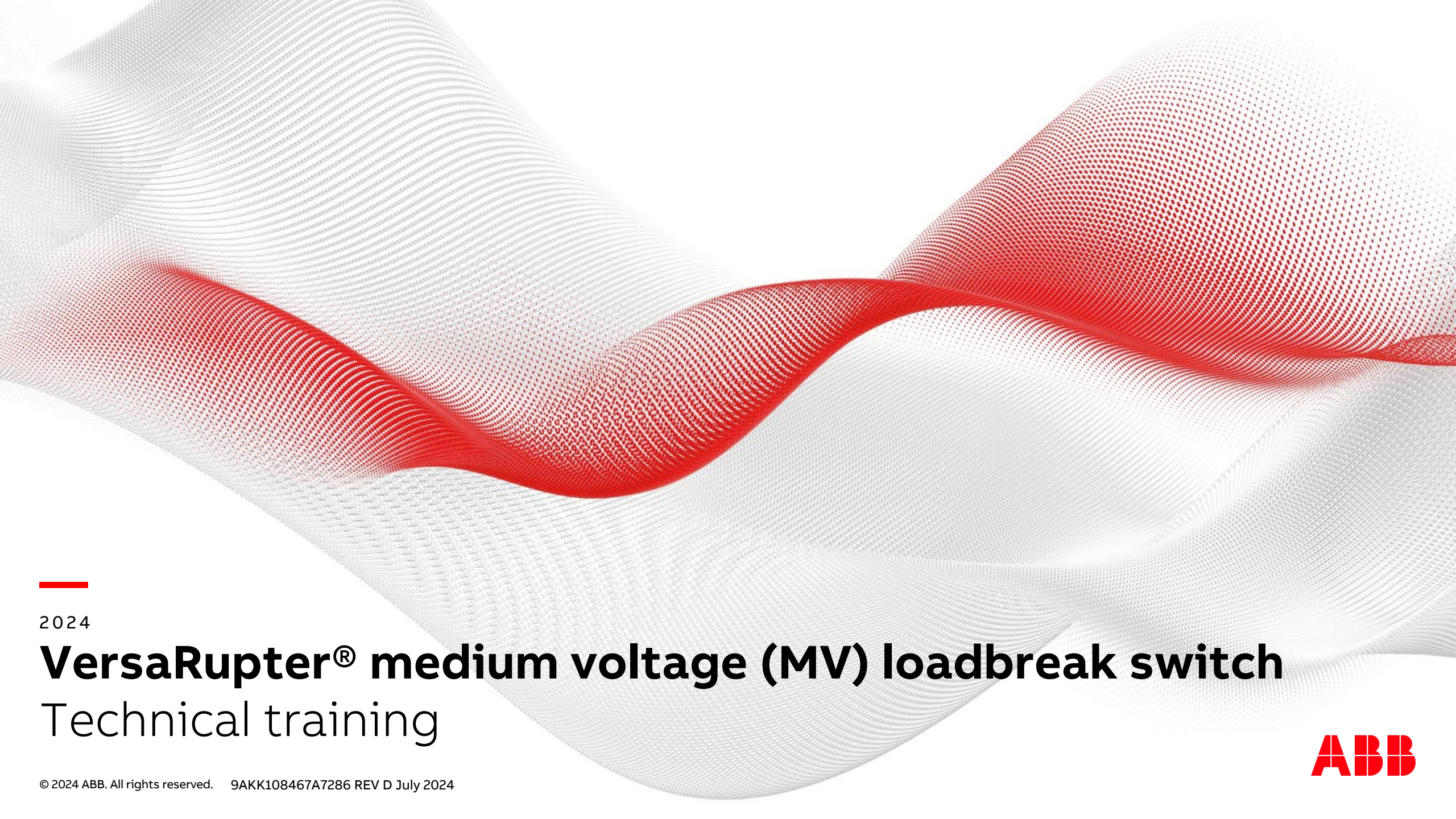




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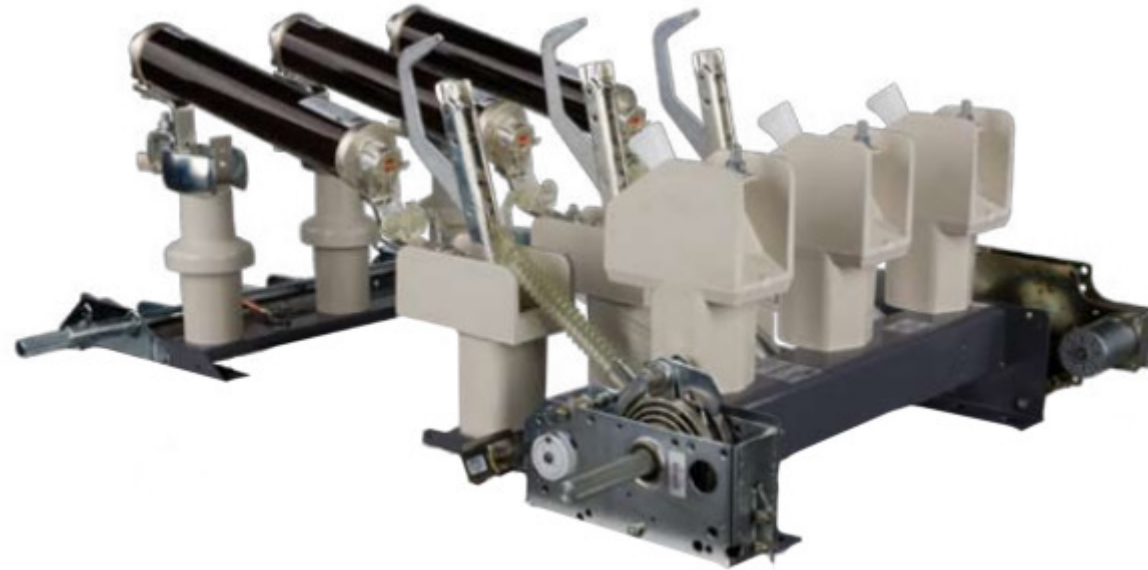
VersaRupter® medium voltage (MV) loadbreak switch

Technical training

Agenda

Topics covered

- Applications
- Ratings
- Standards
- Function
- Accessories
- Maintenance

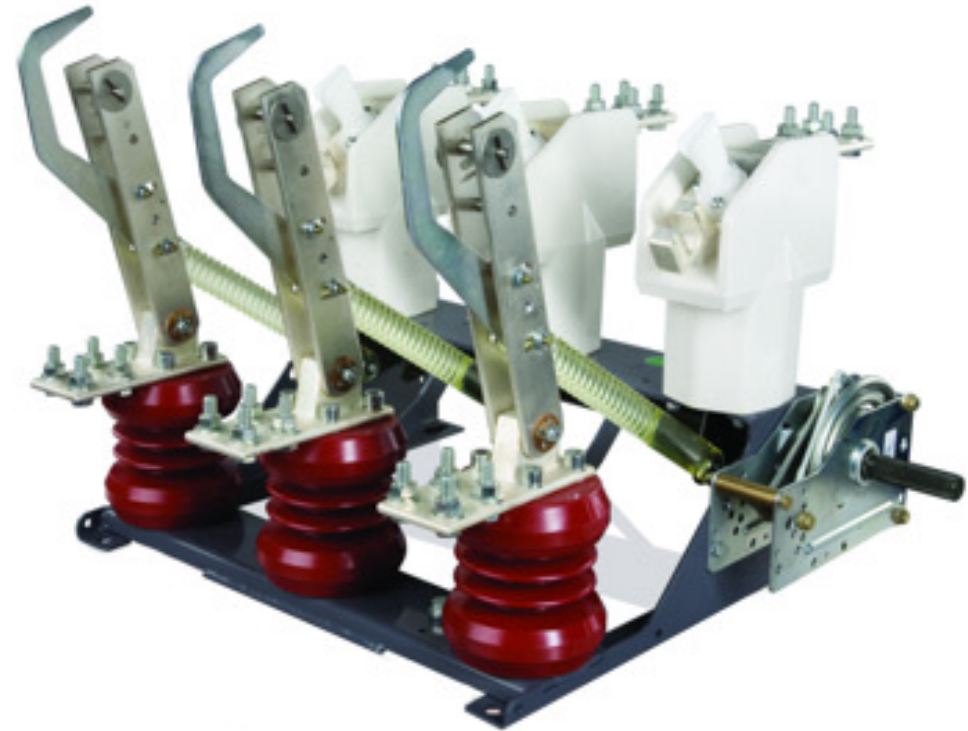


Overview

Loadbreak switches

What is a load break switch?

- Load break switches are designed to open and close circuits under normal current conditions
- Cannot interrupt under fault conditions
- Able to close into a fault up to its fault-close current rating

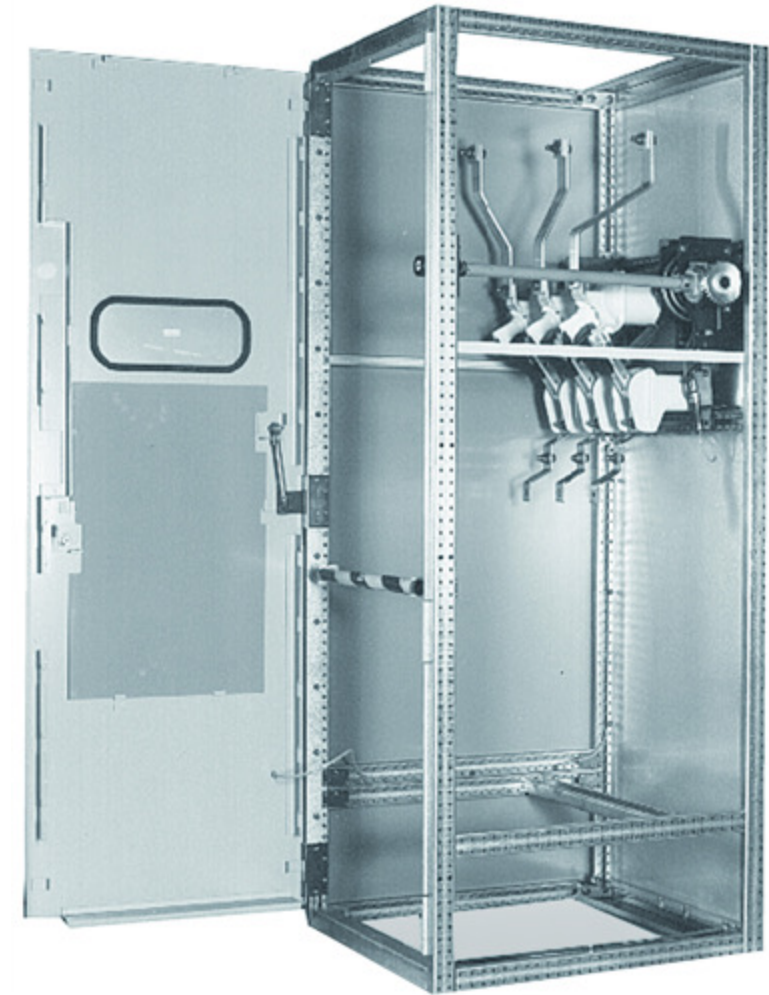


Overview

Applications

What are the applications?

- Line switch disconnect in MV networks:
 - Interrupt load, sectionalize, isolate downstream equipment
- Industrial and commercial settings
- Switching and protection when paired with fuses for:
 - Distribution transformers
 - Motors
- Use when frequent switching and protective relaying is NOT required
- VersaRupter switch capable of:
 - 1000 mechanical no load operations
 - 100 electrical operations at full rated current
 - May require overhaul of switch components after reaching rated number of operations



Overview

Applications cont.

More applications

- VersaRupter switch is an indoor load break switch
- “Indoor” defined in ANSI C37.20.4:

The term “indoor” is intended to indicate that the enclosure provides a degree of protection to the switch and the enclosure may be suitable for indoor, outdoor, or other service conditions. It also complies with the requirements of switchgear assemblies as defined by IEEE Std C37.20.2 or IEEE Std C37.20.3.

- Must protect from water and sunlight (UV)
- Harsh environments may require more frequent inspections/maintenance
- Usual service conditions:
 - Ambient air temp. within -30 and 40 °C
 - Altitude not to exceed 1000m
 - Insignificant solar radiation

Overview

Applications



Overview

Ratings

VersaRupter switch technical details										
Rated voltage (kV)	Rated max voltage (kV)	Rated current (A)	BIL (kV)	60 Hz withstand 1 minute (kV)	Pole spacing (in/mm)	Momentary asymmetrical (kA)	Fault-making asymmetrical (kA)	Peak withstand (peak kA)	Fault-making (peak kA)	Short time current symmetrical (kA/sec)
4.73	4.76	200	60	19	5.91/150	40	40	65	65	25/2
		600								
		1200								
12-13.8	15	200	95	36	6.69/170	40	40	65	65	25/2
		600								
		1200								
13.8	15	600	95	36	9.25/235	61	61	n/a	n/a	50/2
		1200								
		200								
12-16.5	17	600	110	50	9.25/235	40	40	65	65	25/2
		1200								
		200								
23.9-24.9	27	600	125	60	10.8/275	32	32	65	52	25/2
		1200								
		200								
34.5	38	800	150	80	14.4/360	25	25	65	42	25/2
		1000								
		200								



Overview

Standards and certifications

VersaRupter switch standards and certification

ANSI C37.20.4

- Standard for Indoor AC Switches (1-38 kV) for use in Metal-Enclosed Switchgear
 - Required ratings (max voltage, cont. current, etc.)
 - Tests (design, production)
 - Construction
 - Application

CSA C22.2 No. 193-M1983 High Voltage Full-Load Interrupter Switches

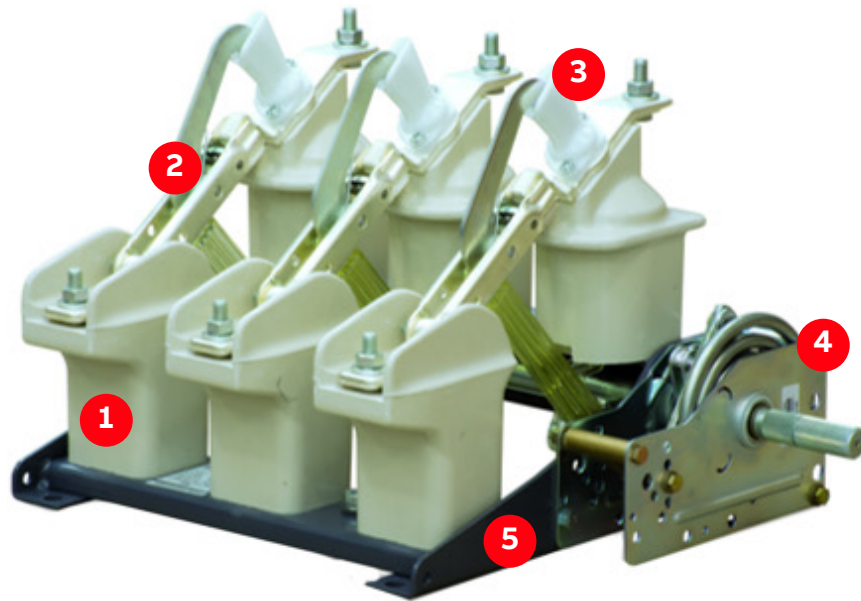
- K-mech and A-mech
 - 15 kV : 600/1200 A : 61 kA
 - 4.76/15/17 kV : 200/600/1200 A : 40kA

UL

- K-mech and A-mech
 - 15 kV : 600/1200 A : 61 kA
 - 4.76/15/17 kV : 200/600/1200 A : 40kA

Overview

VersaRupter switch modular design

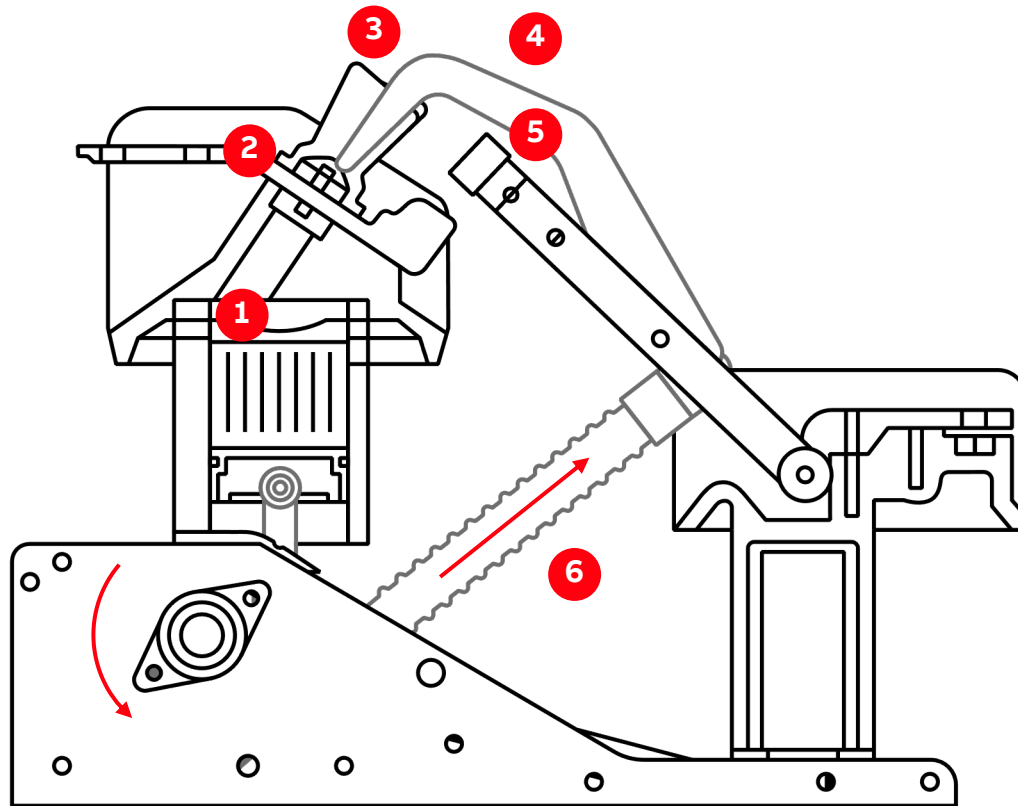


Various accessories

1. Stand-off insulators
2. Current carrying components
3. Puffer type arc extinguishing system
4. Operating mechanism
5. Heavy duty steel frame

Overview

Function – interruption when switch begins to open

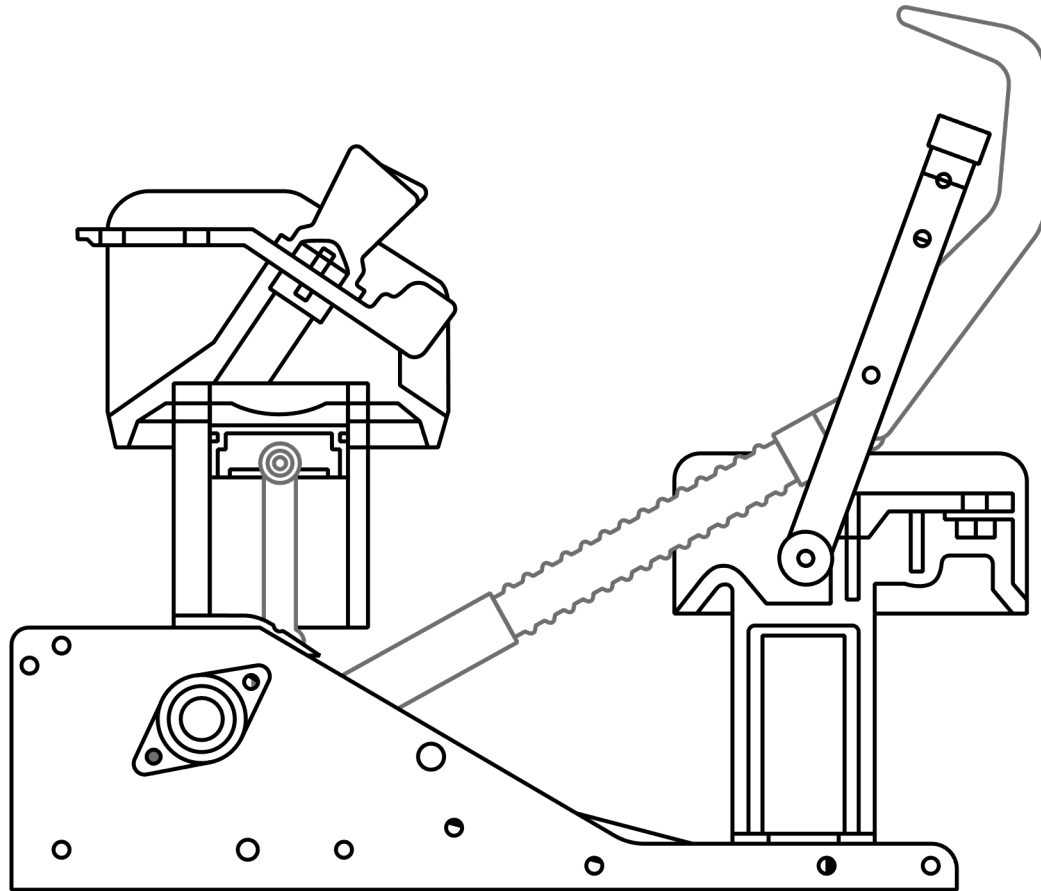


Various accessories

1. Air blast
2. Main stationary contact
3. Gas blast
4. Arcing blade
5. Main movable contact
6. Operating rod

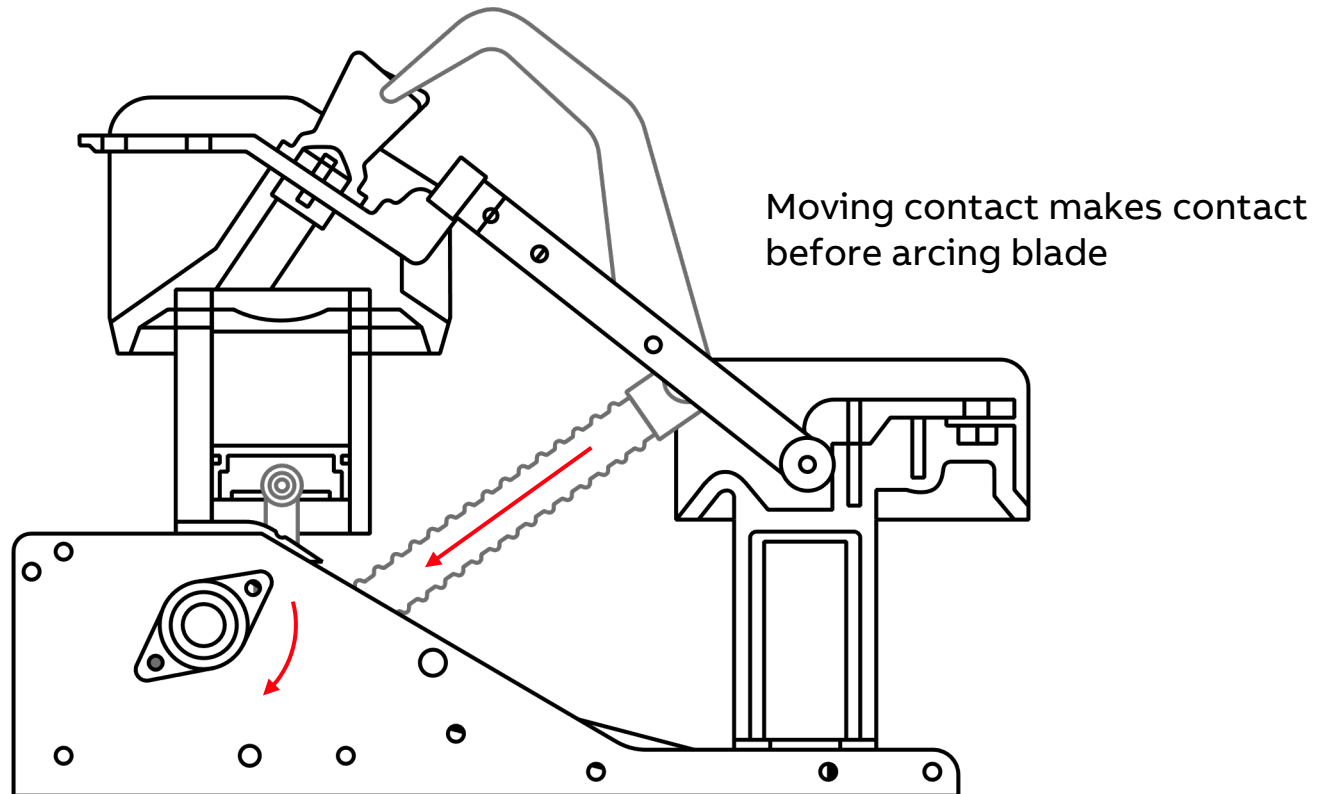
Overview

Function – switch in open position



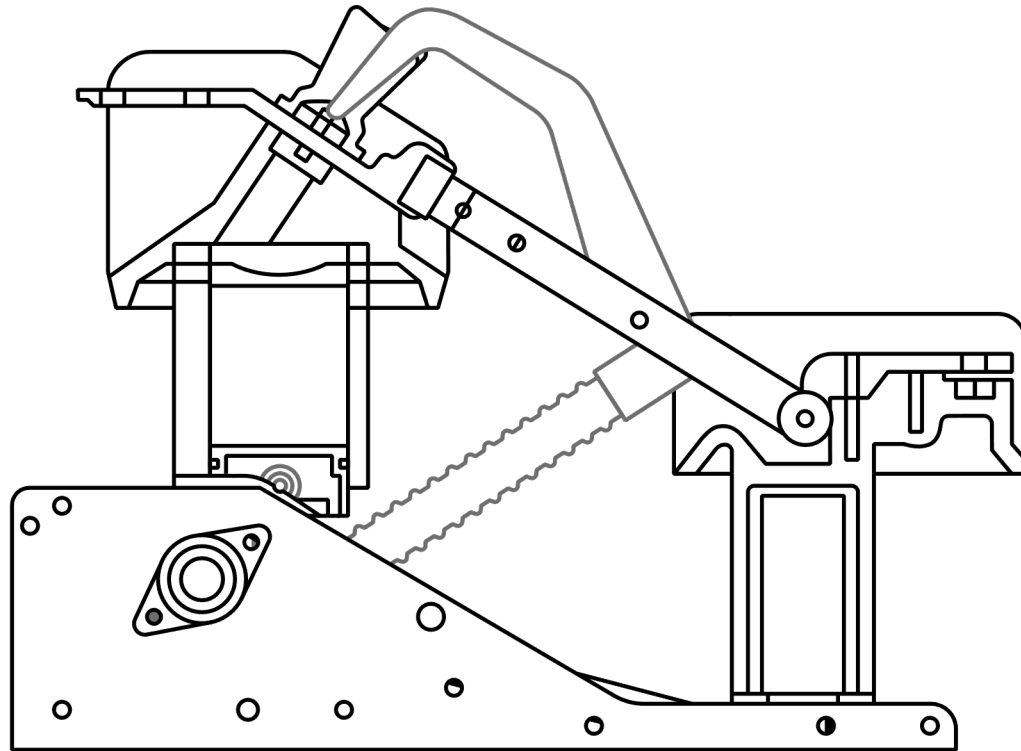
Overview

Function – switch closing



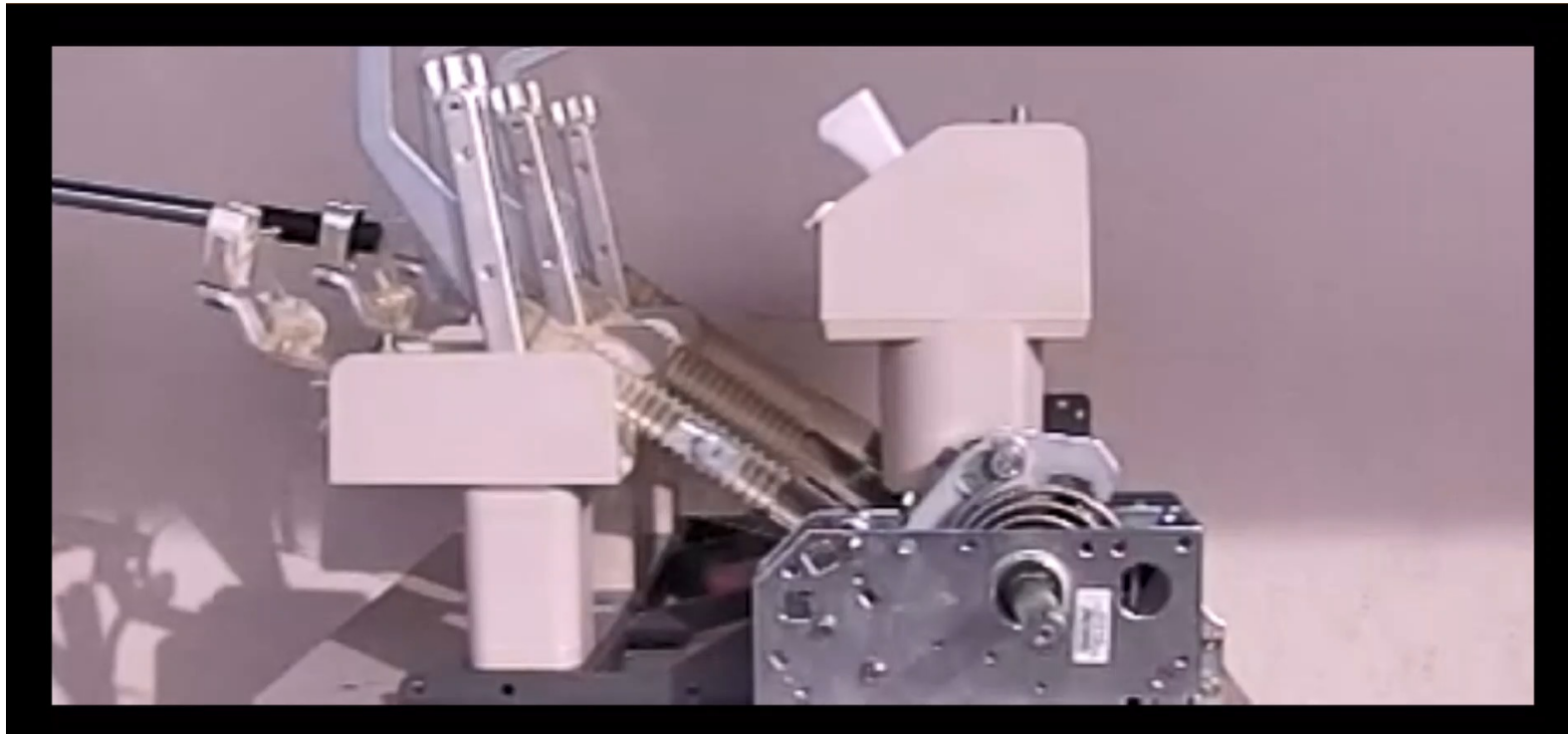
Overview

Function – switch in closed position



Overview

VersaRupter switch opening



Overview

Function – operating mechanisms

K-mechanism

- Single spring snap action device
- Operates when shaft is rotated past dead center
- Clockwise to open, counterclockwise to close
- Compatible with all operating handles
- Can be operated remotely by motor



A-mechanism

- Dual spring stored energy device
- Clockwise to charge spring, counterclockwise to close
- Minimal rotation clockwise to open switch
- Pair with HE or HM handles only
- Can be operated remotely by motor
- Required for shunt and fuse tripping



Overview

Function – arc extinguishing puffer system

Arc extinguishing puffer system

- Ablative arc chutes react to quench the arc
- A balanced combination of air and gas reliably extinguish the arc
- Extended operations at full rated current
 - 100 operation at full rated current vs. 10-20 when relying on ablative chutes only
- Less maintenance required due to reduced wear on arc chutes
- Eliminates the need for interphase barriers on most ratings



Overview

Function – arc blades

Arc blades

- Draws arc within arc chute after main contact separates
- Motion dependent on movement of main contact
- Main contact in open position = arc blade in open position
 - Safer visual inspection (visible disconnect)



Overview

Function – push/pull rods

Push/pull rods

- Excellent mechanical and electrical properties
- **Never** clean with alcohol
 - Brittle fracture
- May vary in color
 - Clear, yellow, black
 - No effect on mechanical properties



Accessories

Operating handles

Front chain drive

- Left or right side
- Kirk Key provisions
- Padlock provisions
- Door interlock optional
- K-mech only



Side direct drive

- Left or right side
- Kirk Key provisions
- Padlock provisions
- K-mech only



HE front direct drive

- Left or right side
- Padlock provisions
- Kirk Key provisions
- Door interlock optional
- K-mech or A-mech



HM front direct drive

- Left or right side
- Padlock provisions
- Kirk Key provisions
- Door interlock optional
- K-mech or A-mech



Chain drive without door interlock

Overview

- Use with K-mech
- Front mounted for attachment directly to K-mech on right side or left-hand shaft extension on left side of switch
 - Right side chain drives have a “spreader bar” that connects front door flange to switch shaft, maintaining tension on the drive chain
- Have provisions for two key interlocks and can handle three interlock schemes: lock open only, lock closed only, and lock open only/lock closed only



Spreader bar and chain



Kirk Key right



Kirk Key left

Chain drive with door interlock

Overview

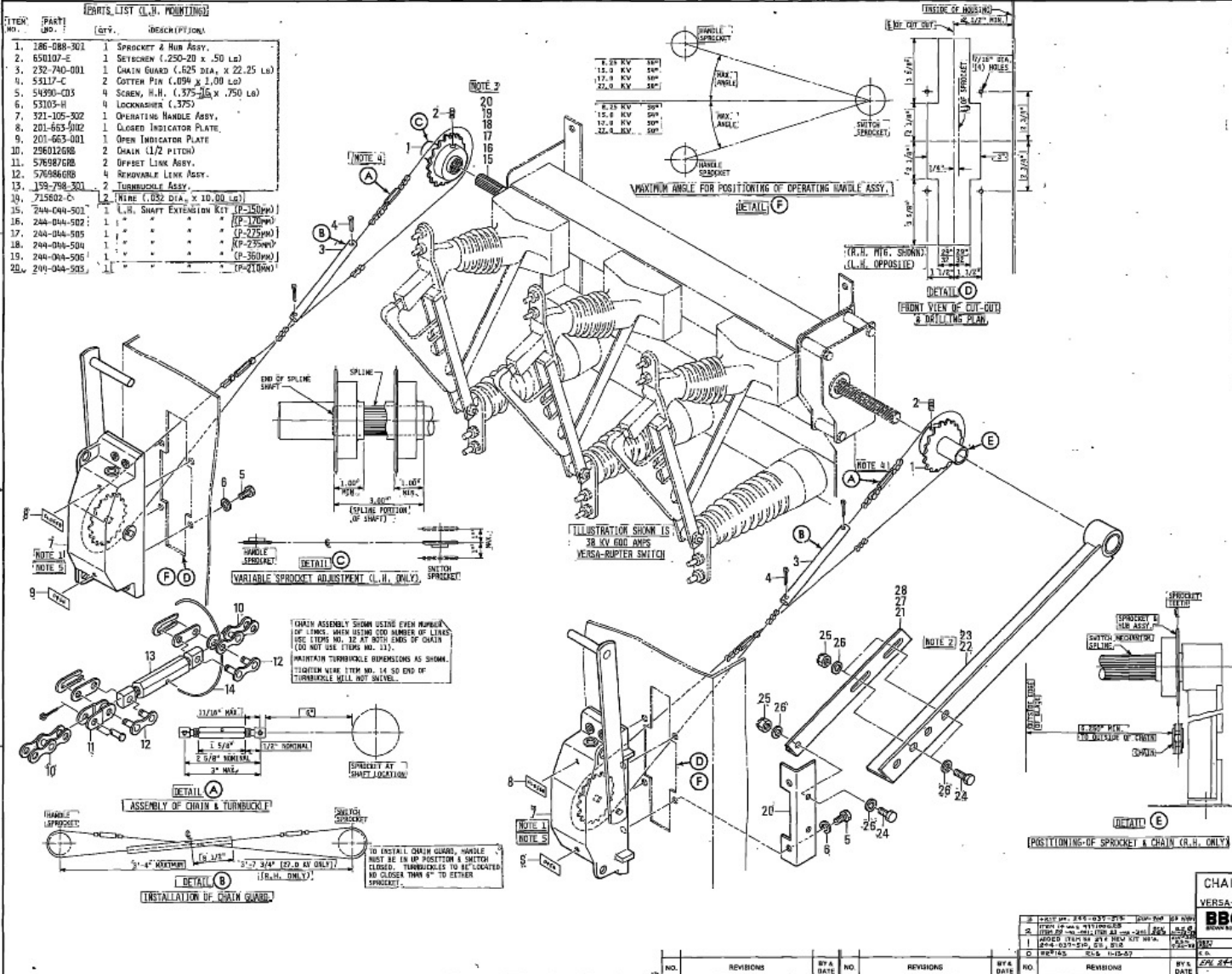
- Chain drive also available for both right and left side operation utilizing a mechanical door interlock
 - Also only use with K-mech
- The mechanical door interlock automatically latches the switchgear door when the VersaRupter switch is closed
- The mechanical door interlock is pre-installed on the chain drive handle assembly and includes the catch plate that fastens to the door to be automatically latched
- Two styles are offered: standard and offset
 - Standard doors close against the front of the switchgear frame and project forward from the switchgear frame a dimension equal to the door depth
 - Offset doors close into a recess in the switchgear frame so that the door is flush with the switchgear front when closed
- When pairing Kirk Keys with the mechanical door interlock, only one Kirk Key is accessible as the second Kirk Key disc is used with the door interlock latch



Mechanical door interlock assembly

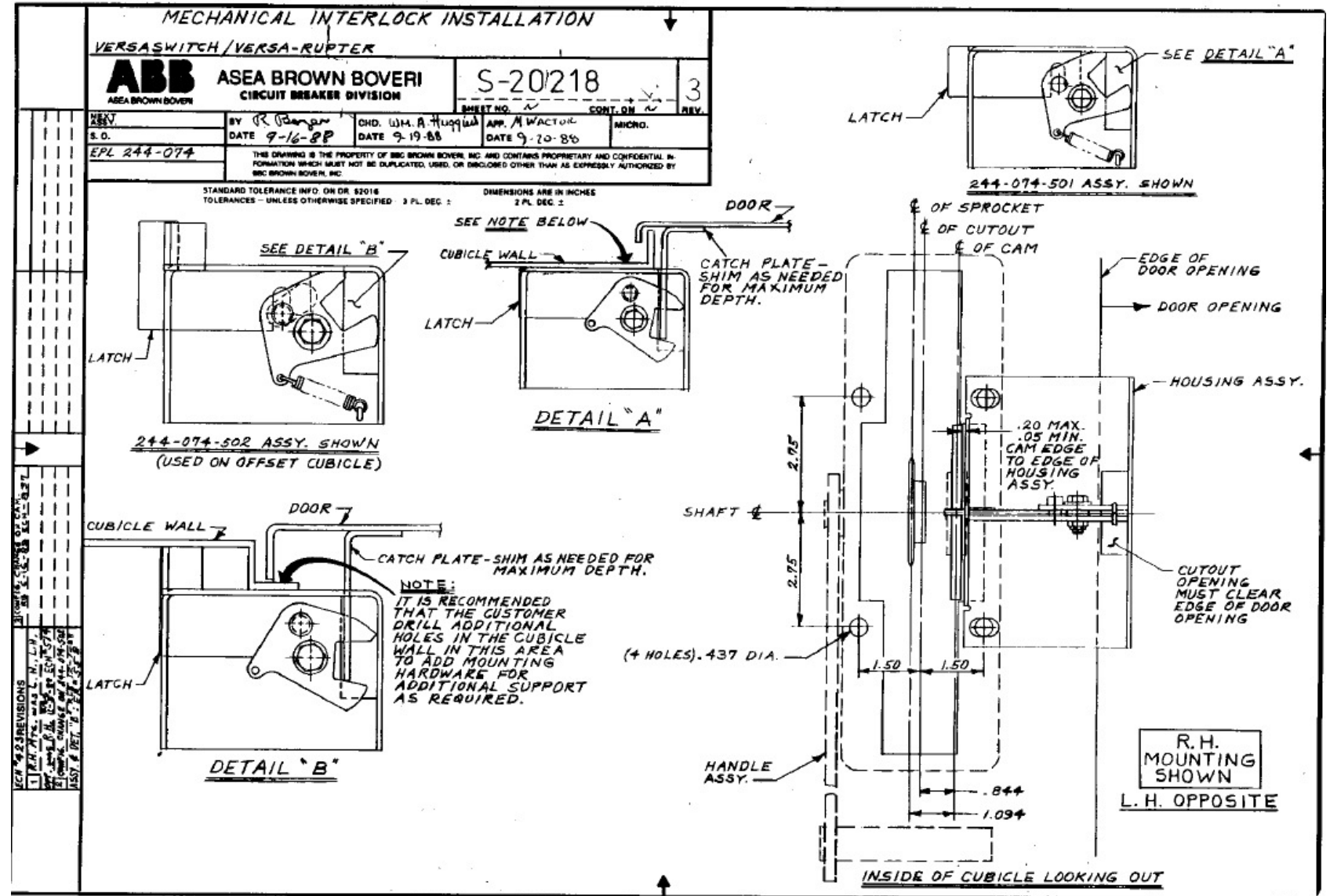


Chain drive handle installed on switchgear



Chain drive

Mechanical interlock drawing



Side direct drive handle

Overview

- Manual operator handle for shaft mounted direct operation of the VersaRupter switch from either side of the switchgear cabinet
- Handles available for fixed-mount applications
- Left side handle includes appropriate left-hand shaft extension kit
- Padlocking provisions
- Have provisions for two key interlocks and can handle two interlock systems including lock open only and lock open / lock closed



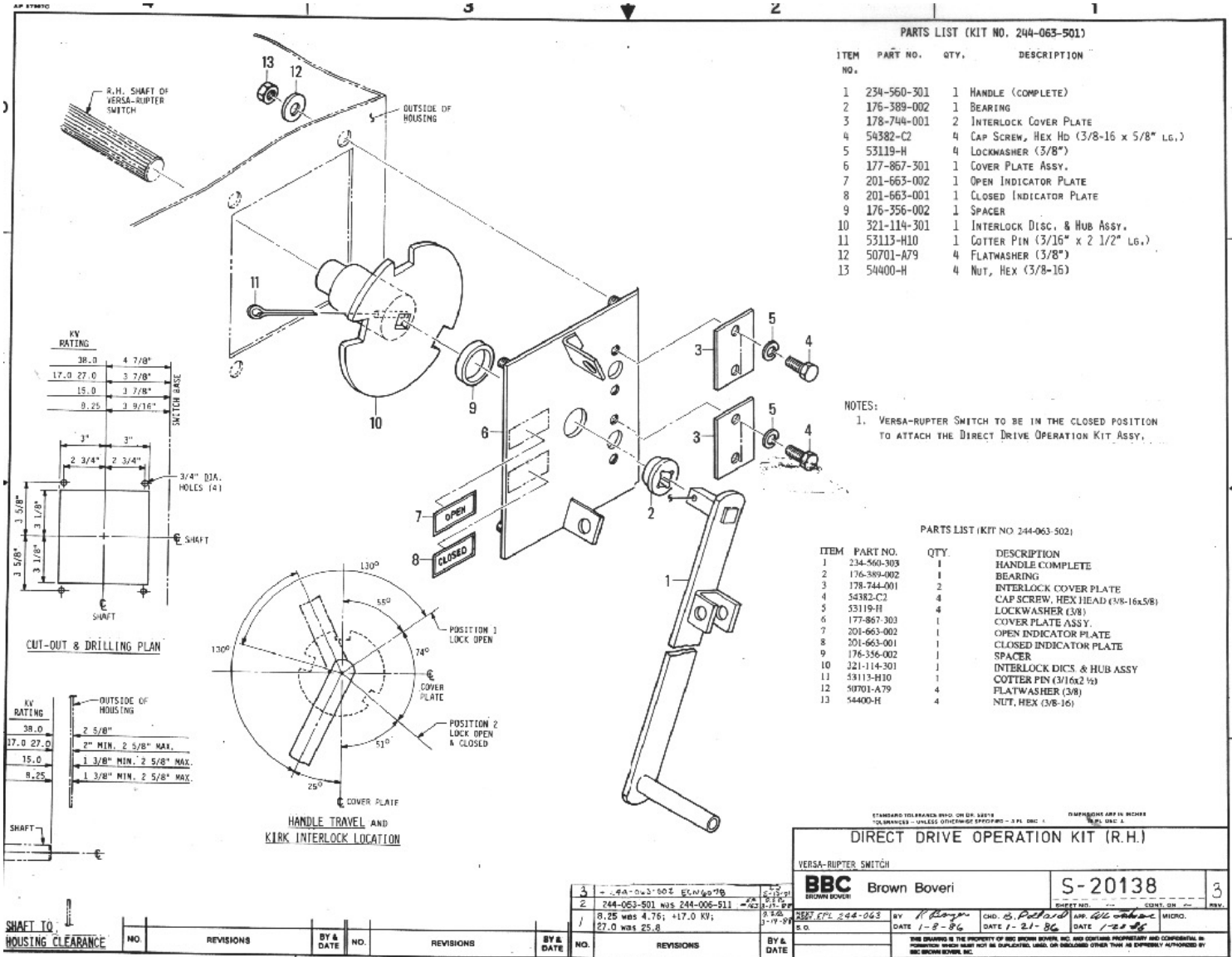
Direct drive handle



Direct drive close up

Side direct drive handle

Drawing



HE and HM handle

Overview

- The HE and HM shaft drive operating handles each provide a front mounted direct drive connection to the switch main shaft
- Both operators include a bevel gear for connection to the switch shaft, and a universal joint linkage at the handle
 - These components accept a 0.75" galvanized pipe (not provided), which allows for the VersaRupter switch to be positioned up to five feet from the front of the enclosure (special 1" fittings are required for greater distances)
- Primary difference between the HE and HM operating handles is the addition of an arrestor ring on the HE handle. The arrestor ring must be pulled out as the removable handle is rotated to open or close the switch
 - The HM handle does not have the arrestor ring, allowing it to be used if manual operation is desired with use of the NM motor operator
- Mechanical door interlock, key interlock, and padlocking provisions are all available for both the HE and HM operating handles (more on next slide)
- Use with a removable handle



HE handle



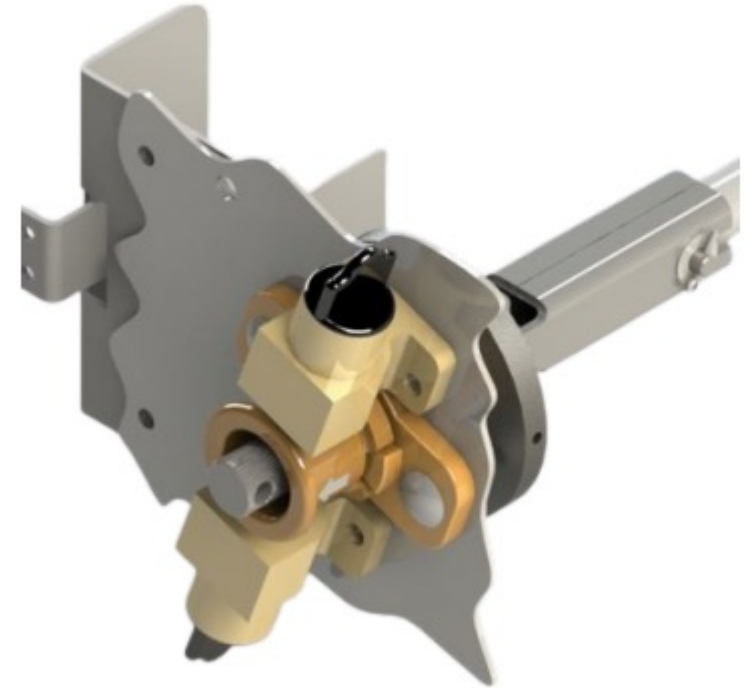
HM handle

HE and HM handle with Kirk Key and door interlock

Overview

Mechanical door interlock, key interlock, and padlocking provisions are all available for both the HE and HM operating handles:

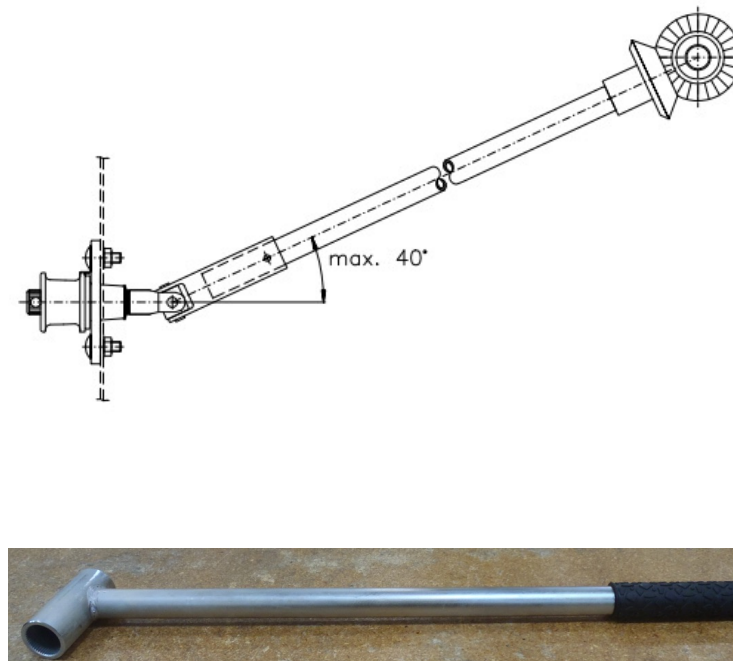
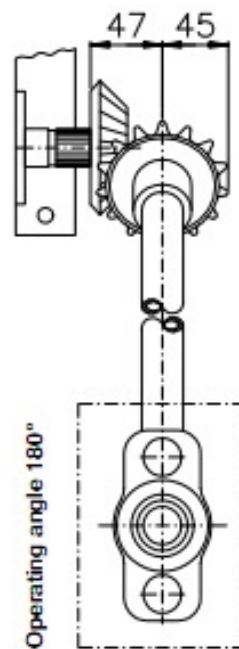
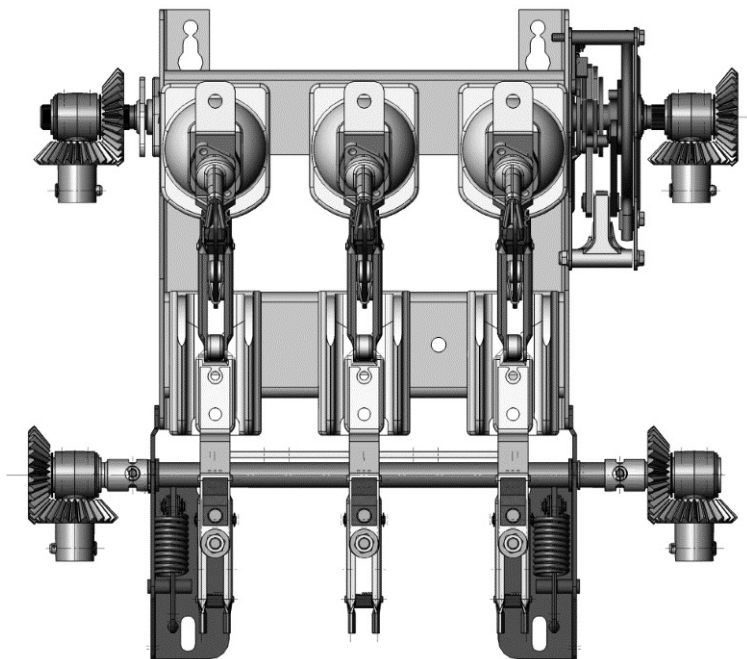
- HE and HM handles have provisions for two key interlocks and can handle three interlock schemes including lock open only, lock closed only, and lock open only/lock closed only
- The mechanical door interlock is pre-installed on the HE/HM handle assembly and includes the catch plate that fastens to the door to be automatically latched
- Two styles are offered: standard and offset
 - Standard doors close against the front of the switchgear frame and project forward from the switchgear frame a dimension equal to the door depth
 - Offset doors close into a recess in the switchgear frame so that the door is flush with the switchgear front when closed
- The Kirk Key interlock provisions are still accessible with the door interlock assembly



HE with Kirk Key and door interlock

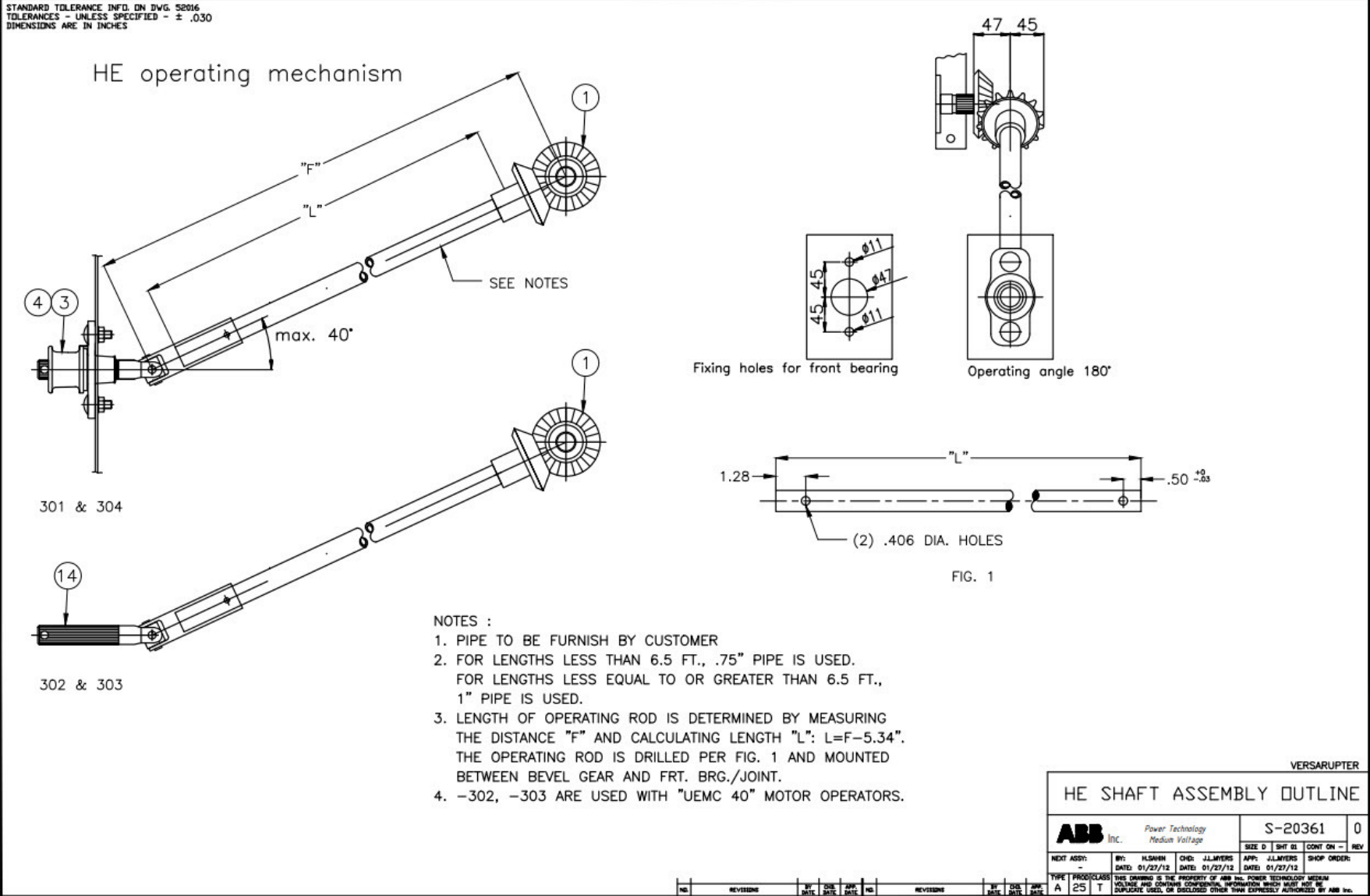
HE and HE handle

Overview



HE and HM handle

Drawing





Operating handles

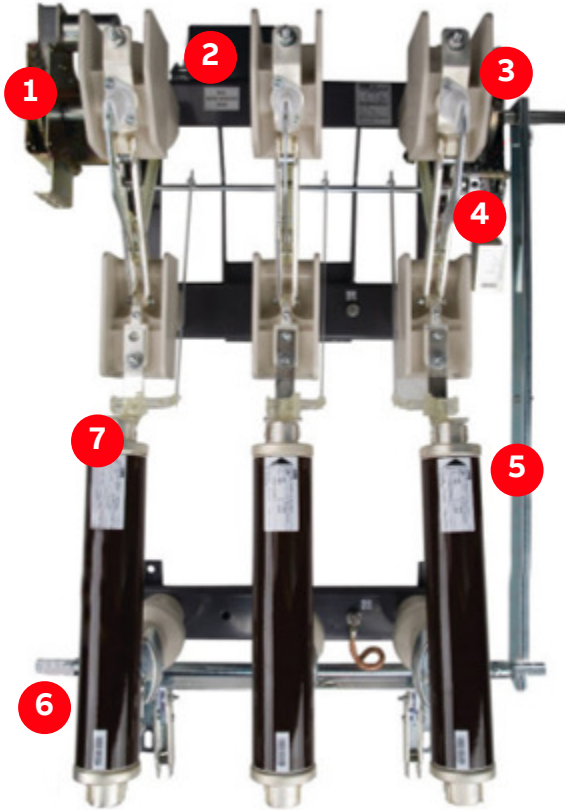
Compatibility

Selection guide – operators vs. feature compatibility							
Handle operator	Location	Use with K-mech	Use with A-mech	Mechanical door interlock	Key interlock	Shunt trip	Motor operator ¹
Chain drive without door interlock	Front mounted with left or right-side drive	●			●		
Chain drive with door interlock	Front mounted with left or right-side drive	●		●	●		
Direct drive	Shaft mounted with left or right-side drive	●			●		
Manual shaft drive type HE ² without door interlock	Front mounted with left or right-side drive	●	●		●	●	
	Manual with NM motor (HM handle)	●	●		●	●	●
Manual shaft drive type HE ² with door interlock	Front mounted with left or right-side drive	●	●	●	●	●	
	Manual with NM motor (HM handle)	●	●	●	●	●	●

1. If manual operator is required in conjunction with NM motor operator, a type HM shaft drive with removable handle should be elected
2. The HE operator has provisions for padlocking the handle spline, which prohibits installation of the removable handle



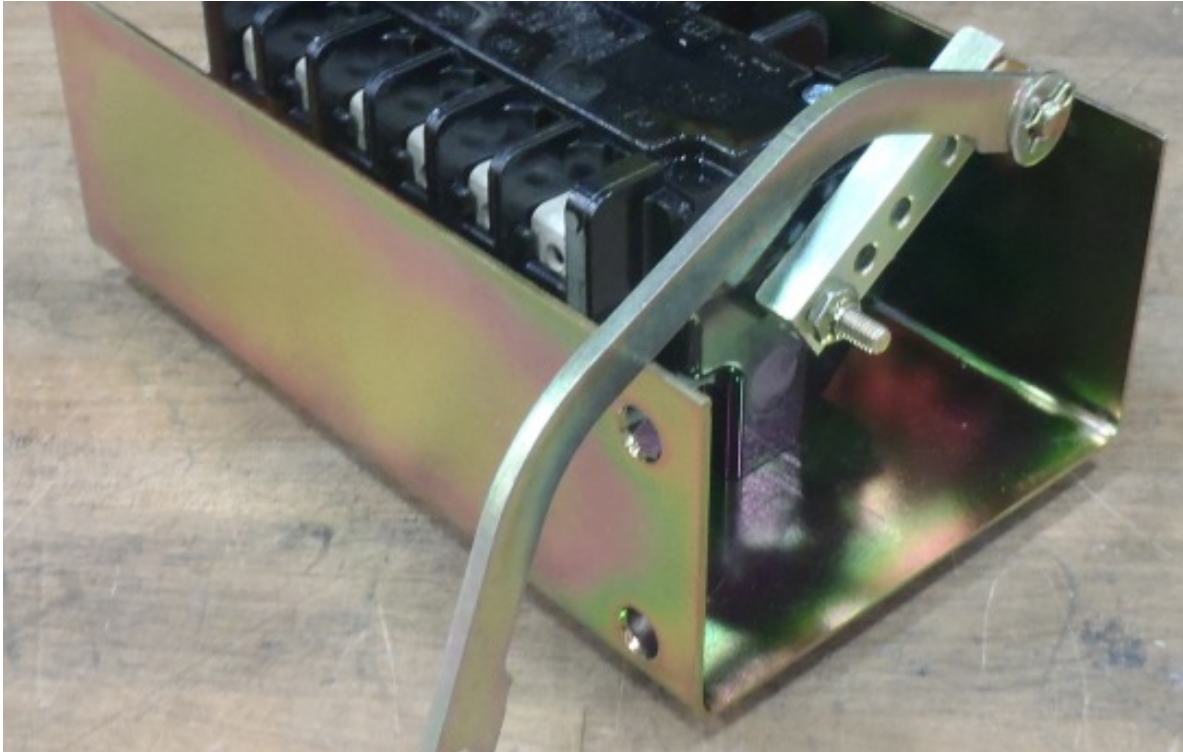
Accessories



1. **Motor drive**
For automatic charge and operating VersaRupter switch
2. **Auxiliary switch**
Shows position of VersaRupter switch (open/close)
3. **Spring mechanism**
For operating VersaRupter switch
4. **Shunt trip**
For releasing charged spring mechanism and opening the VersaRupter switch
5. **Mechanical interlock**
For interlocking VersaRupter switch when in conjunction with a grounding switch
6. **Grounding switch (upper/lower)**
Ground main circuit of VersaRupter switch

Auxiliary switch

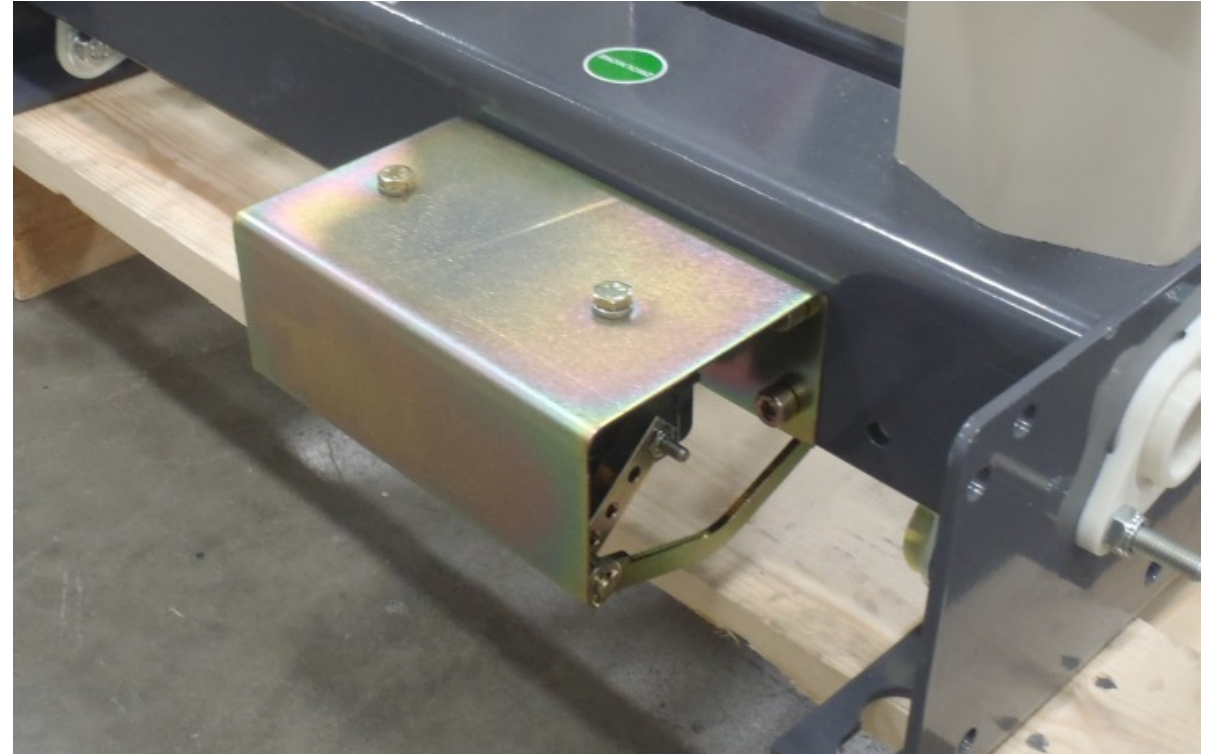
Accessories



- Changes state when the VersaRupter switch changes state via a mechanical linkage connected to the jack shaft
- Can be installed on all VersaRupter switch ratings
- Shipped with an equal number of NO and NC contacts which can be reconfigured in the field
- Must be ordered and wired in series for shunt trip applications
- Available with 6 or 8 contacts
- Different mechanical linkage lengths for 5-27 & 38 kV switches

Auxiliary switch

Accessories

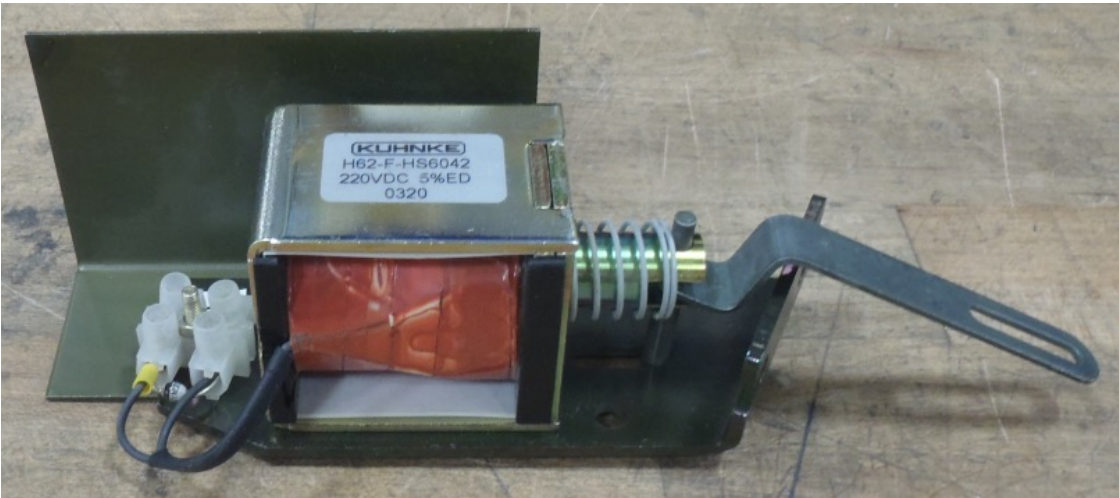


Shunt trip

Accessories

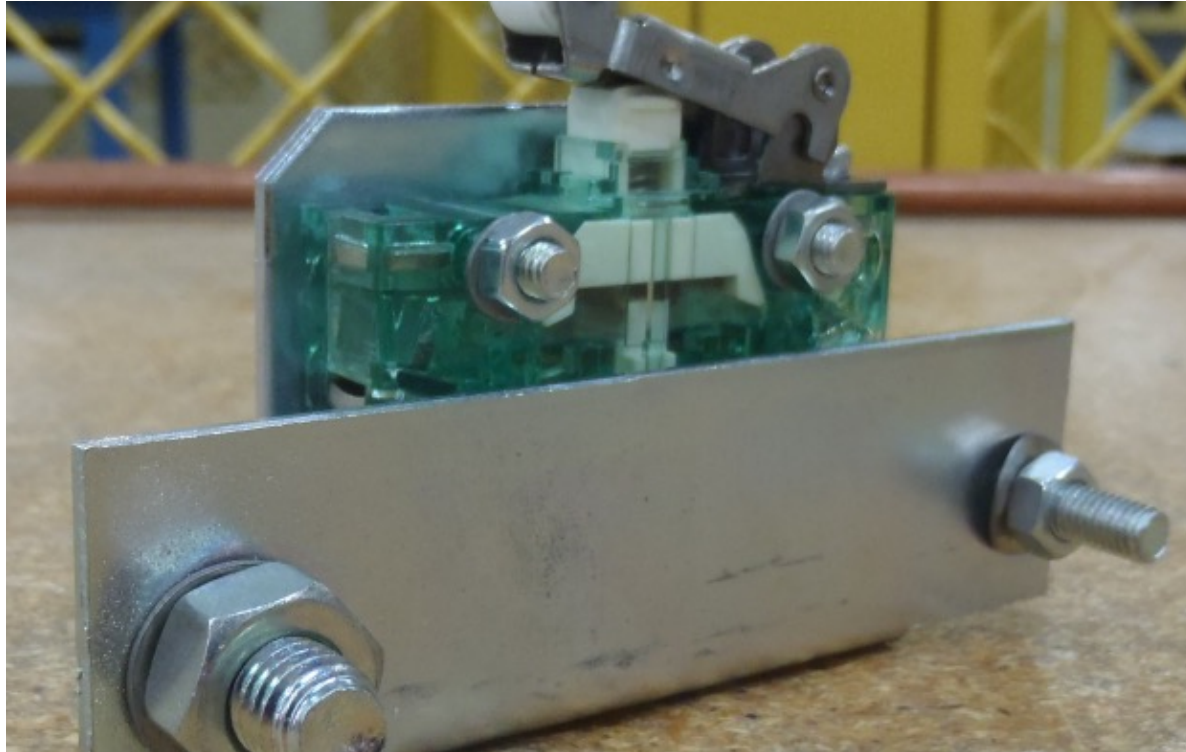
- Actuates the trip latch on the A-mech
- Can only be used on A mech
- Activate by local push button or remote
- Intermittent duty coil
- Auxiliary switch must be ordered and installed in series to remove power after VersaRupter change of state
- May be combined with open fuse auxiliary switch
- Can be used on all VersaRupter switch ratings with A-mech

Technical data: shunt trip device					
Nominal coil voltage	Voltage range	Average current (Amps)			
		IN	Istart	Power(VA)	Resistance (Ω)
24 V DC	-15% to +10%	10.0	10.0	240	3.4 ± 15%
48 V DC	-15% to +10%	2.40	2.40	115	13 ± 15%
110 V DC	-15% to +10%	1.40	1.40	155	79 ± 15%
220 V DC	-15% to +10%	1.50	0.50	110	320 ± 15%
110 V DC	-15% to +10%	2.70	5.00	300	79 ± 15%
220 V DC	-15% to +10%	1.50	2.80	320	320 ± 15%
125 V DC	-15% to +10%	1.40	1.40	155	79 ± 15%



Open fuse auxiliary switch

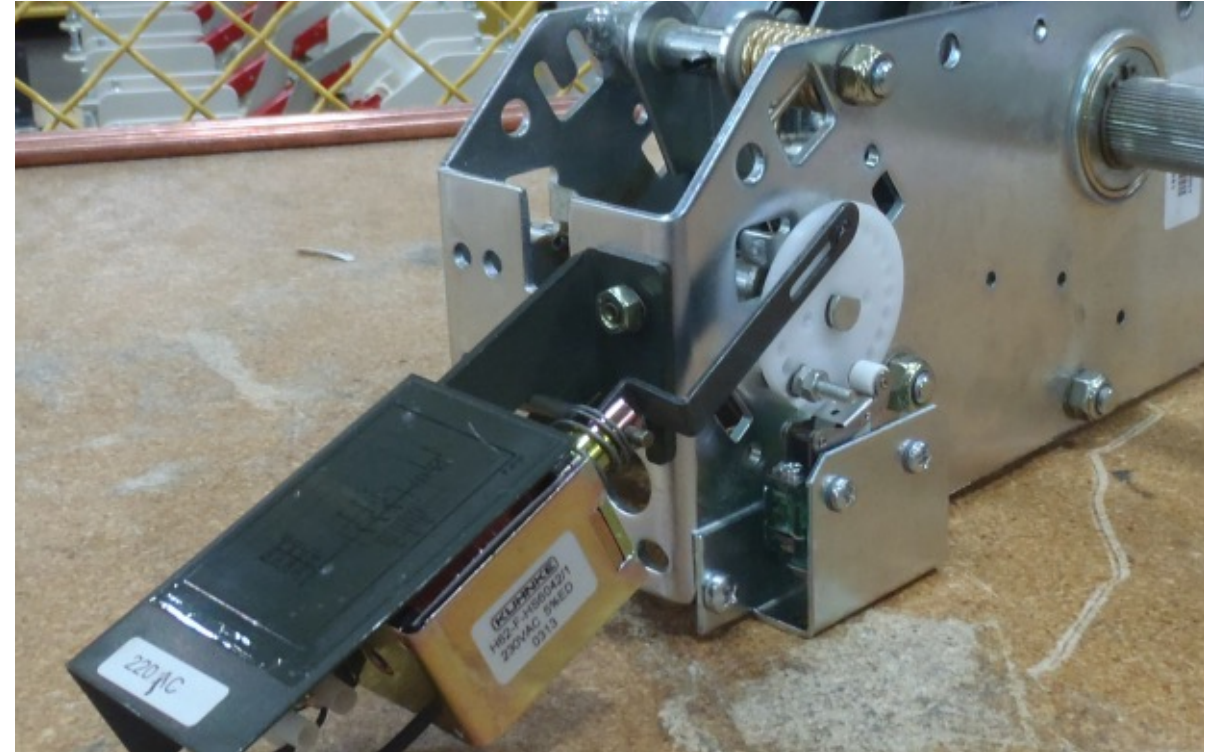
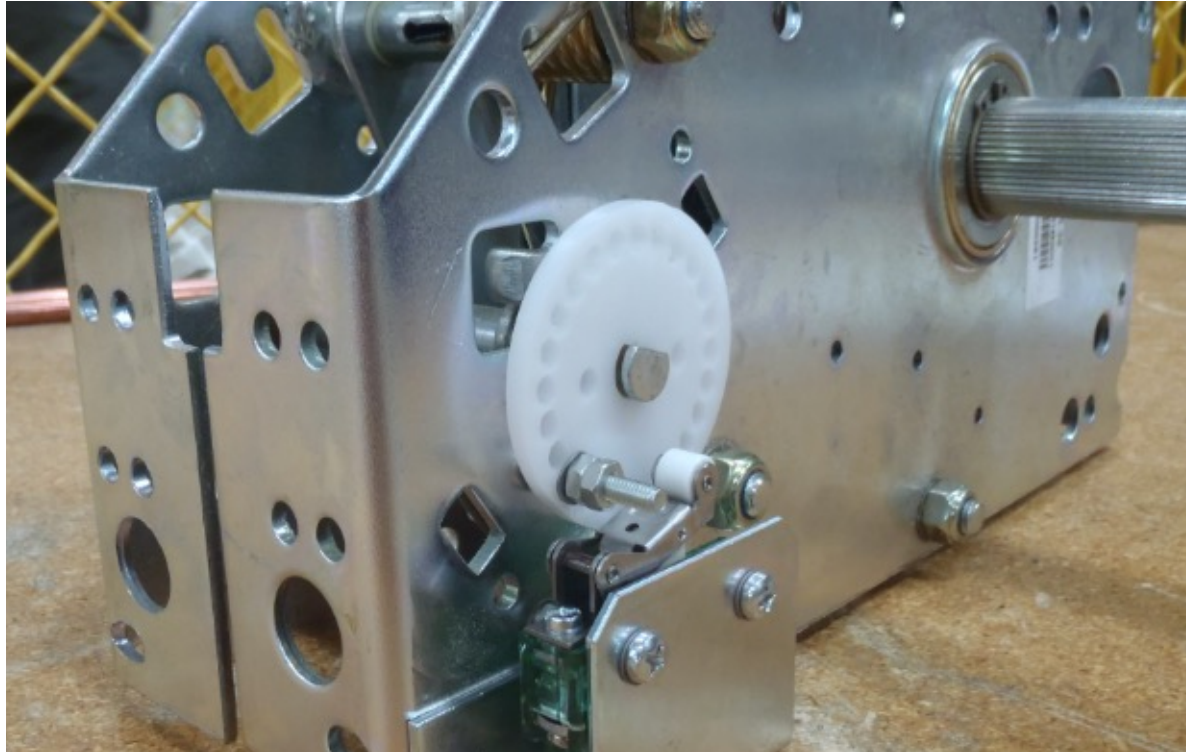
Accessories



- Triggered by fuse link striker system
- Can be wired to an indicator to show a fuse was tripped
- Installs on A-mech only
- Can be combined with shunt trip
- Special motor spacer bracket must be ordered when combined with open fuse aux switch
- Remove micro switch from included bracket and mount directly to motor spacer bracket
- Two contacts, 1 NO and 1 NC

Open fuse auxiliary switch

Accessories



NM motor operator

Accessories

- Provides remote or local electrical opening of the VersaRupter switch
- Installed directly on the operating shaft of the VersaRupter switch
- Right or left side applications, left side comes with left hand shaft extension
- Can be used with either A-mech or K-mech
- Must use HM handle if manual operation is desired
- Motor mechanically disconnects after every operation to manually operate the VersaRupter switch if necessary
- Spacer mounting bracket must be ordered separately dependent upon switch rating and desired mounting location

Voltage AC/DC $\mp$ 10%	24 V	48 V	110 V	220 V
Current (A)	3	3	0.8	0.4
Power consumption (W)	70	140	85	90
Operating time (sec)	~4	~4	~4	~4
Operating temperature (°F)	-40 to 131	-40 to 132	-40 to 134	-40 to 135
Signaling time (sec)	0.5 – 2.0	0.3 – 1.0	0.5 – 2.0	0.5 – 2.0
Weight (lbs) (kg)	13.2 (6)	13.2 (6)	13.2 (6)	13.2 (6)
Operating voltage AC (V)	17-26	34-52	77-137	154-242
Operating voltage DC (V)	22-28	43-57	99-150	198-264



Type E grounding switch

Accessories

- Attach to VersaRupter switch frame near lower terminals or fuse base
- Must order a mechanical interlock separately
- Requires additional handle for operation



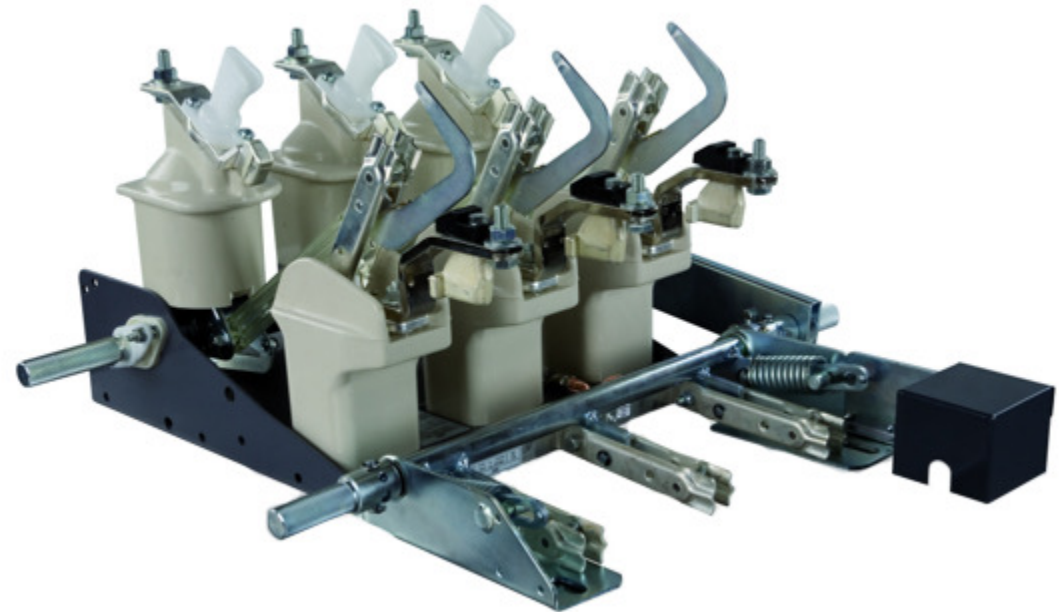
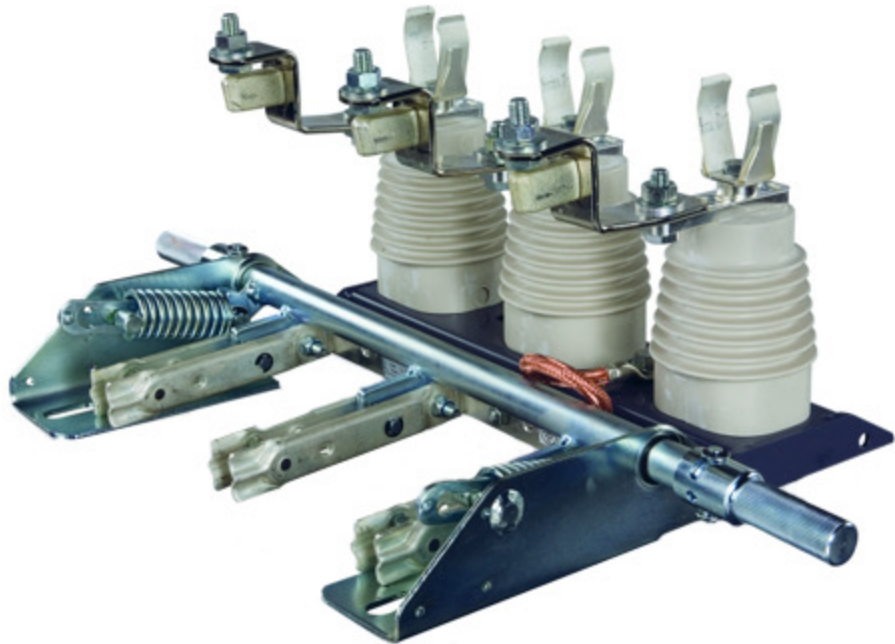
Technical data:					
Rated voltage	kV	4.6-7.2	12.0-13.8	12.0-16.5, 22.9-24.9	34.5
Peak withstand current ¹	kV peak	62/82	40/82	38/82	66
Short circuit current	1 sec.	kA	31.5	31.5	31.5
	2 sec.		25	20	20
	3 sec.		20	16	16
Short circuit making capacity	kA	62/67	40/62.5	38/50	50
Power frequency withstand voltage 50 Hz 1 min.	kV	42	45	50	80
Impulse withstand voltage 1.2/50 µs	kV	75	95	125	170
Pole distance	In/mm	5.9/150	6.69/170	9.25/235, 10.82/275	14.17/360

1. When fed from switch disconnector/grounding switch side

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Type E grounding switch

Accessories



Mechanical interlock for grounding switch

Accessories

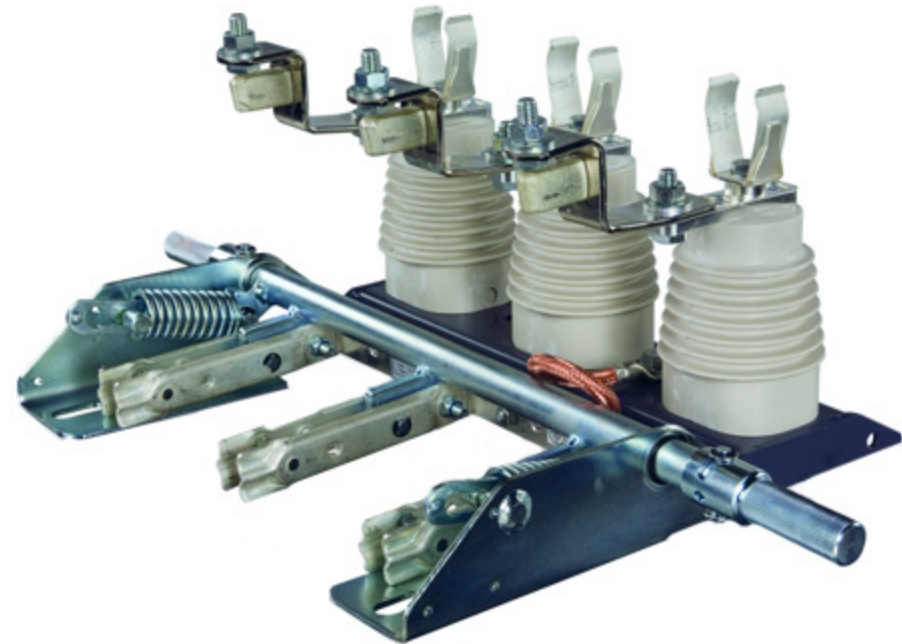
- Prevents the VersaRupter switch from closing while the ground switch is closed
- Must be paired with ground switch applications
- Various lengths to accommodate ground switches mounted on VersaRupter switch or fuse base
- Requires a left-hand shaft extension ordered separately if mounting on left hand side of switch



Fuse base

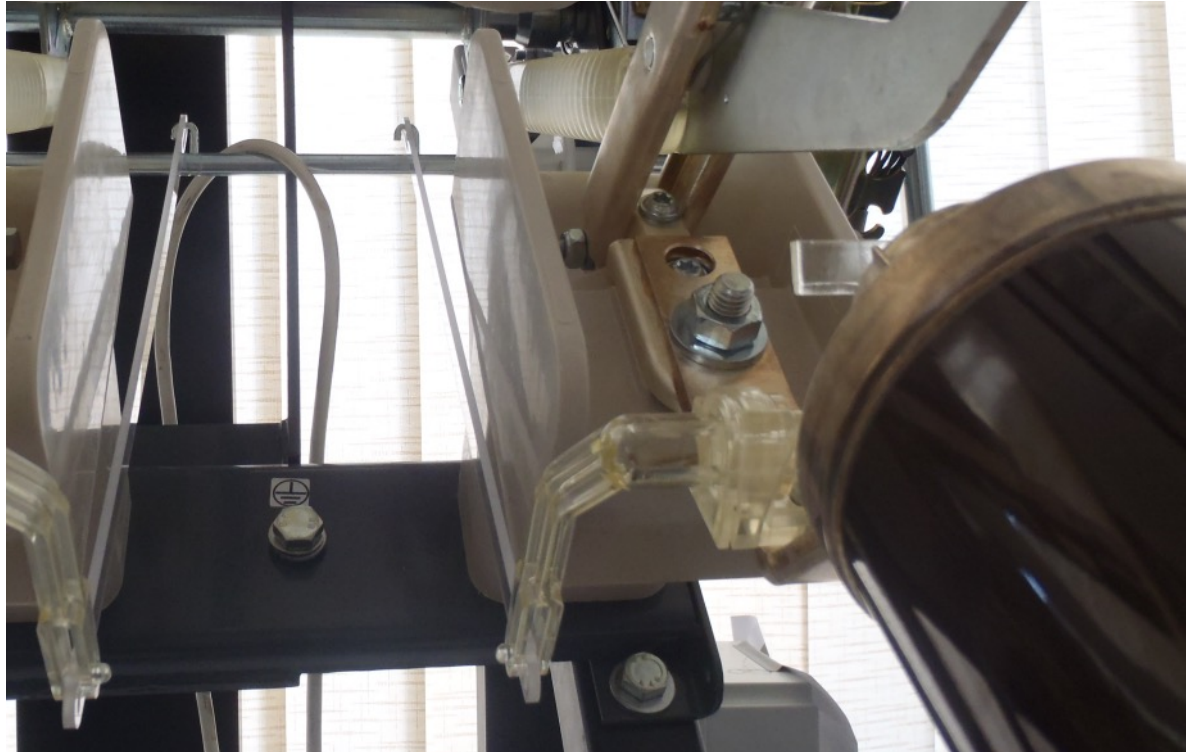
Accessories

- Used with type CEF fuses
- CMF style fuses may be used for MV motor applications
- Available with or without fuse tripping
- Fuse tripping can be paired with fuse blown aux switch for open fuse indication
- Mountable on upper or lower terminals of VersaRupter switch
- Fuse tripping only with A mech
- Use on switches up to 600 A only
- Available CEF fuse ratings
 - 7.2 kV 200 A
 - 12 kV 200 A
 - 17.5 kV 125 A
 - 24 kV 125 A
 - 27 kV 100 A
 - 38 kV 40 A



Fuse base tripping system

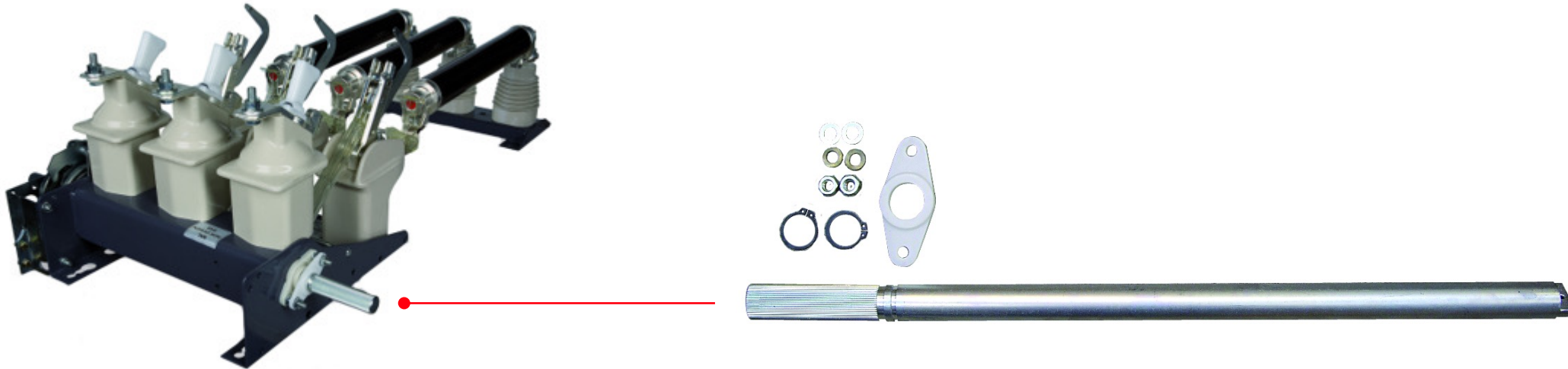
Accessories



Left hand shaft extension

Accessories

- Allows operation of the VersaRupter switch from the left side
- Use with motor operators or manual operator handles
- Different lengths respective to different switch ratings/pole spacing



Accessories

Operating features and functions

Operating features and functions		Mechanism type			
		Snap action K-mech		Stored energy A-mech	
		40/32/25 kA	61 kA	40/32/25 kA	61 kA
UL recognized and CSA compliant		●	●	●	●
Electrical control options	Remote shunt trip ¹			●	●
	Auxiliary switch	●	●	●	●
	Open fuse auxiliary switch			●	
Operating handles	Side direct drive	●	●		
	HE shaft drive ²	●	●	●	●
	HM shaft drive	●	●	●	●
	Chain drive	●	●		
Motor operator (optional)	NM motor ³	●	●	●	●
Interlocks	Mechanical door interlock	●	●	●	●
	Key interlock	●	●	●	●
	Padlock	●	●	●	●
Grounding switch	Type E grounding switch	●		●	
	Mechanical interlock	●		●	
Fuse options	Fuse bases	●		●	
	Mechanical fuse tripping ⁴			●	

1. Shunt trip option provides for operation by local push button or remote signal. Shunt trip requires stored energy type A-mechanism. 2. The HM drive must be used if manual operation is needed in conjunction with motor operator. 3. Chain and direct drive handles cannot be used with motor operators. 4. This feature provides for the switch to open if a fuse operates



Maintenance

Overview

- **Never** use alcohol-based solvents for cleaning!
- Inspection once a year
- NAL New Design 2008 under normal conditions
 - Mechanical overhaul after 1000 operations or 15 years in service
 - Electrical overhaul after 100 operations at full rated current
 - Main contacts, arcing contacts, and arc chamber need to be inspected and replaced if necessary
- Before 2008
 - Mechanical overhaul after 1000 operations or 5 years in service
 - Electrical overhaul remains the same as above
- Grease contacts with ISOFLEX TOPAS NCA52 after cleaning
- Operating mechanisms do not require greasing

ABB