

**VersaRupter medium voltage (MV) indoor switch
4.76 - 38 kV, 200 – 1200 A, 40 and 61 kA**

Instructions for disc interlock, door interlock, and handle
yoke assembly

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SAFETY NOTICE

- Keep these instructions available to those responsible for the product’s proper installation, maintenance and operation.
- Follow your company’s safety procedures.
- Read these instructions carefully before attempting to install, operate, or maintain this device. Failure to follow these instructions could cause severe personal injury, death, or property damage.
- Apparatus covered by this instruction literature should be operated and serviced only by competent personnel familiar with the installation of this type of product and good safety practices. These instructions are written for such personnel and are not intended as a substitute for proper training and experience in safety procedures for this type of equipment.

Instructions for disc interlock, door interlock, and handle yoke assembly for VersaRupter medium voltage (MV) indoor switches

This application, installation and use guide is valid for VersaRupter medium voltage (MV) indoor switches.

1.1 Introduction and safe practices

1.1.1 Introduction

The purpose of this manual is to provide instructions for the installation and operation of a VersaRupter shaft holding disc and door interlock kit. This manual should be carefully read and used as a guide during installation, initial operation, and maintenance.

The switches are protective devices. As such, they are maximum rated devices. Therefore, they should not under any circumstances be applied in applications outside of their nameplate ratings.

1.1.2 WARNING



WARNING

Pay special attention to the hazard notes in the manual marked with this warning symbol.

Always observe the manual and follow the rules of good engineering practice.

The switches described in this book are designed and tested to operate within their nameplate ratings. Operation outside of these ratings may cause equipment to fail resulting in property damage, bodily injury, and death.

All safety codes, safety standards and regulations as they may be applied to this type of equipment must be strictly adhered to.

Hazardous voltage can cause electrical shock and burns. Disconnect power, then earth and short-circuit before proceeding with any work on this equipment.

Verify the position of the main knives before and after each operation. Install the air-insulated switch-disconnectors in applications where it is possible to visually check main knives position through an inspection window.

Only authorized personnel are allowed to work on mounted or unmounted VersaRupter switches. Be sure the switch is cycled open, and power is disconnected down the line. Be sure energy is completely discharged from the switch closing spring mechanism. All service providers must wear proper personal protective equipment when working on VersaRupter switches.

Current knives rotate with great speed and force. Always keep a safe distance from moving parts of the switch. Be careful with type A (double spring) mechanism, this kind of drive stores great energy and can release it by a small rotation of the shaft.

In case of an A mechanism, after switch closing or opening (without opening spring charged) do not turn the mechanism shaft in the closing direction. It can cause damage of the mechanism. Keep well clear of contact knives when operating the switches. During installation on non-flat surfaces, use shims correcting inequalities. This will prevent the stress forces in the switch frame when inequalities of surface are significant. It helps to use a rigid support structure, e.g., a structure made by ABB.

Make sure that under operation condition of the switchgear or switchboard, the specified data in the ratings is not exceeded.

Keep the manual accessible to all persons concerned with installation, operation, and maintenance.

The user's personnel are to act responsibly in all matters affecting safety at work and the correct handling of the switchgear.

There are hazards of electrical shock and burns whenever working in or around electrical equipment. Turn off power before performing any inspection or maintenance operations. Check line terminals to verify that the equipment is de-energized and earthed. Always verify the switch disconnect state (opened/closed) using inspection window before and after every operation. Do not enter the switchgear, if the switch disconnect is closed.

Check terminals to ensure that no back-feed condition exists.

1.1.3 Safe practices

VersaRupter switches are equipped with stored energy high speed spring mechanisms. The following instructions apply to all personnel associated with installation, operation, and maintenance of VersaRupter switches to ensure safety.

Only qualified persons as defined in the National Electric Safety Code who are familiar with installation and maintenance of medium voltage equipment should be permitted to work on these switches.

Read these instructions carefully before attempting any installation, operation, or maintenance of switches.

DO NOT work on an energized switch.

DO NOT work on a switch unless all components are disconnected by means of a visible break and are securely grounded.

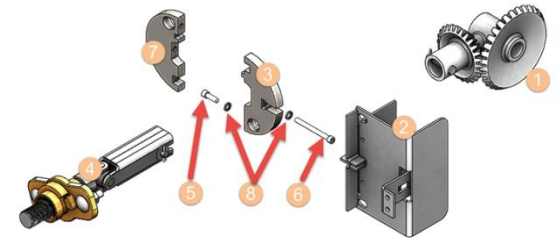
1.1.4 Caution

The apparatus should be protected against the water dripping or runoff on its insulating parts. In addition to this, as the apparatus shall work under indoor conditions, it

is possible for rare episodes of condensations to get deposited on insulations parts and the hollow insulators. To prevent it, the apparatus shall only be installed horizontally or vertically, but ensuring having the hollow insulators on the upper side.

1.2 Safety interlock kit components

Upon receiving the interlock kit, verify all components are present as shown in Figure 2.



02

Included parts:

1. Bevel gear
2. Optional offset or flush door interlock latch
3. Safety interlock slotted disc half
4. HM or HE handle yoke assembly
5. Kirk key blocking bolt
6. Disc halves assembly bolt
7. Safety interlock threaded disc half
8. Lock washers

- 03 Tools not included
- 04 Base HM disc interlock

1.3 Safety tools

The following tools will be needed to install the safety interlock as shown in Figure 3.



03

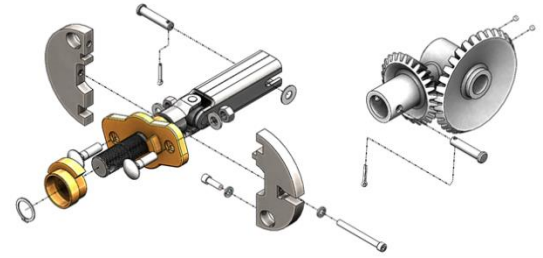
Purchased assembly tools not included:

- A. 1/2" wrench
- B. Ratchet
- C. 1/2" socket
- D. Snap ring pliers
- E. Pipe wrench
- F. 13/32" drill bit
- G. Tape measure
- H. VersaRupter drive handle
- I. Needle nose pliers
- J. 3/16" Allen wrench
- K. 3/16" socket hex key
- L. 17 mm wrench
- M. Marker
- N. 3/32" Allen wrench

Additional tools to note:

- A. Pipe saw
- B. Drill press
- C. Blue 242 Loctite

1.4 Safety disc interlock configurations



04

Table 1 includes a list of the six different safety disc interlock configurations. All six configurations include a bevel gear, handle yoke, and two disc halves (as shown in Figure 4).

- Configuration "STANDARD" will have a door interlock for mounting flush on an enclosure wall.
- Configuration "NO LOCK" will not have a door interlock.
- Configuration "OFFSET" will have a door interlock for mounting spaced off an enclosure wall. This option allows the outside of the door to be flush with the outside of the enclosure.
- Configuration "HM" will have a free rotation handle yoke that is the same as item 4 in Figure 2.
- Configuration "HE" will have a rotation stopping handle yoke as shown in Figure 10.

Table 1 HE/HM Interlock Assemblies (All configuration numbers start with "2RGA025")				
Handle	Door Lock	Left Side Asm.	Right Side Asm.	Bolt Pattern
HM	Standard	"046A0001	"046A0002	"105P0001
	No Lock	"677A0001	"677A0002	"105P0003
	Offset	"186A0001	"186A0002	"105P0002
HE	Standard	"264A0001	"264A0002	"105P0001
	No Lock	"669A0001	"669A0002	"105P0003
	Offset	"277A0001	"277A0002	"105P0002

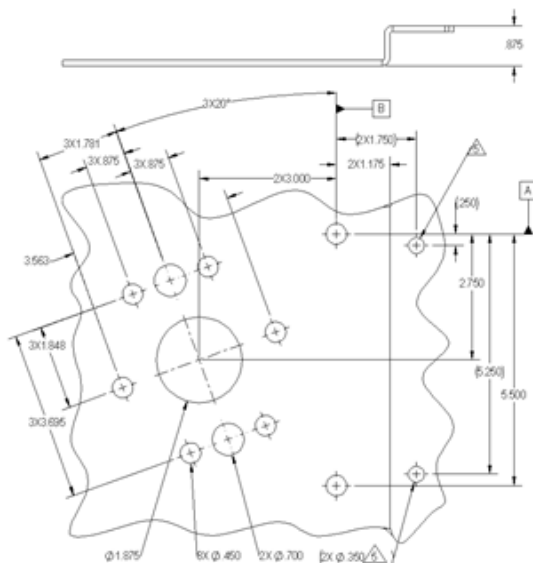
1.5 Safety disc interlock preassembly

- A. Prior to assembly, a mounting bolt pattern must be added to each enclosure. Bolt patterns like Figure

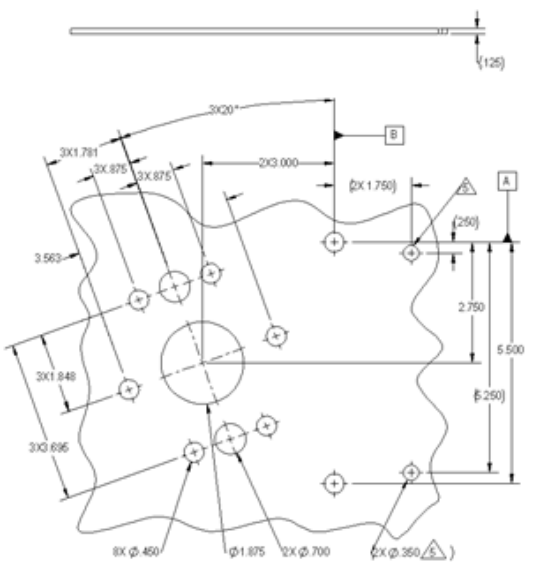
- 05 Left side offset safety interlock bolt pattern
- 06 Left side flush safety interlock bolt pattern
- 07 Set screw location and bevel gear mounting

5 and Figure 6 are listed per configuration in Table 1.

- B. Table 2 is a list of recommended parts purchased separately.



05



06

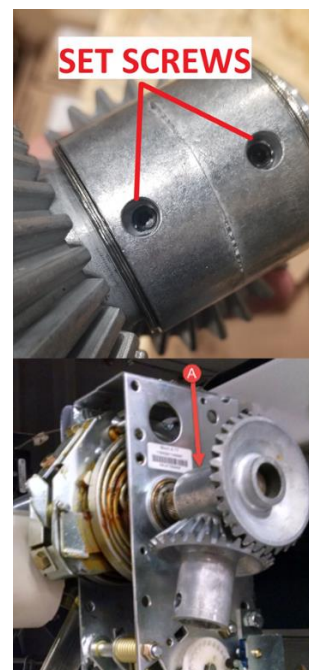
Table 2 Reference Drawings for Parts Not Supplied	
Customer Supplier Drive Shaft	2RGA024661P0001
Customer Supplied Kirk Key Type B (SD)	2RGA023680P0001
Customer Supplied Kirk Key Type B (MD)	2RGA024749P0001
Customer Supplied Kirk Key Type B (HD)	2RGA024750P0001

- C. **It is not recommended to mount a handle yoke vertically.** When using a disc interlock and mounting vertically, a door interlock cannot be used. Additionally, the bolt pattern will not have a 20° rotation like Figure 5 and Figure 6; and the interlock disc must be rotated 20° instead during final assembly for kirk key alignment.

- D. **The handle yoke only has one degree of angular freedom.** The bevel gear must be installed on the same vertical plane as the handle yoke and not horizontally offset, or early failure may occur.

1.6 Safety disc interlock steps

- Put the switch in the open position using VersaRupter drive handle.
- Firmly push to mount the bevel gear onto the splined drive shaft of the VersaRupter switch on either the left or right side as shown in Figure 7 and Figure 8. Use care to ensure the set screws do not come loose. The bevel gear should be approximately 4" offset from the mechanism as shown in Figure 9. (Note, to mount the bevel gear to the left side of the switch, an additional extension shaft must be used with the switch.)



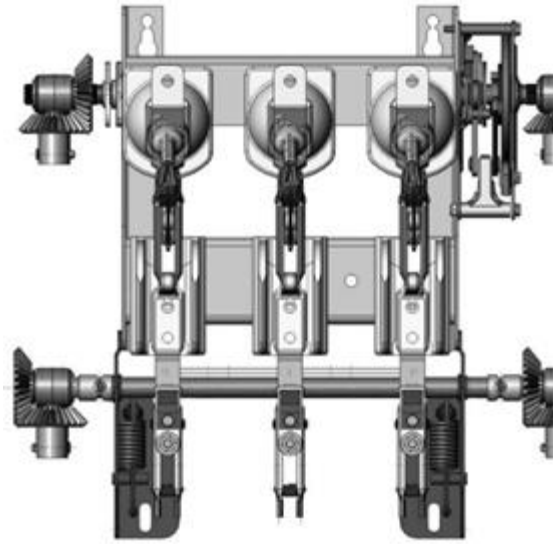
07

08 Bevel gear orientation

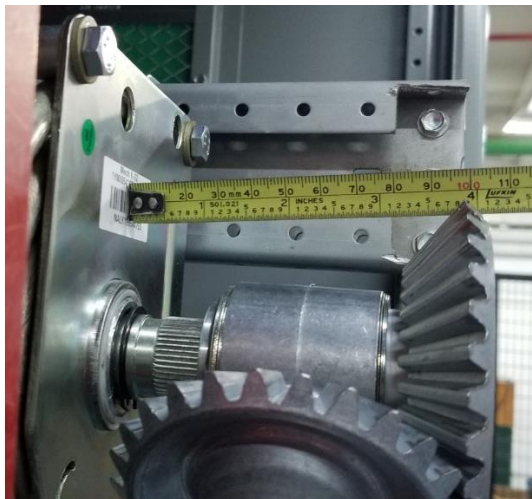
09 Bevel gear 4" offset from mechanism

10 HM handle yoke at 20 degrees

11 HM handle yoke at 90 degrees



08



09

3. Two set screws located at the top of the bevel gear in Figure 7 marked "A" need to be tightened onto the shaft during final assembly. For now, keep them loose, but tightened enough to move the bevel gear freely. Additionally, keep track of their position for future adjustment.
4. When mounting the bevel gear, the orientation is constant for left and right side alignment as shown in Figure 8.
5. Mount the HM or HE handle yoke loose to center, then torque hardware to 36 ft.-lbs.
6. All handle yokes must be mounted at a 20 degree angle for door interlock alignment as shown in Figure 10 (only non-door interlock assemblies can mount the handle yoke vertically as

shown in Figure 11). Always apply the information label supplied with the drive during installation. Stickers must be close to the drive so that they can be easily viewed by personnel.



10



11

If the application does not use a kirk key, skip steps 7, 8, 33, and 37 to 44. Otherwise, continue as normal.

7. Loosely install kirk keys (Table 2) per the desired configuration, if applicable. Do not tighten the kirk key bolts yet.
8. The kirk key blocking bolt (Figure 2, item 5) is used to allow or disallow locking the VersaRupter switch in the open or closed position based on the configuration desired.
 - a. For single kirk key locking in both the open and closed position, remove the 1/4-20 Socket Head Cap Screw (SCHS)

12 Adjusting HM handle yoke collar (splined shaft, snap ring, washer, spring, collar, and rotation block tab

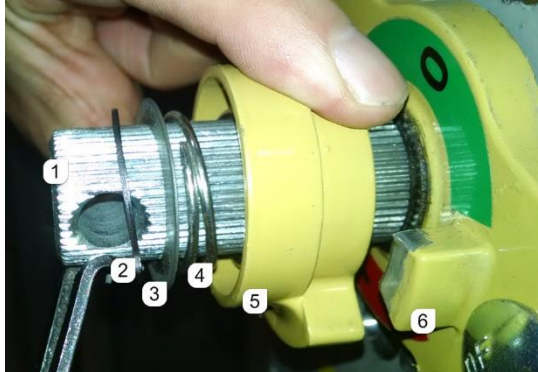
13 Mounting disc halves onto handle yoke

14 Mount door interlock latch

15 Latch and disc spacing

from both disc halves.

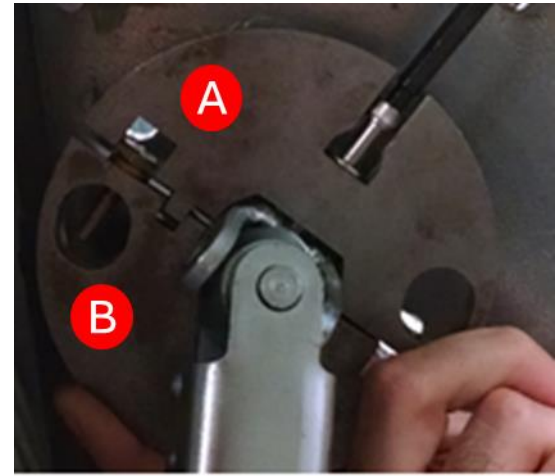
- b. For single kirk key locking in only the opened position, install the SHCS and lock washer into the tapped disc half marked item 7 in Figure 2 to a maximum torque of 10 ft.-lbs.
 - c. For single locking in only the closed position, install the SHCS and washer into the slotted disc half marked item 3 in Figure 2 above (also, maximum 10 ft.-lbs.)
 - d. For double locking in both open and closed positions, install the SHCS in either disc depending on preference.
9. Offset the collar (#5) in Figure 12 by sliding the snap ring (#2), washer (#3), and spring (#4) down the shaft (#1) to clear the rotation blocking tab (#6). Later steps will remove and re-install all parts for final adjustment. If using an HE handle yoke, skinny long nose snap ring pliers will be needed for this step.



12

If the application does not use a door interlock, skip steps 10 through 23.

10. Using a 3/16" Allen wrench and blue 242 Loctite in the threads, install both disc halves A & B from Figure 13 onto the handle yoke with the long SHCS to a maximum torque of 10 ft.-lbs. Align disc half A horizontally similar to that shown in Figure 14.

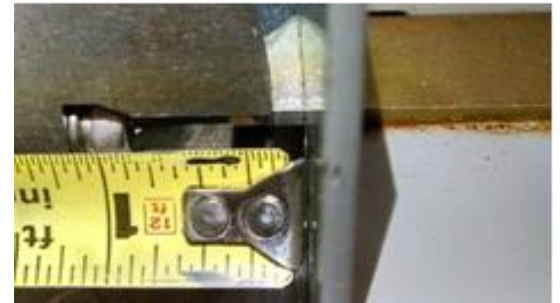


13



14

11. Mount the door interlock latch assembly as shown in Figure 14, keeping the bolts loose for alignment.
12. Measure the spacing of the disc interlock to the door housing in Figure 15 to verify a spacing of approximately $0.1" \pm 0.025"$.



15

13. The door interlock latch should engage the disc interlock with approximately $0.355" \pm 0.05"$.
14. For right side door interlocks, reference Figure 17 and Figure 19. For the left side, reference Figure 18 and Figure 20.

16 Door interlock retracted for free rotation

17 Door mounted latch

18 Engaged door interlock

15. To verify spacing, depress the latch as shown in Figure 16 to retract the door latch and allow free rotation of the disc interlock.



16

16. If the disc does not clear the latch or barely clears the latch, the door interlock needs to be spaced further from the disc.

17. The door interlock can now be tightened. Alignment must be checked again when installing the door mounted latch in Figure 17.



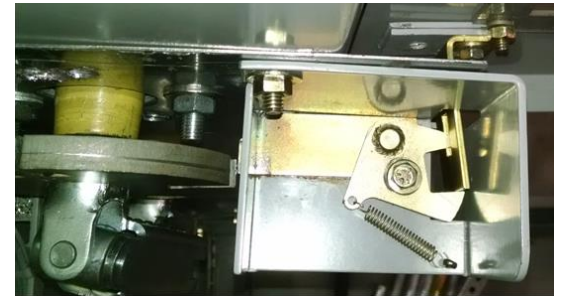
17

18. Additional mounting holes can be added to the door latch assembly as needed and described in the mounting bolt patterns in Table 1.

19. When mounting the door mounted latch in Figure 17, reference Figure 23 and Figure 24 for positioning. Additional spacing off the door may be required to completely engage and retract the door interlock.

20. The door mounted latch will engage best at the apex of its travel and then curve as it follows the tangent arc as shown in Figure 18.

21. Verify the interlock releases the handle yoke disc with the door closed as shown in Figure 18.

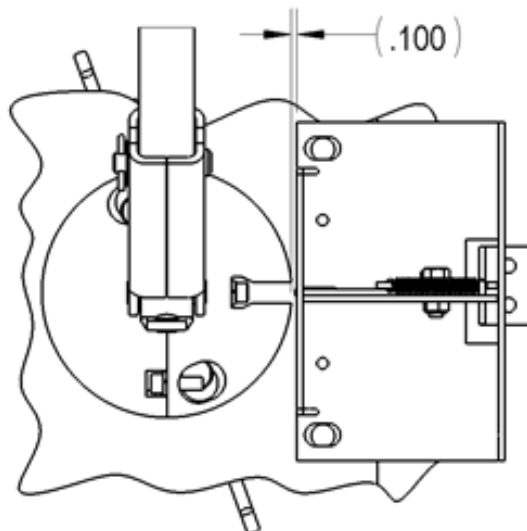


18

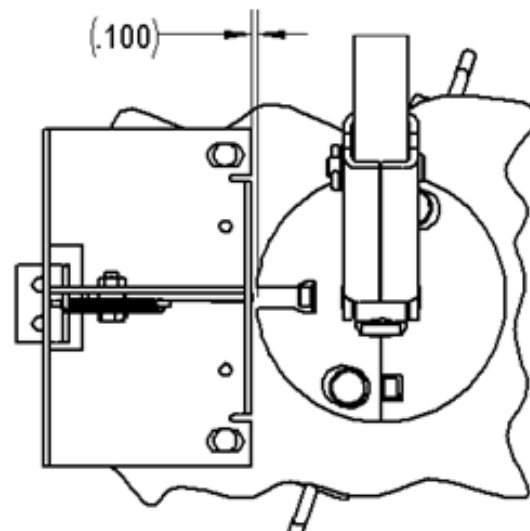
22. If the interlock disc continues to catch on the door latch, space the door mounted latch off from the door to engage sooner as shown in Figure 19 and Figure 20.

23. Additional documentation of the door latching assembly can be referenced in the appendix, Figure 40.

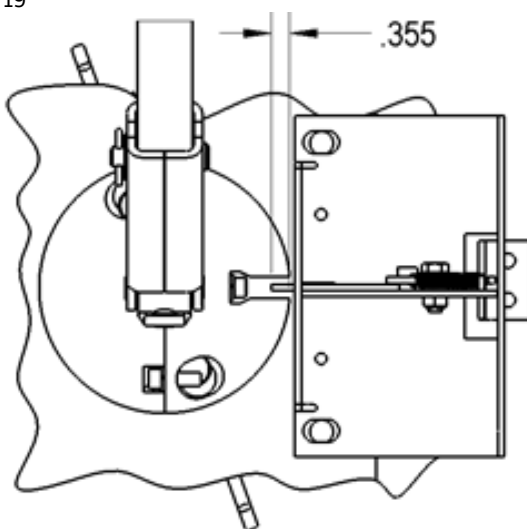
- 19 Right door latch open
- 20 Left door latch open
- 21 Right door latch closed
- 22 Left door latch closed
- 23 Left side door latch
- 24 Right side door latch



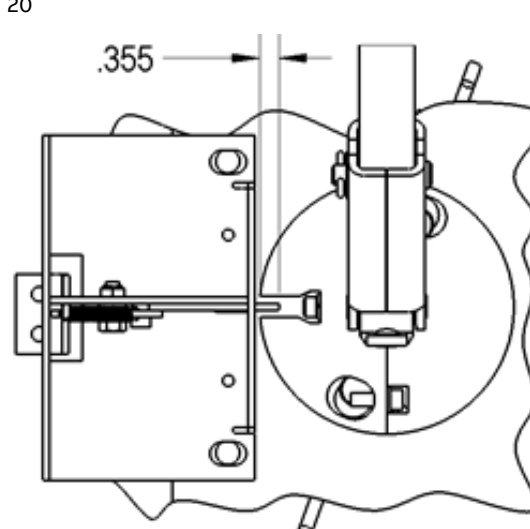
19



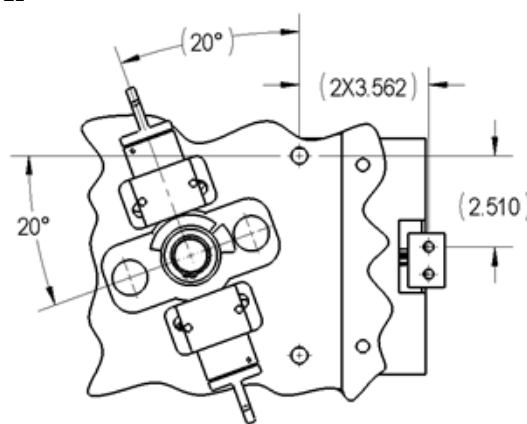
20



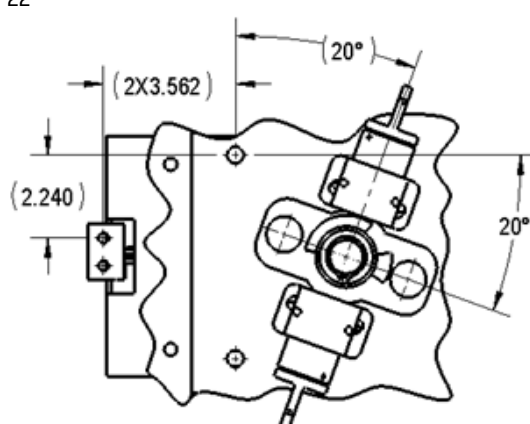
21



22



23



24

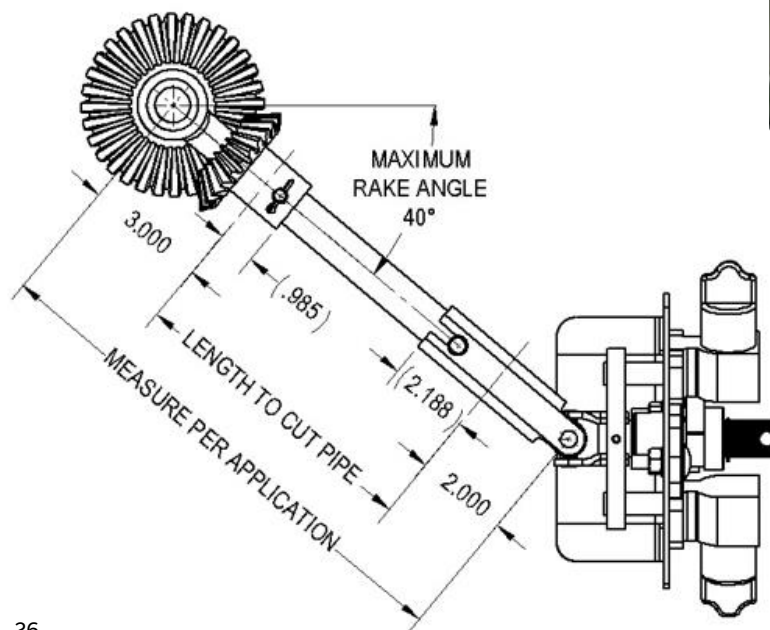
- 25 Measured length
- 26 Installing drive shaft

24. For sizing the 3/4" drive shaft for the specific application, measure the appropriate length as shown in Figure 25 and "Measure Per Application" as shown in Figure 26. Use Equation 1 below to determine the length to cut the drive shaft.

- a. NOTE: The drive shaft may not be in the proper position during the first assembly. Therefore, more than one pipe may be needed for proper setup of the given application. It is recommended to cut at least 3 pipes to length during this stage for use later in adjusting.

Equation 1: MEASURE PER APPLICATION
 $\text{LENGTH} - 5 \text{ in} = \text{LENGTH TO CUT PIPE}$

- 25. The maximum recommended shaft length is 6.5 feet. For longer applications, consult ABB to determine an appropriate design.
- 26. The angle between the bevel gear and the handle yoke assembly must not exceed a 40° angle or premature failure may occur. This is shown as the "Maximum Rake Angle" in Figure 26.



26



25

- 27 Hole location
- 28 Installing drive shaft
- 29 NP horizontal position
- 30 Mark pin hole

If kirk keys are not being used, skip steps 33 and 37 to 44.

27. With the drive shaft pipe cut to length, insert the shaft into the bevel gear and handle yoke assembly.
28. Verify the bevel gear set screws are visible to tighten down onto the spring mechanism spline. Also, verify the bevel gear is in the correct orientation and slid completely onto the spline shaft without contacting the spring mechanism as shown in Figure 8.
29. If the set screws cannot be located for tightening, slide the bevel gear along the spline shaft and rotate the bevel gear until they are aligned with the holes of the bevel gear. Then reinstall the bevel gear while holding the set screw location constant.
30. Re-check spacing from step 24 and then torque the set screws using a 3/32" Allen wrench to 7 ft.-lbs.
31. Prior to installation of the drive shaft, drill a hole using a 13/32" drill bit at 1.3" from one end of the drive shaft (see Figure 27). The hole should go all the way through the shaft.
 - a. Remove the drive shaft to drill the hole to prevent damaging the bevel and handle assembly.
 - b. Additionally, test fit the clevis pins used for securing the drive shaft before continuing to next step. The hole may need to be redrilled to ensure proper fitting of the clevis pins.



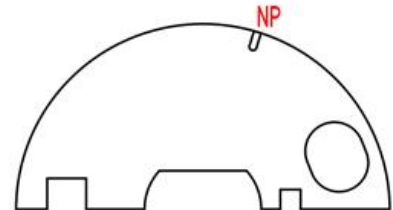
27

32. Slide the drive shaft into the bevel gear and HM/HE handle yoke assembly. Secure the drive shaft in the handle yoke assembly side as shown in Figure 28.



28

33. With the drive shaft secure, rotate the disc until the Nominal Point (NP) reaches a horizontal position as shown in Figure 29. The NP should be perpendicular to the door of the switchgear. Mark a hole in bevel gear side for later drilling as shown in Figure 30.



29



30

31 Secured drive shaft in bevel gear side

32 Kirk key not properly engaged in disc interlock

33 Switch opened/closed position

34. Drill a hole in the position marked in Step 33 with a 13/32" drill bit.

- a. Remove the drive shaft to drill the hole to prevent damaging the bevel and handle assembly.
- b. Additionally, test fit the clevis pins used for securing the drive shaft before continuing to next step. The hole may need to be redrilled to ensure proper fitting of the clevis pins.

35. Assemble the drive shaft in position and secure it with the clevis pins, the cotter pins, and the washer as shown in Figure 28 & Figure 31.



31

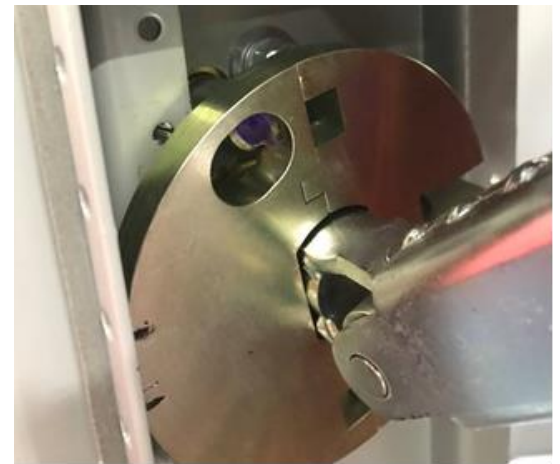
36. Operate the unit by driving a full cycle. The opened and closed positions should be approximately 180 degrees from one position to another. If applicable, the kirk keys should now be able to be used.

37. If while trying to engage the kirk key lock, and the bolt is not properly engaging into the disc interlock as shown in Figure 32, do not push the VersaRupter drive handle more than 195 degrees from the opened/closed to the closed/opened positions (as shown in Figure 33). Overextending the drive handle may cause a mechanical failure. In this case, further adjustment is required. If adjustment is needed, go to the next step. If no adjustment is needed, proceed to step 45.

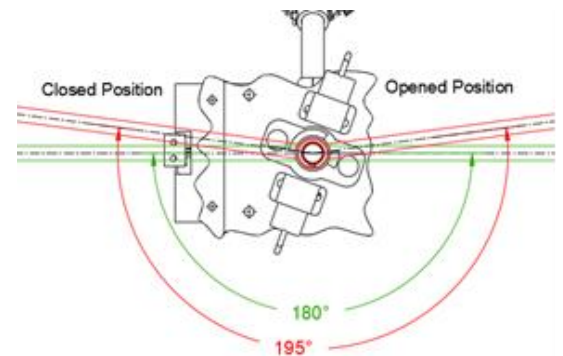
- a. A-Mechanism: When the kirk key is not properly engaging, there will be a strong resistance felt when opening/closing a VersaRupter

equipped with an A-mechanism. Note: In the following steps, when the A-mechanism is said to be open, it will also generally be charged.

- b. K-Mechanism: When the kirk key is not properly engaging, there may not be a strong resistance felt when operating the VersaRupter handle past 180 degrees of rotation when using a VersaRupter equipped with a K-mechanism. However, if the kirk key does not engage within the nominal 180 degree range, further adjustment is also required.



32

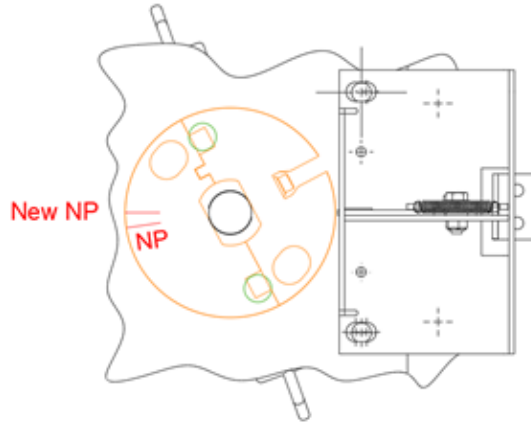


33

38. If the switch has an A-mechanism and too much resistance is found in the closed position for kirk key engagement, or if using a K-mechanism and the kirk key is not engaging within the nominal angular range in the closed position, continue to the next step. Otherwise, go to step 42.

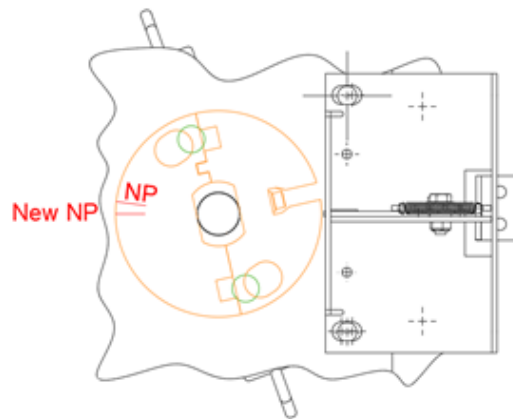
- 34 NP counterclockwise rotation
- 35 NP clockwise rotation
- 36 Kirk key properly engaged in door interlock
- 37 Install snap ring and collar flush

- 39. Put the VersaRupter in the open position, use a new drive shaft pipe, and repeat steps 31 and 32. Then proceed to step 40.
- 40. Move the NP slightly down as shown in Figure 34. Mark the location of the new NP and repeat steps 34 to 36.



34

- 41. If the kirk key is still not engaging, repeat steps 39 and 40. Only proceed to step 45 once the kirk key is properly engaging as shown in Figure 36.
- 42. If the switch has an A-mechanism and too much resistance is found in the open position for kirk key engagement, or if using a K-mechanism and the kirk key is not engaging within the nominal angular range in the open position, then put the VersaRupter in the open position, use a new drive shaft pipe, and repeat steps 31 and 32. Then proceed to step 43.
- 43. Move the NP slightly up as shown in Figure 35 and repeat steps 34 to 36.



35

- 44. If the kirk is still not engaging, repeat steps 42 and 43. Only proceed to step 45 once the kirk key is properly engaging as shown in Figure 36.



36



WARNING

READ ALL STEPS COMPLETELY BEFORE PROCEEDING!

- 45. Reference step 9 and Figure 12, observing the handle yoke collar (Figure 12, #5) relative to the housing blocking tab (Figure 12, #6).
- 46. Verify the collar (Figure 12, #5) is still spaced off from the blocking tab (Figure 12, #6). Then cycle the switch closed and back to open while observing the collar. If the collar didn't overlap, slide the collar back on and install the snap ring, washer, and spring back on (Figure 37), and then cycle the switch again.

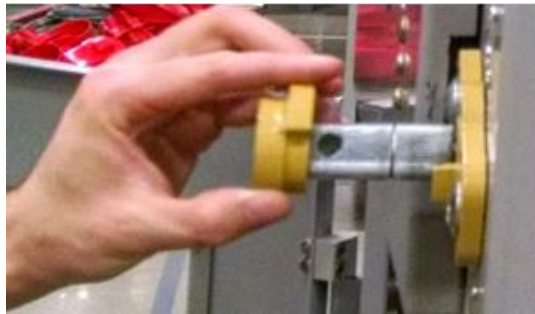


37

38 Remove collar

39 Open to close/Close to open position

47. If the collar overlapped the blocking tab or didn't complete a cycle when installed, the collar must be removed (Figure 38) and reinstalled with an orientation clocked to prevent interference.



38

48. If during the installation the switch partially completes a cycle and does not return to the open-safe position, do not attempt to enter the enclosure, or touch the VersaRupter directly.
49. Remove only the snap ring and, with the assistance of a second person, rotate the handle yoke shaft to remove the collar assembly.
50. With one person holding tension off the collar, carefully slide the collar down the spine to clear the blocking tab (Figure 12, #6) on the housing.
51. Return the operation handle to a neutral position without load and repeat steps 27 to 44.

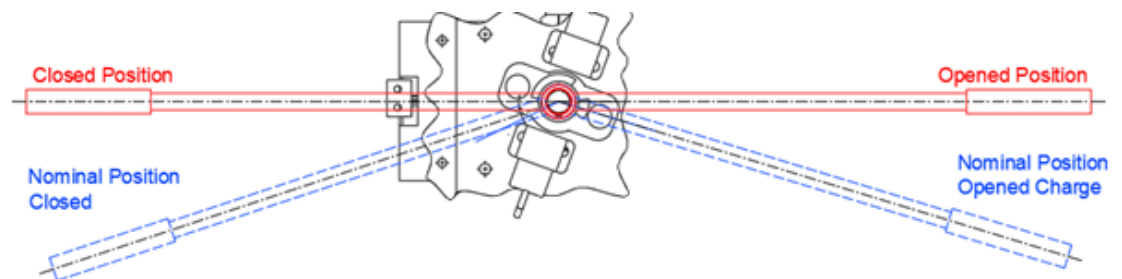
1.7 Test operation and switch mechanical behavior

1.7.1 Test operation for kirk key option

1. Check if the switch cannot be opened while the kirk key lock is locked in the "CLOSE" position.
2. Check if the switch cannot be closed while the kirk key lock is locked in the "OPEN" position.
3. Check if the switchgear door cannot be opened while the switch is closed.

1.7.2 Mechanical behavior

It is expected that the VersaRupter will reach positions no wider than 180 degrees to achieve a full open to close, or close to open operation. It is normal to experience a relaxation in the system every time a cycle is achieved (see Figure 39 for nominal positions for relaxed behavior). Hence, if the kirk key option is used, the user will have to hold the VersaRupter drive handle in a horizontal position (slight tension may be needed) for kirk key engagement. The same will occur if the door interlock is used.

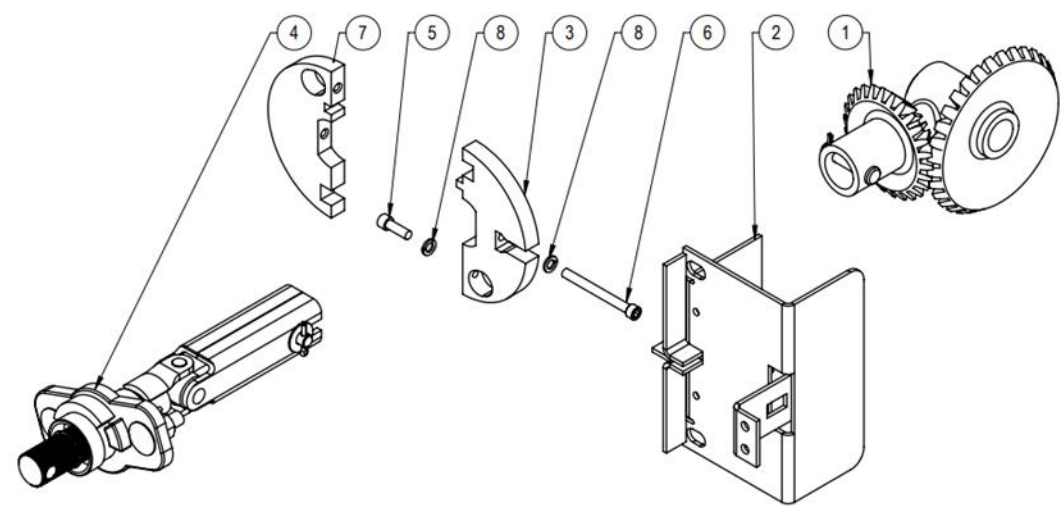


39

40 Chain drive door
interlock #S-20218
[FOR REFERENCE
ONLY]

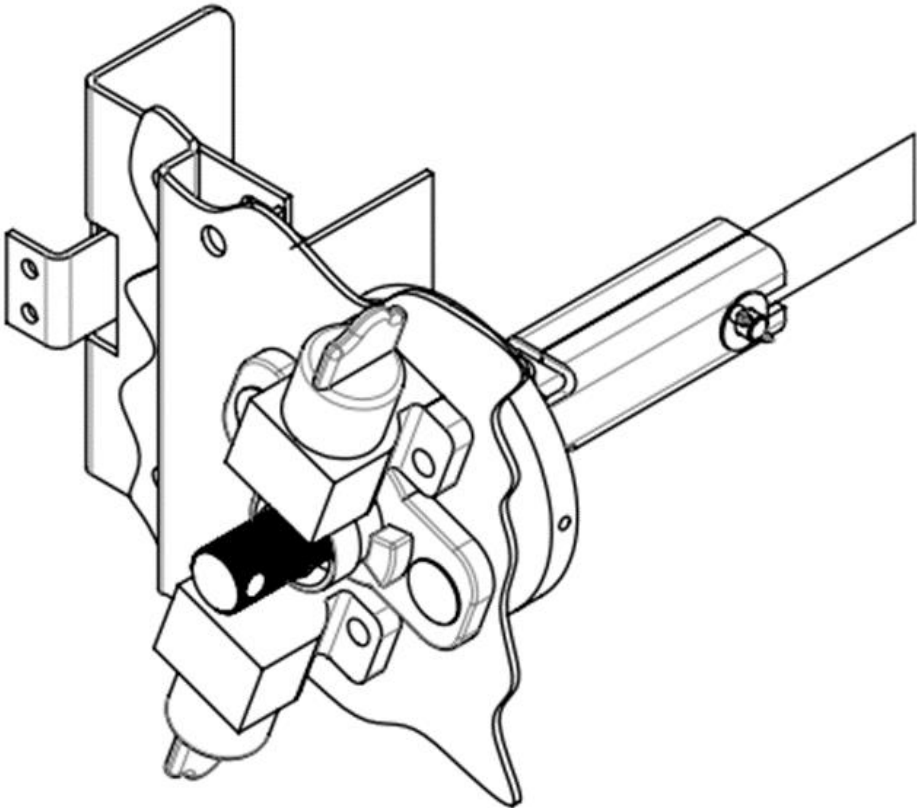


- 41 Exploded HM handle with offset door interlock
- 42 Right side HM handle with offset door interlock



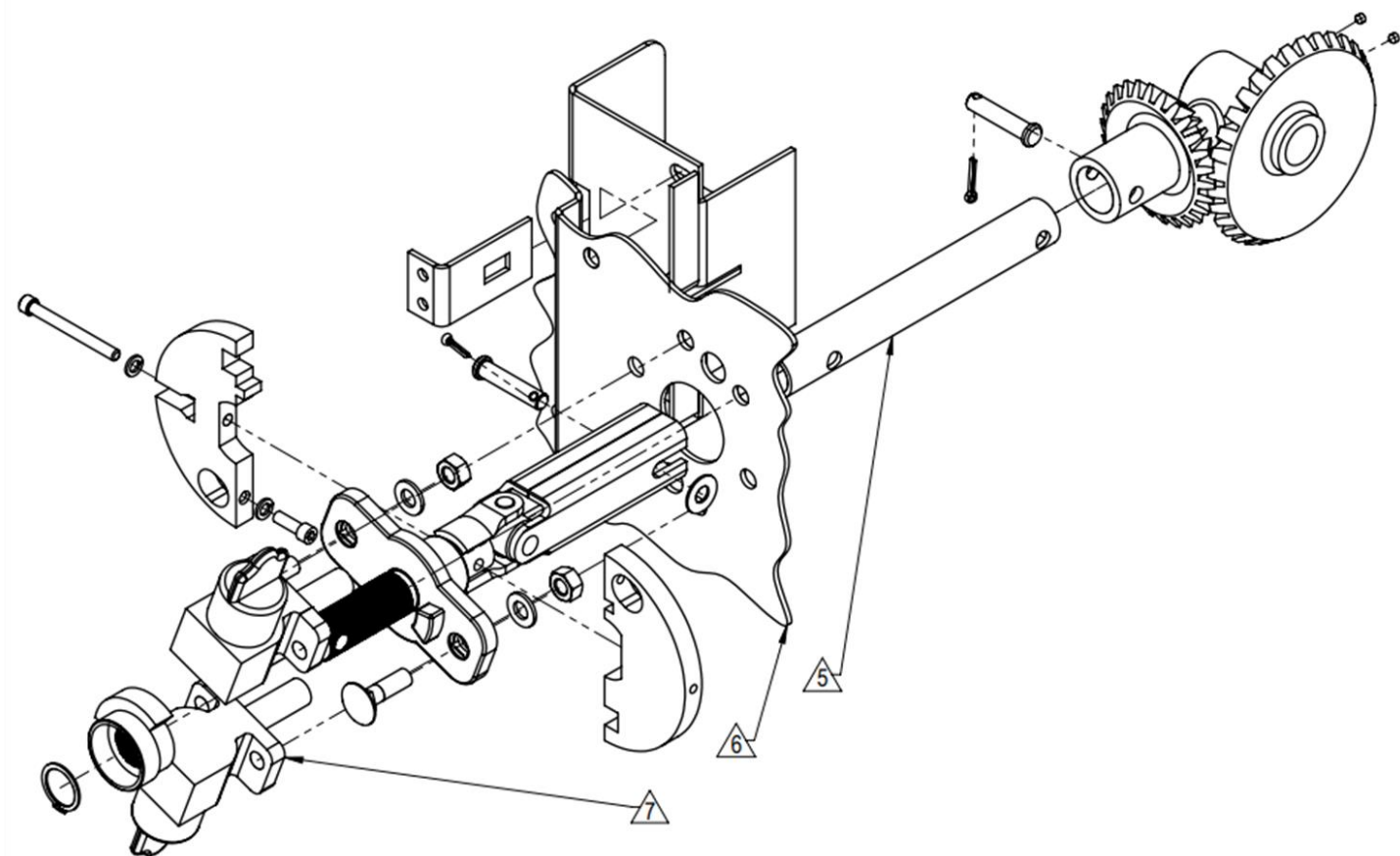
A0001	A0002	PC. NO.	DRAWING NO.	DESCRIPTION
1	1	1	2RGA025034A0001	BEVEL GEAR ASSEMBLY (HE&HM) W/ HARDWARE
1	1	2	2RGA024306A0001	OFFSET DOOR INTERLOCK ASSEMBLY
1	1	3	2RGA022828P0001	SLOTTED HE&HM DISC INTERLOCK HALF
1	1	4	2RGA024154A0001	HANDLE YOKE ASSEMBLY (HM) (MACHINED), MODIFICATION
1	1	5	3WGA014894P0017	1/4-20 X 3/4 SHCS, ALLOY STEEL, Fe/Zn-YLW, ANSI B18.3
1	1	6	3WGA024296P0005	1/4-20 X 2 1/2 SHCS, PARTIAL THD, STEEL, Fe/Zn, ANSI B18.3
1	1	7	2RGA022829P0001	TAPPED HE&HM DISC INTERLOCK HALF
2	2	8	70510DQ10M	1/4 LOCKWASHER, SSTL

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43 Right side HM handle
with offset door interlock



- △ SUGGESTED KIRK KEY TYPE B (MD), TO BE SUPPLIED BY THE CUSTOMER. ALTERNATIVE KIRK KEYS ARE ANY TYPE B & U ONLY.
- △ ENCLOSURE WALL BOLT PATTERN FOR ASSEMBLY CLEARANCE.
- △ GALVANIZED PIPE TO BE SUPPLIED BY THE CUSTOMER.

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