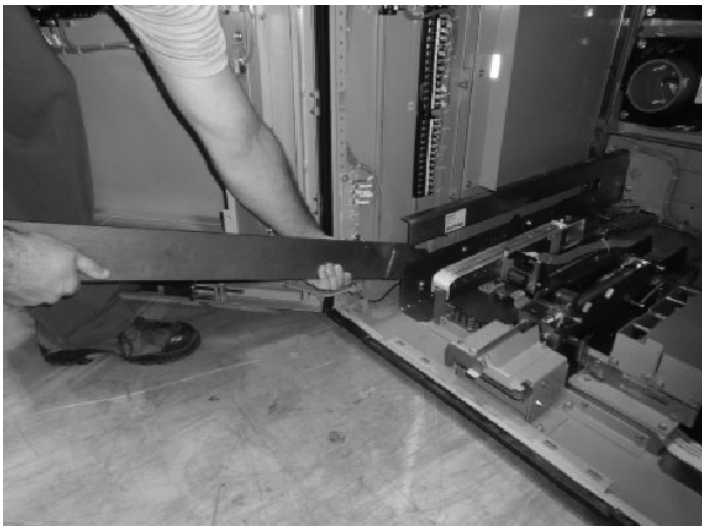


Figure 9. Insertion of the drawout extension rails.

Figure 10. Lifting and setting the breaker in the housing.

Checking pan operation:

A. TEST or DISCONNECT/TEST position

To operate the breaker at this time (TEST position mode), it is necessary to connect the secondary harness with the breaker.

Automatic secondary: For an automatically engaged secondary harness, lever the breaker into the TEST position identified by the breaker position indication (BPI) label.

Manual secondary: For a manually engaged secondary harness, pull the secondary plug handle forward until the secondary receptacle, located on the compartment levering pan, fully mates with the secondary breaker wiring plug.

Note: It is recommended that the power to the secondary connector be de-energized prior to manually engaging the secondaries to prevent damage to the secondary pins associated with the spring charging motor circuit.

Note: To prevent damage never rely on racking to engage secondary on a manually engaged secondary.

In these positions, the breaker control circuit can be tested offline (breaker is not connected to the primary circuit).

B. Racking the breaker to the CONNECTED position

1. Movement of the breaker from the TEST or DISCONNECT/TEST position to the CONNECTED position.
   a. The breaker will trip as the levering-in crank is pushed in to gain access to the hex drive nut on the levering system.
   b. Rotate the levering-in crank in a clockwise direction until the torque limiter on the levering-in crank "breaks free." As a position verification;
      - BPI pan assembly: the breaker cover plate MUST align with the black line associated with the CONNECTED position, location shown on the BPI label (Figure 12 item 7).
      - Non-BPI pan assembly: the red indicator on the levering system as shown through the window below the levering-in crank on the front of the levering system (Figure 13, item 7).

C. Racking the breaker from CONNECTED position to TEST or DISCONNECT/TEST position

BPI pan assembly:

1. Insert the levering-in crank onto the hex drive nut on the levering system. In order to engage the hex drive nut, you must push in the levering system slider.

Note: If the breaker is closed, it will trip as the levering-in crank is pushed in to gain access to the hex drive nut in the levering system.

2. Rotate the levering-in crank in a counterclockwise direction until the breaker is in the TEST or the DISCONNECT position.

Note: The breaker secondary control receptacle on the compartment levering system is automatically disengaged from the breaker secondary plug when moved to the DISCONNECT position.

Non-BPI pan assembly:

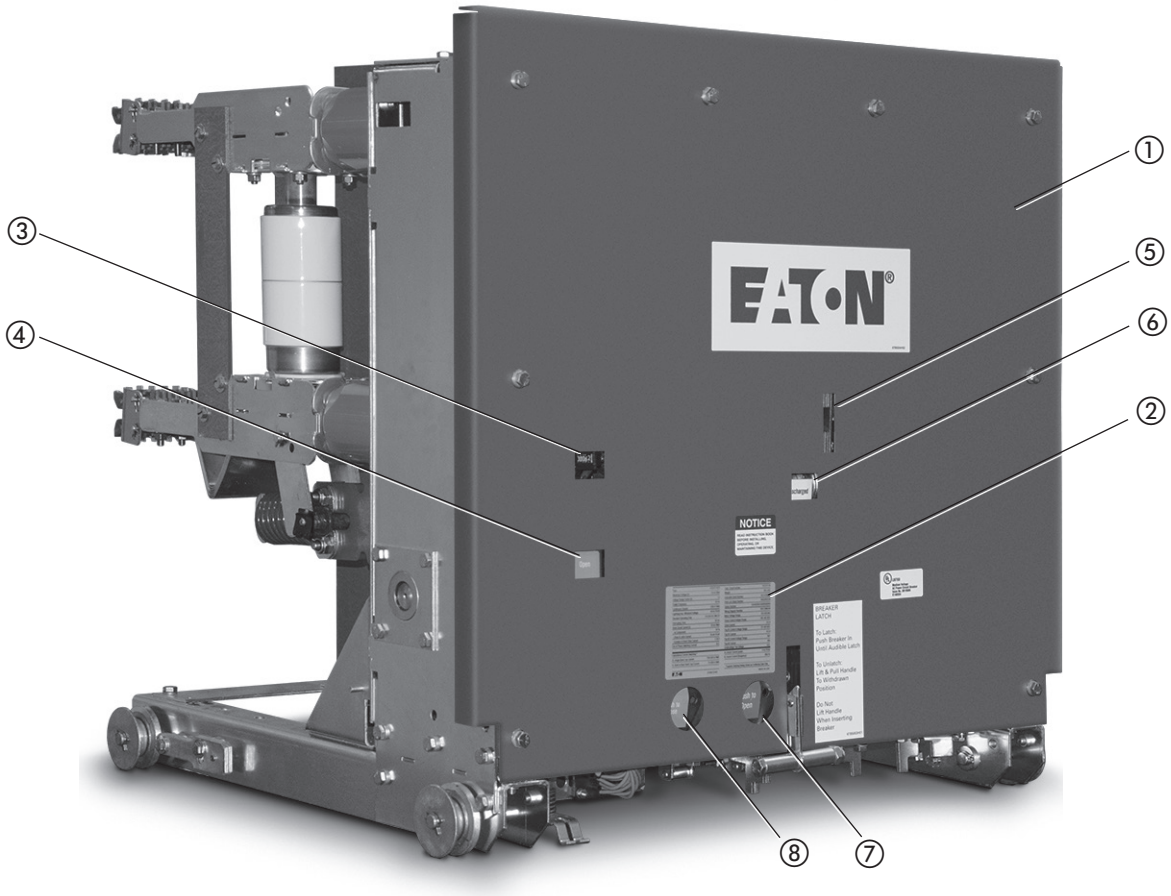
1. If the breaker is closed in the CONNECTED position, then access to the hex drive nut on the levering system will be denied. The breaker must be opened prior to levering operation being performed.
2. Insert the levering-in crank onto the hex drive nut on the levering system. In order to engage the hex drive nut, you must push in the levering system slider.
3. Rotate the levering-in crank in a counterclockwise direction until the breaker is in the DISCONNECT/ TEST position.

Note: The breaker secondary control receptacle on the compartment levering system is automatically disengaged from the breaker secondary plug when moved to the DISCONNECT/TEST position.

Automatic/manual hybrid BPI pan assembly:

1. If the breaker is closed in the CONNECTED position, then access to the hex drive nut on the levering system will be denied. The breaker must be opened prior to levering operation being performed.
2. Insert the levering-in crank onto the hex drive nut on the levering system. In order to engage the hex drive nut, you must push in the levering system slider.
3. Rotate the levering-in crank in a counterclockwise direction until the breaker is in the DISCONNECT/TEST position.

Note: The breaker secondary control receptacle on the compartment levering system is automatically disengaged from the breaker secondary plug when moved to the DISCONNECT/ TEST position.



1. Front panel
2. Nameplate
3. Operation counter
4. Open /closed indicator
5. Manual charge socket
6. Spring charge/discharge indicator
7. Manual open button
8. Manual close button

Figure 11. Front panel.

Note: The legend for Figures 12 and 13 follow Figure 13.

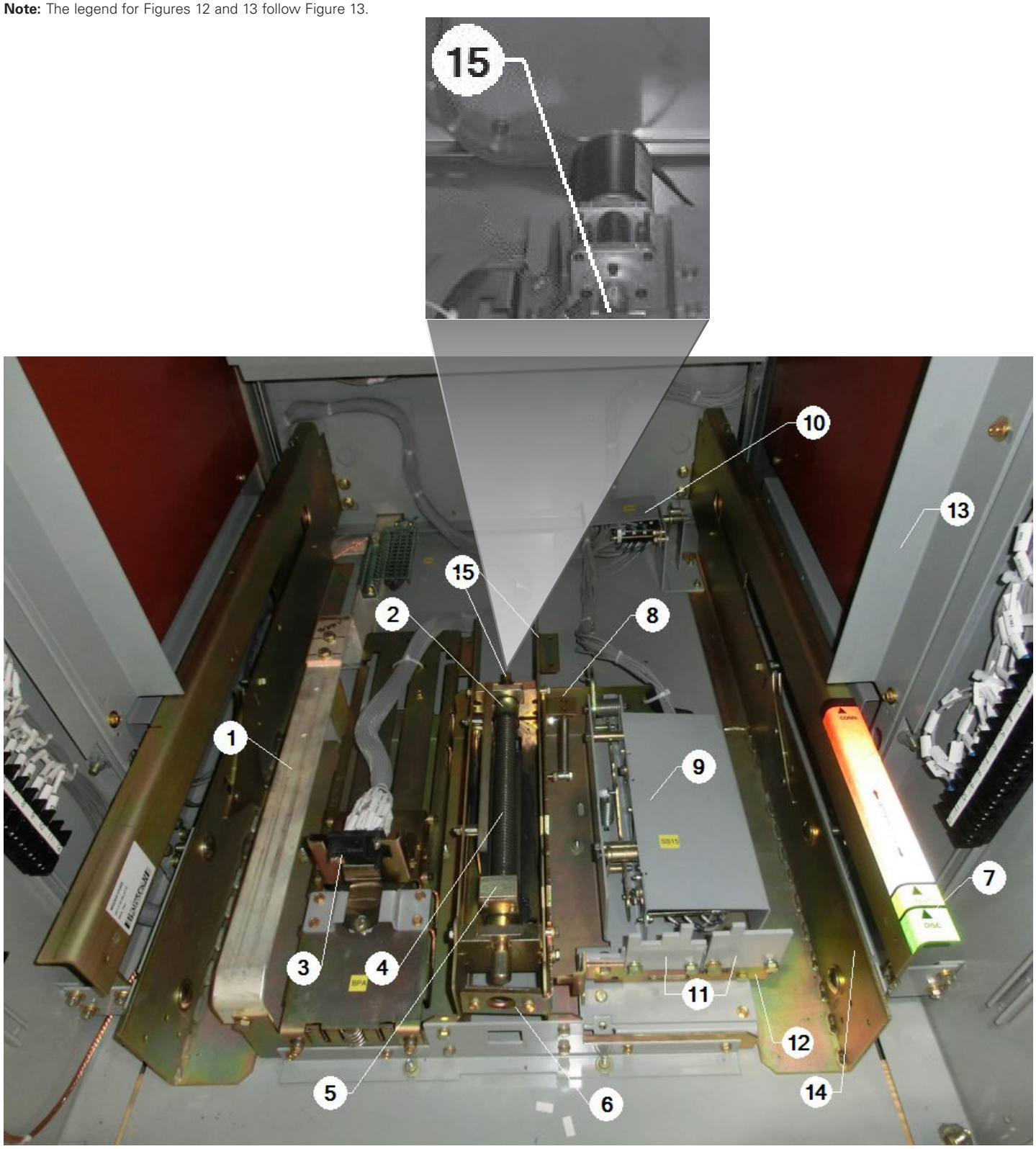
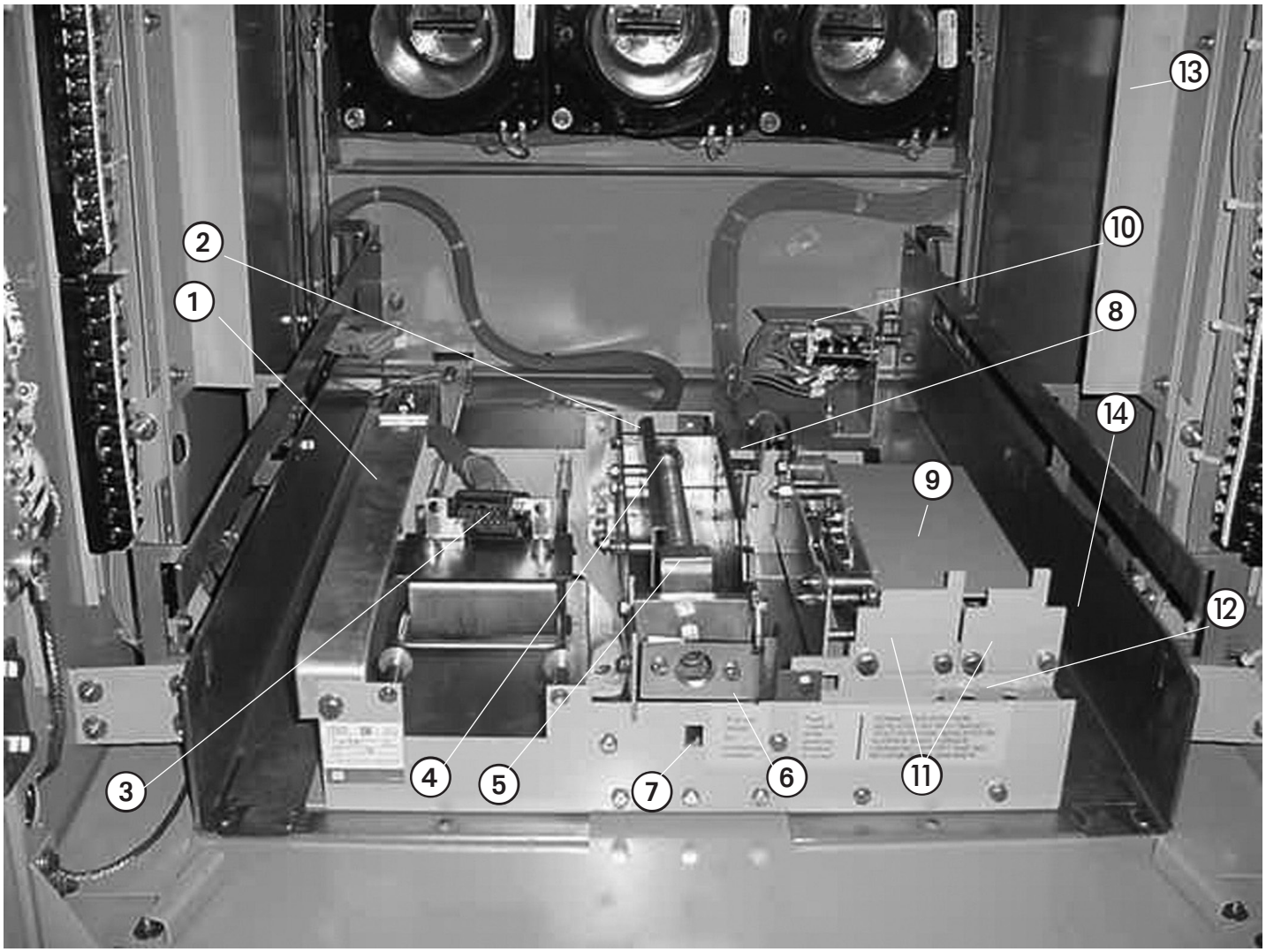


Figure 12. BPI pan assembly.



Legends for Figures 12 & 13.

1. Ground contacts
2. Levering system.
3. Automatic (BPI) or manual (non-BPI) secondary
4. Racking screw
5. Moving block
6. Slider
7. Breaker position indication
8. Slider interlocks
9. MOC switch
10. TOC switch
11. Coding plates
12. Provision for padlocking
13. Picture frame
14. Breaker rail
15. MR2 integral racking provisions (optional)

Figure 13. Non-BPI pan assembly.

Breaker pan assembly:

Call out descriptions for Figure 12 and 13.

1. Grounding contact grounds the breaker in the DISCONNECT, TEST, and CONNECTED positions.
2. The levering system prevents removal of the breaker in any position other than the DISCONNECT position (BPI pan) or DISCONNECT/TEST position (non-BPI pan).
3. The control wiring is arranged for pullout disconnecting by means of a 25-point female receptacle arranged to connect to a male plug on the breaker. The secondary disconnect is the connection for the control leads between the removable breaker and the stationary housing.

   Automatic secondary: Figure 12 represents an automatically engaged secondary, as offered on the BPI pan assembly, requires no manual input from the customer to engage the secondary harness. The secondary harness will engage automatically when the breaker is levered-in to the discrete TEST position.

   The secondary harness will then disengage automatically when the breaker returns to the DISCONNECT position.

   Manual secondary: Figure 13 represents a manually engaged secondary assembly which requires the customer to engage the secondary harness manually when the breaker is in the DISCONNECT position. When engaged, the breaker will now be in the TEST position.

   Automatic/manual hybrid secondary (optional): Figure 46 represents an automatic engaging secondary with a manual release feature incorporated into the BPI pan assembly. It requires the customer to manually lift up the secondary release lever to allow the secondary harness to engage the breaker in the DISCONNECT/TEST position.

   The secondary harness will then disengage automatically when the breaker returns to the DISCONNECT/TEST position.
4. Racking screw performs breaker insertion and withdrawal.
5. Moving block couples to breaker for insertion and withdrawal.
6. Slider is used with #8 to prevent levering a closed breaker. May also be used in conjunction with #12 to padlock a breaker in either position.
7. Indicates when the breaker is in the fully connected position.

   Breaker position indication (BPI) label: Figure 12 represents positive indication of breaker location at any position through use of a colored label mounted on the top flange of the right hand rail assembly. Green indicates the DISCONNECT position, yellow indicates the TEST position, and red indicates the CONNECT position. Upon arriving at any of the three discrete positions; DISCONNECT, TEST, and CONNECT, there is a black mark that aligns with the breaker cover to indicate exact location.

   Standard indication: Figure 13 represents positive indication of the breaker in the CONNECT position by use of a red flag that rotates into viewing position when the breaker is fully connected.
8. **Slider interlocks:**
   BPI pan assembly: Figure 12 displays the "L" shaped slider interlock that enables tripping of a closed breaker by pushing in on the slider (item 6) that prevents access to the racking screw.

   Non-BPI pan assembly: Figure 13 displays the "Z" shaped slider interlock that prevents a closed breaker from being levered out of the cell.
9. The breaker mechanism-operated cell (MOC) switch is an assembly of switches that is operated by a lever on the breaker mechanism. It can contain as many as 15 normally closed and 15 normally open contacts (beneath the cover) in the standard design.

   The MOC switch is activated by the breaker closing. It extends a plunger out the bottom of the mechanism and pushes down on the MOC switch operating mechanism. This, in turn, transmits the motion to operate the switch.
10. The truck operated cell (TOC) switch has nine poles - four normally open and five normally closed contacts that change state as the breaker is levered to the connected position. As the breaker is being levered into the connected position, a bracket on the breaker pushes the TOC switch lever during the last inch of travel. As a result, the TOC switch can be used to electrically indicate whether or not the breaker is in the connected position (beneath cover).
11. Code plates: (see Interface interlocks/interfacing check, Section 4.9.1).
12. Provision for padlocking a breaker in any position. Also a location for a key interlock.
13. Picture frame provides a closed barrier to the primary compartment when the breaker is connected.
14. Rail on which the breaker rolls.
15. Optional MR2 integral racking provisions for inclusion during manufacturing or aftermarket.

For additional information on the levering mechanism, refer to paragraph 5.6 in this manual.

4.8.2 Circuit breaker performance check

1. Study and understand the electrical drawings furnished with each switchgear system.
2. Install the circuit breaker in the DISCONNECT position.
3. Engage secondaries or lever breaker to TEST position to automatically engage secondaries:

   Automatic secondary: To engage secondary harness, lever the breaker to the TEST position to engage the control circuit.

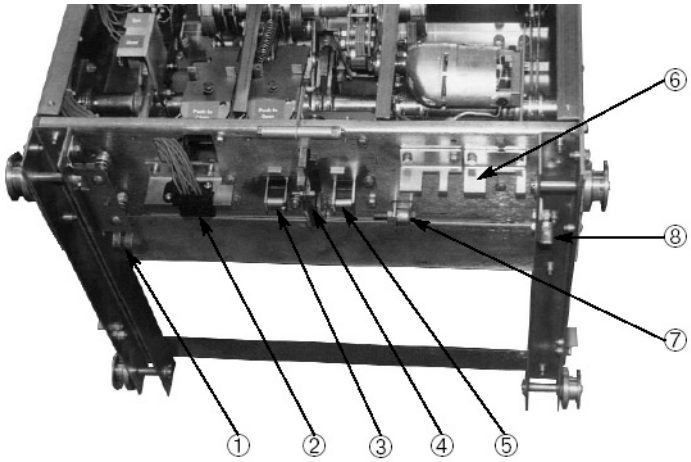
   Manual secondary: To engage secondary harness, lift and pull the secondary disconnect forward to engage the control circuit.

   Note: It is recommended that the power to the secondary connector be de-energized prior to manually engaging the secondaries to prevent damage to the secondary pins associated with the spring charging motor circuit.

   Automatic/manual hybrid secondary (optional): To engage secondary harness, lift and release the secondary disconnect so that it automatically slides forward to engage the control circuit.
4. Verify breaker operation; once the secondaries are engaged the closing springs will automatically charge unless inhibited by the switchgear control circuit, the condition will be indicated by a Spring Charged/Discharged indicator on the front of the circuit breaker (Figure 7). In addition, the status of the main contacts, open or closed, is indicated on the front of the circuit breaker.

   Close and trip the circuit breaker several times to verify closing and tripping operations. Conclude by closing the circuit breaker. The circuit breaker is now closed in the TEST position with springs charged.

Figure 14. Engaging extension rails in a lower circuit breaker compartment.



1. Ground contact
2. Secondary disconnect
3. Close floor tripper
4. Levering latch
5. Trip floor tripper
6. Code plates
7. MOC operator
8. TOC operator (Non-BPI pan assembly

Figure 15. Typical VCP-W circuit breaker bottom view.

4.9 Circuit breaker/structure interfacing

⚠ WARNING

NEVER DISABLE OR DEFEAT ANY INTERLOCKS. THEY ARE INTENDED FOR PROPER AND SAFE OPERATION. FAILURE TO COMPLY COULD RESULT IN DEATH, SEVERE PERSONAL INJURY, AND/OR PROPERTY DAMAGE DUE TO THE HAZARDOUS VOLTAGE PRESENT.

Type VCP-W circuit breakers are supplied with a series of interlocks to insure safe and proper interfacing between the circuit breaker and its compartment. Specific interlocks are described in the next paragraph to provide proper familiarization. An interfacing check should be performed as also described in the next paragraph.

4.9.1 Interface interlocks/interfacing check

Refer to Figures 7, 9, and 15 for visual interlock and interface check references. The following interlocks are provided to ensure safe and proper operation.

Code plates

A coding plate is fastened to the bottom front edge of the breaker compartment. There is also a coding plate fastened to the front of the breaker. If the breaker has a lower interrupting rating than the rating of the compartment, or if the voltage and continuous current characteristics do not match, the coding plate on the compartment will prevent the entrance of the breaker into the compartment. In general, per the IEEE standards, a higher rated breaker is always permitted to be inserted into a lower rated cell; however, there are certain physical characteristics of the breakers that may still prevent this from happening.

NOTICE

EVEN WITH THE CODING PLATES, IT IS POSSIBLE TO PUT A BREAKER INTO THE COMPARTMENT THAT'S CONTROL WIRING IS NOT COORDINATED WITH THAT OF THE COMPARTMENT. ALWAYS CHECK THE SHOP ORDER DRAWING TO MAKE SURE THE CONTROL WIRING OF THE BREAKER AND THE COMPARTMENT ARE THE SAME.

Maintenance interlock

This interlock trips, closes, and trips the circuit breaker if it is closed and charged as the circuit breaker is withdrawn from the DISCONNECT (BPI pan assembly) or DISCONNECT/TEST position on to the extension rails or rolled out of the cell for the direct roll-in-breaker. The circuit breaker open and closing springs are, therefore, discharged. A closed breaker cannot be moved into the DISCONNECT (BPI pan assembly) or DISCONNECT/TEST position from the extension rails, or from the floor as a roll-on-floor breaker. This interlock consists of the interaction between the switchgear cell features and the close floor tripper and the trip floor tripper found under the breaker per Figure 15.

Figure 16. Pulling secondary disconnect cage to engage secondaries in TEST position (old version shown). New version will have BPI pan with automatic secondaries.

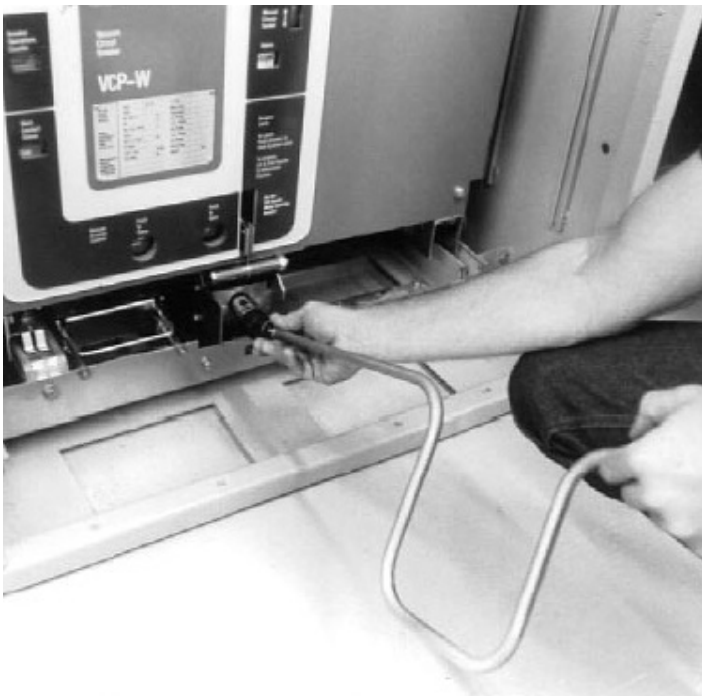


Figure 17. Engaging levering-in crank.

Levering interlock

If the breaker is closed in the TEST position, then as the levering-in crank is pushed in to gain access to the hex drive nut on the levering system the breaker will trip Open automatically.

If the circuit breaker is closed as the levering-in crank is engaged to move the circuit breaker from the CONNECTED to the TEST position, the circuit breaker will do one of the following.

1. **BPI pan assembly (Figure 12):** If the breaker is closed in the CONNECTED position, then as levering-in crank is pushed in to gain access to the hex drive nut on the levering system the breaker will trip Open automatically.

2. **Non-BPI pan assembly (Figure 13):** If the breaker is closed in the CONNECTED position, then access to the hex drive nut on the levering system will be denied when pushing in the levering-in crank. The breaker must be opened prior to the levering operation being performed.

Automatic/manual hybrid secondary (optional - Figure 46): It will function the same as the Non-BPI pan assembly above.

Positive Interlock

BPI pan assembly (Figure 12): The "L" shaped slider interlock that enables tripping of a closed breaker by pushing in on the slider (item 6) that protects the racking screw. If desired, the customer can request the "Z" bracket to be added to the BPI pan assembly if the switchgear design permits it.

Non-BPI pan assembly (Figure 13): The "Z" shaped slider interlock that prevents a closed breaker from being levered out of the cell.

Automatic/manual hybrid secondary (optional - Figure 46): It will function the same as the Non-BPI pan assembly above due to the replacement of the "L" bracket with the "Z" bracket.

Negative interlock

The negative interlock prevents the circuit breaker from closing between the CONNECTED and TEST positions.

Position closing interlock

The circuit breaker is prevented from closing automatically when it is moved from the TEST to the CONNECTED position if the closing switch is maintained during the levering-in operation.

Position withdrawal interlock

This interlock prevents the circuit breaker from being withdrawn by pulling unless it is in the DISCONNECT or DISCONNECT/TEST position.

Extension rail interlock

The extension rail interlock prevents the circuit breaker from being withdrawn out of its compartment unless the extension rails or the breaker lifter are properly engaged to the fixed rails, or the lower cell is configured for a direct roll-in-breaker.

Overall system interlock check

The correct operation of provided interlocks should be confirmed. Keep in mind that an interfacing check is made with a compatible structure. As such, the instructions provided here may overlap with the instructions provided with the assembly. In any case, all provided interlocks should be confirmed. Review paragraph 4.8.1 before proceeding if additional instructions are needed on insertion and removal of a circuit breaker.

At the conclusion of the operations check as described in paragraph 4.8.2, the circuit breaker was closed in the TEST position with its springs charged. Perform one of the following depending on the slider interlock (also called positive interlock) style.

BPI pan assembly:

Engage the levering-in crank and the circuit breaker will automatically trip and the MOC switches will operate if the circuit breaker cell is equipped with MOC switches designed to operate in the TEST position.

Lever the circuit breaker towards the CONNECTED position. As the circuit breaker moves, protective compartment shutters will automatically begin to open uncovering fixed primary contacts.

TOC switches will also operate once the CONNECTED position is reached, if TOC switches are provided in the structure. Remove the levering-in crank at this point.

Close the circuit breaker. Any provided MOC switches will operate and the motor closing springs will charge if control power is available.

Engage the levering-in crank. The slider can be pushed in to engage the levering-in crank and the circuit breaker will automatically trip. Lever the circuit breaker out approximately halfway towards the TEST position.

Attempt to lift the circuit breaker lift/pull handle to pull the circuit breaker out. The position withdrawal interlock will prevent lifting the handle high enough to disengage the levering latch from the nut. This prevents the circuit breaker from being pulled out.

Non-BPI pan assembly:

Engage the levering-in crank and the circuit breaker will automatically trip and the MOC switches will operate if the circuit breaker cell is equipped with MOC switches designed to operate in the TEST position.

Lever the circuit breaker towards the CONNECTED position. As the circuit breaker moves, protective compartment shutters will automatically begin to open uncovering fixed primary contacts. TOC switches will also operate once the CONNECTED position is reached. TOC switches are provided in the structure. Remove the levering-in crank at this point, if equipped with this option.

Close the circuit breaker. Any provided MOC switches will operate and the motor closing springs will charge if control power is available.

Attempt to engage the levering crank. The slider cannot be pushed far enough to engage the levering-in crank. Trip the circuit breaker, engage the levering-in crank, and lever the circuit breaker out approximately halfway towards the DISCONNECT/TEST position.

Attempt to lift the circuit breaker lift/pull handle to pull the circuit breaker out. The position withdrawal interlock will prevent lifting the handle high enough to disengage the levering latch from the nut. This prevents the circuit breaker from being pulled out.

Attempt to close the circuit breaker by pushing the manual close button. The circuit breaker will go trip free (springs discharge but circuit breaker will not close). Lever the circuit breaker to the DISCONNECT/TEST position. The secondary contacts will disengage automatically.

BPI and non-BPI pan assembly:

If the extension rails are installed, then remove the extension rails. Disengage the levering latch by lifting the handle on the circuit breaker and attempt to pull the circuit breaker out. The circuit breaker will not move out more than two inches beyond the DISCONNECT or DISCONNECT/TEST position. Push the circuit breaker back to the DISCONNECT or DISCONNECT/TEST position. Engage the extension rails. Once again disengage the levering latch and pull the circuit breaker out. The circuit breaker will trip, close and trip as it comes out on to the extension rails from the DISCONNECT or DISCONNECT/TEST position.

Automatic/manual hybrid secondary (optional - Figure 46):

It will function the same as the Non-BPI pan assembly above due to the replacement of the "L" bracket with the "Z" bracket.

NOTICE

THE INTERFACE CHECKS OUTLINED IN THIS MANUAL AND THE MANUAL PROVIDED WITH THE ASSEMBLY STRUCTURE ARE INTENDED TO VERIFY SAFE AND PROPER OPERATION. IF OBSERVED CONDITIONS ARE NOT AS DESCRIBED, CONTACT EATON FOR ASSISTANCE.

5. Description and operation

5.1 Introduction

Type VCP-W, VCPW-SE, VCP-WC, and VCPW-ND vacuum circuit breakers are horizontal drawout designs for use in metal-clad switchgear compartments. Most ratings can be stacked two high in a vertical section resulting in a considerable savings of floor space.

Vacuum interrupters are used with all circuit breakers to close and open the primary circuit. All VCP-W circuit breakers are operated by a front mounted spring type stored energy mechanism (Figure 5). The stored energy mechanism is normally charged by an electric motor, but can be charged manually with the manual maintenance tool. Since the same basic, front accessible mechanism is used for all VCP-W circuit breakers, a minimum investment in spare parts is required.

The primary insulation used with Type VCP-W circuit breakers is flame retardant and track resistant glass polyester except for the Type VCPW-SE circuit breaker. The VCPW-SE special environment circuit breaker design utilizes cycloaliphatic epoxy for its primary insulation. "Fast On" type secondary control terminations are used on Types VCP-W, VCP-WC, and VCPW-ND circuit breakers, while the Type VCPW-SE circuit breaker utilizes ring type secondary control terminations.

The rest of this section describes the overall operation of the VCP-W circuit breaker as well as the function and operation of all major sub-assemblies and/or parts. Keep in mind that VCP-W will be used throughout the text when referring to any one of the three types of circuit breakers, unless there is a specific difference between VCP-W, VCPW-SE, VCP-WC, and VCPW-ND.

5.2 Interrupter assembly

Vacuum interrupters are mounted vertically and supported from the fixed stem which is clamped to the top conductor. The exclusive current transfer system consists of a series of plated, high-conductivity copper leaf conductors that are pressed on the movable interrupter stem. This design provides a multipoint contact resulting in low electrical and thermal resistance. Utilizing this non-sliding current transfer system between the movable stem and the breaker main conductor eliminates the need for maintenance (Figure 18). Multiple finger, floating type primary disconnecting contacts at the ends of the top and bottom conductors provide a means for interfacing with the primary conductors mounted in the switchgear (Figure 18).

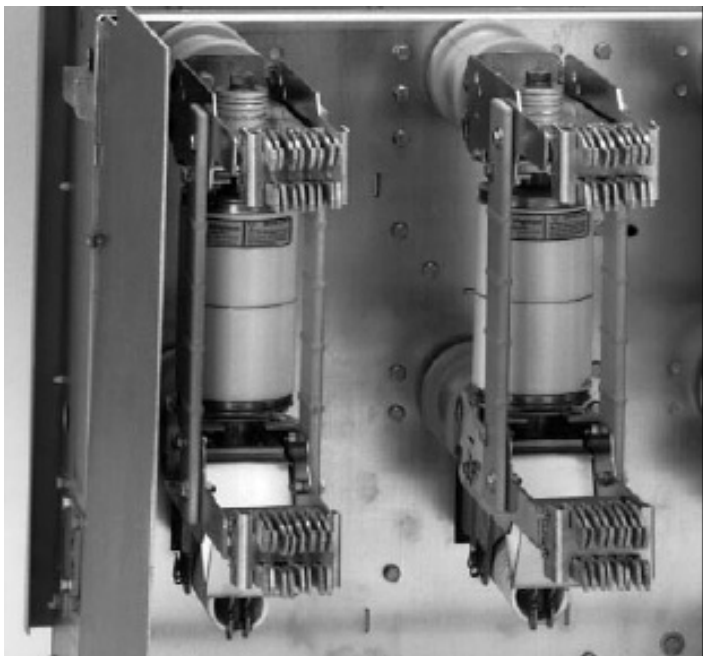


Figure 18. Typical VCP-W rear view showing vacuum interrupters and current carrying system.

Direct acting insulated operating rods in conjunction with the circuit breaker's mechanism provide a fixed amount of interrupter movable stem motion. This motion is directly related to the interrupter's "wipe" and "stroke," each of which is discussed in detail later in this section.

5.2.1 Vacuum interrupter

Type VCP-W vacuum circuit breakers utilize vacuum interrupters for interruption and switching functions. The vacuum interrupters use petal type copper chrome contacts for superior dielectric strength, better performance characteristics, and lower chop current. Vacuum interruption provides the advantages of enclosed interrupters, reduced size and weight, short interrupting time, long life, reduced maintenance, and environmental compatibility.

Arc interruption is simple and fast (Figure 19). In the closed position, current flows through the interrupter. When the contacts are opened, the arc is drawn between the contact surfaces. It is moved rapidly around the slotted contact surfaces by a self-induced magnetic force, which prevents gross contact erosion as well as the formation of hot spots on contact surfaces. The arc burns in an ionized metal vapor which continually leaves the contact area and condenses on the surrounding metal shield.

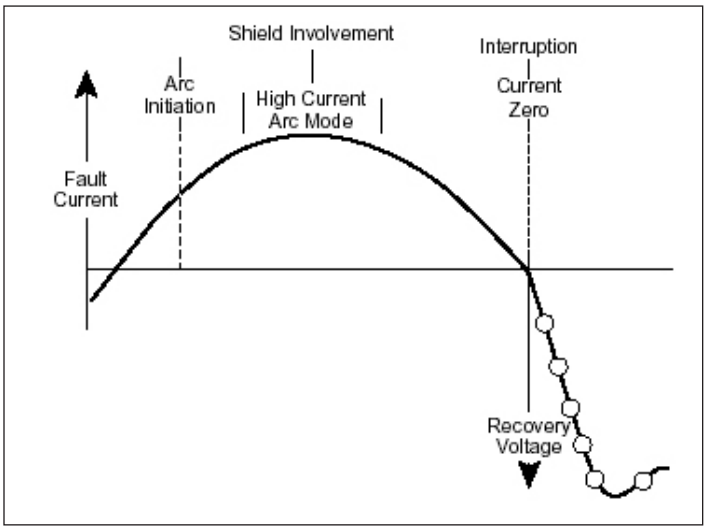


Figure 19. Graphic representation of arc interruption.

At current zero, the arc is extinguished and vapor production ceases. Very rapid dispersion, cooling, recombination, and deionization of the metal vapor plasma, together with the fast condensation of metal vapor products, cause the vacuum to be quickly restored. Hence, the opened contacts withstand the transient recovery voltage.

5.2.2 Contact erosion indication

The purpose of a contact erosion indicator is to monitor the erosion of the vacuum interrupter contacts, which is very minimal over time with vacuum interrupters utilizing copper-chrome contact material. If contact erosion reaches 1/8 in. (3.18 mm), the interrupter must be replaced. A horizontal colored or machined contact erosion indicator mark is located on the moving stem of the interrupter (Figures 27 and 28).

In order to determine if the contacts have eroded to the extent that the interrupter must be replaced, observe the erosion mark placed on each moving stem from the rear of the breaker with the breaker closed. The interrupter is satisfactory if the mark on the stem is visible with the breaker closed. The entire interrupter assembly must be replaced if the mark is no longer visible.

5.2.3 Loading spring indicator

The loading spring indicator is an additional method provided to indicate conditions within the interrupter. The indicator is used to indicate whether the contact springs are maintaining the adequate contact pressure to keep the contacts closed. Severe contact erosion would result in an unacceptable indication from the indicator (Figure 29). Depending upon the structural design, a small mirror may be required to inspect all three poles.

Note that the actual configuration and/or appearance of the indicator can vary from one circuit breaker rating to another. The actual appearance of the indicator depends upon the color of the contact springs in a specific circuit breaker. When making this inspection, first observe the color of the contact springs to determine how the indicator will appear. Figure 29 illustrates what the actual indicator appearance will be, depending upon the color of the springs.

5.2.4 Contact wipe and stroke

Contact wipe is the indication of (1) the force holding the vacuum interrupter contacts closed and (2) the energy available to hammer the contacts open with sufficient speed for interruption.

Stroke is the gap between fixed and moving contacts of a vacuum interrupter with the circuit breaker open.

The circuit breaker mechanism provides a fixed amount of motion to the operating rods. The first portion of the motion is used to close the contacts (i.e. stroke) and the remainder is used to further compress the pre-loaded wipe spring. This additional compression is called wipe. Wipe and stroke are thus related to each other. As the stroke increases due to the erosion of contacts, the wipe decreases.

A great deal of effort has been spent in the design of all VCP-W vacuum circuit breakers in order to eliminate the need for field adjustments of wipe or stroke.

⚠ CAUTION

THERE IS NO PROVISION FOR IN-SERVICE ADJUSTMENTS OF CONTACT WIPE AND STROKE. ALL SUCH ADJUSTMENTS ARE FACTORY SET AND SHOULD NOT BE ATTEMPTED IN THE FIELD.

5.2.5 Phase barriers

Phase barriers on all VCP-W circuit breakers are made of glass polyester. Table 21 gives the number and configuration of the barriers required for each circuit breaker rating.

Table 21. VCP-W & VCP-WC circuit breaker barrier configurations.

ANSI breaker identification	Amps	Reference vacuum interrupter diameter inches	Number of barriers
50VCPW-ND250	1200	4	0
50VCP-W250	1200 2000 3000	4 5 7	2 (OUTER) 4 2 (INNER) 2 in cell
50VCP-W350	1200 2000 3000	7 or 5 7 or 5 7	2 (INNER) 2 in cell 2 (INNER) 2 in cell 2 (INNER) 2 in cell
75VCP-W500	1200 2000 3000	5 or 4 5 7	2 (OUTER) 4 2 (INNER) 2 in cell
150VCP-W500	1200 2000 3000	4 or 3 5 7	2 (OUTER) 4 2 (INNER) 2 in cell
150VCP-W750	1200 2000 3000	4 5 7	2 (OUTER) 4 2 (INNER)2 in cell
150VCP-W1000	1200 2000 3000	7 or 5 7 or 5 7	2 (INNER) 2 in cell 2 (INNER) 2 in cell 2 (INNER) 2 in cell
150VCP-W63	1200 2000 3000	7 7 7	2 (INNER) 2 in cell 2 (INNER) 2 in cell 2 (INNER) 2 in cell
270VCP-W	630 1200 2000	4 4 or 5 5	2 (INNER) 2 in cell 2 (INNER) 2 in cell 2 (INNER) 2 in cell
50VCP-W25C	1200 2000 3000	4 5 7	2 (INNER) 2 in cell 2 (INNER) 2 in cell 2 (INNER) 2 in cell
150VCP-W25C	1200 2000 3000	4 5 7	2 (INNER) 2 in cell 4 2 (INNER) 2 in cell
50VCP-W40C 150VCP-W40C 50VCP-W50C 150VCP-W50C	1200 2000 3000	5 5 7	2 (INNER) 2 in cell 2 (INNER) 2 in cell 2 (INNER) 2 in cell
50VCP-W63C 150VCP-W63C	1200 2000 3000	7 7 7	2 (INNER) 2 in cell 2 (INNER) 2 in cell 2 (INNER) 2 in cell

Note: Although only standard ANSI rated VCP-W breakers are given in these configurations, all VCPW-SE and IEC rated breakers follow the same barrier configurations based on the diameter of the vacuum interrupter.

VCP-W (K = 1) circuit breaker barrier configurations.

ANSI breaker identification	Amps	Reference vacuum interrupter diameter inches	Number of barriers
50VCP-W25	1200 2000 3000	3 4 5	2 (INNER) 4 2 (INNER)
50VCP-W40	1200 2000 3000	4 4 5	4 4 2 (INNER)
50 VCP-W50	1200 2000 3000	5 5 5	2 (INNER), 2 in cell 2 (INNER), 2 in cell 2 (INNER), 2 in cell
50 VCP-W63	1200 2000 3000	7 7 7	2 (INNER), 2 in cell 2 (INNER), 2 in cell 2 (INNER), 2 in cell
75 VCP-W40	1200 2000 3000	4 4 7	4 4 2 (INNER)
75 VCP-W50	1200 2000 3000	5 5 7	2 (INNER), 2 in cell 2 (INNER), 2 in cell 2 (INNER), 2 in cell
150 VCP-W25	1200 2000 3000	3 4 7	2 (INNER) 4 2 (INNER)

VCP-W (K = 1) circuit breaker barrier configuration (cont).

ANSI breaker identification	Amps	Reference vacuum interrupter diameter inches	Number of barriers
150 VCP-W40	1200 2000 3000	5 5 7	4 4 2 (INNER)
150 VCP-W50	1200 2000 3000	5 5 7	2 (INNER), 2 in cell 2 (INNER), 2 in cell 2 (INNER), 2 in cell
150 VCP-W63	1200 2000 3000	7 7 7	2 (INNER), 2 in cell 2 (INNER), 2 in cell 2 (INNER), 2 in cell

⚠ WARNING

DO NOT PLACE THE CIRCUIT BREAKER IN ITS COMPARTMENT WITHOUT THE PHASE BARRIERS IN PLACE. THE ABSENCE OF THE BARRIERS COULD CAUSE A CATASTROPHIC FAILURE DURING INTERRUPTION OR OPERATION RESULTING IN DEATH, SEVERE PERSONAL INJURY, AND/OR PROPERTY DAMAGE.

The multiple finger primary disconnect contacts are silver plated and waxed. In order to provide visual indication of the presence of wax, a blue dye is added during the waxing process to give a bluish color to the disconnect contacts. The wax acts as a conductive lubricant without attracting dirt. For this reason the contacts do not require any additional lubricant.

5.3 Stored energy mechanism

⚠ WARNING

KEEP HANDS AND FINGERS AWAY FROM THE CIRCUIT BREAKER'S INTERNAL PARTS WHILE THE CIRCUIT BREAKER CONTACTS ARE CLOSED OR THE CLOSING SPRINGS ARE CHARGED. THE CIRCUIT BREAKER CONTACTS MAY OPEN OR THE CLOSING SPRINGS DISCHARGE CAUSING A CRUSHING INJURY. DISCHARGE THE SPRINGS AND OPEN THE CIRCUIT BREAKERS BEFORE PERFORMING ANY CIRCUIT BREAKER MAINTENANCE, INSPECTION, OR REPAIR.

The spring stored energy operating mechanism is arranged vertically in front of all VCP-W circuit breakers (Figure 5). It includes all the elements for storing the energy, closing and tripping of the circuit breaker, as well as manual and electrical controls. The manual controls are all front accessible. Motion to close and open the interrupter contacts is provided through operating rods connecting the mechanism pole shaft to the bell cranks of the interrupter assemblies.

5.3.1 Operation of stored energy mechanism

The mechanism stores the closing energy by charging the closing springs. The mechanism may rest in any one of the four positions shown in Figure 20 and as follows:

a. Breaker element open, closing springs discharged;
b. Breaker element open, closing springs charged;
c. Breaker element closed, closing springs discharged; and
d. Breaker element closed, closing springs charged.

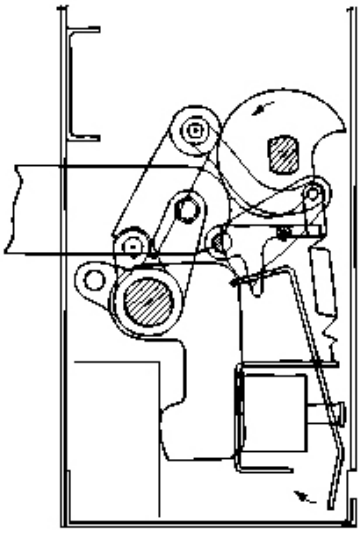


Figure 20a Breaker open and closing spring discharged

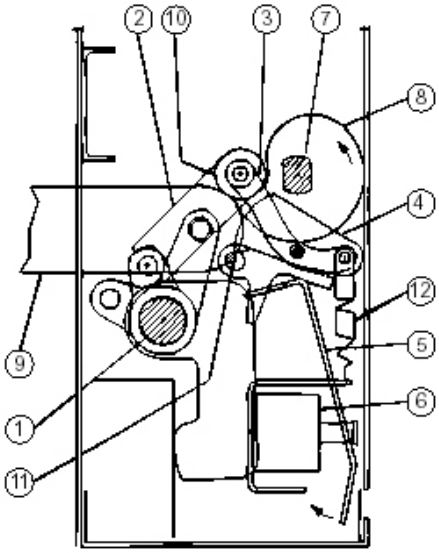


Figure 20b Breaker open and closing spring discharged

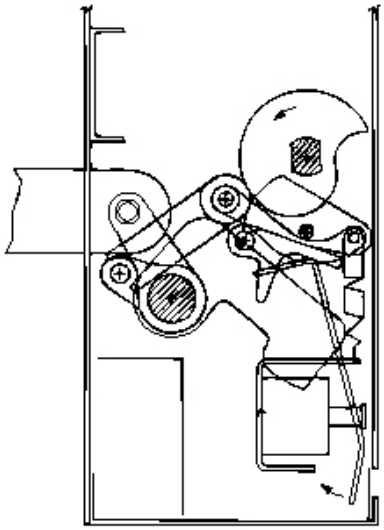


Figure 20c Breaker closed and closing spring discharged

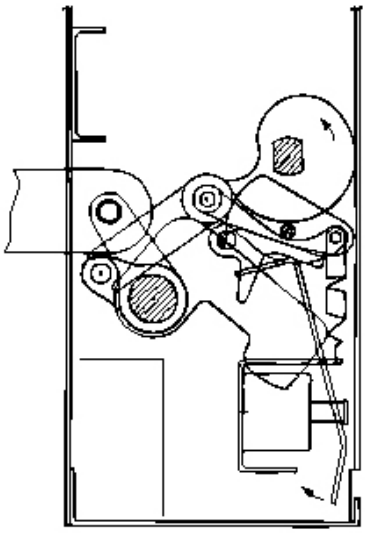
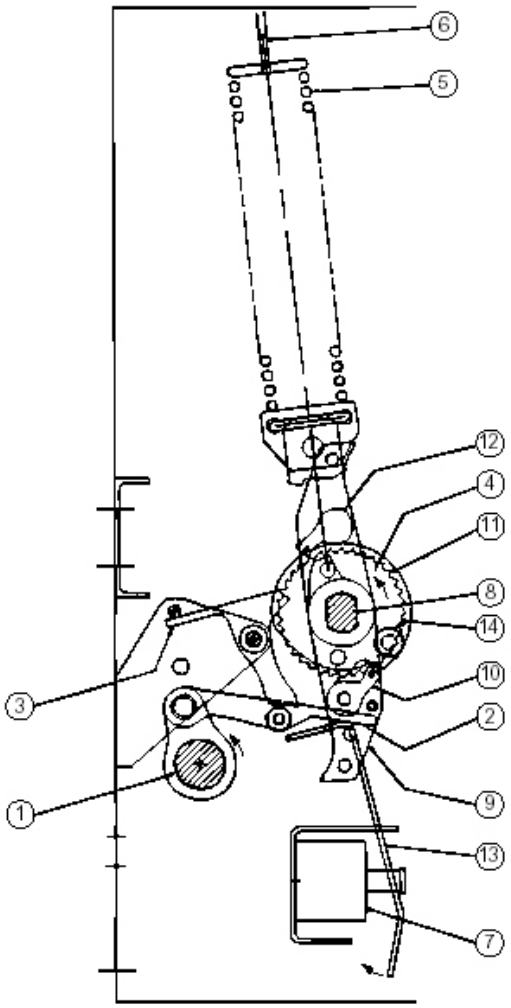


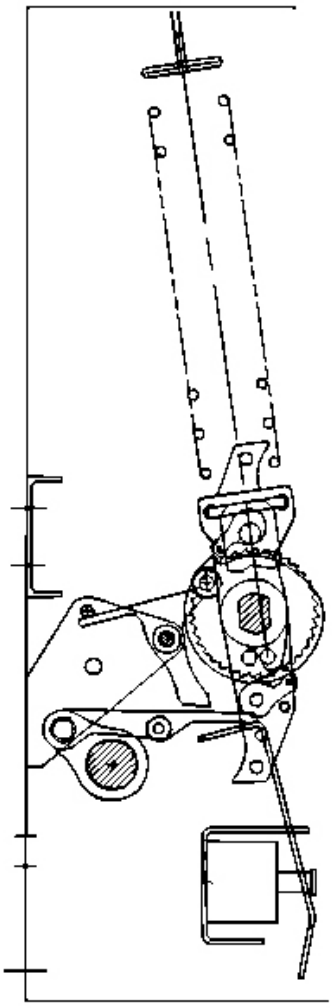
Figure 20d Breaker closed and closing spring discharged

1. Pole shaft
2. Main link
3. Banana link
4. Trip latch
5. Shunt trip lever
6. Shunt trip coil
7. Cam shaft
8. Closing cam
9. Operating rod
10. Main link roller
11. Trip bar "D" shaft
12. Trip latch reset spring

Figure 20. Closing cam and trip linkage.



Breaker open, springs discharged



Breaker closed, springs discharged

1. Pole shaft
2. Anti-close interlock
3. Spring release (close) latch
4. Spring crank
5. Closing spring
6. Closing spring fixed end
7. Spring release (close) coil
8. Cam shaft
9. Motor ratchet lever
10. Drive pawl
11. Ratchet wheel
12. Holding pawl
13. Spring release (close) clapper
14. Spring release latch (close roller)

Figure 21. Charging schematic.

5.3.2 Charging

Figure 21 is a schematic view of the spring charging parts of the stored energy mechanism.

The major component of the mechanism is a cam shaft assembly which consists of a drive shaft to which are attached two closing spring cranks (one on each end), the closing cam, drive plates, and a free-wheeling ratchet wheel. The ratchet wheel is actuated by an oscillating mechanism driven by the motor eccentric. As the ratchet wheel rotates, it pushes the drive plates which in turn rotate the closing spring cranks and the closing cam with it.

The closing spring cranks have spring ends connected to them, which are in turn coupled to the closing springs. As the cranks rotate, the closing springs are charged. When the closing springs are completely charged, the spring cranks go over dead center, and the closing stop roller comes against the spring release latch. The closing springs are now held in the fully charged position.

Closing springs may also be charged manually. Insert the maintenance tool in the manual charging socket. Move it up and down approximately 38 times until a clicking sound is heard, and the closing springs charging indicator indicates "Charged." Any further motion of the maintenance tool will result in free wheeling of the ratchet wheel.

5.3.3 Closing operation

Figure 20 shows the position of the closing cam and tripping linkage. Note that in Figure 20a in which the circuit breaker is open and the closing springs are discharged, the trip "D" shaft and trip latch are in the unlatched position.

Once charged, the closing springs can be released to close the circuit breaker by moving the spring release latch out of the way. This is done electrically or manually by depressing the spring release lever, which turns the spring release latch out of the way of the closing stop roller. The force of the closing spring rotates the cam shaft through the spring cranks. The closing cam, being attached to the camshaft, in turn rotates the pole shaft through the main link to close the circuit breaker.

In Figure 20c the linkage is shown with the circuit beaker in the closed position before the closing springs have been recharged. Interference of the trip "D" shaft with the trip latch prevents the linkage from collapsing, and the circuit breaker is held closed.

Figure 20d shows the circuit breaker in the closed position after the closing springs have been recharged. Note that the spring charging rotates the closing cam by one-half turn. Since the cam surface in contact with the main link roller is cylindrical in this region, the spring charging operation does not affect the mechanism linkage.

Since the primary contacts are completely enclosed in the vacuum interrupter and not adjustable in any way, a "Slow Close" capability is not provided with VCP-W circuit breakers.

5.3.4 Tripping operation

When the trip "D" shaft is turned either by the trip button or trip coil, all links return to the original "Open" condition shown in Figure 20a.

5.3.5 Trip free operation

When the manual trip button is held depressed, any attempt to close the circuit breaker results in the discharge of the closing springs without any movement of the pole shaft or vacuum interrupter stem.

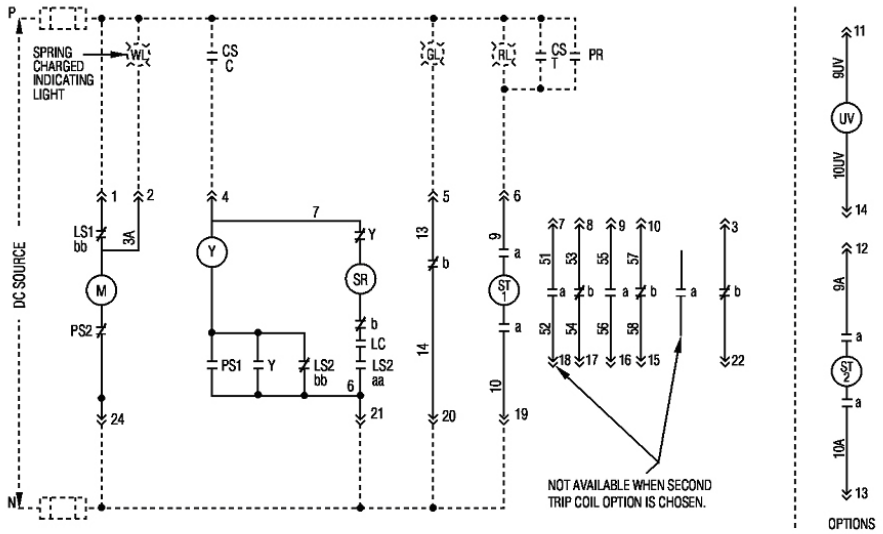
5.4 Control schemes

There are two basic control schemes for VCP-W circuit breakers: one for DC control and one for AC control voltages (Figure 22), however, there are many other more advanced control schemes that can be configured by the switchgear provider. There may be different control voltages or more than one tripping element, but the principal mode of operation is as follows.

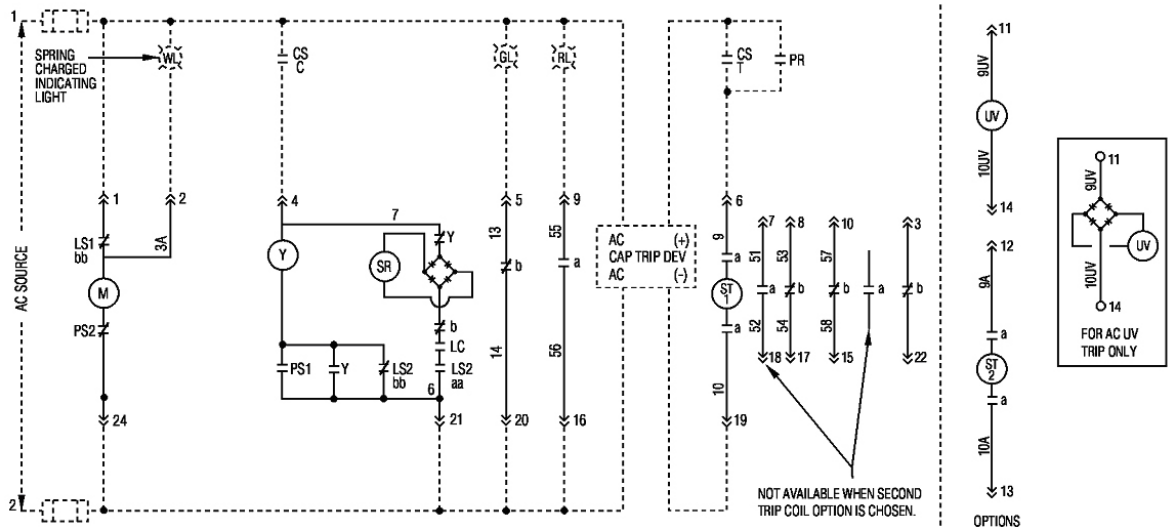
As soon as the control voltage is applied, the spring charging motor automatically starts charging the closing springs. When the springs are charged, the motor cut off LS1/bb switch turns the motor off. The circuit breaker may be closed by making the control switch close (CS/C) contact. Automatically upon closing of the circuit breaker, the motor starts charging the closing springs. The circuit breaker may be tripped at any time by making the control switch trip (CS/T) contact.

Note the position switch (PS1) contact in the spring release circuit in the scheme. The contact remains made while the circuit breaker is being levered between the TEST and CONNECTED positions. Consequently, it prevents the circuit breaker from closing automatically, even though the control close contact (CS/C) may have.

ANSI STANDARD VCP-W BREAKER DC CONTROL SCHEMATIC '96



ANSI STANDARD VCP-W BREAKER AC CONTROL SCHEMATIC '96



CS C	–	Breaker Control Switch – close
CS T	–	Breaker Control Switch – trip
Y	–	Anti Pump Relay
SR	–	Spring Release Coil (Close Coil)
M	–	Spring Charging Motor
ST	–	Shunt Trip Coil
PR	–	Protective Relay
⩔	–	Secondary Disconnect

	OPERATION	SWITCH TERMINAL	
LS1 bb	Closed until springs are fully charged	'C' and 'NO'	Brown Switch
LS2 aa	Open until springs are fully charged	'C' and 'NC'	Black Switch
LS2 bb	Closed until springs are fully charged	'C' and 'NO'	Black Switch
LC	Open until mechanism is reset	'C' and 'NO'	
PS1	Open in all except between TEST and CONNECTED Positions	'C' and 'NC'	
PS2	Closed in all except between TEST and CONNECTED Positions	'C' and 'NO'	

Figure 22. Typical VCP-W DC and AC control schemes. (Dashed lines represent customer wiring and components. This is just one of the many wiring methods that can be used to control the breaker.)

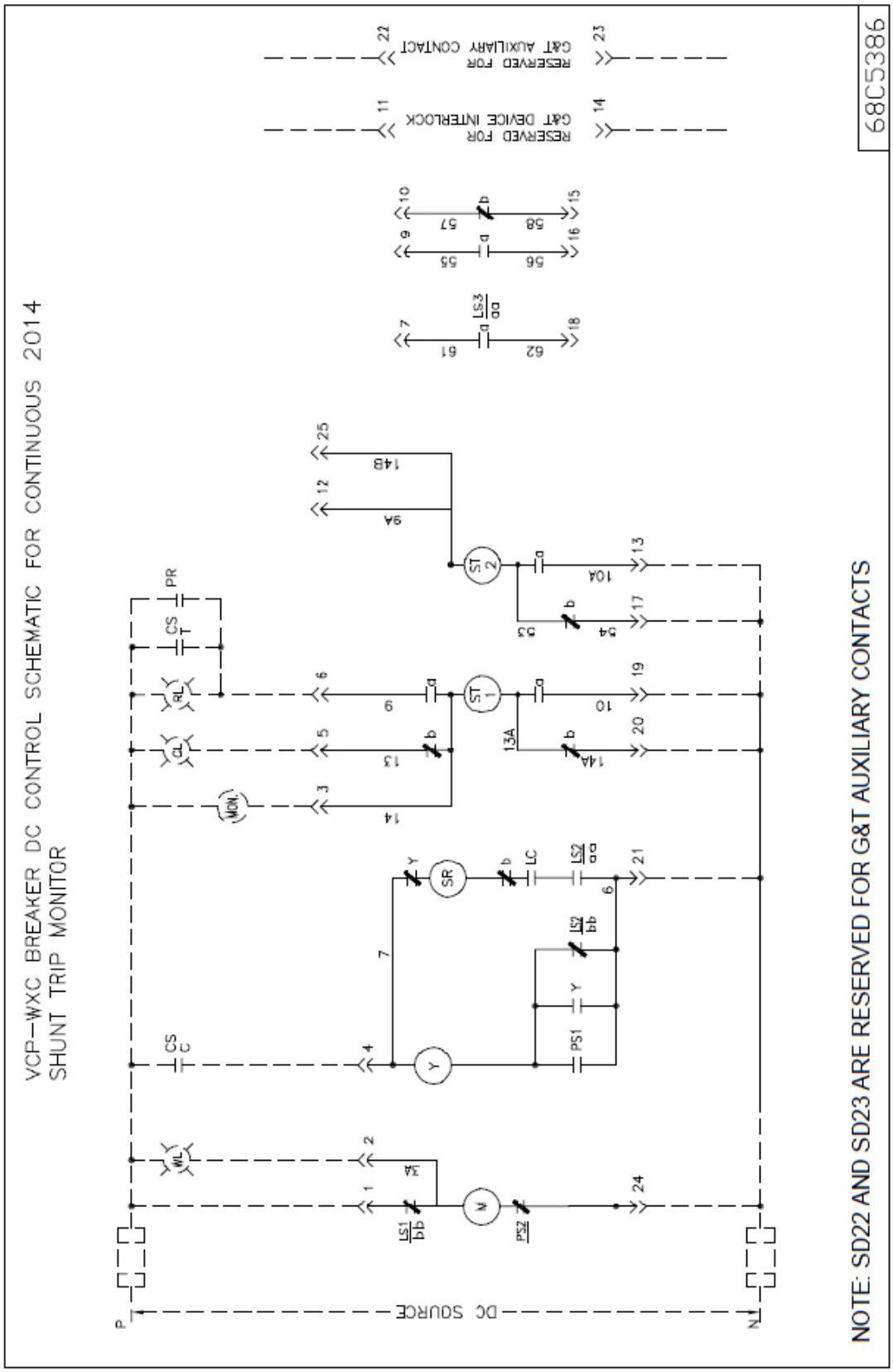


Figure 23. 15 kV VCP-WXC 63 kA 1200-3000 A special power plant breakers, styles: 4A35390G10, 4A35391G10, 4A35392G10 - DC control scheme and diagram. (Dashed lines represent customer wiring and components.)

Note: This differs from the standard VCP-W breaker with the addition of a third motor-cut-off switch and other wiring changes.

⚠ WARNING

15 KV VCP-WXC 63 KA 1200-3000 A SPECIAL POWER PLANT BREAKERS STYLES: 4A35390G10, 4A35391G10, 4A35392G10 CIRCUIT BREAKERS ARE CONFIGURED FOR POWER PLANT SPECIFIC APPLICATIONS ONLY. POTENTIALLY SEVERE UNINTENDED CONSEQUENCES COULD RESULT IF THESE DEVICES ARE MISAPPLIED. PLEASE CONSULT AN EATON APPLICATION ENGINEER FOR ANY QUESTIONS BEFORE USE OF THESE PRODUCTS.

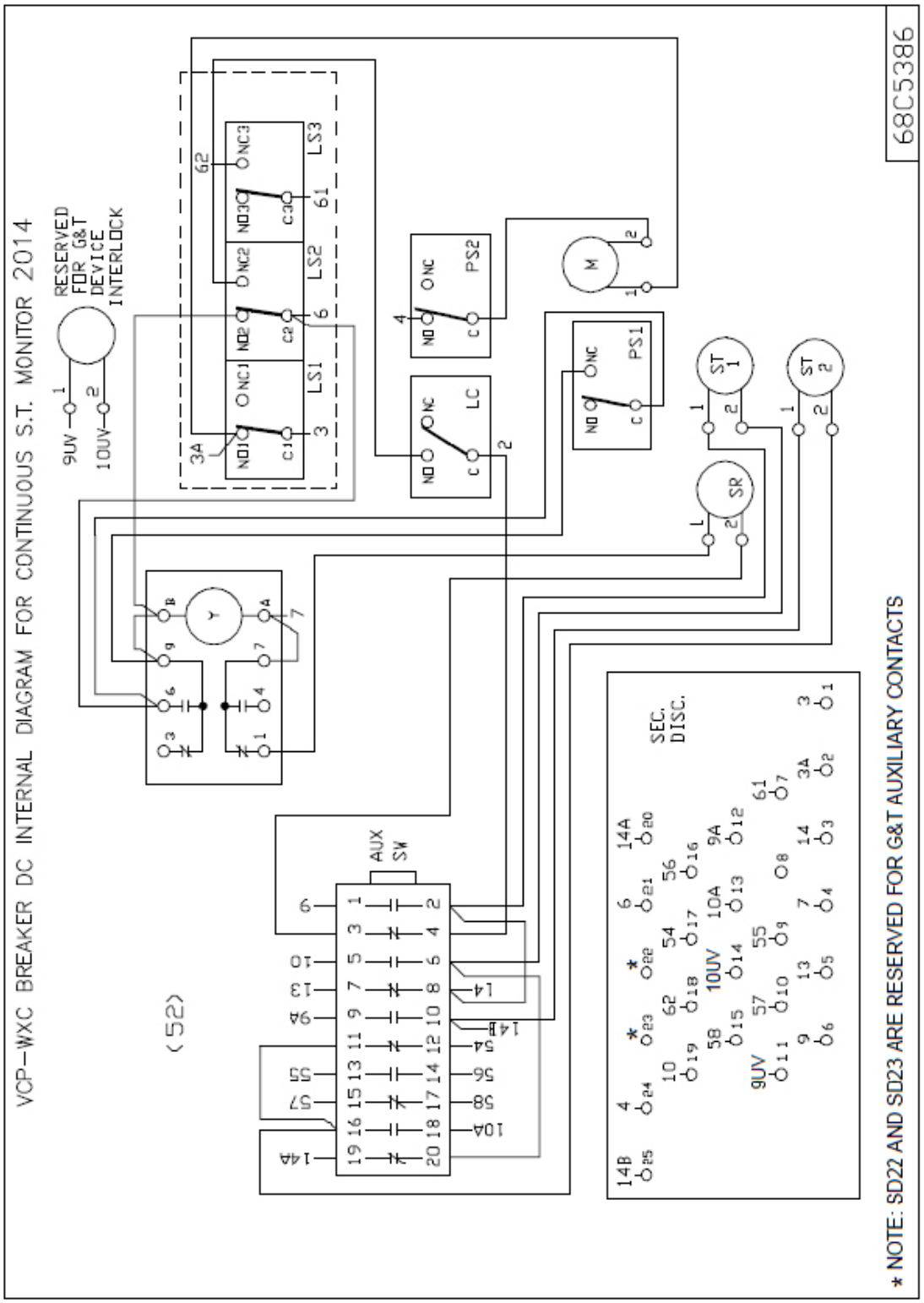


Figure 23 - 5 kV VCP-WXC 63 kA 1200-3000 A special power plant breakers, styles: 4A35390G10, 4A35391G10, 4A35392G10 - DC control scheme and diagram (continued).

When the CS/C contact is made, the SR closes the circuit breaker. If the CS/C contact is maintained after the circuit breaker closes, the Y relay is picked up. The Y/a contact seals in Y until CS/C is opened. The Y/b contact opens the SR circuit, so that even though the circuit breaker would subsequently open, it could not be reclosed before CS/C was released and remade. This is the anti-pump function.

5.4.1 Timing

The opening and closing times for the circuit breakers vary depending upon the control voltage and the power rating. Typical values for VCP-W breaker elements are shown in Table 22.

Table 22. Circuit breaker timing (made while the circuit breaker is levered to the CONNECTED position).

Event	Milliseconds (maximum)
Closing time (From Initiation of close signal to contact make)	45-60
Opening time (Initiation of trip signal to contact break)	30-45
Reclosing time (Initiation of trip signal to contact make)	140-165

5.4.2 Secondary disconnects

The circuit breaker control wiring is arranged to connect a standard 25 point male plug with a corresponding switchgear compartment mounted female plug. The circuit breaker plug is fixed mounted on the left side under the bottom pan of the mechanism (Figure 15). The female plug is mounted in the compartment on a movable carriage (Figure 12 and 13).

To engage secondary contacts:

- **For BPI:** secondary contacts engage automatically in TEST position
- **For non-BPI:** raise the handle and pull the carriage all the way towards the front (Figure 16).
- **For automatic/manual hybrid:** raise the handle, spring pressure will force the carriage all the way towards the front. Check contacts fully engaged.

To disengage secondary contacts:

- **For BPI:** rack the breaker to the DISCONNECT position.
- **For non-BPI:** push the carriage to the rear, contacts will disengage.
- **For automatic/manual hybrid:** push the carriage to the rear against spring pressure, contacts will disengage. Allow carriage handle to catch in latch cutout of mechanism.

5.4.3 Shunt trip device

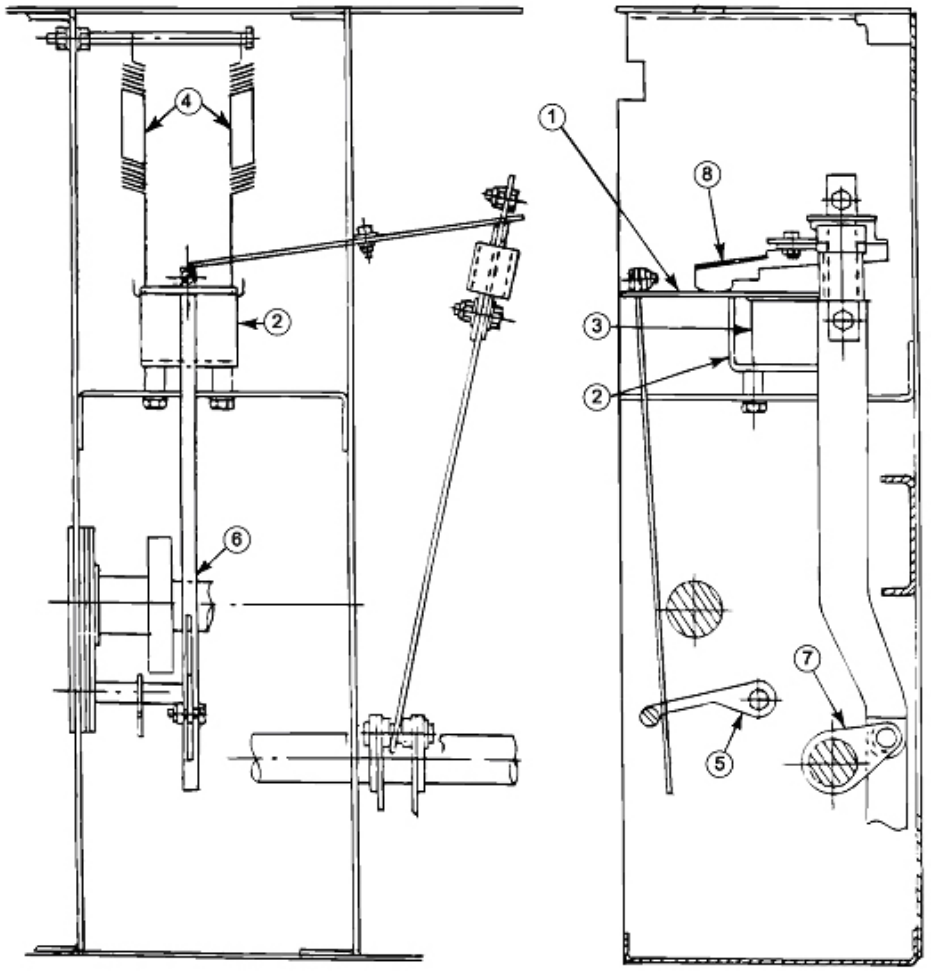
The shunt trip device is an electro-mechanical device that operates to open the circuit breaker. When the coil is energized by some extenal source, it will trip the breaker open. The shunt trip device is available with rated voltages of 24 Vdc, 48 Vdc, 125 Vdc, 250 Vdc, 120 Vac, and 240 Vac. A cap trip device must be used with the 120 Vac and 240 Vac options. If needed, continuous trip coil monitoring is available. Also there is an option to have a second shunt trip which can be rated at a different voltage other than the voltage specified for the primary shunt trip.

5.4.4 Under-voltage trip device

The under-voltage trip device for VCP-W circuit breakers is an electro-mechanical device that operates to open the circuit breaker at 30% or less of the voltage rating of the trip coil. The device does not open the circuit breaker at values above 60% of the voltage rating of its trip coil. It may operate, however, to open the circuit breaker when the voltage across the trip coil is greater than 30%, but less than 60% of the voltage rating of its trip coil. The circuit breaker can be closed as long as the voltage to the trip coil is maintained at 85% or above the rated level. The under-voltage trip device is available only as an instantaneous type with rated voltages of 48 Vdc, 125 Vdc, 250 Vdc, 120 Vac, and 240 Vac.

For a basic understanding of the operation of the under-voltage trip device refer to the specific items identified in Figure 24 and the following operation description.

1. With the circuit breaker closed and sufficient voltage on the under-voltage trip device coil, the moving clapper (1) is held to the stationary yoke (2) by the magnetic force produced by the coil (3) against the extension springs (4) pulling the moving clapper apart from the yoke.
2. The moving clapper is connected to the mechanism trip "D" shaft lever (5) by a slotted link (6).
3. When the voltage to the under-voltage trip coil goes down as described earlier, the extension springs force overcomes the reduced magnetic force and pulls the moving clapper up. The slotted link in turn upsets the trip "D" shaft and the circuit breaker trips open.
4. As the circuit breaker opens, the reset lever (8) connected to the pole shaft lever (7) operates to reset the moving clapper. As long as the circuit breaker remains open, the reset lever holds down the moving clapper to the yoke.
5. When the circuit breaker closes, the reset lever moves away from the moving clapper. If the under-voltage trip device coil has at least 85% of the rated voltage applied, the moving clapper is held to the yoke by the magnetic force, even though the reset lever has moved up.



1. Moving clapper
2. Stationary yoke
3. UV trip device coil
4. Extension springs
5. Trip D shaft lever
6. Slotted link
7. Pole shaft lever
8. Reset lever

Figure 24. 15 kV under-voltage trip device configuration.

5.5 Interlocks and interfacing

Refer to Paragraph 4.9 of this manual for detailed information concerning circuit breaker interlocks and their interfacing with a switchgear structure compartment. In addition, refer to the instruction manual supplied with the switchgear assembly.

5.6 Levering mechanism

BPI pan assembly: (Figure 12)

The purpose of the levering device is to move the circuit breaker between the DISCONNECT, TEST, and CONNECTED positions. For Type VCP-W circuit breakers, the device is a racking screw, racking nut, and moving block.

Although the device is mounted in the switchgear compartment, a brief description here will help understand the operation (Figures 12 and 15). For additional information on the insertion and removal of a circuit breaker from its compartment, refer to paragraph 4.8.1 in this manual.

The levering device consists of a racking screw, a racking nut, moving block, two side rails, and a slider. In the DISCONNECT position, the moving block is all the way to the front of the racking screw. As the circuit breaker is pushed into the breaker cell, the levering latch snaps on the moving block. In this position the front cover of the breaker will be aligned with the black line associated with the green area of the label. In order to turn the racking nut, push on the slider with the levering-in crank until fully engaged. Turning the levering-in crank clockwise while still pushing forward on the slider advances the circuit breaker toward the TEST (approximately six full turns) position. In this position, the front cover of the breaker will be aligned with the black line associated with the yellow area of the label. During this travel, the trip floor tripper is lifted up holding the circuit breaker trip free. When the circuit breaker reaches the TEST position, the breaker can be closed. Turning the levering-in crank clockwise while pushing forward advances the circuit breaker toward the CONNECT position.

Rotate the levering-in crank in a clockwise direction until the torque limiter on the levering-in crank "breaks free." As a position verification:

- **BPI pan assembly:** the breaker cover plate MUST align with the black line associated with the CONNECTED position, location shown on the BPI label (Figure 12, item 7).

If the circuit breaker is closed in the CONNECTED position, the slider can be pushed forward to permit engagement of the levering-in crank which will trip the breaker by pushing up on the trip floor tripper. This functionality is enabled by the "L" shaped slider interlock.

The breaker can be moved to the TEST position by pushing forward on the levering-in crank and turning the racking screw counterclockwise until the breaker reaches the TEST position.

The breaker can be moved to the DISCONNECT position by pushing forward on the levering-in crank and turning the racking screw counterclockwise until the breaker reaches the DISCONNECT position (approximately six full turns).

The circuit breaker levering latch can be disengaged only when the circuit breaker is in the DISCONNECT position by lifting the lift/pull handle. As the circuit breaker is withdrawn, it comes out with the contacts open and the springs discharged because of the close floor tripper and trip floor tripper interlocks.

Non-BPI pan assembly: (Figure 13)

The purpose of the levering device is to move the circuit breaker between the TEST and CONNECTED positions. For Type VCP-W circuit breakers, the device is a racking screw, racking nut, and moving block.

Although the device is mounted in the switchgear compartment, a brief description here will help understand the operation (Figures 13 and 15). For additional information on the insertion and removal of a circuit breaker from its compartment, refer to paragraph 4.8.1 in this manual.

The levering device consists of a racking screw, a racking nut, moving block, two side rails, and a slider. In the TEST position, the moving block is all the way to the front of the racking screw. As the circuit breaker is pushed into the breaker cell, the levering latch snaps on the moving block. In order to turn the racking nut, push on the slider with the levering-in crank until fully engaged. Turning the levering-in crank clockwise while still pushing forward on the slider advances the circuit breaker toward the CONNECTED position. During this travel, the Trip Floor Tripper is lifted up holding the circuit breaker trip free. When the circuit breaker reaches the CONNECTED position, the levering-in crank will "spin-free" and cannot advance the breaker any further. A red flag indicates that the circuit breaker is fully engaged.

If the circuit breaker is closed in the CONNECTED position, the slider cannot be pushed forward to permit engagement of the levering-in crank due to the "Z" shaped slider interlock.

After tripping the circuit breaker, push on the slider with the levering-in crank until fully engaged. Turning the levering-in crank clockwise while still pushing forward on the slider advances the circuit breaker toward the DISCONNECT position. This position is indicated by no further motion of the crank and by the green flag indicating that the circuit breaker has reached the TEST position

Automatic/manual hybrid secondary (optional - Figure 46): It will function the same as the Non-BPI pan assembly above due to the replacement of the "L" bracket with the "Z" bracket.

5.7 Operations counter

All circuit breakers are equipped with a mechanical operations counter. As the circuit breaker opens, the linkage connected to the pole shaft lever advances the counter reading by one (Figure 5).

5.8 Ground contact

The ground contact is an assembly of spring loaded fingers providing a disconnectable means for grounding the circuit breaker chassis, after it has been inserted into a switchgear structure. The ground contact is located on the left side of the circuit breaker under the mechanism bottom pan. An extension of the switchgear ground bus is secured to the cell floor in such a position to engage the ground contact automatically, when the circuit breaker is moved into the DISCONNECT or DISCONNECT / TEST position. It remains engaged in all other circuit breaker positions within the cell (Figures 12, 13, and 15).

5.9 MOC and TOC switch operations

The mechanism operated cell (MOC) switch operator is coupled to the pole shaft (Figure 15). In the TEST and CONNECTED positions of the circuit breaker, the operator aligns directly above the MOC switch bell crank levers in the cell. As the circuit breaker closes, the operator moves down and pushes the bell crank lever to change the MOC switch contact position. Thus, the MOC switch contacts operate in the same manner as the auxiliary switch contacts in the circuit breaker. Although the MOC switch operator is provided on all circuit breakers, the cell mounted MOC switches are only provided when specified with the switchgear order. The standard electrical connector for the control wires is a plug on style connector. Optional ring tongue lug connectors can be provided.

The truck operated cell (TOC) switch operator is mounted inside the right corner of the circuit breaker cell (Figure 15). It operates the TOC switch as the circuit breaker moves to the CONNECTED position in the switchgear cell.

6. Inspection, maintenance, and trouble-shooting

6.1 Introduction

⚠ WARNING

- **DO NOT WORK ON A BREAKER ELEMENT WITH PRIMARY POWER APPLIED.**
- **DO NOT WORK ON A BREAKER ELEMENT WITH SECONDARY CONTACTS CONNECTED.**
- **DO NOT WORK ON A BREAKER ELEMENT WITH SPRINGS CHARGED OR CONTACTS CLOSED.**
- **DO NOT DEFEAT ANY SAFETY INTERLOCKS.**
- **DO NOT LEAVE MAINTENANCE TOOL IN THE SOCKET AFTER CHARGING THE CLOSING SPRINGS.**
- **DO NOT STAND LESS THAN ONE METER AWAY FROM THE BREAKER ELEMENT WHEN TESTING FOR VACUUM INTEGRITY.**

FAILURE TO FOLLOW ANY OF THESE INSTRUCTIONS MAY CAUSE DEATH, SERIOUS BODILY INJURY, OR PROPERTY DAMAGE. SEE SECTION 2 - SAFE PRACTICES - FOR MORE INFORMATION.

6.2 Frequency of inspection and maintenance

Periodic inspections and associated maintenance are essential to the safe and reliable operation of VCP-W vacuum circuit breaker elements. The inspection frequency and associated maintenance recommended are intended to insure the best possible ongoing service. It is imperative that an established schedule be followed. To establish an exact schedule for a specific installation, use the following guidelines.

1. Customers such as utilities having extensive experience with power distribution components should schedule their inspection and maintenance intervals using well established best practices in their industry.
2. All other customers should use the following guidelines as good conservative practice:
   a. For installations defined as normal service conditions per IEEE C37.20.2 and considered clean, non-corrosive environments, inspect, and maintain each circuit breaker every 500 operations or 10 years, whichever comes first. If it is determined after completing the "Inspection and maintenance procedures" in section 6.3 of this manual that the breaker is still like new based on visual inspection and performance, then the next maintenance interval shouldn't exceed 500 operations or 10 years from the date of the inspection.
   b. For special conditions such as frequent circuit breaker element operation, contaminated environments, and high temperature/humidity conditions, the inspection frequency should be a minimum of twice per year.
3. Fault interruptions have the greatest impact on contact erosion inside of the vacuum interrupters. Circuit breakers that have been subjected to 15 full rated fault interruptions should be immediately inspected and the schedule for inspection and maintenance should be re-evaluated based upon the inspection results. Additionally, because of the variability of system fault characteristics, if there are any customer uncertainties in the records of the magnitude, duration, or other fault details, increased inspection frequency should be considered.
4. Follow the steps presented in paragraph 6.3 entitled "Inspection and Maintenance Procedures" for scheduled programs.
5. Create and maintain a dated permanent record of all inspections, maintenance performed, actions taken, observations made, and measurements taken. Not only will this provide valuable historical information, it can help to establish whether or not the present schedule needs to be adjusted.
6. Perform ongoing visual inspections, when possible, of all equipment on a regular basis. Be alert for an accumulation of dirt in and around the circuit breaker elements, loose hardware or discolored insulation.

For assistance in establishing or updating a detailed inspection and maintenance schedule for a specific application, please contact your local Eaton representative.

Eaton's vacuum interrupters are tested to exceed the minimum fault interruptions as required by IEEE/ANSI and IEC Standards without inspection. Please contact your local Eaton representative if you would like a copy of the life curve of the vacuum interrupters in your specific circuit breakers.

In addition to the instructions in this instruction book, Eaton has created a visual tool to assist maintenance personnel. Contact Eaton for the **Visual Instruction Booklet Essentials (VIBE)** which is an interactive PDF with embedded videos to show how to perform many common types of field testing and part replacements.

6.2.1 Qualified personnel

For the purpose of operating this type of equipment, only individuals thoroughly trained in the operation of power circuit breakers and associated equipment, and having knowledge of connected loads may be considered to be qualified.

Refer to further definitions in the National Electrical Safety Code.

For the purpose of inspecting and maintaining such equipment, a qualified person must also be trained in regard to the hazards inherent to working with electricity and the proper way to perform such work. Such an individual should be able to de-energize, clear, and tag circuits in accordance with established safety practices. In addition, these individuals should have access to and be trained in the use of protective equipment, such as rubber gloves and flash clothes.

All personnel should be familiar with and understand the material presented in this instruction manual and other related manuals.

6.2.2 General torque guidelines

Bolts and screws must be properly torqued. This is especially true if part(s) and/or accessory(ies) are added or replaced. Table 23 provides guidelines on torque levels. The table is intended as a general guideline and should be applied in conjunction with the experience and good judgment of the individual performing the work.

⚠ CAUTION

OVER TORQUING CAN CAUSE PERMANENT DAMAGE WHILE UNDER TORQUING WILL NOT PROVIDE THE PROPER CLAMPING FORCE AND MAY EVENTUALLY WORK LOOSE.

Table 23. Torque guidelines.

Bolt size	Torque lb-in (ib-ft)
8 - 32	24
10 - 32	36
1/4 - 20	72 (6 lb-ft)
5/16 - 18	144 (12 lb-ft)
3/8 - 16	300 (25 lb-ft)
1/2 - 13	540 (45 lb-ft)

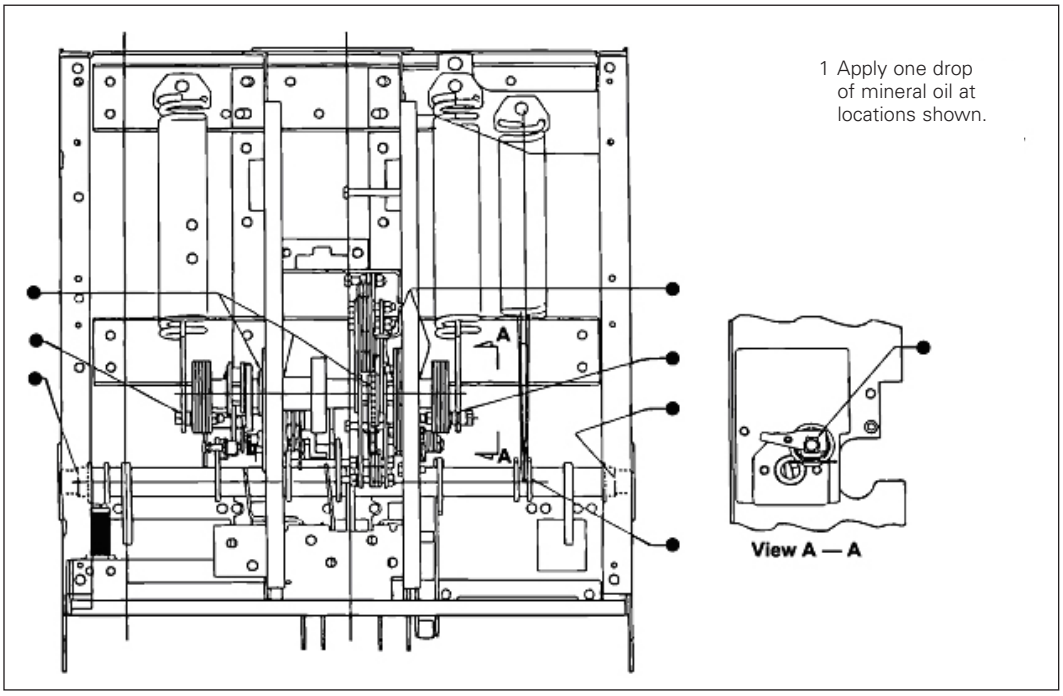


Figure 25. Lubrication points.

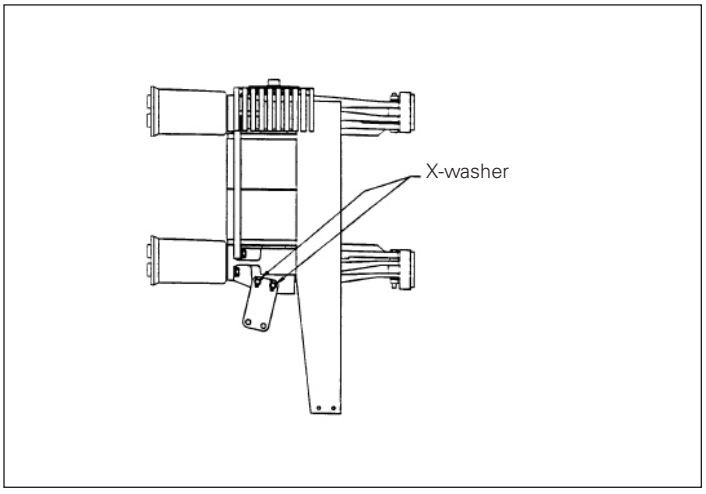


Figure 26. 50 VCP-W 63 - 63 kA pole unit.

6.3 Inspection and maintenance procedures

No./section	Inspection item	Criteria	Inspection method	Corrective action
1.Insulation	Drive insulator, barriers, and stand-off insulators	No dirt and No cracking	Visual check Visual check	Clean with lint-free cloth or replace cracked piece.
Insulation integrity	Main circuit to ground	Withstand	Hipot tester	Clean and retest or replace .
	Between main circuit terminals	Withstand	Hipot tester	Clean and retest or replace.
	Control circuit to ground	Withstand	Hipot tester	Clean and retest or replace.
2. Power elements	Vacuum interrupters	Visibility of contact erosion marks	Visual - Close the circuit breaker and observe if all black, blue or machined groove marks on moving stems are visible	If a mark is not visible, then check if the pole unit plastic bushing is intact on the moving stem of the VI just below the cup plate. If the bushing is intact, then replace the interrupter assembly and perform contact wipe check. If the bushing is NOT intact, then glue back the bushing to the cup plate and observe the mark again.
		Contact wipe indicator visible	Refer to paragraph 6.5	Replace interrupter assembly.
		Adequate vacuum	Proceed with integrity check as described in Paragraph 6.4	If integrity check is not satisfactory, replace interrupter assembly.
	Primary disconnects	Dirt on ceramic body	Visual check	Clean with lint-free cloth.
		No burning or damage	Visual check	Replace if burned, damaged or eroded.
	Pole unit X-washers for 150 VCP-W 63	Every 1000 operations	Operation counter	Replace all X-washers per Figure 26.
3. Control circuit parts	Closing and tripping device including disconnects	Smooth and correct operation by control power	Test closing and tripping of the circuit breaker twice	Replace any defective device. Identify per trouble-shooting chart .
	Wiring	Securely tied in proper place	Visual check	Repair or tie as necessary.
	Terminals	Tight	Visual check	Tighten or replace if necessary.
	Motor	Smooth, normal operation	Functional test	Replace brushes or motor.
4. Operating mechanism	Tightness of hardware	No loose or missing parts	Visual and by feel	Refer to Table 23 and tighten or reinstate if necessary with appropriate tools.
	Dust or foreign matter	No dust or foreign matter	Visual check	Clean as necessary.
	Lubrication	Smooth operation and no excessive wear	Sight, feel and per maintenance schedule	Refer to Figure 25 and paragraph 6.10 and lubricate very sparingly with light mineral oil.
	Deformation or excessive wear	No excessive deformation or wear	Visual and operational	Remove cause and replace parts.
	Manual ooperation	Smooth operation	Manual charging, closing and tripping	Correct per troubleshooting chart if necessary.
	CloSure test	0.6 inch over-travel	CloSure Test (6.9.1)	If < 0.6, contact your local Eaton Sales and Service Center.

6.4 Vacuum interrupter integrity test

Vacuum interrupters used in Type VCP-W vacuum circuit breaker elements are highly reliable interrupting elements. Satisfactory performance of these devices is dependent upon the integrity of the vacuum in the interrupter and the internal dielectric strength. Both of these parameters can be readily checked by a one minute AC high potential test. Refer to Table 24 for the appropriate test voltage. During this test, the following warning must be observed.

⚠ WARNING

APPLYING ABNORMALLY HIGH VOLTAGE ACROSS A PAIR OF CONTACTS IN VACUUM MAY PRODUCE X-RADIATION. 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 MAXIMUM PERMITTED BY STANDARDS. HOWEVER, AS A PRECAUTIONARY MEASURE AGAINST POSSIBILITY OF APPLICATION OF HIGHER THAN RECOMMENDED VOLTAGE AND/OR BELOW NORMAL CONTACT SPACING, IT IS RECOMMENDED THAT ALL OPERATING PERSONNEL STAND AT LEAST 13 FEET (4 METERS) AWAY IN FRONT OF THE BREAKER ELEMENT.

With the breaker element open, connect all top primary studs (bars) together and to the high potential machine lead. Connect all bottom studs together and ground them along with the breaker frame. Start the machine at zero potential, increase to appropriate test voltage and maintain for one minute.

A successful withstand indicates that all interrupters have a satisfactory vacuum level. If there is a break-down, the defective interrupter or interrupters should be identified by an individual test and replaced before placing the breaker in service.

⚠ WARNING

AFTER THE HIGH POTENTIAL IS REMOVED, AN ELECTRICAL CHARGE MAY BE RETAINED BY THE VACUUM INTERRUPTERS. FAILURE TO DISCHARGE THIS RESIDUAL ELECTROSTATIC CHARGE COULD RESULT IN AN ELECTRICAL SHOCK. ALL SIX PRIMARY TERMINALS AND THE CENTER RING OF EACH VACUUM INTERRUPTER OF THE CIRCUIT BREAKER SHOULD BE GROUNDED TO REDUCE THIS ELECTRICAL CHARGE BEFORE COMING IN CONTACT WITH THE PRIMARY CIRCUIT.

To avoid any ambiguity in the AChigh potential test due to leakage or displacement (capacitive) current, the test unit should have sufficient volt-ampere capacity. It is recommended that the equipment be capable of delivering 25 milliamperes for one minute.

ONLY AC HIGH POTENTIAL TESTS ARE RECOMMENDED.

EATON DOES NOT RECOMMEND DC POWER FREQUENCY WITHSTAND VOLTAGE TEST.

Table 24. Test voltage (insulation and vacuum integrity).

Breaker rated maximum voltage	Vacuum interrupter integrity test voltage AC 60 Hz
Up to and including 5 kV	15 kV
7.5 kV - 17.5 kV	27 kV
24 kV and 27 kV	45 kV

The current delivery capability of 25 mA AC and 5 mA DC apply when all three vacuum interrupters are tested in parallel. If individual vacuum interrupters are tested, current capability may be one third of these values.

⚠ CAUTION

SOME DC HIGH POTENTIAL UNITS, OPERATING AS UNFILTERED HALF-WAVE RECTIFIERS, ARE NOT SUITABLE FOR USE TO TEST VACUUM INTERRUPTERS BECAUSE THE PEAK VOLTAGE APPEARING ACROSS THE INTERRUPTERS CAN BE SUBSTANTIALLY GREATER THAN THE VALUE READ ON THE METER.

6.5 Contact erosion and wipe

Since the contacts are contained inside the interrupter, they remain clean and require no maintenance. However, during high current interruptions there may be a minimum amount of erosion from the contact surfaces. Maximum permitted erosion is about 1/8 in. (3.18 mm). To determine contact erosion, close the breaker and observe the vacuum interrupter moving stem from the rear of the breaker. If the mark on each stem is visible, erosion has not reached maximum value thus indicating satisfactory contact surface of the interrupter. If the mark is not visible, the pole unit assembly must be replaced (Figures 27 and 28).

The adequacy of contact wipe can be determined by observing the vacuum interrupter side of the operating rod assembly on a closed circuit breaker. Figure 29 shows the procedure for determining the contact wipe. If the wipe is not adequate, the vacuum interrupter assembly (pole unit) must be replaced. A field adjustment is not possible. Refer to paragraph 7.3.2 for a replacement procedure.

⚠ WARNING

FAILURE TO REPLACE A POLE UNIT ASSEMBLY, WHEN CONTACT EROSION MARK IS NOT VISIBLE OR WIPE IS UNSATISFACTORY, WILL CAUSE THE BREAKER TO FAIL TO INTERRUPT AND THEREBY CAUSE PROPERTY DAMAGE OR PERSONAL INJURY.

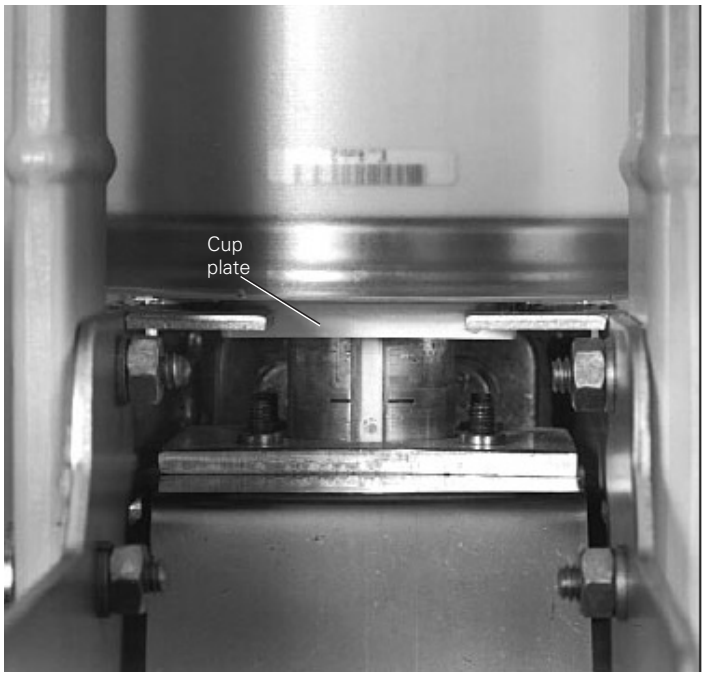


Figure 27. Vacuum interrupter showing contact erosion indicator with breaker open (shown here for clarity purposes only).

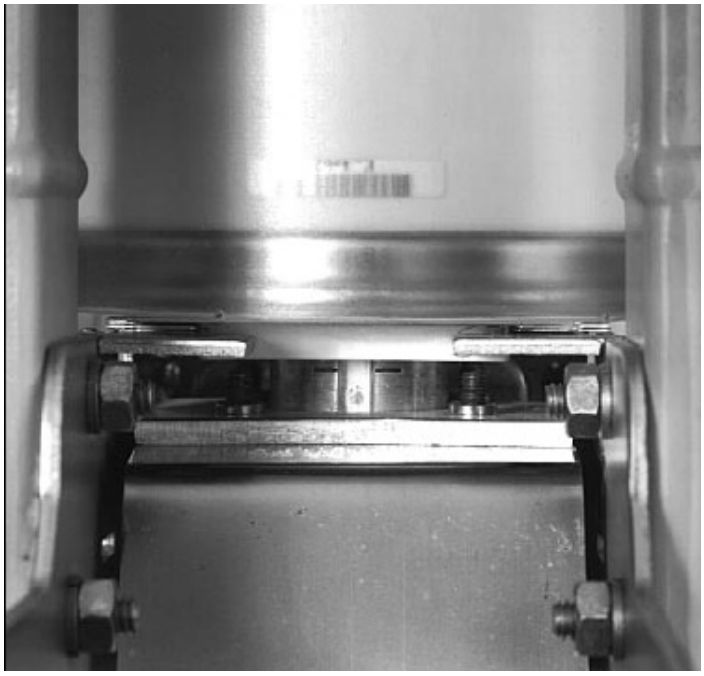


Figure 28. Vacuum interrupter showing contact erosion indicator with breaker closed (indicators are checked only when the breaker is closed).

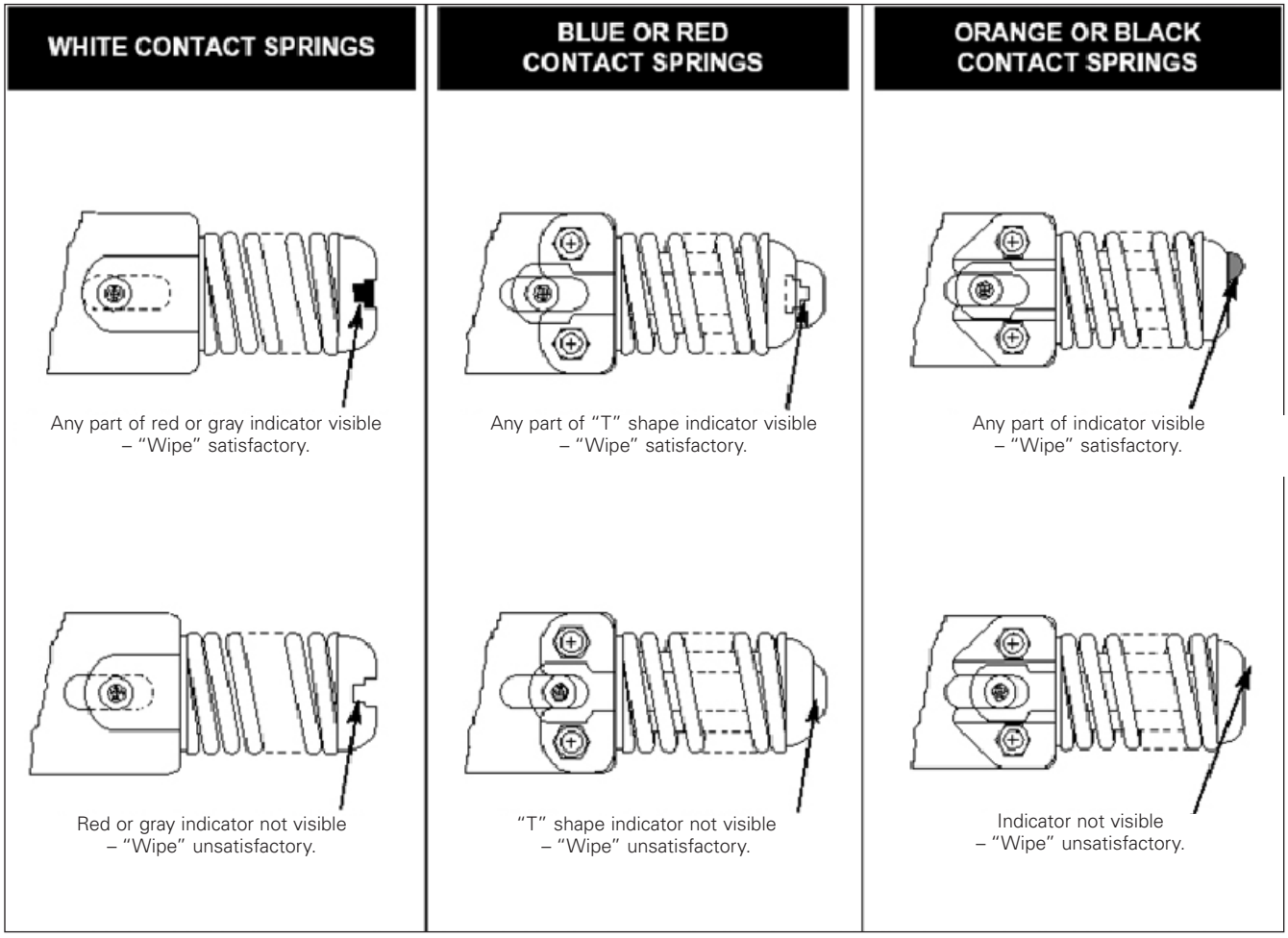


Figure 29. Wipe indication procedure (performed only with the breaker closed).

6.6 Insulation

Type VCP-W circuit breaker insulation maintenance primarily consists of keeping all insulating surfaces clean. This can be done by wiping off all insulating surfaces with a dry lint free cloth or dry paper towel. In case there is any tightly adhering dirt that will not come off by wiping, it can be removed with mild solvent or distilled water. Be sure that the surfaces are dry before placing the circuit breaker in service. If a solvent is required to cut dirt, use Stoddard's Solvent Eaton 55812CA or commercial equivalent. Secondary control wiring also requires inspection for insulation damage.

6.7 Insulation integrity check

Primary circuit:

The integrity of primary insulation may be checked by the 60 Hz AC high potential test. The test voltage depends upon the maximum rated voltage of the breaker. For the breaker elements rated 4.76 kV, 8.25 kV, 15 kV, and 27 kV, the test voltages are 15 kV, 27 kV, 27 kV, and 45 kV RMS respectively. Conduct the test as follows.

Close the breaker. Connect the high potential lead of the test machine to one of the poles of the breaker. Connect the remaining poles and breaker frame to ground. Start the machine with output potential at zero and increase to the test voltage. Maintain the test volt-age for one minute. Repeat for the remaining poles. Successful withstand indicates satisfactory insulation strength of the primary circuit.

If a DC high potential machine is used, make certain that the peak voltage does not exceed the peak of the corresponding AC RMS test voltage.

Secondary circuit:

Isolate the motor by pulling apart the two insulated quick disconnecting terminals in the two motor leads provided for this purpose, or remove the two motor wires from the ring tongue terminals (Figure 5). Connect all points of the secondary disconnect pins with shooting wire. Connect this wire to the high potential lead of the test machine. Ground the circuit breaker frame. Starting with zero, increase the voltage to 1125 Vac RMS, 60 Hz. Maintain the voltage for one minute. Successful withstand indicates satisfactory insulation strength of the secondary control circuit. Remove the shooting wire and reconnect motor leads.

6.8 Primary circuit resistance check

Since the main contacts are inside the vacuum chamber, they remain clean and require no maintenance at any time. Unlike many typical circuit breaker designs, VCP-W breakers do not have sliding contacts at the moving stem either. Instead they use a highly reliable and unique flexible clamp design that eliminates the need for lubrication and inspection for wear.

If desired, the DC resistance of the primary circuit may be measured as follows:

- Close the circuit breaker, pass at least 100 amps DC current through the circuit breaker. With a low resistance instrument, measure resistance across the studs on the circuit breaker side of the disconnects for each pole.

The resistance should not exceed the values shown in Table 25.

Table 25. Typical resistance measurements.

Rated continuous current (amperes)	Resistance (microohms)
1200	60
2000	40
3000	20

6.9 Mechanism check

Make a careful visual inspection of the mechanism for any loose parts such as bolts, nuts, pins, and rings. Check for excessive wear or damage to the circuit breaker components. Operate the circuit breaker several times manually and electrically. Check the closing and opening times to verify that they are in accordance with the limits in Table 22.

6.9.1 CloSure™ test

Introduction

The CloSure test is a simple yet extremely effective means to determine and monitor the ability of the mechanism to close the breaker contacts fully. It provides a quantitative measure of the extra energy available in terms of over travel in inches to close the breaker contacts to their full extent. It maybe used periodically to monitor the health of the mechanism.

At times, circuit breakers are called upon to operate mechanism operated cell (MOC) switches that place extra load upon the closing mechanism of the circuit breaker. If this load is excessive, it can prevent the circuit breaker from closing fully. In such a case, it is important to determine that the circuit breaker will close fully. The CloSure test provides this assurance.

General information

The CloSure test can be per-formed on the VCP-W, VCP-WR, VCPW-ND, DHP-VR, W-VACR, and W-VAC lines of vacuum circuit breakers. Refer to Table 26 a for list of circuit breakers. If the CloSure travel obtained is as specified, the mechanism performance is satisfactory. If the CloSure travel does not conform as shown in Figure 36, contact Eaton for further information (see Step 13).

⚠ WARNING

DO NOT ATTEMPT TO INSTALL OR PERFORM MAINTENANCE OR TESTS ON THE EQUIPMENT WHILE IT IS ENERGIZED. NEVER PUT YOUR HANDS NEAR THE MECHANISM WHEN THE CIRCUIT BREAKER IS IN THE CHARGED OR CLOSED POSITION. DEATH OR SEVERE PERSONAL INJURY CAN RESULT FROM CONTACT WITH ENERGIZED EQUIPMENT. ALWAYS VERIFY THAT NO VOLTAGE IS PRESENT BEFORE PROCEEDING WITH THE TASK AND ALWAYS FOLLOW GENERALLY ACCEPTED SAFETY PROCEDURES.

6.10 Megger and power factor testing

Both the megger and power factor type testing of high voltage insulation are not recognized by IEEE as a design, production, or conformance test for determining product acceptance during initial commissioning. If an end user wishes to use these tests for trending purposes, then they should record the initial readings during commissioning along with temperature and humidity during the testing. The trend of the test results should be tracked over the life of the product and any abnormalities should be investigated.

Safety precautions

Read and understand these instructions before attempting any maintenance, repair, or testing on the breaker. The user is cautioned to observe all recommendations, warnings, and cautions relating to the safety of personnel and equipment.

The recommendations and information contained herein are based on Eaton experience and judgment, but should not be considered to be all-inclusive or covering every application or circumstance which may arise. If further information is required, you should consult Eaton.

Testing procedures

Assuming that the breaker is safely pulled out to the Test/Disconnect position in the enclosure or placed on the workbench, follow this procedure to perform the CloSure test. For further instructions on disconnecting the circuit breaker consult Section 4 of this manual. If the enclosure is equipped with the MOC operating in the test position also, make certain that the MOC is connected to operate.

1. On the front cover identify the status indicators. **Make sure the closing spring status indicates "Discharged" and the main contact indicator shows "Open"** (Figure 7).
2. Remove the circuit breaker front cover. **Be sure to save the original fasteners for reassembly.**
3. Cut a piece of one-inch (25.4 mm) wide drafting/masking tape approximately 8 to 10 in. (203 to 254 mm) long.

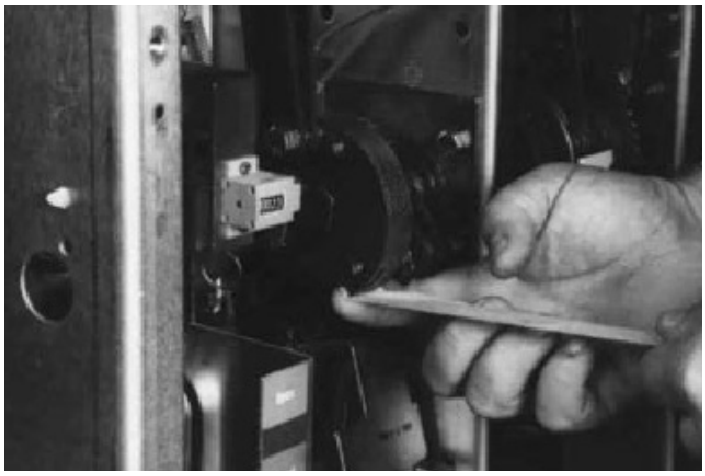


Figure 30. Starting tape at the bottom of the cam.

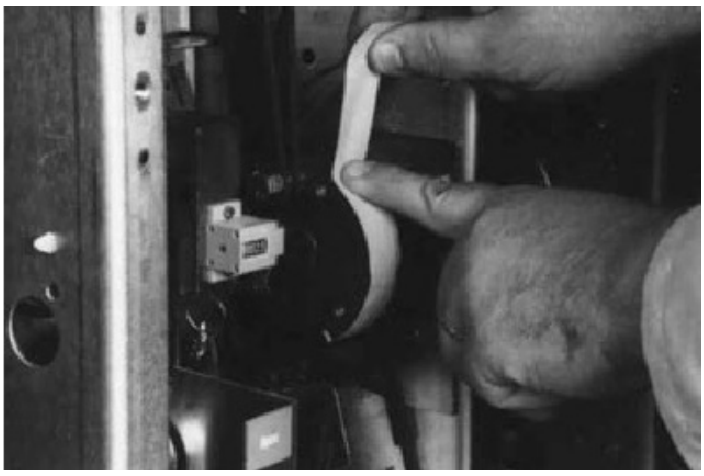


Figure 31. Wrapping tape up around the cam.

4. Place the tape around the cam starting from the bottom up. Make certain that the tape adheres well to the cam surface (see Figures 30, 31, and 32).

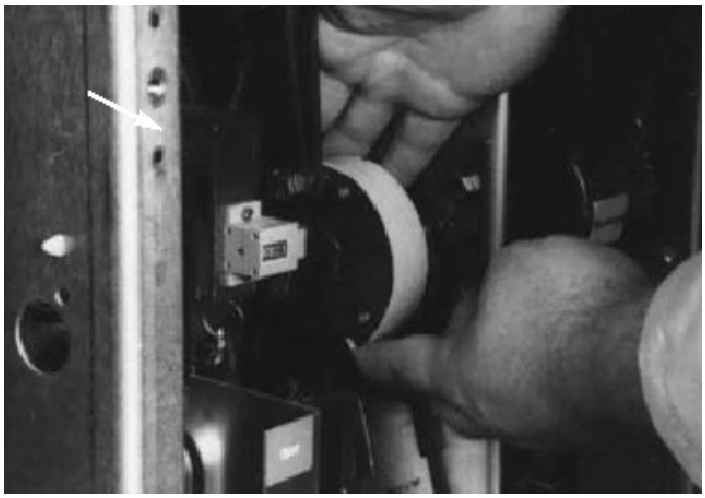


Figure 32. Attaching tape around to the back of the cam.

Figure 33. Attaching CloSure test tool at hole "A".

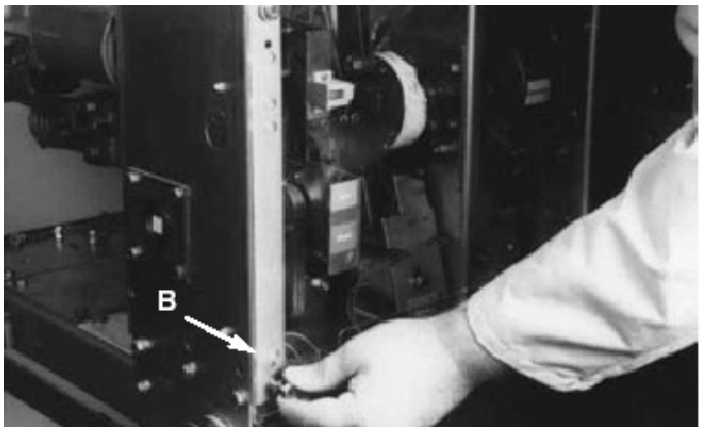


Figure 34. Attaching CloSure test tool at "B".

5. Mount the transparent CloSure test tool with two bolts and washers. Refer to Figures 43, 44, and Table 26 for appropriate mounting holes. Hand tighten the bolts (Figures 33, 34, 43, and 44).

6. A Sanford® Sharpie® black fine point permanent marker, item no. 30001, is recommended for this next step. Place the marker tip in the proper hole ("C"). Refer to Figure 43 and make a heavy mark on the tape as shown in Figure 34.

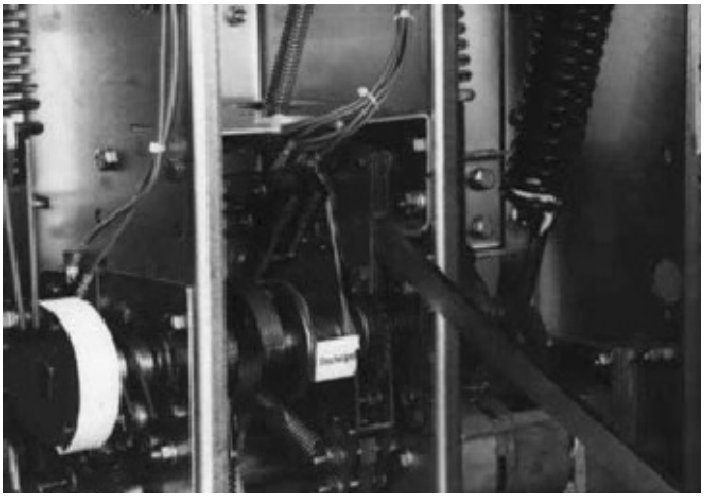


Figure 35. Manually charging the closing springs.

7. Charge the closing springs with the maintenance tool. Continue charging the closing springs until a "click" is heard and the status indicator shows "Charged" (Figure 35).
8. While holding the marker tip on the tape, close the breaker (Figure 36).
9. Move the marker back and forth horizontally approximately 15 degrees in both directions to create a line on the tape that identifies the closed rest position (Figures 37, 43, and 39).

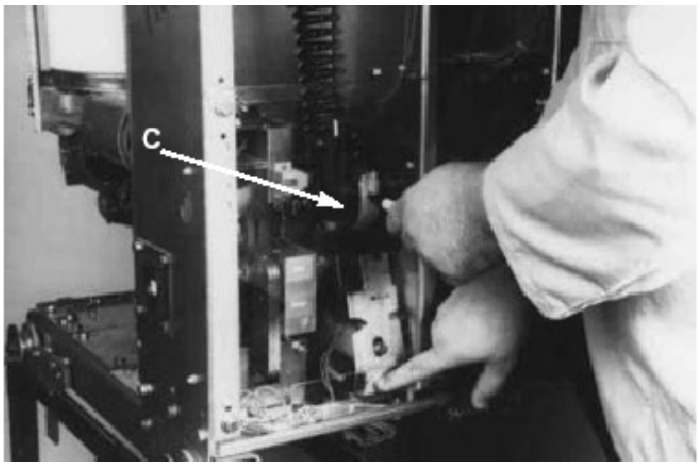


Figure 36. Manually closing the circuit breaker with the marker in hole "C".

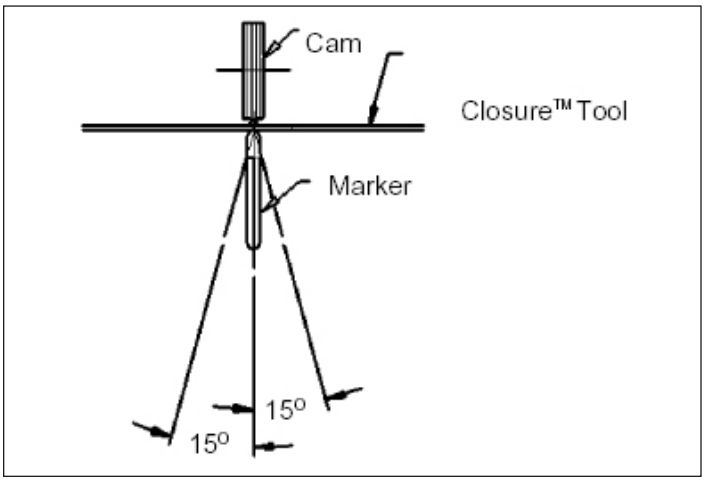


Figure 37. Top view of the cam and marker interface.

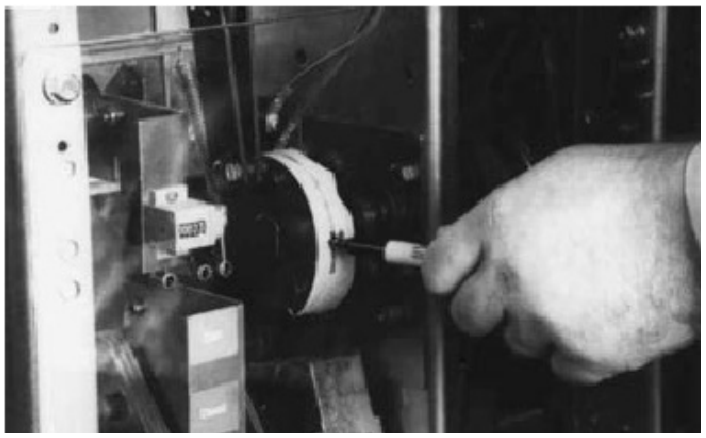


Figure 38. Move marker 15° to the right.

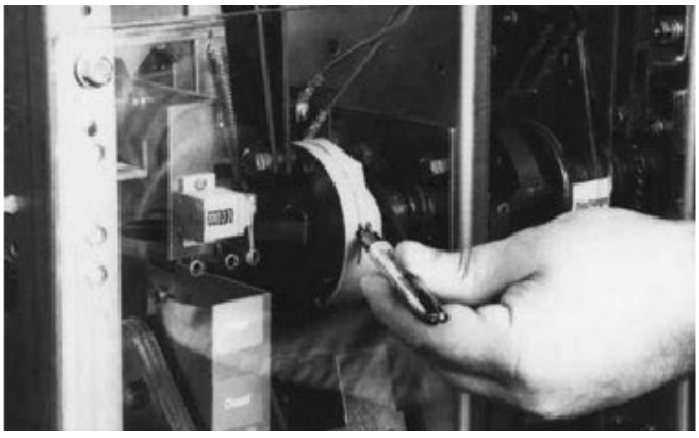


Figure 39. Move marker 15° to the left.

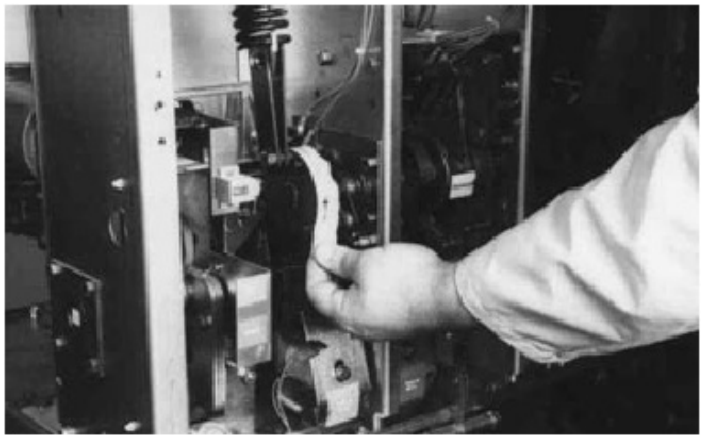


Figure 40. Remove marked masking tape from the cam.

Figure 41. Place the tape on the right side panel of the breaker.

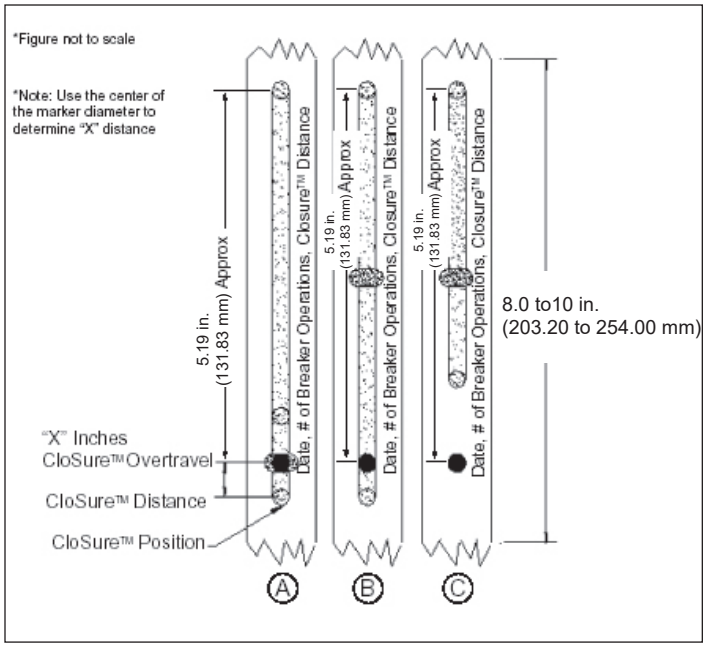


Figure 42. Illustrative testing tape sample.

10. Remove the marker from hole "C".
11. Push the "push to open" clapper to open the circuit breaker.

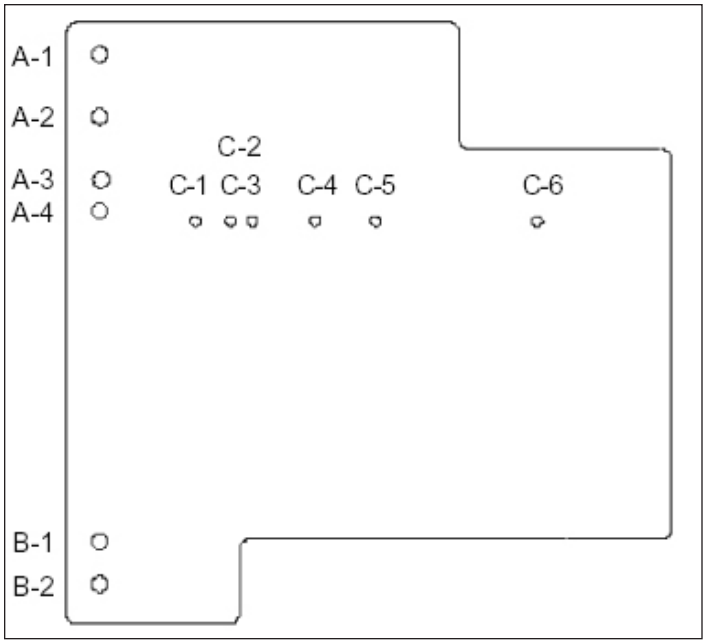


Figure 43. Front view of closure tool showing mounting/testing locations (6352C49H01).

12. Inspect the circuit breaker to assure it is in the open position and the closing springs are discharged. Remove the transparent CloSure tool. Remove the tape from the cam and stick the tape on the front right side sheet of the circuit breaker. Record the date of the test and the operations counter reading on the tape (Figures 40, 41 and 42).

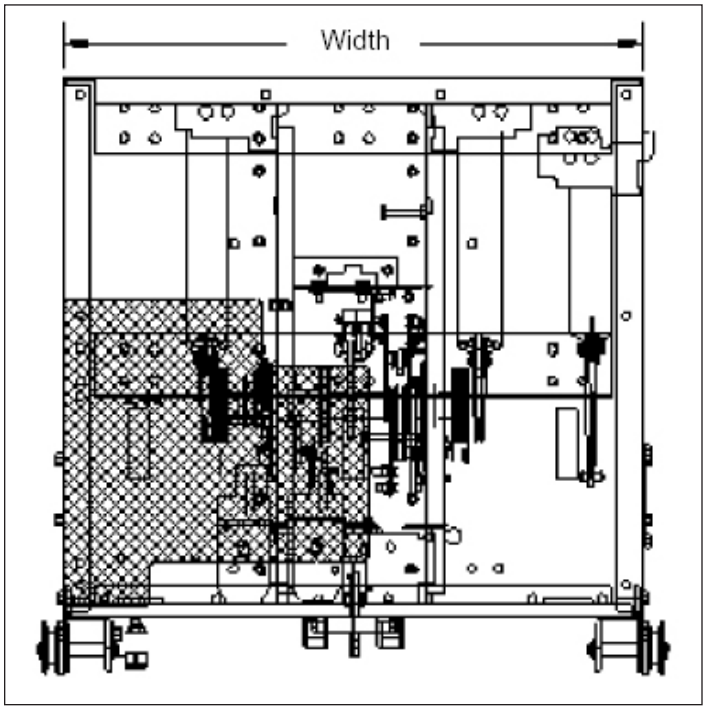


Figure 44. Typical circuit breaker front view with CloSure tool attached (approximate mechanism chassis width).

13. Evaluate the CloSure performance by comparing the test tape with the illustrations in Figure 41. If the marking is similar to 42, detail A, measure the over travel "x". If "x" is greater than or equal to 0.6 in. (15.2 mm), the circuit breaker performance is satisfactory. If "x" is less than 0.6 in. (15.2 mm) or if the marking is similar to 42, detail B or 42, detail C, immediately contact the Product Integrity Center for Technical Support at (412) 787-6518.
14. Remove the CloSure tool. Reassemble the front cover onto the circuit breaker. Return the circuit breaker to its original configuration and setup.

6.11 Mechanism lubrication

For breakers built prior to 01/01/18

All parts that require lubrication have been lubricated during the assembly with molybdenum disulfide grease (Eaton Material No. 53701 QB) which is no longer available. Over a period of time, this lubricant may be pushed out of the way or degrade. Proper lubrication at regular intervals is essential for maintaining the reliable performance of the mechanism. Once a year or every 500 operations whichever comes first, the circuit breaker should be lubricated, as shown in Figure 24, with a drop of mineral oil.

Table 26. Closure tool mounting/testing locations by circuit breaker type.

Breaker line	Approximate mechanism cabinet width (inch)	Upper mounting hole	Lower mounting hole	Marker placement hole
DHP-VR	20 29	A1 A1	B2 B1	C2 C5
VCPW-ND	20/21	A1	B2	C2
VCP-W,	29 33	A1 A2	B2 B2	C5 C6
VCP-WR	18 20 29	A1 A1 A1	B2 B2 B2	C1 C2 C5
W-VAC, W-VACR	18 25 33	A1 A1 A2	B2 B1 B2	C1 C4 C6

After lubrication, operate the circuit breaker several times manually and electrically.

Roller bearings are used on the pole shaft, the cam shaft, the main link, and the motor eccentric. These bearings are packed at the factory with a top grade grease, as specified by code, which normally should be effective for many years. They should not be disturbed unless there is definite evidence of sluggishness, dirt, or parts are dismantled for some reason.

If it becomes necessary to disassemble the mechanism, the bearings and related parts should be thoroughly cleaned. Remove old grease in a good grease solvent. **Do not use carbon tetrachloride.** They should then be washed in light machine oil until the cleaner is removed. After the oil has been drawn off, the bearings should be packed with Eaton's synthetic grease.

Eaton's synthetic grease can be mixed with the molybdenum disulfide grease with no side effects.

For breakers built after 1/1/2018

All parts that require lubrication have been lubricated during the assembly with Eaton's new synthetic grease. Over a period of time, this lubricant may be pushed out of the way or degrade. Proper lubrication at regular intervals is essential for maintaining the reliable performance of the mechanism. Every 500 operations or 10 years whichever comes first, the circuit breaker should be lubricated.

Roller bearings are used on the pole shaft, the cam shaft, the main link, and the motor eccentric. These bearings are packed at the factory with a top grade synthetic grease which will be effective for 10 years. They should not be disturbed.

If it becomes necessary to disassemble the mechanism, the bearings and related parts should be thoroughly cleaned. Remove old grease in a good grease solvent. **Do not use carbon tetrachloride.** They should then be washed in light machine oil until the cleaner is removed. After the oil has been drawn off, the bearings should be packed with Eaton's synthetic grease.

6.12 Finger clusters and switchgear stab lubrication

The breaker finger clusters are shipped with a lubricating blue wax applied from the factory and the switchgear stabs are shipped with a lubricating blue wax applied from the factory. The blue wax is used instead of grease lubrication purposes for the following reasons:

1. The blue wax has a higher melting point and a lower viscosity point then grease. So the blue wax will stay on warm contact surfaces instead of dripping off like some greases.
2. Dust particles are less likely to stick to blue wax as opposed to grease. Dirty grease can be a poor conductor.
3. The blue additive is added by Eaton to provide the ability to perform visual checks of the breaker finger cluster engagement on the switchgear stabs.

The breaker should never be levered into the cell when the blue wax has been removed from the breaker finger clusters or the switchgear stabs.

When routine maintenance is performed on the breaker or switchgear, the blue wax can be reapplied under de-energized conditions. The blue wax can be purchased from Eaton by ordering material code number 83342CE.

6.13 Main contacts to switchgear primary engagement

When the circuit breaker is in the complete and fully connected position, the circuit breaker main contacts should be engaged on the flat portion of the stationary primary contacts and not on the leading radius.

6.14 How to determine the manufacturing date

The date code is located in the serial number - see the example:

Serial no. X X X X X X X XX

The first four characters provide the date information. The first two characters are the year and the next two characters are the month. The last five characters are the production unit identifier.

6.15 Troubleshooting chart

Symptom	Inspection	Probable defects
Fails to close		
• Closing springs not charged	• Control circuit	• Control power (fuse blown or switch off) • Secondary disconnects • Motor cut-off switch (poor or burned contacts, lever not operational) • Terminals and connectors (poor or burned contacts) • Motor (brushes worn or commutator segment open)
	• Mechanism	• Pawls (slipping or broken) • Ratchet wheel (teeth worn or broken) • Cam shaft assembly (sluggish or jammed) • Oscillator (reset spring off or broken)
• Closing spring charged but breaker does not close	• No closing sound (close coil does not pick up)	• Control power (fuse blown or switch off) • Secondary disconnects • Anti-pump relay Y relay N. C. (contact open or burned or relay picks up) • Close coil (open or burned) • Latch check switch (contact open-bad switch or trip bar not reset) • Auxiliary switch (B contact open or burned) • Motor cut-off (contacts open or burned) • Trip coil assembly (clapper fails to reset)
	• Closing sound but no close	• Pole shaft (not open fully) • Trip latch reset spring (damaged or missing) • Trip bar-d shaft (fails to remain reset) • Trip latch-hatchet (fails to remain reset) • Trip floor tripper (fails to remain reset) • Close latch (binding) • Close latch roller (binding) • Trip circuit energized
Undesirably closes		
	• Control circuit	• Close circuit (CS/C getting shorted)
	• Mechanism	• Close release latch (fails to reset) • Close floor tripper (fails to reset)
Fails to trip		
• No trip sound	• Control circuit	• Control power (fuse blown or switch off) • Secondary disconnect • Auxiliary switch (A contact not making, poor or burned) • Trip coil (burned or open) • Terminals and connections (poor or burned or open)
	• Trip mechanism	• Trip clapper (jammed)
• Trip sound but no trip	• Trip mechanism	• Trip bar, trip latch (jammed) • Pole shaft (jammed) • Operating rod assembly (broken or pins out)
	• Vacuum interrupter (one or more welded)	
Undesirably trips		
	• Control circuit	• Control Power (CS/T Switch, remains made)
	• Mechanism	• Trip coil clapper (not resetting) • Trip bar or trip latch (poor engagement of mating or worn surfaces) • Trip bar reset spring (loss of torque)

6.16 End of life procedures

This circuit breaker design does not contain SF_6, asbestos, or other hazardous materials that require special handling. On removal from service, the contacts shall be open and the closing spring discharged. The unit can be discarded/destroyed in a similar manner as the switchgear that it is contained within. The breaker raw materials in general are made from copper, steel, aluminum, and plastic.

6.17 Failure reporting

It is important to learn the field failures. To aid in this process, it is recommended that IEEE Std C37.10 (section A.1) and the reporting form IEEE Std 1325 be considered for reporting the breaker failure event to EATON.

7. Renewal parts

7.1 General

In order to minimize production downtime, it is recommended that an adequate quantity of spare parts be carried in stock. The quantity will vary from customer to customer, depending upon the service severity and continuity requirements. Each customer should develop their own stock level based on operating experience. Refer to Tables 27 and 28 for guidance.

7.1.1 Ordering instructions

1. Always specify the breaker rating information and shop order number.
2. Describe the item, give the style number, and specify the quantity required.
3. Provide the style number from the interrupter assembly.
4. Specify the voltage for electrical components.
5. Specify the method of shipping desired.
6. Send all orders or correspondence to the nearest Eaton sales office.

Table 27. Recommended renewal parts for ANSI rated breakers (continued next page).

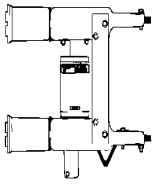
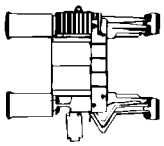
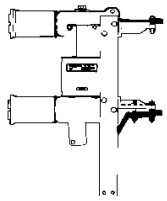
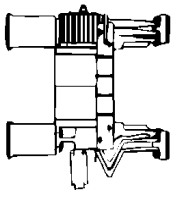
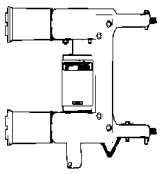
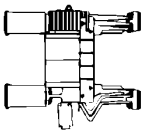
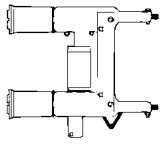
Line no.	Description	Style number VCP-W	VCPW-SE & 27 kV	VCPW-ND	Qty.	
	Interrupter Assembly					
1	50/250, 1200 A-58 kA	8297A02H01	8297A02H02	8297A02H03	3	
1A	50/250, 1200 A-58 kA (4" SC)	8297A02H21	8297A02H22		3	
2	50/250H, 1200 A-78 kA	8297A05H01	8297A05H02		3	
3	50/250, 2000 A-58 kA	8297A03H01	8297A03H02		3	
3A	50/250, 2000 A-58 kA (5" SC)	8297A03H21	8297A03H22		3	
4	50/250H, 2000 A-78 kA	8297A06H01	8297A06H02		3	
5	50/250, 3000 A-58 kA	8297A04H01	8297A04H02		3	
6	50/250H, 3000 A-78 kA	8297A07H01	8297A07H02		3	
7	50/350, 1200 A-78 kA	8297A08H01	8297A08H02		3	
7A	50/350, 1200 A-78 kA (5" SC)	8297A08H21	8297A08H22		3	
7B	50/350C, 1200 A-78 kA	8297A08H23	8297A08H24		3	
8	50/350, 2000 A-78 kA	8297A09H01	8297A09H02		3	
8A	50/350, 2000 A-78 kA (5" SC)	8297A09H21	8297A09H22		3	
8B	50/350C, 2000 A-78 kA	8297A09H23	8297A09H24		3	
9	50/350, 3000 A-78 kA	8297A10H01	8297A10H02		3	
9A	50/63, 1200 A	8297A29H05			3	
9B	50/63, 2000 A	8297A30H05			3	
9C	50/63, 3000 A	8297A31H03			3	
9D	50VCP-W40C, 3000 A		8297A10H23		3	
9E	50VCP-W50C, 3000 A		8297A10H23		3	
10	75/500, 1200 A-66 kA (5")	8297A11H01	8297A11H02		3	
10A	75/500, 1200 A-66 kA (4")	8297A11H03	8297A11H04		3	
11	75/500, 2000 A-66 kA	8297A12H01	8297A12H02		3	
11A	50VCP-WC, 1200 A		8297A11H23		3	
11B	50VCP-WC, 2000 A		8297A12H23		3	
12	75/500, 3000 A-66 kA	8297A13H01	8297A13H02		3	
12A	75VCP-W50C, 3000 A		8297A13H23		3	
13	150/500, 1200 A-37 kA (4")	8297A17H01	8297A17H02		3	
13A	150/500, 1200 A-37 kA (3" SC)	8297A17H21	8297A17H22		3	
14	150/500H, 1200 A-58kA	8297A20H01	8297A20H02		3	
15	150/500, 2000 A-37 kA	8297A18H01	8297A18H02		3	
16	150/500H, 2000 A-58 kA	8297A21H01	8297A21H02		3	
16A	150VCP-W25C, 1200 A		8297A20H23		3	

Table 27. Recommended renewal parts for ANSI rated breakers (continued next page).

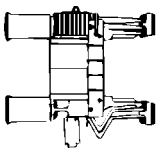
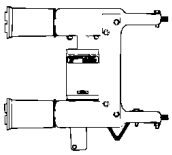
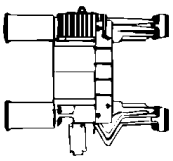
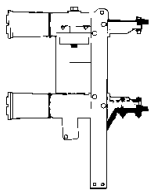
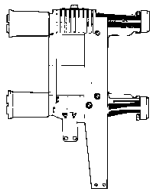
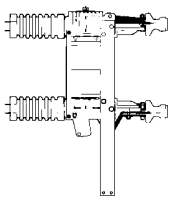
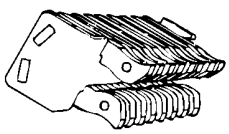
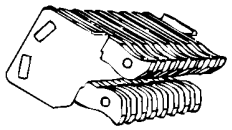
Line no.	Description	Style number VCP-W	VCPW-SE & 27 kV	VCPW-ND	Qty.	
17 18	150/500, 3000 A-37 kA 150/500, 3000 A-58 kA	8297A19H01 8297A22H01	8297A19H02 8297A22H02		3 3	
19 20 21 22	150/750, 1200 A-58 kA 150/750H, 1200 A-77 kA 150/750, 2000 A-58 kA 150/750H, 2000 A-77 kA	8297A23H01 8297A26H01 8297A24H01 8297A27H01	8297A23H02 8297A26H02 8297A24H02 8297A27H02		3 3 3 3	
23 24	150/750, 3000 A-58 kA 150/750H, 3000 A-77 kA	8297A25H01 8297A28H01	8297A25H02 8297A28H02		3 3	
25 25A 25B 25C 26 26A 26B 26C 26D 26E 26F 26G	150/1 000, 1200 A-77 kA (7") 150/1 000, 1200 A-77 kA (5") 150/1 000, 1200 A-77 kA (5")LT 150/1000C, 1200 A-77 kA (5")LT 150/1 000, 2000 A-77 kA (7") 150/1 000, 2000 A-77 kA (5") 150/1 000, 2000 A-77 kA (5")LT 150/1000C, 2000 A-77 kA (5")LT 150VCP-W40C, 1200 A 1 50VCP-W40C, 2000 A 150VCP-W50C, 1200 A 150VCP-W50C, 2000 A	8297A29H01 8297A29H03 8297A29H21 8297A29H23 8297A30H01 8297A30H03 8297A30H21 8297A30H23	8297A29H02 8297A29H04 8297A29H22 8297A29H24 8297A30H02 8297A30H04 8297A30H22 8297A30H24 8297A29H36 8297A30H36 8297A29H37 8297A30H37		3 3 3 3 3 3 3 3 3 3 3 3	
27 27A 27B 27C	150/1000, 3000 A-77 kA 150/63, 1200 A 150/63, 2000 A 150/63, 3000 A	8297A31H01 8297A29H31 8297A30H31 8297A31H31	8297A31H02		3 3 3 3	
28 29 29A 29B 29C 29D 29E	270/25, 630 A-37 kA 270/25, 1200 A-37 KA 270/25, 2000 A-37 kA 270/32, 1200 A-50 kA 270/32, 1200 A-50 kA 270/40, 1200 A-64 kA 270/40, 2000 A-64 kA		8299A04H01 8299A05H01 8299A02H01 8299A05H01 8299A02H01 8299A05H01 8299A02H01		3 3 3 3 3 3 3	
30	Primary disconnects Up to 15 kV, 1200 A	508B022G01	508B022G01	502A851G02	6	
31	Up to 15 kV, 2000 A	508B012G01	508B012G014		6	

Table 27. Recommended renewal parts for ANSI rated breakers (continued next page).

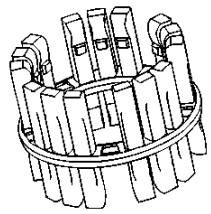
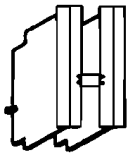
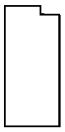
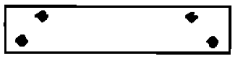
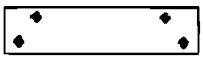
Line no.	Description	Style number VCP-W	VCPW-SE & 27 kV	VCPW-ND	Qty.	
32 32A 33B 34 34A	Up to 15 kV, 3000 A All 63 kA 27 kV, 630 A 27 kV, 1200 A 27 kV, 2000 A	692C037G01 692C037G01	692C037G01 692C037G01 699B352G01 699B352G01 502A852G02		6 6 6 6 6	
35	Phase barrier kits (2 barriers per kit) Up to 15kV Interphase barriers 2000 A outside Barriers 1200/2000 A	 694C549G03 694C549G06	 694C549G03 694C549G06	 (4) Barriers 694C622G03 694C622G03	 1 1	
36	Up to 15 kV, All 50/350, 150/1000, 150/63 and 3000 A breakers	691C648G01	691C648G01		1	
37	27 kV		691C218H01		2	
38	Push rod assemblies Up to 15 kV - white springs	 691C650G01	 691C650G02		 3	
39 39A 39B	Up to 15 kV - blue springs Up to 15 kV - red springs 150/63 - orange springs	691C651G01 691C651G03 1C94385G01	691C651G02 691C651G04 (for SE only) 1C94385G02	692C799G01	3 3 3	
40 40A	27 kV - blue springs 27 kV - black springs		691C241G01 1C94715G01		3 3	
41 41A	Tie bars Up to 15 kV 63 kA only	3619A09H01 1C94404H01	691C271H01	3619A09H01	6 6	
42 42A	27 kV (up to 25 kA) 27 kV (31.5/40 kA)		691C223H01 1C94707H01		6 6	

Table 27. Recommended renewal parts for ANSI rated breakers (continued next page).

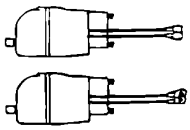
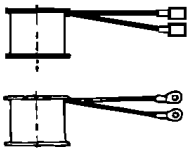
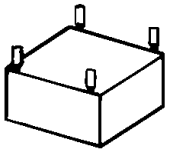
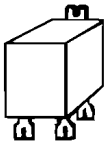
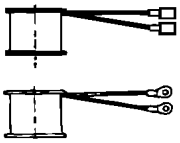
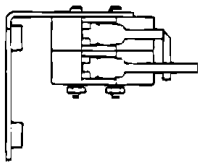
Line no.	Description	Style number VCP-W	VCPW-SE & 27 kV	VCPW-ND	Qty.	
	Charging motor					
43	48 Vdc	699B196G03	699B196G06	699B196G03	1	
44	125 Vdc/120 Vac	699B196G01	699B196G04	699B196G01	1	
45	250 Vdc/240 Vac	699B196G02	699B196G05	699B196G02	1	
46	Motor brush kit	8063A77G01	8063A77G0	8063A77G01	1	
	Spring release coils					
47	48 Vdc	3759A76G01	3759A76G11	3759A76G01	1	
48	125 Vdc/120 Vac	3759A76G02	3759A76G 12	3759A76G02	1	
49	250 Vdc/240 Vac	3759A76G03	3759A76G13	3759A76G03	1	
50	Rectifier (1 20/240 Vac)	3759A79G02	3759A79G01	1	1	
	Anti pump (Y) relay					
51	48 Vdc	3759A74G03	8237A27H03	3759A74G03	1	
52	125 Vdc	3759A74G04	8237A27H04	3759A74G04	1	
53	250 Vdc	3759A74G05	8237A27H05	3759A74G05	1	
54	120 Vac	3759A74G01	8237A27H01	3759A74G01	1	
55	240 Vac	3759A74G02	8237A27H02	3759A74G02	1	
	Shunt trip coils					
56	24 Vdc	3759A76G04	3759A76G14	3759A76G04	1	
57	48 Vdc	3759A76G01	3759A76G1 1	3759A76G01	1	
58	125 Vdc/125 Vac cap trip	3759A76G02	3759A76G12	3759A76G02	1	
59	250 Vdc/240 Vac cap trip	3759A76G03	3759A76G 13	3759A76G03	1	
	UV trip coils					
60	48 Vdc	8064A19G01	8064A19G01	8064A19G01	1	
61	125 Vdc	8064A19G02	8064A19G02	8064A19G02	1	
62	250 Vdc	8064A19G03	8064A19G03	8064A19G03	1	
62A	120 AC	8064A19G09	8064A19G09	8064A19G09	1	
62B	240 AC	8064A19G10	8064A19G10	8064A19G10	1	
63	Motor cut off switch	699B199G01	699B199G04	699B199G01	1	
64	Latch check switch	699B147G01	699B147H04	699B147G01	1	

Table 27. Recommended renewal parts for ANSI rated breakers (continued next page).

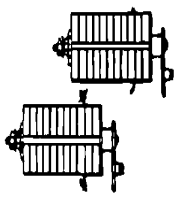
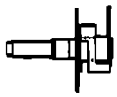
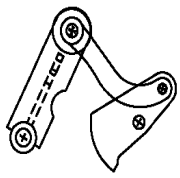
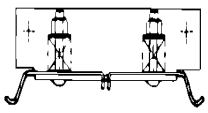
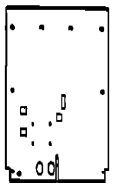
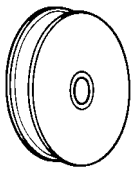
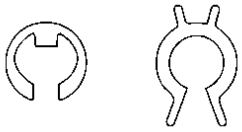
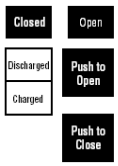
Line no.	Description	Style number VCP-W	VCPW-SE & 27 kV	VCPW-ND	Qty.	
65 65A	Position switch 1 Position switch 2	8064A03G01 3759A93G01	699B147H01 3759A93H02	8064A03G01 3759A93G01	1 1	
66	Auxiliary switch	698B822H01	5697B02G01	5697B02G02	1	
67	Trip D-shaft	694C638G02	694C638G02	694C638G02	1	
68	Main link & trip latch	3A75675G01	3A75675G01	3A75675G01	1	
69	Ground contact assy.	691C506G01	691C506G01	691C506G02		
70 71 72	Front panel (w/o ESCN) 3000 A, 350/1000 MVA, 63 kA 27 kV All others	691C655H01 691C192H03	691C655H01 691C214H01 691C192H03	 691C253H01		
73	Breaker wheel (H03 and H04) = 1 wheel	3617A99H03 3617A99H04	3617A99H03 3617A99H04	8237A50H01		
74	Fastener kit	8061A01G01	8061A01G01	8061A01G01	1	

Table 27. Recommended renewal parts for ANSI rated breakers

Line no.	Description	Style number VCP-W	VCPW-SE & 27 kV	VCPW-ND	Qty.	
75	Labels kit	8295A45G04	8295A45G04	8295A45G04	10	
76	Wiring harness repair kit	691C281G01	691C281G01	691C281G02		
	Complete replacement	691C281G03	691C281G07 (SE) 691C281G05 (27kV)	691C281G09	}Standard & UV	
		691C281G04	691C281G08 (SE) 691C281G06 (27kV)	691C281G10	}With shunt trip 2	
77	UV trip kit					
	48 Vdc	691C274G01	691C274G01	691C274G01		
	125 Vdc	691C274G02	691C274G02	691C274G02		
	250 Vdc	691C274G03	691C274G03	691C274G03		
	120 Vac	691C274G04	691C274G04	691C274G04		
	240 Vac	691C274G05	691C274G05	691C274G05		
78	Closure test	6352C58G01	6352C58G01	6352C58G01		

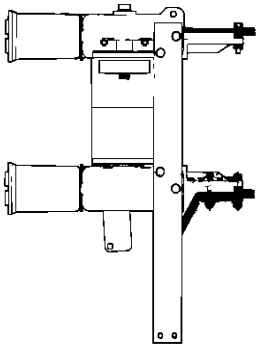
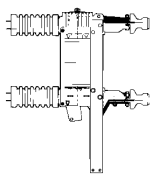
Line no.	Description	Style number VCP-WC	Qty.	Typical view
	Interrupter Assembly			
101	50/25C, 1200 A	8297A33H01	3	
102	50/25C, 2000 A	8297A33H02	3	
103	50/25C, 3000 A	8297A33H03	3	
104	50/40C, 1200 A	8297A34H01	3	
105	50/40C, 2000 A	8297A34H02	3	
106	50/40C, 3000 A	8297A34H03	3	
107	50/50C, 1200 A	8297A34H04	3	
108	50/50C, 2000 A	8297A34H05	3	
109	50/50C, 3000 A	8297A34H06	3	
110	50/63C, 1200 A	8297A35H01	3	
111	50/63C, 2000 A	8297A35H02	3	
112	50/63C, 3000 A	8297A35H03	3	
113	75/50C, 1200 A	8297A34H07	3	
114	75/50C, 2000 A	8297A34H08	3	
115	75/50C, 3000 A	8297A34H09	3	
116	150/25C, 1200 A	8297A33H11	3	
117	150/25C, 2000 A	8297A33H12	3	
118	150/25C, 3000 A	8297A33H13	3	
119	150/40C, 1200 A	8297A34H11	3	
120	150/40C, 2000 A	8297A34H12	3	
121	150/40C, 3000 A	8297A34H13	3	
122	150/50C, 1200 A	8297A34H14	3	
123	150/50C, 2000 A	8297A34H15	3	
124	150/50C, 3000 A	8297A34H16	3	
125	150/63C, 1200 A	8297A35H11	3	
126	150/63C, 2000 A	8297A35H12	3	
127	150/63C, 3000 A	8297A35H13	3	
128	270/25C, 1200 A	8297A36H01	3	
129	270/25C, 1600 A	8297A36H02	3	
130	270/32C, 1200 A	8297A36H03	3	
131	270/32C, 1 600 A	8297A36H04	3	
132	270/40C, 1200 A	8297A36H05	3	
133	270/40C, 1600 A	8297A36H06	3	

Table 28. Recommended renewal parts for IEC rated breakers (continued next page).

Line no.	Description	Style number		Qty.	Typical view
		Up to 17.5 kV	24 kV		
	Interrupter assembly				
1	36/25- 630 A	8299A01H01		3	
2	36/25- 1250 A	8299A01H02		3	
3	36/25- 2000 A	8299A01H03		3	
4	36/32-1250 A	8299A01H04		3	
5	36/32- 2000 A	8299A01H05		3	
6	36/40-1250 A	8299A01H06		3	
7	36/40-2000 A	8299A01H07		3	
8	72/25- 630 A	8299A01H08		3	
9	72/25- 1250 A	8299A01H09		3	
10	72/25- 2000 A	8299A01H10		3	
11	72/32-1250 A	8299A01H11		3	
12	72/32- 2000 A	8299A01H12		3	
13	72/40- 1250 A	8299A01H13		3	
14	72/40- 2000 A	8299A01H14		3	
15	120/25-630 A	8299A01H15		3	
16	120/25-1250 A	8299A01H16		3	
17	120/25-2000 A	8299A01H17		3	
18	120/32-1250 A	8299A01H18		3	
19	120/32-2000 A	8299A01H19		3	
20	120/40-1250 A	8299A01H20		3	
21	120/40-2000 A	8299A01H21		3	
22	175/25-1250 A	8299A01H22		3	
23	175/25-2000 A	8299A01H23		3	
24	175/32-1250 A	8299A01H24		3	
25	175/32-2000 A	8299A01H25		3	
26	175/40-1250 A	8299A01H26		3	
27	175/40-1250 A	8299A01H27		3	

Table 28. Recommended renewal parts for IEC rated breakers (continued next page).

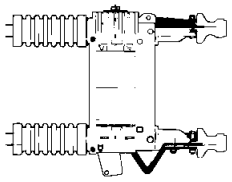
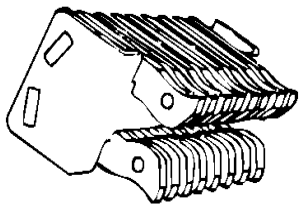
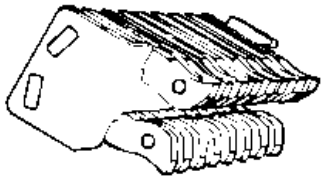
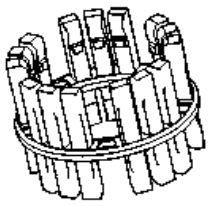
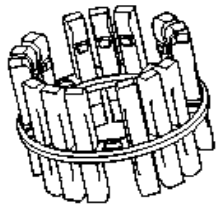
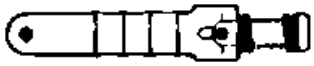
Line no.	Description	Style number		Qty.	Typical view
		Up to 17.5 kV	24 kV		
28 29 29A	240/25-650 A 240/25-1250 A 240/25-2000 A		8299A01H28 8299A01H29 8299A01H30	3 3 3	
	Primary disconnects				
30 31	Up to 175/40-630 A Up to 175/40-1250 A	699B104G01 699B104G01		6 6	
32	Up to 175/40-2000 A	508B012G01		6	
33	240/25-630 A		699B352G01	6	
34 34A	240/25-1250 A 240/25-2000 A		699B352G01 699B352G02	6 6	
	Phase barrier				
35 37	Up to 175/40 240/25	691C176H04	691C218H01	2	
	Push rod assemblies				
38 39	Up to 175/40-white springs Up to 175/40-blue springs	691C650G01 691C651G01		3 3	

Table 28. Recommended renewal parts for IEC rated breakers (continued next page).

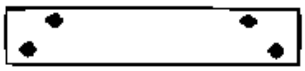
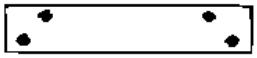
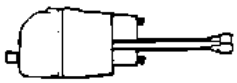
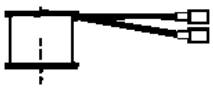
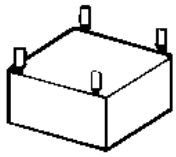
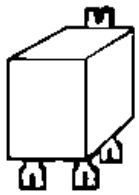
Line no.	Description	Style number		Qty.	Typical view
		Up to 17.5 kV	24 kV		
40	240/25		691C241G01	3	
	Tie bars				
41	Up to 175/40	3619A09H01		6	
42	Tie bars 240/25		691C223H01	6	
	Charging motor				
43	48 Vdc	699B196G03	699B196G06	1	
44	125 Vdc/120 Vac	699B196G01	699B196G04	1	
45	250 Vdc/240 Vac	699B196G02	699B196G05	1	
46	Motor brush kit	8063A77G01	8063A77G01	1	
	Spring release coils				
47	48 Vdc	3759A76G01	3759A76G11	1	
48	125 Vdc/120 Vac	3759A76G02	3759A76G12	1	
49	250 Vdc/240 Vac	3759A76G03	3759A76G13	1	
50	Rectifier (120/240 Vac)	3759A79G01	3759A79G02	1	
	Anti pump (Y) relay				
51	48 Vdc	3759A74G03	8237A27H03	1	
52	125 Vdc	3759A74G04	8237A27H04	1	
53	250 Vdc	3759A74G05	8237A27H05	1	
54	120 Vac	3759A74G01	8237A27H01	1	
55	240 Vac	3759A74G02	8237A27H02	1	
	Shunt trip coils				
56	24 Vdc	3759A76G04	3759A76G14	1	
57	48 Vdc	3759A76G01	3759A76G11	1	
58	125 Vdc/120 Vac cap trip	3759A76G02	3759A76G12	1	
59	250 Vdc/240 Vac cap trip	3759A76G03	3759A76G 13	1	

Table 28. Recommended renewal parts for IEC rated breakers (continued next page).

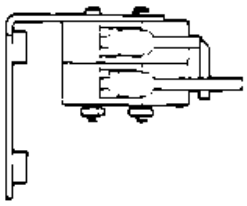
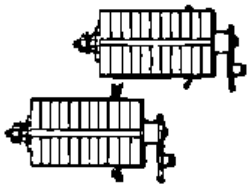
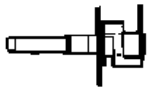
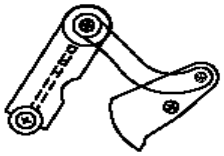
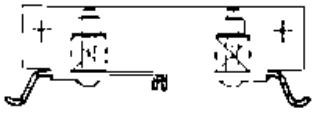
Line no.	Description	Style number		Qty.	Typical view
		Up to 17.5 kV	24 kV		
	UV trip coils				
60	48 Vdc	8064A19G01	8064A19G01	1	
61	125 Vdc	8064A19G02	8064A19G02	1	
62	250 Vdc	8064A19G03	8064A19G03	1	
62A	120 AC	8064A19G09	8064A19G07	1	
62B	240 AC	8064A19G08	8064A19G08	1	
63	Motor cut off switch	699B199G01	699B199G04	1	
64	Latch check switch	699B147G01	699B147H04	1	
65	Position switch 1	8064A03G01	699B147H01	1	
65A	Position switch 2	3759A93G01	3759A93H02	1	
66	Auxiliary switch	698B822H01	5697B02G01	1	
67	Trip D-shaft	694C638G02	694C638G02	1	
68	Main link & trip latch	3A75675G01	3A75675G01	1	
69	Ground contact assembly	691C506G01	691C506G01		

Table 28. Recommended renewal parts for IEC rated breakers.

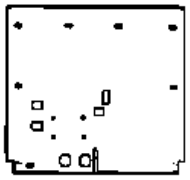
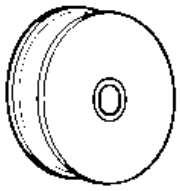
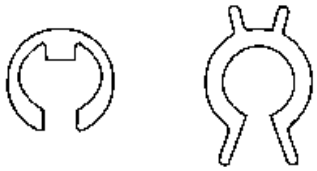
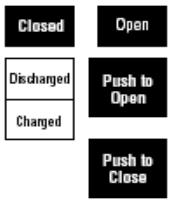
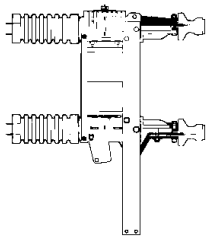
Line no.	Description	Style number		Qty.	Typical view
		Up to 17.5 kV	24 kV		
70 71	Front panel W/O escutch 240/25 All others	691C192H02	691C214H01		
73	Breaker wheel	3617A99G01	3617A99G01		
74	Fastener kit	8061A01G01	8061A01G01		
75	Labels kit	3759A79G01	8295A45G04	1	
76	Wiring harness repair kit complete replacement	691C281G01 691C281G03 691C281G04	691C281G01 691C281G05 691C281G06	Standard & UV with shunt trip 2	
77	UV trip kit 48 Vdc 125 Vdc 250 Vdc 120 Vac 240 Vac	 691C274G01 691C274G02 691C274G03 691C274G04 691C274G05	 691C274G01 691C274G02 691C274G03 691C274G04 691C274G05		
78	CloSure test	6352C58G01	6352C58G01		

Table 29. Recommended renewal parts for GB rated breakers.

Line no.	Description	Style Number			Qty.	
		VCP-W	W-VACW	W-VACX		
1	150VCP-WGC50 1200 A	8297A36G28			3	

8. Optional accessories

8.1 Optional factory installed roll-on-floor wheel kit

Eaton (29" wide frame) breakers:

- Rated at 5, 15, or 27 kV - can be ordered with the "optional" factory installed, roll-on-floor wheel kit, as configured through Bidmanager.

Note: This roll-on-floor wheel kit can also be ordered as an aftermarket item and installed in the field as required.

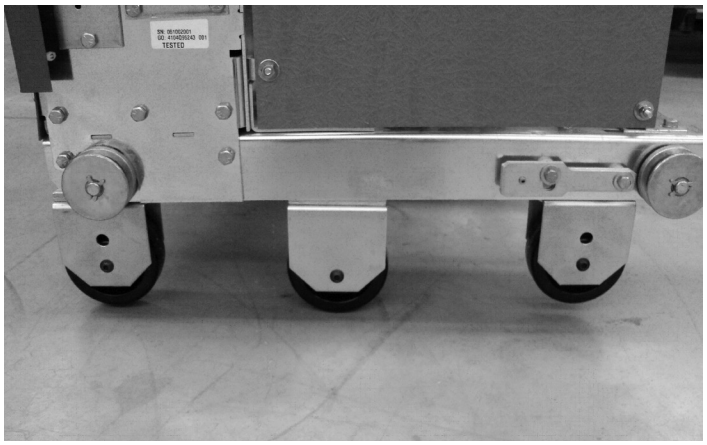


Figure 45. Roll-on-floor wheel kit (shown installed on a standard 5/15 kV VCP-W breaker).

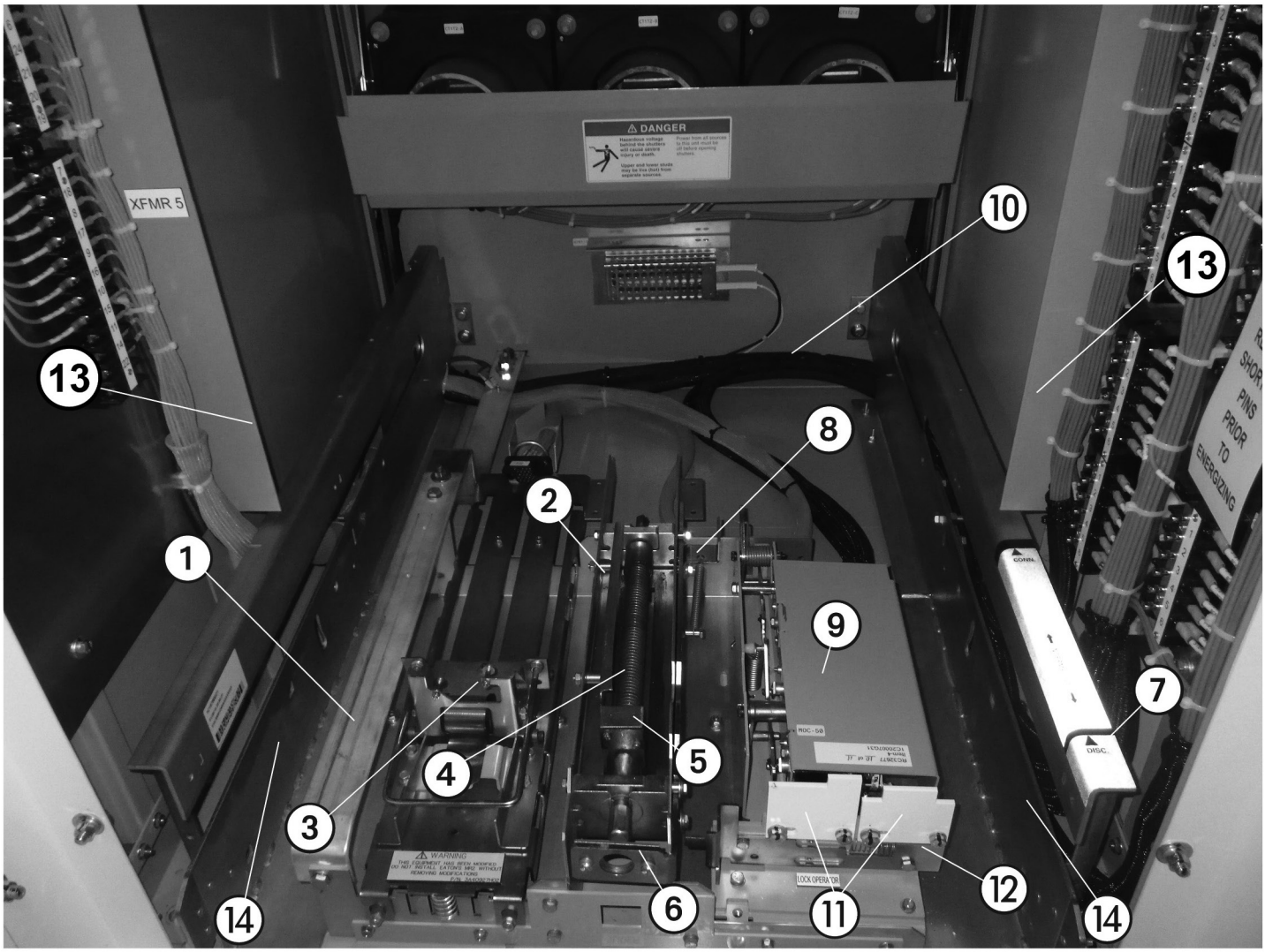
The center wheel on the 27 kV roll on the floor breaker is rotated 180 degrees from the picture shown above to align better with the center of gravity.

8.2 Optional automatic/manual hybrid secondary for BPI pan assembly

Figure 46 represents an automatic engaging secondary with a manual release feature incorporated into the BPI pan assembly. It requires the customer to manually lift up the secondary release lever to allow the secondary harness to engage the breaker in the DISCONNECT/TEST position.

The secondary harness will then disengage automatically when the breaker returns to the DISCONNECT/TEST position.

The slider interlocks from the non-BPI pan assembly: Figure 13 displays the "Z" shaped slider interlock that prevents a closed breaker from being levered out of the cell has been incorporated into this feature.



Legend

1. Ground contacts
2. Levering system.
3. Automatic/manual secondary
4. Racking screw
5. Moving block
6. Slider
7. Breaker position indication
8. Slider interlocks
9. MOC switch
10. TOC switch location (see Figure 12 for actual TOC)
11. Coding plates
12. Provision for padlocking
13. Picture frame
14. Breaker rail

Figure 46. Optional automatic/manual secondary for BPI pan assembly.

This optional accessory is style number 1C20335G01.

8.3 Optional 3,000 A ball screw drive for BPI pan assembly

A ball screw kit has been developed for the BPI pan assembly to reduce the required force to manually rack in a 63 kA or 3,000 A breaker. If the customer is using a MR2 system to lever in the breakers, then this system is not required.

This optional accessory is style number 1C20376G01.

Instruction Booklet IB131006EN

Effective March 2019

Instructions for installation, operation, and maintenance of type VCP-W vacuum circuit breakers

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