

VOLTECH

EXCELLENCE IN ENGINEERING PRODUCTS & SERVICES

**OPERATIONAL &
MAINTENANCE MANUAL
OF 11kV VACCUM CIRCUIT
BREAKER**

VACUUM CIRCUIT BREAKER COMPONENTS, FEATURES & BENEFITS

BOM FOR 12kV,1250A (BREAKER PARTS)

SI.N O	PART NO	DESCRIPTION	DETAIL AND SPECIFICATIO N	MATERIAL/MO DEL	QUANTI TY	UNIT
SHAFT ASSEMBLY						
<u>1</u>	12BR-001-WAMS	W.A OF MAIN SHAFT	Ø35x512 lg, mm	MS	1	NO'S
<u>2</u>	12BR-006-BB	BEARING BLOCK	100x85x20 mm	MS	2	NO'S
<u>3</u>	12BR-007-MDR	MAIN DRIVE ROD	Ø20x235 mm lg	MS	1	NO'S
<u>4</u>	12BR-008-PNMS	SS PIN FOR DRIVE ROD WITH MAINSHAFT	Ø12x52 mm lg	SS	6	NO'S
<u>5</u>	12BR-009-A-REB	ROD END BEARING A	Ø10 mm	10 POS MALE	3	NO'S
<u>6</u>	12BR-009-B-REB	ROD END BEARING B	Ø12 mm	12 POS FEMALE	2	NO'S
7	12BR-009-01-BTD	BEARING SPEC.	62x25 mm	6305ZZ	2	NO'S
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POLE ASSEMBLY

8	12BR-011-EHI	HOUSING FOR INTERRUPTER	620x150 mm	EPOXY	3	NO'S
9	12BR-012-VI-B14	VACUUM INTERRUPTER	Ø110x227 mm 2000A	B14	3	NO'S
10	12BR-013-TT-800A	TOP TERMINAL(630-800A)	50x10x275 lg mm	COPPER	3	NO'S
11	12BR-014-TT-1250A	TOP TERMINAL(1250A)	60x12x275 lg mm	COPPER	3	NO'S
12	12BR-015-ISOC-800A	ISOLATING CONTACT	120x50x6 mm	COPPER	12	NO'S
13	12BR-016-A-PP	PRESSURE PLATE 1MM	20x2x9 mm	SPRING STEEL	24	NO'S
14	12BR-016-B-PP	PRESSURE PLATE 2MM	20x1x95 mm	SPRING STEEL	24	NO'S
15	12BR-017-A-STUD	STUD FOR ISOLATING CONTACT M6	M6x65mm	STEEL	12	NO'S
16	12BR-017-B-STUD	STUD FOR ISOLATING CONTACT M8	M8x65 mm	MS	12	NO'S
17	12BR-018-SAS	SELF ALIGN SPRING	Ø9 mm	MS	12	NO'S

18	12BR-019-MCB(800A)	MOVING CONTACT BLOCK (800A)	47x60x20 mm	ELY.Cu/Br	3	NO'S
19	12BR-019-MCB(1250A)	MOVING CONTACT BLOCK (1250A)	47x60x20 mm	ELY.Cu/Br	3	NO'S
20	12BR-020-BT(1250A)	BOTTOM TERMINAL(1250A)	60x12x275 mm	ELY.Cu/Br	3	NO'S
21	12BR-021-BT(800A)	BOTTOM TERMINAL(800A)	50x10x275 mm	ELY.Cu/Br	3	NO'S
22	12BR-022-F(1250A)	COPPER FLEXIBLE(1250A)	60x230x12 mm	COPPER	3	NO'S
23	12BR-022-F(800A)	COPPER FLEXIBLE(800A)	50x190x6 mm	COPPER	3	NO'S
24	12BR-023-DRFP	DRIVE ROD FOR POLE	Ø16x208 lg mm	MS	3	NO'S
25	12BR-024-IFDR	INSULATOR FOR DRIVE ROD	Ø43.5x150 mm	EPOXY	3	NO'S
		SPRING ASSEMBLY (CLOSE)				
26	12BR-025-OCS	OUTER CLOSING SPRING	Ø6x260 lg mm	SPRING STEEL	1	NO'S
27	12BR-026-LWFCS	LOCATING WASHER FOR CLOSING SPRING	Ø52x10 lg mm	MS	2	NO'S
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28	12BR-029-WAGR	WA OF GUIDE ROD	355x50x20 mm	MS	1	NO'S
29	12BR-030-WASBCS	WA OF SWIVEL BLOCK FOR CLOSING SPRING	98x40x40 mm	MS	1	NO'S
		SPRING ASSEMBLY (OPEN)				
30	12BR-031-PN-REB	PIN FOR ROD END BEARING	Ø10x52 lg mm	SS	3	NO'S
31	12BR-031-1-PNBC	SS PIN FOR BEL CRANK	Ø12x66 lg mm	SS	3	NO'S
32	12BR-032-SWBC	SWIVEL BLOCK FOR BEL CRANK	Ø12x58x30 lg mm	MS	3	NO'S
33	12BR-033-LWCS	LOCATING WASHER FOR CONTACT SPRING	Ø50x15 lg mm	MS	6	NO'S
34	12BR-034-STUD-CS	STUD FOR CONTACT SPRING	Ø12x235 lg mm	MS	3	NO'S
35	12BR-035-CS(I)	CONTACT SPRING (INNER)	Ø4x122 mm lg	SPRING STEEL	3	NO'S
36	12BR-036-HS(O)	HOLD OPEN SPRING(OUTER)	Ø4.5x250 lg mm	SPRING STEEL	1	NO'S
37	12BR-037-H(I)	HOLD OPEN SPRING(INNER)	Ø20x250 lg mm	SPRING STEEL	1	NO'S
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38	12BR-038-LWOS	LOCATING WASHER FOR HOLD OPEN SPRING	Ø35x10 mm	MS	2	NO'S
39	12BR-039-SFBC	SPACER FOR BELL CRANK	Ø18x25 lg mm	MS	3	NO'S
40	12BR-040-B	BELL CRANK	84x74x6 mm	MS	6	NO'S
41	12BR-041-SFOS	STUD FOR OPEN SPRING	Ø12x290 mm	MS	1	NO'S
42	12BR-042-SBFHO	SWIVEL BLOCK ASSEMBLY FOR HOLD OPEN SPRING	100x60x6 mm	MS	1	NO'S
43	12BR-043-AB	ADOPTER BLOCK FOR SPRING GUIDE	Ø20x40 lg mm	MS	3	NO'S
44	12BR-044-CS(O)	CONTACT SPRING OUTER	Ø6x112 lg mm	SPRING STEEL	3	NO'S
		DASHPOT ASSEMBLY				
45	12BR-045-PISR	PISTON RING	Ø52.25 lg mm	CAST IRON	1	NO'S
46	12BR-046-DP	DASH POT	Ø60x76 lg mm	ALUMINIUM	1	NO'S
47	12BR-047-WAPIS	WA OF PISTON DASHPOT	Ø49.5x175 lg mm	MS	1	NO'S
48	12BR-050-SWDP	WA SWIVEL BLOCK FOR DASHPOT	90x85x10 mm	MS	1	NO'S

BREAKER ACCESSORIES

49	12BR-054-CH	CHARGING HANDLE	Ø16x390 lg mm	MS	1	NO'S
50	12BR-054-DH	DOOR HANDLE	Ø11x141 mm	MS	2	NO'S
51	12BR-055-ASL	AUXILIARY SWITCH LEVER	24x73x12 mm	NYLON	1	NO'S
		TRIPPING INTERLOCK ASSEMBLY				
52	12BR-056-TIR	TRIPPING INTERLOCK ROD	12x12 SQx855 mm	MS	1	NO'S
53	12BR-058-WFTI	WHEEL FOR TRIPPING INTERLOCK	Ø45x25 mm	NYLON	2	NO'S
54	12BR-059-PNFTI	SS PIN FOR TRIPPING INTERLOCK	10x52 lg mm	SS	1	NO'S
		SCREWROD ASSEMBLY				
55	12BR-060-WARH	WA OF RACK IN/OUT HANDLE	Ø12x900 mm	MS	1	NO'S
56	12BR-060-01-SR	SCREWROD	360x Ø30 mm	MS	1	NO'S
57	12BR-061-NB	NUT BLOCK FOR SCREWROD	76x76x16mm	MS	1	NO'S

8

58	12BR-062-HB	HINGE BLOCK FOR SCREWROD	76x76x16 mm	MS	1	NO'S
		SHUTTER ASSEMBLY				
59	12BR-063-SH	SMC SHUTTER	684x140x4 mm	FRP	2	NO'S
60	12BR-064-SSR	SHUTTER SQUARE ROD	12x12SQx1020 mm	MS	2	NO'S
61	12BR-065-RLFS	RISING LEVER FOR SHUTTER	670x25x6 mm	MS	2	NO'S
62	12BR-073-RO-SH	WHEEL FOR SHUTTER	Ø65x25 mm	NYLON	2	NO'S
		WHEEL ASSEMBLY				
	12BR-075-TW	TRUCK WHEEL	Ø84x25 lg mm	NYLON	4	NO'S
63	12BR-076-PNFTW	SS PIN FOR TRUCK WHEEL	Ø12x62 lg mm	SS	4	NO'S
		COIL ASSEMBLY				
64	12BR-077-CC	CLOSING COIL	110 V DC, 285W, 37Ω	COPPER COIL	1	NO'S
65	12BR-078-TC	TRIP COIL	110 V DC, 285W, 37Ω	COPPER COIL	1	NO'S
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PUSH BUTTON ASSEMBLY

66	12BR-079-PLB	PLUNGER FOR L BRACKET	Ø20X65 mm	MS	2	NO'S
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67	12BR-085-CLB	CLOSING FOR L BRACKET	100x500x5 mm	MS	1	NO'S
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ELECTRICAL ITEMS

68	12BR-087-LS	LIMIT SWITCH FOR SPRING CHARGE MOTOR	2NO+2NC	JO2 SILR	1	NO'S
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69	12BR-088-AS	AUXILIARY SWITCH	8NO+8NC	1	NO'S
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70	12BR-089-SP.M	SPRING CHARGE MOTOR	230VAC, 150w	SG103S12	1	NO'S
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71	12BR-090-W	WIRES	1.5 SQ.mm	COPPER	100	NO'S
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72	12BR-091-LU	LUGS	1.5 SQ.mm	ALUMINIUM	90	NO'S
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73	12BR-092-BNW-1	BOLT NUTS WITH WASHERS-1	M08x25 mm	MS	10	NO'S
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74	12BR-093-BNW-2	BOLT NUTS WITH WASHERS-2	M10x30 mm	MS	15	NO'S
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75	12BR-094-P&S	PLUG & SOCKET	24 PIN	PLASTIC	1	NO'S
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76	12BR-095-TB	TERMINAL BLOCK	CTS 6	PLASTIC	10	NO'S
77	12BR-096-TWR	TRUFF WITH RAIL	25x40	MS	MTR,200 C	NO'S
78	12BR-097-SCM	SPRING CHARGE COMPONENTS	MS-2mm	1	NO'S
79	12BR-098-GM	GROUP MARKER	GMH6	PLASTIC	1	NO'S
80	12BR-099-EP	END PLATE	EP6/10U	PLASTIC	1	NO'S
81	12BR-100-EC	END CLAMP	EA702	PLASTIC	2	NO'S
82	12BR-101-CT	COUNTER	RS5 STROKE COUNTER	FRP	1	NO'S
		HARDWARES				
83	12BR-102-NLN-1	NYLON LOCK NUT -1	M6	SS	24	NO'S
84	12BR-103-NLN-1	NYLON LOCK NUT -2	M8	SS	26	NO'S
85	12BR-104-WS-1	WASHER -1	M6	SS	24	NO'S
86	12BR-105-WS-1	WASHER -2	M8	MS	26	NO'S 11

87	12BR-107-HN-2	HALF NUT -2	M12	MS	12	NO'S
88	12BR-108-HEN	HEX NUT	M16	MS	2	NO'S
89	12BR-110-BW-1	BRASS WASHER -1	M12X1 mm	MS	15	NO'S
90	12BR-111-BW-2	BRASS WASHER -2	M12X0.5 mm	MS	15	NO'S
91	12BR-112-HC	HELICOIL	M10X1(800A)	MS	6	NO'S
92	12BR-114-AB	ALLEN BOLT	M12X45 mm	MS	3	NO'S
93	12BR-115-HB-1	HEX BOLT -1	M10X55 mm	MS	22	NO'S
94	12BR-117-HB-3	HEX BOLT -3	M10X30 mm	MS	10	NO'S
95	12BR-119-HB-A	HEX BOLT -A	M8X40 mm	MS	2	NO'S
96	12BR-121-HB-C	HEX BOLT -C	M8X25 mm	MS	65	NO'S
97	12BR-122-HB-D	HEX BOLT -D	M6X25 mm	MS	10	NO'S
98	12BR-123-CHS	C.H.S	6X15 mm	MS	10	NO'S 12

99	12BR-124-MECH	MECHANISM (WITH CLOSE & TRIP LATCH ASSEMBLY, WITHOUT COIL AND SPRING)	250X280 mm	MS	1	NO'S
100		ALUMINIUM PUSH BUTTON WITH M.S WELDED BRACKET			1	Set
101		M.S PUSH BUTTON WITH M.S HOLLOW BUSH			1	Set
		OLD BREAKER COMPONENTS WHICH ARE NOT USED				
102	12BR-053-SP-A	SUPPORT PILLAR FOR BREAKER -A	Ø16X346 lg mm	MS	1	NO'S
103	12BR-053-SP-B	SUPPORT PILLAR FOR BREAKER -B	Ø16X352 lg mm	MS	1	NO'S
104	12BR-069-SP-SH	SHUTTER BUSH FOR SHUTTER	Ø12x15 lg mm	MS	2	NO'S
105	12BR-109-SP	ZINC PLATED SPLIT PIN 2.5X25	2.5x25 mm	MS	50	NO'S
106	12BR-116-HB-2	HEX BOLT -2	M10x45 mm	MS	20	NO'S
107	12BR-118-AB	ALLEN BOLT	M8x75 mm	MS	6	NO'S
108	12BR-120-HB-B	HEX BOLT -B	M8x30 mm	MS	14	NO'S
						13

WELDING ASSEMBLY OF MAIN SHAFT



- Main shaft is the shaft used to convert x-axis force into y-axis for switching ON & OFF the Vacuum Circuit Breaker by using welded attachments to the shaft at a particular angle.
- It is made up of Mild steel which is having high torsion and shear strength . Hence it does not twist easily.
- It is mounted on the bearing block holding bearing spec.

PROPERTIES	MILD STEEL	STAINLESS STEEL
CORROSION RESISTANCE	LOW	HIGH
MALLEABILITY	MEDIUM	LOW
HARDNESS	120HB	200HB
STRENGTH	247 MPa	215 MPa
DURABILITY	LOW	HIGH
WEIGHT	HIGH	LOW
WEAR RESISTANCE	MEDIUM	LOW

BEARING BLOCK



- Bearing block is used to hold the bearing.
- It is made up of Mild Steel which has high toughness and ductility makes to withstand more weight.

BEARING SPEC



- The Deep groove Ball bearing (for high loads) allows friction-free movement and rotation of the main shaft held by bearing block.
- It has the ability to adapt to many different functions or activities and overall performance.
- It is made up of 52100 bearing steel, a high carbon, chromium contained alloy steel having high wear resistance, and anti-friction properties.

ROD END BEARING A&B



Rod end bearing A



Rod end bearing B

- POS series male & female Rod End Bearing or heim joint is used where shaft may be misaligned or dynamic.
- It is made up of heat treated Medium carbon steel/Bearing steel has lower coefficient of friction and high strength.
- Hence wear is reduced greatly.

MAIN DRIVE ROD



- Main drive rod is used to drive the main drive shaft while switching ON & OFF the Vacuum Circuit Breaker
- It is made up of Mild steel because it has great strength to withstand sudden impact load.
- The middle part is larger to increase the hardness and strength while the upper part is small in diameter to hold it.

SS PIN FOR DRIVE ROD



- SS Pin is used to connect drive rod with main shaft.
- It made up of Stainless Steel (SS) which has high ductility hence wear is reduced.
- Since Main Drive Rod & Main Drive shaft is same material, SS pin is selected to eliminate galling (i.e cold welding due to friction)

HOUSING FOR INTERRUPTER



- Interrupter housing acts as insulator and also for holding the Vacuum Interrupter.
- It is made up of Epoxy which is known for its durability, strength, functionality and resistance to corrosion & abrasion.
- It has high heat resisting and electrical insulating properties.

VACUUM INTERRUPTER(B14)



- Vacuum interrupter is a device which interrupts the electrical contact and quenches the arc by a vacuum medium.
- Vacuum interrupters are used in power transmission systems, power generation unit, and power-distribution systems for industrial plants.
- The contact part is made by oxygen free copper-chromium alloy because of High breakdown voltage and resistance to electrical erosion, Resistance to welding, Low cut-off current value, Low gas content.
- It has ceramic housing to enhance dielectric properties.

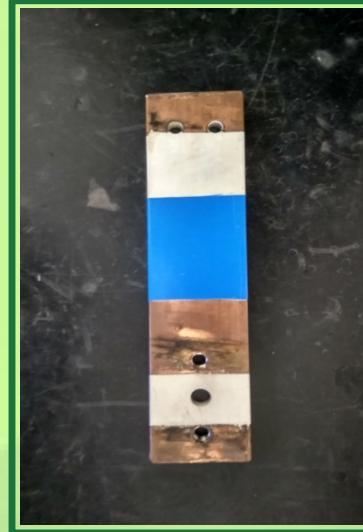
MATERIALS

PROPERTIES	EPOXY	CERAMIC	NYLON	FRP	DMC
WHY?	It has excellent mechanical properties than other polymers with 83 SHORE D hardness .	Since it is made up of clay, it can withstand generally 1000 to 1600 degrees temperature.	They resist corrosion and compresses under pressure to form a high quality seal.	They are transparent to most electromagnetic fields with electromagnetic interference shielding.	It is the best insulator with great mechanical properties.
ADVANTAGES	Its thermal and electrical properties, strength, and durability are its advantages.	It has very high dielectric strength and can withstand high temperatures	It can be manufactured into any shape/design.	They are very light weighted when compared to other materials.	They are very less in weight with greater strength.

MATERIALS

PROPERTIES	EPOXY	CERAMIC	NYLON	FRP	DMC
USED IN	Housing for interrupter	Vacuum interrupter	Gasket & locknut	SMC shutter	Bus bar supports
PROPERTIES	<ul style="list-style-type: none"> heat dissipation electrical insulation light weight sound dampening & vibration 	<ul style="list-style-type: none"> High electrical resistivity Low thermal conductivity High hardness(15.7 HV) and very brittle 	<ul style="list-style-type: none"> Wear resistant Good dielectric Oil & chemical resistance Hardness of 115R 	<ul style="list-style-type: none"> Electrical insulator Thermal insulator Flexible 	<ul style="list-style-type: none"> Low Shrinkage Good Electrical Properties Heat Resistance Good Mechanical Strength

TOP TERMINAL(630A,1250A)



- Input Current is given through Top Terminal which is connected to the vacuum interrupter
- With respect to the quantity(amps) of current the dimensions of the copper terminal is decided.
- Top terminal is made of copper for it's high conductivity & resilience to higher temperatures, providing extra security during short circuit situations.

BOTTOM TERMINAL(1250A & 800A)

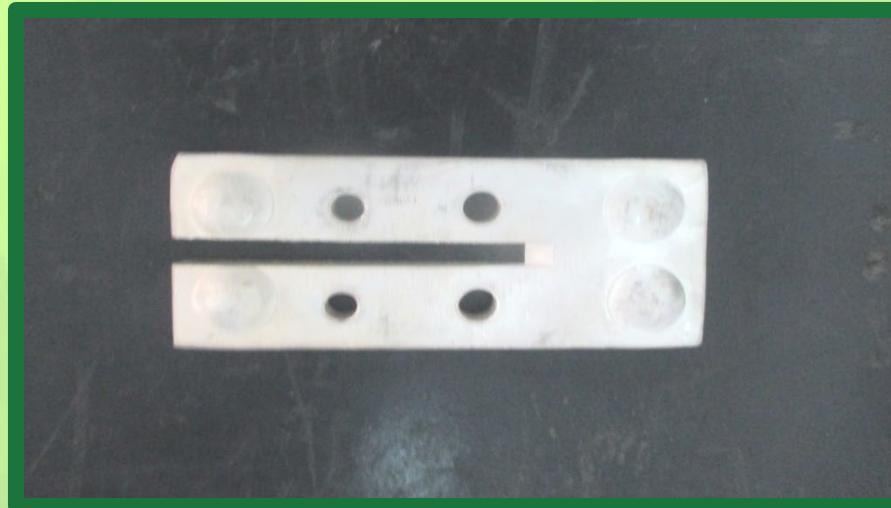


- Output Current is given through Bottom Terminal which is connected to the vacuum interrupter
- With respect to the quantity(amps) of current the dimensions of the copper terminal is decided.
- Bottom terminal is made of copper for it's high conductivity & resilience to higher temperatures, providing extra security during short circuit situations.

MATERIALS

PROPERTIES	COPPER	ALUMINIUM
HARDNESS	235-878 MPa	160-350 MPa
RESISTANCE	$1.68 \times 10^{-8} \Omega \cdot \text{m}$	$2.65 \times 10^{-8} \Omega \cdot \text{m}$
CORROSION	CORROSIVE (GALVANIC CORROSION)	LESS CORROSIVE
PROPERTY	DUCTILE	LESS DUCTILE
ELECTRICAL CONDUCTIVITY	$60.7 \times 10^6 \text{ S m}^{-1}$	$37.7 \times 10^6 \text{ S m}^{-1}$
MELTING POINT	1084.62 °C	660.3°C

ISOLATING CONTACT



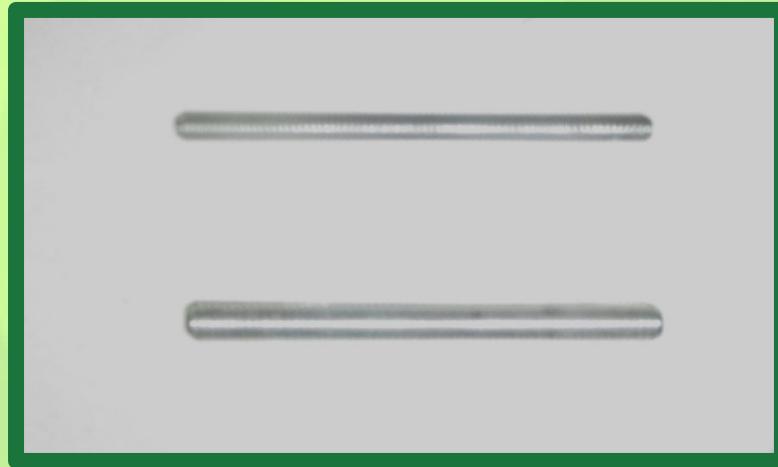
- Isolating contact/finger clipping Top & Bottom terminal is used to conduct input current to the terminal via isolating contact.
- It is made up copper coated with silver to improve thermal resistance and corrosion resistance
- The rectangular cut is given to easily bend without twisting while tilting the breaker.

PRESSURE PLATE(1mm,2mm)



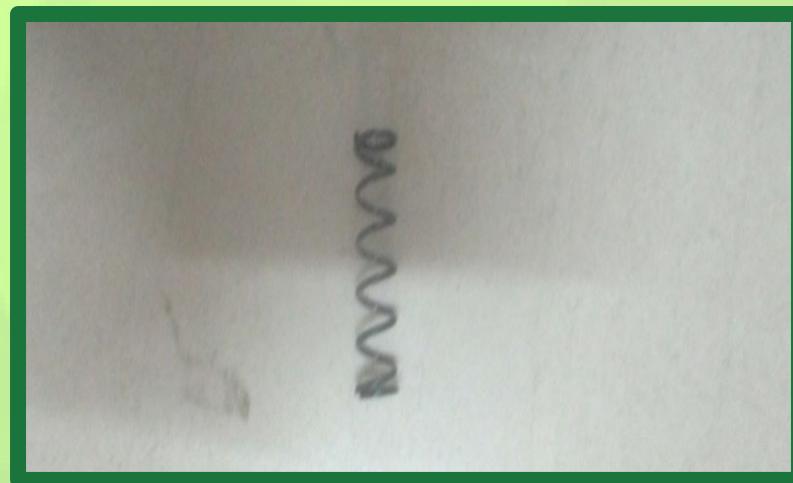
- Pressure plate is used above isolating contact to hold with the screw for clipping action.
- Spring steel is used because of high fatigue strength and formability.

STUD FOR ISOLATING CONTACT(M6,M8)



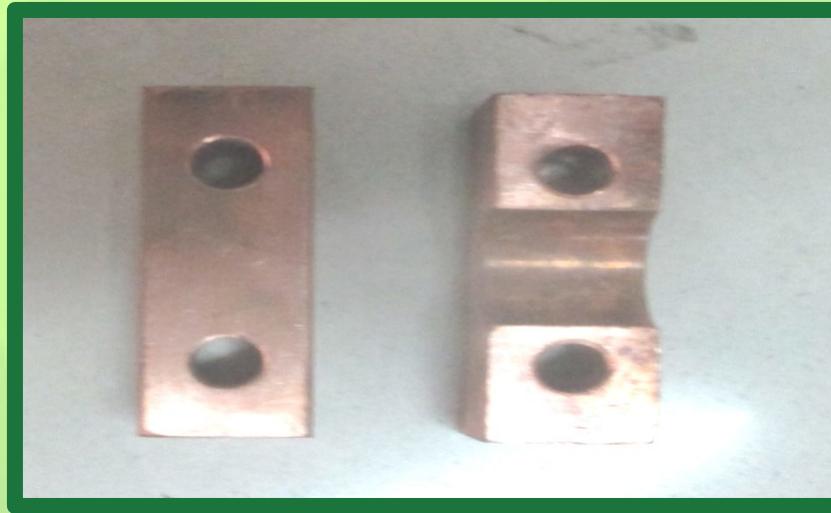
- Stud is used for combining isolating contact with terminal for locking purpose.
- It is made up of steel as well as mild steel for reducing weight and increased strength.

SELF ALIGN SPRING



- Self aligning spring is used in isolating contact for clipping purpose to retain its initial position.
- It is made of Mild steel having high modulus of elasticity and tensile strength

MOVING CONTACT BLOCK(800&1250A)



- Moving contact block is used in bottom of vacuum interrupter for conducting current through copper flexible to Bottom terminal.
- Ely. Copper is used for higher electricity conductivity.

COPPER FLEXIBLE (1250A & 800A)



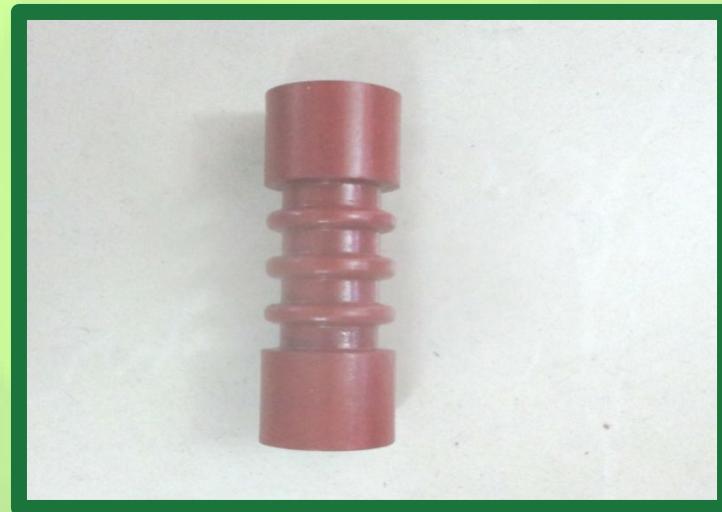
- Copper flexible is used to conduct electricity from Moving Contact Block to the Bottom terminal.
- It is made of number of strips together to made flexible for required movement.

DRIVE ROD FOR POLE



- Drive rod is used to drive the bottom interrupter for opening and closing by the action of spring charging mechanism.
- It is made up of Mild steel because it has great strength to withstand sudden impact load.

INSULATOR FOR DRIVE ROD



- Drive rod is inserted in the insulator for insulation from the Bottom terminal.
- It is made up of epoxy because of high heat resisting and electrical insulating properties.

OUTER CLOSING SPRING



- Outer closing spring is the main spring which is used to store charge for closing purpose.
- It is an open coil spring which is compressed for storing the charge.
- It is made of spring steel which is processed via heat or mechanical treatment to have a high yield stress. This allows it to undergo deflection without permanent deformation.

LOCATING WASHER FOR CLOSING SPRING & CONTACT SPRING



FOR CLOSING SPRING



FOR HOLD OPEN SPRING



FOR CLOSING SPRING

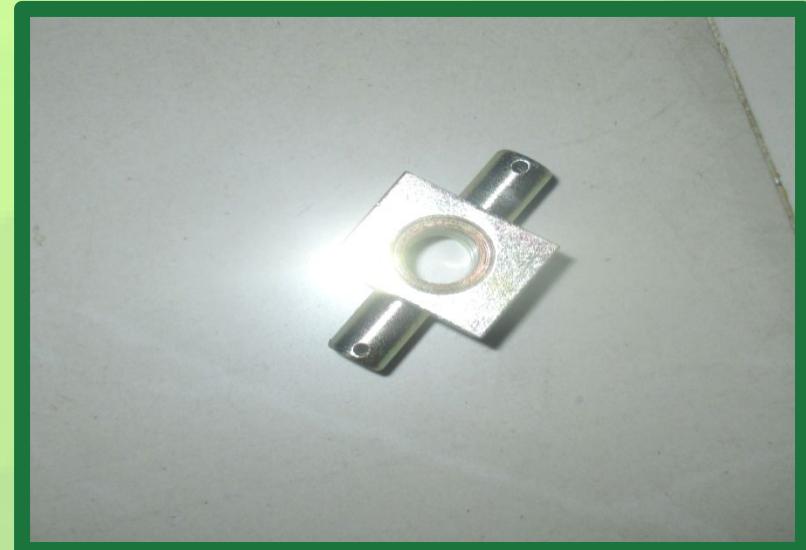
- Locating washer is used in closing spring assembly to hold the spring and the main rod, as swivel block and rod end bearing & to hold the swivel block.
- It is made up of Mild steel because it has great strength to withstand sudden impact load.

WA OF GUIDE ROD



- Guide rod is used to compress the spring as well as for guiding the closing spring.
- It is made up of Mild steel because it has great strength to withstand sudden impact load.

WA OF SWIVEL BLOCK FOR CLOSING SPRING & BELL CRANK



- Closing spring Swivel bock is used in upper part of closing spring assembly to swivel the guide rod along with it.
- Bell Swivel block swivels with the hold open spring assembly to give appropriate movement to the bell crank.
- It is made up of Mild steel because it has great strength to withstand sudden impact load.

SS PIN FOR ROD END BEARING & BELL CRANK



SS PIN FOR ROD END BEARING



SS PIN FOR BELL CRANK

- REB Pin is used to connect rod end bearing with bell crank.
- BC Pin is used to connect bell crank with the attachment for holding.
- It made up of Stainless Steel (SS) which has high ductility hence wear is reduced.

STUD FOR CONTACT SPRING



- Stud is used to guide the spring and also to transfer the spring force to the bell crank.
- It is made up of steel as well as mild steel for reducing weight and increased strength.

CONTACT SPRING & HOLD OPEN SPRING (INNER & OUTER)



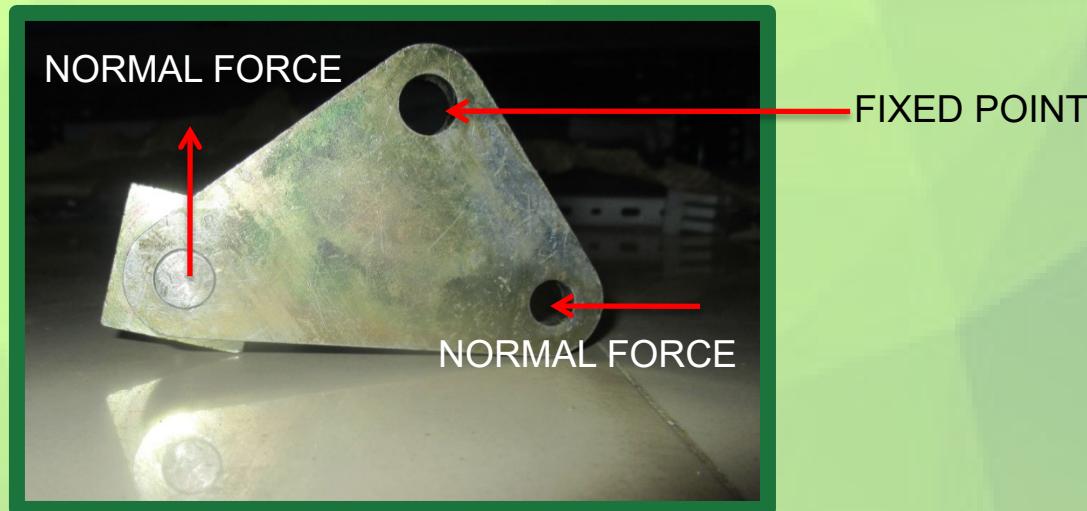
- Inner & Outer contact spring is the spring which is used to store charge. Open spring is the spring which is used to store charge for opening purpose.
- It is an open coil spring which is compressed for storing the charge.
- It is made of spring steel which is processed via heat and mechanical treatment to have a high yield stress. This allows it to undergo deflection without permanent deformation.

SPACER FOR BEL CRANK



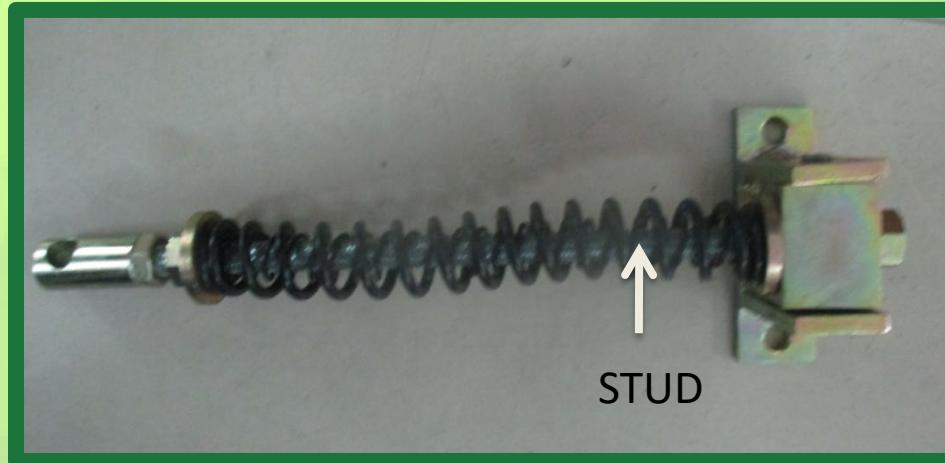
- Spacer is used to provide space in between the welding assembly of closing spring guide rod and the mechanism.
- In the absence of spacer it may lead to dislocate the guide rod of closing spring.

BEL CRANK



- A bell crank is a type of crank that changes motion through an angle. It has a lever with two arms which have a common fulcrum(fixed point) at their junction.
- It is used to drive the vacuum interrupter by the movement of opening spring assembly from 0° to 90° .

SWIVEL BLOCK ASSEMBLY FOR HOLD OPEN SPRING & STUD FOR OPEN SPRING



- Swivel block swivels with the hold open spring assembly to give appropriate movement. Without this may lead to dislocate of the stud.
- Stud is used to guide the spring and also to transfer the spring force to the bell crank.
- It is made up of Mild steel because it has great strength to withstand sudden impact load.

ADOPTER BLOCK FOR SPRING GUIDE



- Adopter block is used in top of the contact spring assembly to force the stud for closing spring.
- It is made up of Mild steel because it has great strength to withstand sudden impact load.

PISTON RING



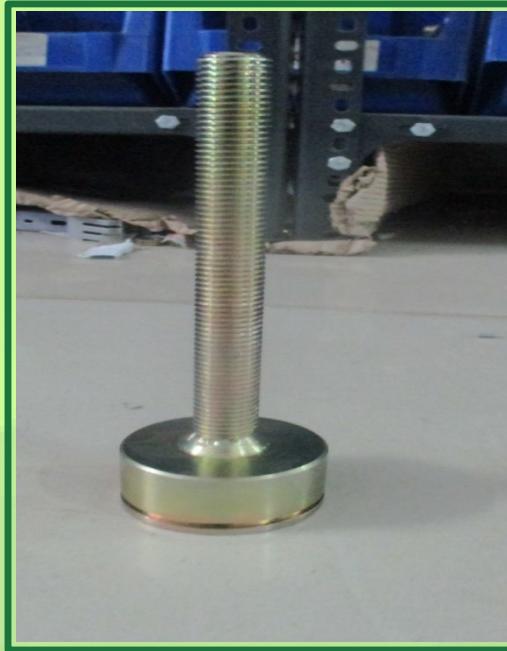
- Piston ring used in dashpot is used to block the leakage of air inside the cylinder.
- It is fitted in the piston groove to seal with the cylinder.
- Piston rings are subject to wear as they move up and down the cylinder bore due to load and due to the air load acting on the ring. To minimize this, they are made of wear-resistant materials, such as cast iron.

DASHPOT



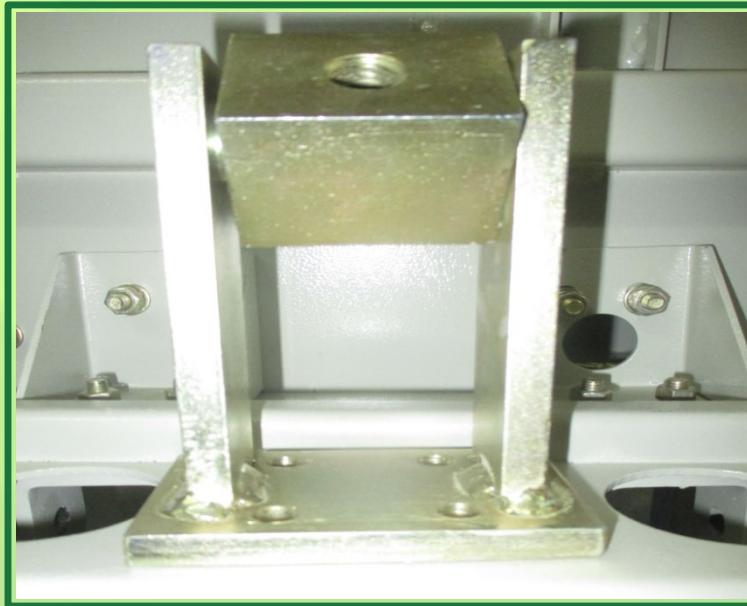
- Air Dashpots are used when there is the need to reduce or eliminate harmful or excessive motion by damping the vibrations and shocks.
- Aluminium made due to light weight and corrosion resistance.

WA OF PISTON FOR DASH POT



- Piston is used to compress the air inside the cylinder and also to resist the motion as well.
- It is made up of Mild steel because it has great strength and wear resistance.

WA SWIVEL BLOCK FOR DASHPOT



- Swivel block swivels with the piston to give appropriate movement to the dashpot.
- It is made up of Mild steel because it has great strength to withstand sudden impact load.

CHARGING HANDLE & DOOR HANDLE



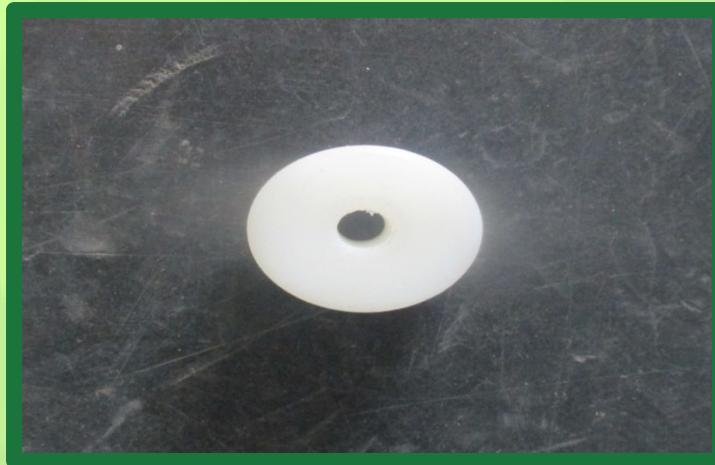
- Charging handle is used to crank the ratchet mechanism to charge the closing spring. It is the manual type of charging the closing spring.
- Door handle is used to open and close the door of the breaker.
- It is made up of Mild steel because it has great strength and hardness.

TRIPPING INTERLOCK ROD



- Tripping interlock is a safety tripping rod. When the breaker is brought to test or service position it must trip for safety concern.
- It is made up of Mild steel because it has great strength and hardness.

TRIPPING INTERLOCK, TRUCK & SHUTTER WHEEL



- Interlock tripping is achieved through this wheel. This wheel is provided to match the breaker movement.
- Truck wheel is provided to transport the breaker easily.
- Shutter wheel is provided for guiding the shutter square rod for opening and closing the SMC shutter.
- It is made by nylon for:
 - Low Wear and Extremely Abrasion Resistant.
 - Low Roll Resistance, Can Carry Heavy Loads.

SS PIN FOR TRIPPING INTERLOCK & TRUCK WHEEL



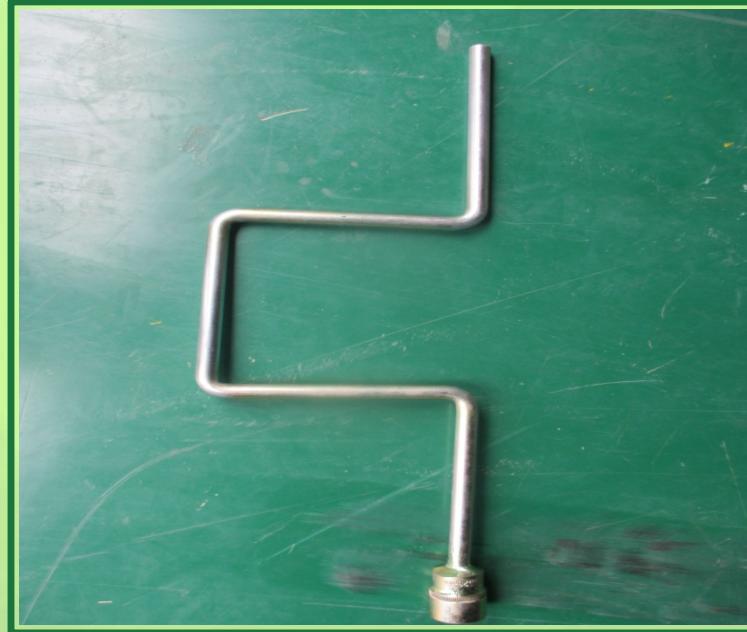
FOR TRIPPING INTERLOCK



FOR TRUCK WHEEL

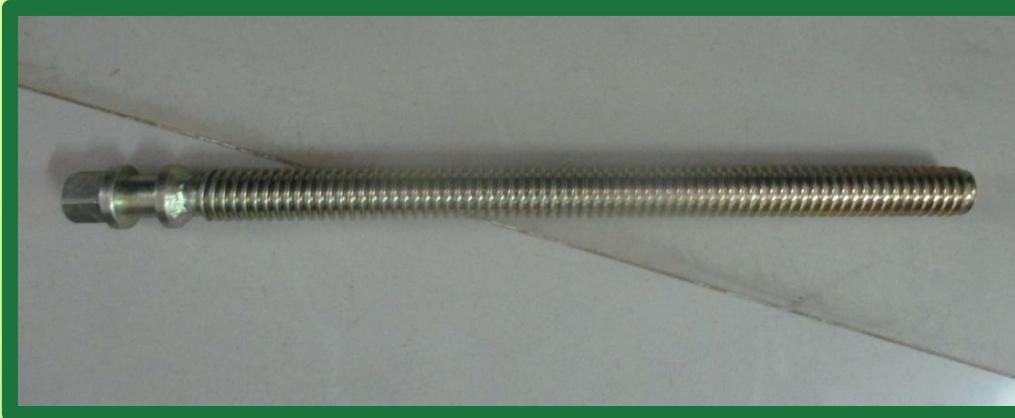
- This Pin is used to connect tripping interlock rod with nylon wheel.
- This Pin is used to connect truck wheel with shutter rod.
- It made up of Stainless Steel (SS) which has high ductility hence wear is reduced.

WA OF RACK IN/OUT HANDLE



- Rack in/out handle is used to drive the screw rod to rack the whole breaker into the compartment.
- This handle is bended in the middle to increase the screwing torque for easy work.

SCREW ROD



- Screw rod is used to drive the whole breaker to rack into the breaker compartment.
- This screw has thread for movement of the breaker with the nut block.

NUT BLOCK & HINGE BLOCK FOR SCREW ROD



NUT BLOCK



HINGE BLOCK

- Nut block is fixed attachment wherein screw rod drives in to rack the breaker.
- Hinge block is used to support the screw rod and to provide the guide way to the screw rod.
- It is made up of Mild steel because it has great strength to withstand sudden impact load.

SMC SHUTTER



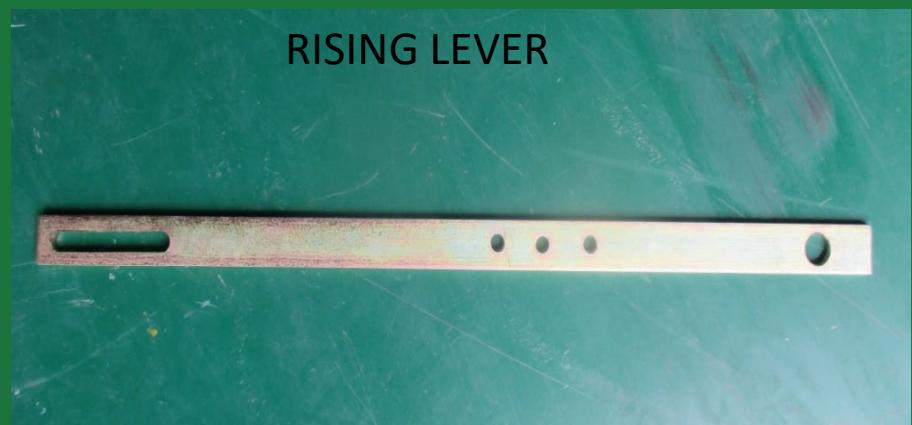
- Sheet Moulding Compound Shutter is provided to open and close the incoming and outgoing side from the panel while rack in/out the breaker.
- It is made of Fibre glass Reinforced Plastic for weightless insulation properties.

SHUTTER SQUARE ROD & RISING LEVER

SHUTTER SQUARE ROD



RISING LEVER



- Shutter square rod is used in the operation of opening and closing of shutter while racking in & out of the breaker.
- The rising lever is used to lift the shutter up and down automatically .

CLOSING COIL & TRIP COIL

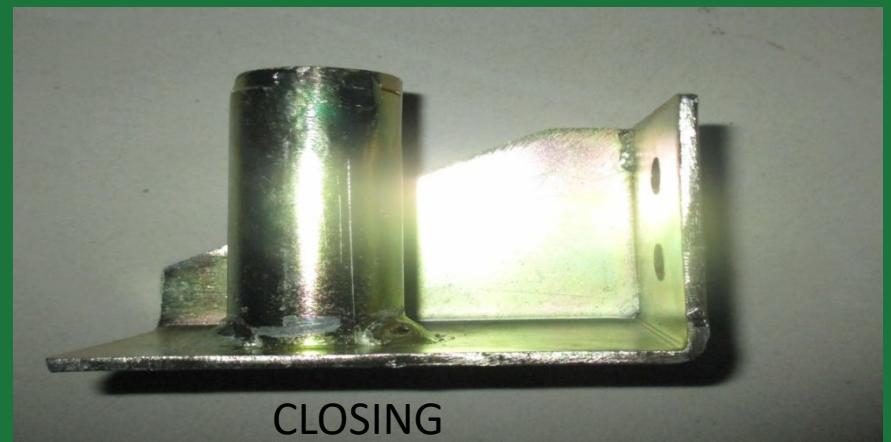


- Trip coil is a solenoid coil which is connected to a sensitive circuit that designed to disconnect power line.
- Closing circuit coil is one that connected to a circuit that ensures the power conditions are normal this coil acts to establish broken circuit.

PLUNGER & CLOSING FOR L BRACKET



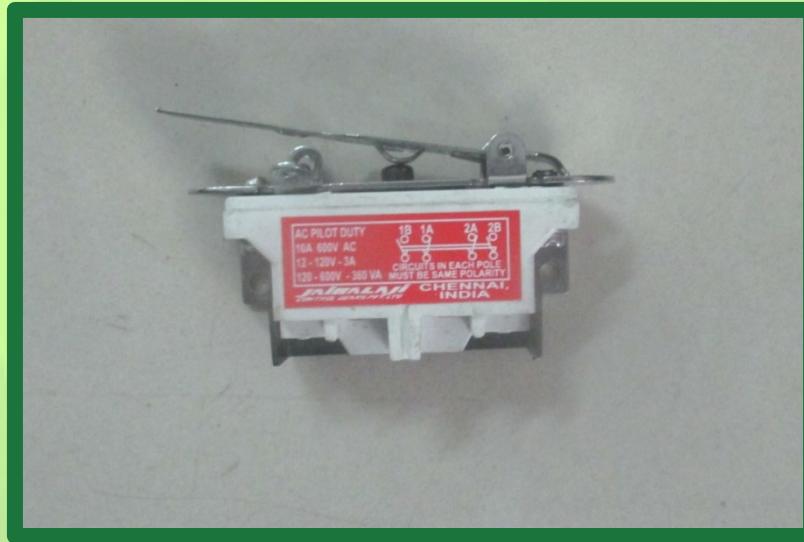
PLUNGER



CLOSING

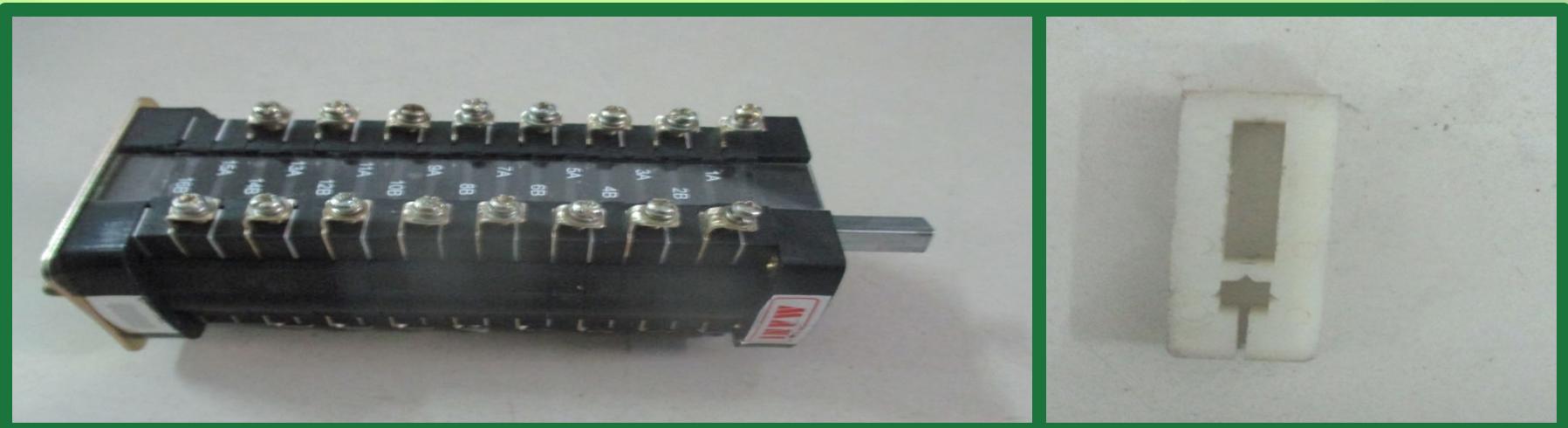
- Push button provided as a L bracket has a plunger to push the closing and opening coil with aligning spring to bring back to the original position.
- Closing for L bracket assembles with the plunger and align spring to provide necessary push button for opening and closing coils.

LIMIT SWITCH FOR SPRING CHARGE MOTOR



- A limit switch is an electro-mechanical device that consists of an actuator mechanically linked to a set of contacts. When an object comes into contact with the actuator, the device operates the contacts to make or break an electrical connection.
- It is used for spring charge motor by setting a limit to charge the spring.

AUXILIARY SWITCH & AUX.SWITCH LEVER



- An auxiliary switch is a single-pole, double-throw switch operated by the movable contact arm assembly. It is used to remotely indicate the position of the main circuit breaker contacts, whether open or closed. Auxiliary switches can be used to operate indicator lights, relays or other accessories.
- Auxiliary switch lever is used to lock the auxiliary switch with the socket.
- It is made of nylon for high abrasion resistance.

SPRING CHARGE MOTOR



- A spring charge motor is used to crank the ratchet mechanism to charge the closing spring. It is the automatic type of charging the closing spring.

WIRE



- A wire is a single, usually cylindrical, flexible strand or rod of metal.
- Wires are used to bear electricity. Wire is commonly formed by drawing the metal through a hole in a die or draw plate.
- It is usually covered with insulator such as plastic.

LUGS



- Electrical lugs are used when permanent connection is not possible between devices or cables.
- Use of cable lugs allows in easy installation, repair and maintenance of electrical devices or cables.

BOLT NUT WITH WASHERS -1



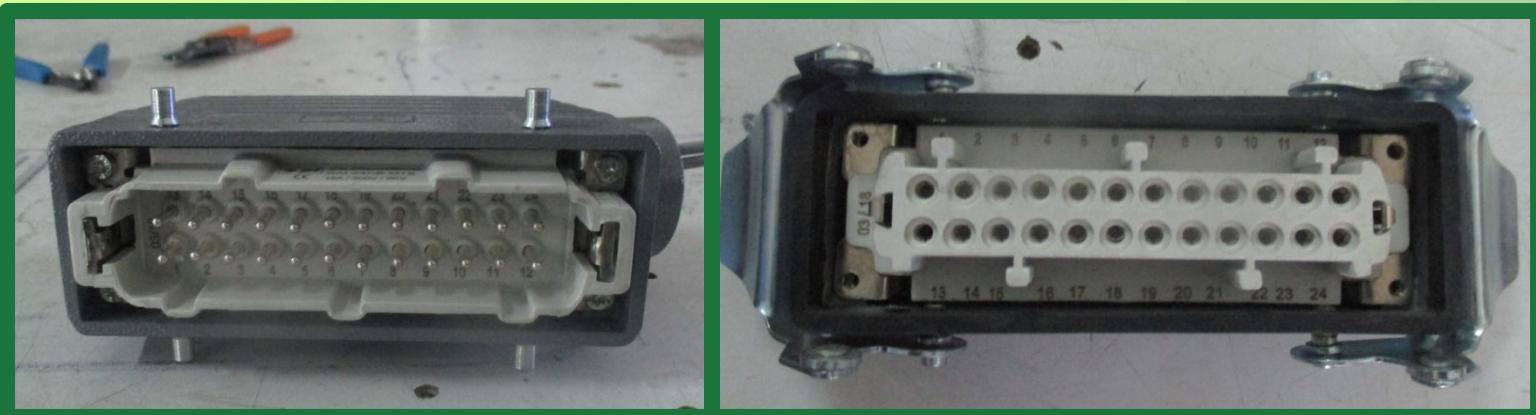
- Bolt is a mechanical fastener that is usually used with a nut for connecting two or more parts. A bolted joint can be readily disassembled and reassembled.
- Washer is used to distribute the load on the bolt evenly to the surfaces.

BOLT NUTS WITH WASHERS -2



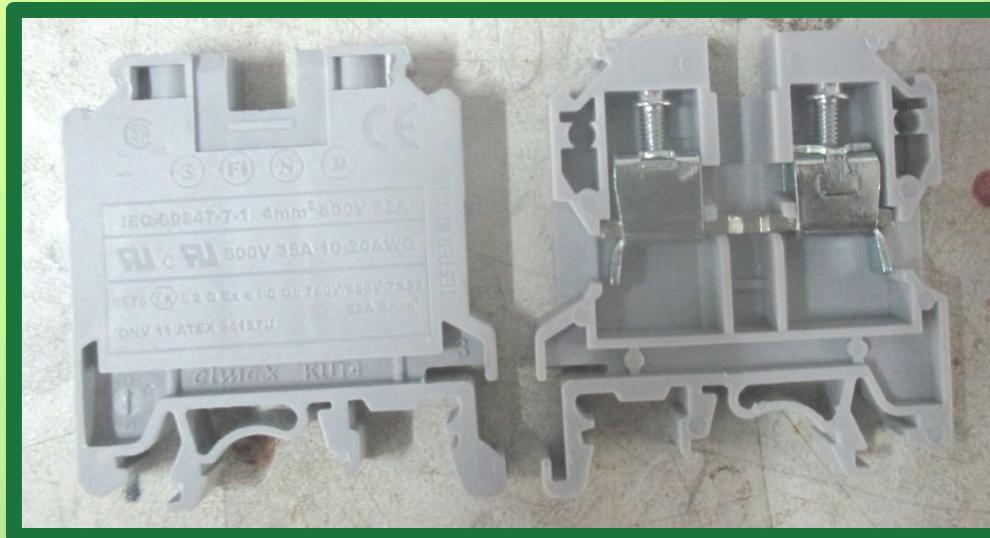
- Bolt has outer thread and nut has inner threads to make a screw function and thereby locking it. Washer is also used to neglect the slipping of the bolt while tightening or loosening the nut.

PLUG & SOCKET



- Plug from the switchgear panel is connected to the breaker via socket for sending and receiving the signals.

TERMINAL BLOCK



- Terminal block is used to loop the wire and to eliminate the wire joint.
- Multiple terminal blocks mounted on the rail to provide hassle free wire connections.

TRUFF WITH RAIL



- Truff is used to make the wire in a group manner for hassle free wire connections.
- Rail is used to mount the terminal blocks and various equipments.

GROUP MARKER



- Group markers are used to identify an assembly of adjacent terminals that are associated with a specific function, control circuit, or part of a machine.

END PLATE & END CLAMP



END PLATE



END CLAMP

- These end plates are used to cover the end clamp mounted on rail.
- End clamps also known as End Stoppers are used to hold a stack of terminal blocks on the mounting rail.

COUNTER



- Counter is used to count the number of tripping operation done.
- It is made up of Fibre reinforced plastic composite material for precision counting.

NYLON LOCK NUTS -1 & 2



- Nylon lock nut is a kind of locknut with a nylon collar insert that resists turning.

WASHERS -1 & 2



- Washer is used to distribute the load on the bolt evenly to the surfaces.
- Washer is also used to neglect the slipping of the bolt while tightening or loosening the nut.

Types of Washers:

1. Plain Washer
2. Spring Washer
3. Fender Washer
4. Penny Washer
5. Spherical Washer
6. Torque Washer
7. Wave Washer
8. Belleville Washer
9. Curved disc Washer
10. Split Washer

PLAIN WASHER	SPRING WASHER
<ul style="list-style-type: none">•Plain washer spreads a load and prevent damage to the surface.•Plain washers can also be used when the hole is bigger than the nut.	<ul style="list-style-type: none">•Spring washer have axial flexibility and are used to prevent fastening loosening due to vibrations<ul style="list-style-type: none">• They are typically used in machines and equipment that create strong vibrations.

HEX NUTS & HALF NUTS



- Hex nut is nothing but a normal nut but with six faces. hexagonal fastener with internal threads that screws on to the shank of a bolt or a hex cap screw.
- A screw nut split lengthwise so that either one part may be arranged to ride on a screw or the two parts may be arranged to clamp about a screw.

BRASS WASHERS -1 & 2



- Washers made from brass are often used for applications where low friction is required.

HELICOIL



- A Helicoil is a coiled-wire type of thread repair insert used to create internal screw threads to accommodate standard-sized fasteners.

ALLEN BOLT & HEX BOLT -1

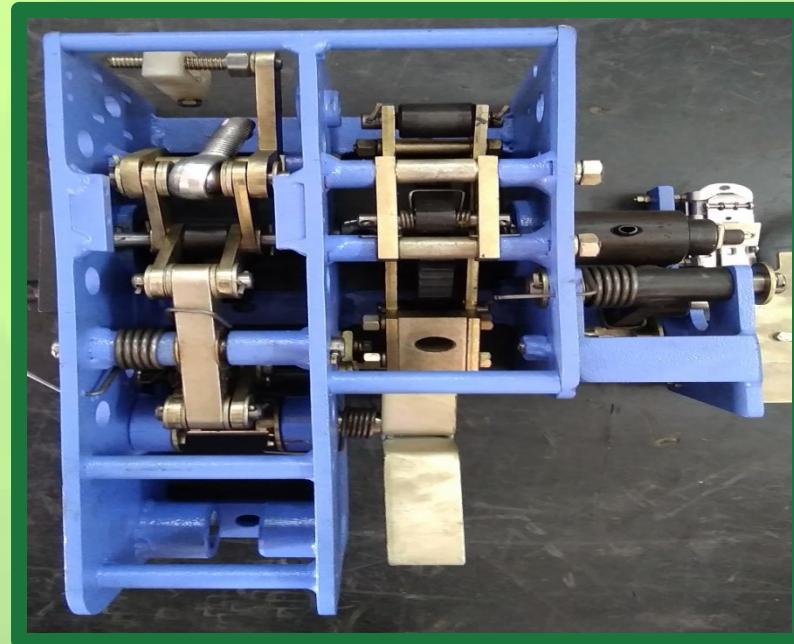


- Allen bolt is a bolt with a hexagonal socket in its head that is designed to be used with an Allen wrench.
- Hex bolts with forged heads are also commonly used as headed anchor bolts.

SIZE(MX)	GRADE
4MM	4.4 GRADE M.S PLATED
5MM	AS ABOVE
6MM	AS ABOVE
8 & ABOVE	HT 8.8 GRADE M.S PLATED

- The first digit relates to the ultimate strength of the material, while the second is the ratio of yield stress to ultimate strength.
- Thus grade 4.4 bolts have an ultimate material strength of 400N/mm^2 and the yield stress is 40% of the ultimate strength.
- It has Zinc yellow coating to resist corrosion.

MECHANISM



- It is the spring charge mechanism for vacuum circuit breaker. It has a mechanism to charge the coil and to trip the breaker.

AI. PUSH BUTTON & MS PUSH BUTON WITH M.S HOLLOW BUSH



AL. PUSH BUTTON



M.S PUSH BUTTON

- Aluminium push buttons are used in the breaker outdoor panel which is connected with trip and closing coil for easy operation.
- M.S push button assembly allows you to trip and close the coil easily with this push button. It has a self align spring to bring back the initial position.