



# USER INSTRUCTIONS

**Worcester Controls**

**Installation**

**Operation**

**UltraSwitch™ WXCL/WXML**

**Maintenance**

FCD WCENIM2076-05

## **Description:**

Worcester Controls UltraSwitch™ limit switch enclosures provide local and remote position indication for automated valves. They generally feature a visual indicator with “red=closed” and “green=open” for intuitive local position determination. The UltraSwitch™ is available with a number of limit switch options for remote indication in a variety of electrical applications. They may also be used as a junction box for direct installation of solenoid valves.

## **Installation:**

UltraSwitches may be installed to valves or valve actuators with a variety of mounting hardware. For best results, specify the NAMUR shaft option and NAMUR mounting hardware when installing to NAMUR compliant actuator. These options allow direct coupling to actuators without couplings, reducing dead band.

Simply bolt bracket to actuator and UltraSwitch™ to bracket, leaving bolts finger tight. For NAMUR applications the UltraSwitch™ shaft features an integral alignment pin. This pin must engage the tapped hole in the actuator shaft. For non-NAMUR applications, make sure to properly install a coupler between UltraSwitch™ and actuator. Once the UltraSwitch™ is installed with fasteners loosely tightened, stroke the actuator two or three times to align the bracket. Then tighten all fasteners.

## **Wiring Instructions:**

UltraSwitch™ enclosures feature pre-wired switches. All user connections are made at a numbered terminal strip. Both external bonding and internal grounding locations have been provided for use in installation. A wiring diagram is located inside the cover and indicates which terminal numbers correspond to switch contacts: normally open, normally closed, common, etc. Simply follow the wiring diagram and electric code to connect switches to your system.

For field wiring: ensure that any excess wire lengths or loops are routed away from any moving parts and are short enough, or secured to ensure a ¼” clearance between the wire and the inside surface of the switchbox cover.

Note: for all magnetically tripped proximity switches, the top switch (top and third switches for 4-switch versions) should only be used to indicate the clockwise position: the bottom switch (second and fourth switches for 4-switch versions) should only be used to indicate the counter-clockwise position. Any deviation from these settings may result in erratic indication.

Solenoids may also be wired through the UltraSwitch™ enclosure. At least two auxiliary terminals are included as standard.



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A ground screw is also included. Simply wire the solenoid to auxiliary terminals, then connect power leads to the opposite terminal side. Be sure to properly ground the solenoid at provided ground terminal. UltraSwitch™ XCL series enclosures include two 3/4" NPT conduit entries and the XML series includes two M25x1.5 conduit entries. Installation shall be per National Electric Code, local codes, and manufacturers' instructions. In all cases, environmental seals must be used to protect against ingress of water through the conduit.

## Special Hazardous Location Instructions:

For North America installations you must install a conduit sealing fitting within 18 inches of the enclosure to meet NEC regulations. For ATEX and IECEx installations an appropriately rated Cable Gland is required. Any unused conduit entry must have a suitably rated blanking element.

### CAUTION: ⚠

- Substitution of components may impair suitability for Zone 2 Increased Safety.
- Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.
- Cleaning this housing by rubbing should be done in a non-hazardous area.
- Potential electrostatic charging hazard, clean only with a damp cloth – danger of propagating discharge.
- All grounding and bonding installation requirements must be addressed
- All installation, inspection, and maintenance of the equipment should be performed by suitably trained personnel. In addition, for ATEX, all installation, inspection, maintenance and repair must be done by suitably trained personnel. For more information refer to EN 60079-14:1997, EN 60079-17, EN 60079-19
- Replacement parts not to invalidate certification and to be only obtained direct from the manufacturer.

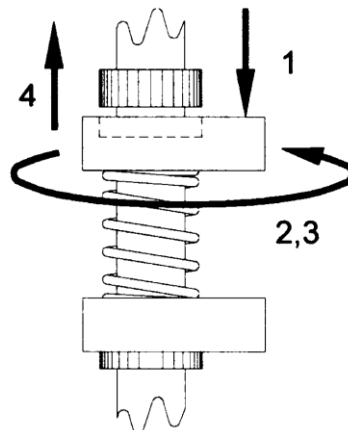
## Adjusting Limit Switches:

Ultra Switch™ enclosures feature quick-set cams which are used to trip the limit switches. These cams are easily adjusted without tools. **Caution: disconnect power before removing cover when installed in hazardous locations.** Remove cover and set aside. Rotate actuator/valve to full clockwise (CW) position. Adjust cam(s) associated with CW as follows:

1. Push or pull cam against spring to disengage it from splines.
2. Rotate cam CW breaking contact with switch (or moving magnet away from switch).
3. Continue rotating cam CW just until switch trips.
4. Release cam and reengage it with splines.

Rotate actuator/valve to full counterclockwise (CCW) position. Adjust cam(s) associated with CCW as described in steps 1 through 4, except rotate cam(s) CCW.

*Note: factory setting is top switch = CW (closed), second switch = CCW (open), third switch = CW, and fourth switch = CCW.*





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## **Fine Cam Adjustment:**

Some cams have a fine adjustment available. These cams will have a small screw embedded into the side of the cam. Adjusting this screw inward or outward will deform the cam, changing the trip point slightly.

## **Adjusting UltraDome Position Indicator:**

UltraDome visual indicators are easily adjusted to match the dome's clear windows to the rotor's colored sections. The dome is secured to the UltraSwitch housing with screws mounted through slotted holes. The slotted holes allow approximately 20° adjustment of the dome. In addition, the dome can be completely removed and reoriented in 45° and 90° increments. The rotor may be reoriented with respect to the shaft by removing the shaftcoupler and rotating 90° before reinstalling. This may be necessary to obtain the correct orientation of windows in a multi-way application.

## **Calibrating 4-20 mA Transmitter:**

Setting direct/reverse action: A dip-switch setting controls the direction of increasing travel. For 4 mA in the full clockwise position, select "D," for 4 mA in the full counterclockwise position, select "R."

Adjusting zero/span:

1. Attach a DC mA meter to +/- terminals.
2. Operate valve/switchbox to position corresponding to 4 mA.
3. Adjust feedback board zero trim pot to yield 4 mA. (Turning CW increases value, turning CCW decreases value).
4. Operate valve/switchbox to position corresponding to 20 mA feedback.
5. Adjust feedback board span trim pot to yield 20 mA. (Turning CW increases value, turning CCW decreases value).
6. The zero and span adjustments are interactive. Repeat steps 1 through 5 as necessary.

Note: If transmitter adjustment gets difficult (i.e., trim pots do not have desired effect) start over by "centering" the trim pots. This is accomplished by turning in one direction for 20 turns and reversing direction for 10 turns.



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## Switch Option Specifications:

| Switch Option                         | Manufacturer  | Part Number   | Load Capacity  |
|---------------------------------------|---|---------------|--|
| M1 – SPDT Mechanical                  | Honeywell MicroSwitch                               | V7-1C13D8-201 | 15.1A (1/2 HP) at 125/250 VAC; ½A at 125 VDC; 1/4A at 250VDC; 5A at 120Vac |
| MC – SPDT Mechanical 250°F            | Honeywell MicroSwitch                               | V7-1C13D8-201 | 15.1A (1/2 HP) at 125 VAC; ½A at 125 VDC; 1/4A at 250VDC; 5A at 120Vac     |
| MG – SPDT Gold Mechanical             | Honeywell MicroSwitch                               | V7-1D19D8-201 | 1A at 125 VAC / 50 mA at 24 VDC  |
| MA – 3-Position Control               | Honeywell MicroSwitch                               | V7-1C13D8-201 | 15.1A (1/2 HP) at 125 VAC; ½A at 125 VDC; 1/4A at 250VDC; 5A at 120Vac     |
| M3 – DPDT Mechanical                  | Cherry  | E19-00A       | 15A, 125/250 VAC 3/5HP   |
| MB – DPDT Mechanical                  | Licon   | 22-104        | 10A (1/2 HP) at 125 VAC  |
| MD – 3-Pos. Control w/Indication (DA) | Licon   | 22-104        | 10A (1/2 HP) at 125 VAC  |
| MS – 3-Pos. Control w/Indication (SR) | Licon   | 22-104        | 10A (1/2 HP) at 125 VAC  |
| P4 – SPST Proximity                   | Aleph   | PS-6132       | 0.35A at 140 VAC / .25A at 200VDC (50 W Max.)                              |
| P5 – SPDT Proximity                   | Hamlin  | 59135-030     | 0.25A at 120 VAC / 0.25A at 28 VDC (3 W Max.)                              |
| PE – SPDT Sabre Proximity             | Flowserve   | XA0199        | 1A at 120 VAC / 2A at 24 VDC   |
| PP – SPDT Phazer Proximity            | Flowserve   | XA0155        | 3A at 120 VAC / 2A at 24 VDC   |
| PL – SPDT Phazer w/LED                | Flowserve   | XA0154        | 0.5A at 120 VAC / 0.3A at 24 VDC   |
| PT – SPST BRS Proximity               | Flowserve   | XA0157        | 3A at 120 VAC / 0.5 at 24 VDC  |
| PX – SPST BRS w/LED                   | Flowserve   | XA0156        | 0.5A at 120 VAC / 0.3A at 24 VDC   |
| N8 – Solid State Proximity            | Pepperl + Fuchs                                     | NJ2-V3-N      | NAMUR Sensor Output / 5-25 VDC Supply                                      |
| NP – Solid State Proximity            | Pepperl + Fuchs                                     | SJ3.5-N       |  |
| NQ – Solid State Proximity            | Pepperl + Fuchs                                     | NJ4-12GK-N    |  |
| NR – Solid State Proximity            | Pepperl + Fuchs                                     | NJ4-12GM40-E1 | PNP Sinking / 200 mA max. Current / 10-60 VDC                              |
| NS – Solid State Proximity            | Pepperl + Fuchs                                     | NJ4-12GM40-E2 | NPN Sourcing / 200 mA max. Current / 10-60 VDC                             |
| NT - Solid State Proximity            | Pepperl + Fuchs                                     | NJ4-12GK40-E2 | NPN Sourcing / 200 mA max. Current / 10-60 VDC                             |
| NU – SPDT GO Proximity                | GO  | 35-13319-A1A  | 4A at 120 VAC / 2A at 240 VAC  |
| N9 – Solid State Proximity            | Pepperl + Fuchs                                     | NBB3-V3-Z4    | NPN Sourcing/ 100 mA max. Current / 5-60 VDC                               |
| SN – 3-way Pneumatic                  | <i>Consult factory for technical specifications</i> |               |  |
| FZ – AS-I Bus Card                    | 31VDC 28 mA   |               |  |



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## Analog Feedback Option Specifications:

Options T, D, E, S - 4-20 mA Transmitter

Voltage Supply: 6-30 VAC  
Impedance: 300 Ohms at 20 mA

Options A, B, C - Potentiometer Output  
Maximum Load: 1 Watt

### **Enclosure Ratings**

NEMA 4, 4x, 7, and 9  
IP67(CSA only)

## Hazardous Location Approvals:

All Switch Options  
Flame-proof



ATEX  
II 2 G Ex d IIB T5  
II 2 D Ex tD A21 IP 65  
T5 @  $-20^{\circ}\text{C} \leq \text{Tamb} \leq +55^{\circ}\text{C}$ ,  
EN 60079-0:2004  
EN 60079-1:2004  
EN 61241-0:2006  
EN 61241-1:2004

IECEX &  
Ex d IIB T5  
Ex tD A21 IP 65  
T5 @  $-20^{\circ}\text{C} \leq \text{Tamb} \leq +55^{\circ}\text{C}$ ,  
IEC 60079-0:2004 (Ed.4)  
IEC 60079-1:2003 (Ed.5)  
IEC 61241-0:2004 (Ed.1)  
IEC 61241-1:2004 (Ed.1)

InMetro  
BR Ex d IIB T5  
T5 @  $-20^{\circ}\text{C} \leq \text{Tamb} \leq +55^{\circ}\text{C}$ ,

Mechanical Switch Options  
Explosion-Proof (UL/CSA)  
Class I, Divisions 1, Groups C and D  
Class II, Divisions 1, Groups E, F and G  
Class II, Division 2, Groups F and G  
Class III (CSA only)

FM U.S. Canada Intrinsically Safe Switch Options  
Switch Type: MG, PE, PT, P4, N8, NQ, NP  
Class I,II,II Division 1 Groups A,B,C,D,E,F,G T5

Proximity / Solid State Switch Options  
Explosion-Proof (UL/CSA)  
Class I, Division 1, Groups C and D  
Class I, Division 2 Groups A, B, C and D T3  
Class II, Divisions 1, Groups E, F and G  
Class II, Division 2, Groups F and G  
Class III (CSA only)

NOTE: When using a sealed proximity switch (P4, P5, PP, and PL ) in North American Division 2 applications, a sealing fitting is not required.



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## Product Nomenclature:

### □ Prefix

W - Worcester Controls

### □ SHAFT TYPE

D - Double "D" Shaft  
N - NAMUR Shaft  
M - 0.085 Double "D" Shaft

### □ BODY STYLE

XCL - Aluminum Housing, Explosion-proof / Flame-proof, (2) ¾" NPT Conduit  
XML - Aluminum Housing, Explosion-proof / Flame-proof, (2) M25 Conduit

### □ INDICATOR TYPE

1 - Flat Top Cove, No Indicator  
U - Standard Ultradome (Green / Red)  
3 - Four Window Ultradome  
C - 90° 3-Way Ultradome  
D - 180° 3-Way Ultradome  
E - 180° 3-Way Center Blocked Ultradome  
F - 120° Thru / Divert Ultradome  
H - Black / Gray / Yellow Ultradome  
K - Green / Red with Ektar Ultradome  
P - Stainless Steel Arrow Indicator  
R - Reverse – Red = Open / Green = Closed Ultradome  
W - White (=closed) / Blue (=open) Ultradome  
X - Three Position Type 6 White (=closed) / Blue (=open) Ultradome

### □ NUMBER OF SWITCH ELEMENTS

0 - 0 Switch Elements  
1 - 1 Switch Element  
2 - 2 Switch Elements  
4 - 4 Switch Elements

## □ SWITCH ELEMENT TYPE

|    |   |  |
|----|---|--|
| 00 | - | No Switches (empty housing)  |
| M1 | - | SPDT Mechanical  |
| MA | - | SPDT Mechanical with Cams for 3-Position control (see note 1)          |
| MD | - | DPDT Mechanical with Cams for DA 3-Position w/ Indication (see note 1) |
| MS | - | DPDT Mechanical with Cams for SR 3-Position w/ Indication (see note 1) |
| MC | - | SPDT Mechanical – Construction for 250' F                              |
| MG | - | SPDT Mechanical – Gold Contacts  |
| M3 | - | DPDT Mechanical – Cherry   |
| MB | - | DPDT Mechanical – Licon  |
| P4 | - | SPST Proximity   |
| P5 | - | SPDT Proximity   |
| PE | - | Sabre SPDT Proximity   |
| PP | - | Phazer II SPDT Proximity   |
| PL | - | Phazer II SPDT Proximity with LED                                      |
| PT | - | Phazer II BRS SPST Proximity   |
| PX | - | Phazer II BRS SPST Proximity with LED                                  |
| N8 | - | P&F NJ2-V3-N / NJ2-V3-N-V5 (NAMUR)                                     |
| N9 | - | P&F NBB3-V3-Z4   |
| NQ | - | P&F NJ4-12GK-N (NAMUR)   |
| NR | - | P&F NJ4-12GM40-E1 (3-Wire NPN NO)                                      |
| NS | - | P&F NJ4-12GM40-E2 (3-Wire NPN NO)                                      |
| NT | - | P&F NJ4-12GK40-E2 (3-Wire NPN NO)                                      |
| NP | - | P&F SJ3.5-N (NAMUR)  |
| NU | - | GO SWITCH proximity  |
| SN | - | 3-Way Pneumatic Valves   |
| FN | - | DeviceNet Controller Card, 4 in / 2 out, with (2) type 4 switches      |
| FZ | - | AS-i 2.1 Controller Card, 4in / 2 out, with (2) type 4 switches        |

## □ CERTIFICATIONS

|     |   |  |
|-----|---|--|
|     | - | (see note 2)   |
| -14 | - | General Purpose  |
| -17 | - | (CSA/UL) Class I, Div 1, CD; Class I Div 2, ABCD T3; Class II Div 1, EFG; Class II Div 2, FG; Class III T5 |
| -18 | - | UL/CSA CI I, Div 1 Gr CD / CI II Div 1,2 Gr EFG/ ATEX II 2G Ex d IIB T5                                    |
| -19 | - | ATEX - II 2 G Ex d IIB T5; ; II 2 D Ex tD A21 IP 65  |
| -25 | - | IECEX - Ex d IIB T5; Ex tD A21 IP 65   |
| -26 | - | InMetro – BR Ex d IIB T5   |
| -27 | - | Factory Mutual/CUS Intrinsically Safe Class I,II,III Div 1 Gr A,B,C,D,E,F,G T5 (See Note 7)                |
| -M1 | - | Metal Nameplate UL/CSA CI I Div 1 Gr CD / CI II Div 1,2 Gr EFG   |
| -M2 | - | Metal Nameplate UL/CSA CI I Div 1 Gr CD Div 2 Gr ABCD T3 / CI II Div 1,2 Gr EFG                            |



# USER INSTRUCTIONS

## □ ANALOG OUTPUT OPTIONS

- (see note 3)
- 0 - None
- T - 4-20mA Transmitter (40' to 100' travel)
- D - 180' Travel 4-20mA Transmitter
- A - 0-1k Ohm Potentiometer
- B - 0-5k Ohm Potentiometer
- C - 0-10k Ohm Potentiometer

## □ WIRING OPTIONS

- 0 - None
- 1 - Brad Harrison Connectors -3 pins
- 2 - Brad Harrison Connectors -5 pins
- 3 - Brad Harrison Connectors – 7 pins
- H - Heavy Duty Terminal Block
- P - Sealed/Potted Leads (see note 4)

## □ MINIMUM OPEN TERMINALS OPTION

- 2 - 2 (standard – see note 5)
- 4 - 4
- 6 - 6
- 8 - 8

## □ SPECIAL OPTIONS

- 0 - None
- L - Lubricated (greased) cover Cover Bolts
- N - No Silicone
- P - 180' Potentiometer Gears (for analog options A,B, or C)
- V - Viton O-Rings

## □ COATING OPTIONS

- 0 - Black Polyester Powercoat
- E - White Epoxy Coated
- W - White Epolon II





# USER INSTRUCTIONS

## Notes

- 1) MA switch element must be ordered with qty. (2) switch elements. MD and MS switch elements must be ordered with qty. (4) switch element
- 2) Certifications:

Valid certification codes for Mechanical Switches ( options M1,MA,MD,MS,MC,MG,M3 and MB) include -14, -18, -19, -25, -M1

Valid certification codes for Proximity Switches (options P4,P5,PE,PP,PL,PT,PX,N8,N9, NQ,NR,NS,NJ,NP, and NU include -14,-17, -18,-19,-25, -M2

Valid certifications codes for Analog Output (options T,D,A,B,D) include -14,-18,-19,-24, -M1

- 3) Transmitter option available for switch options 00,M1,MG, N8 only, maximum number of switch elements is (2)
- 4) When Ordering potted leads, specify the conduit (left or right), number of leads, length, and color of wires.
- 5) Some models have more than (2) open terminal locations open as standards. Consult factory for details.
- 6) Switch option FN(Device Net), F2, F4,(Foundation Fieldbus), SN (pneumatic switch) not approved for ATEX or IECEx
- 7) Valid switch options for Intrinsically Safe (-27 code) are MG, PE, PT, P4, N8, NQ, NP

Example:

WNXCLU2M1-18-00200 = Worcester Controls brand, NAMUR shaft, XCL, Ultradome indicator, (2) SPDT mechanical switches UL/CSA and ATEX certifications

## Materials of Construction:

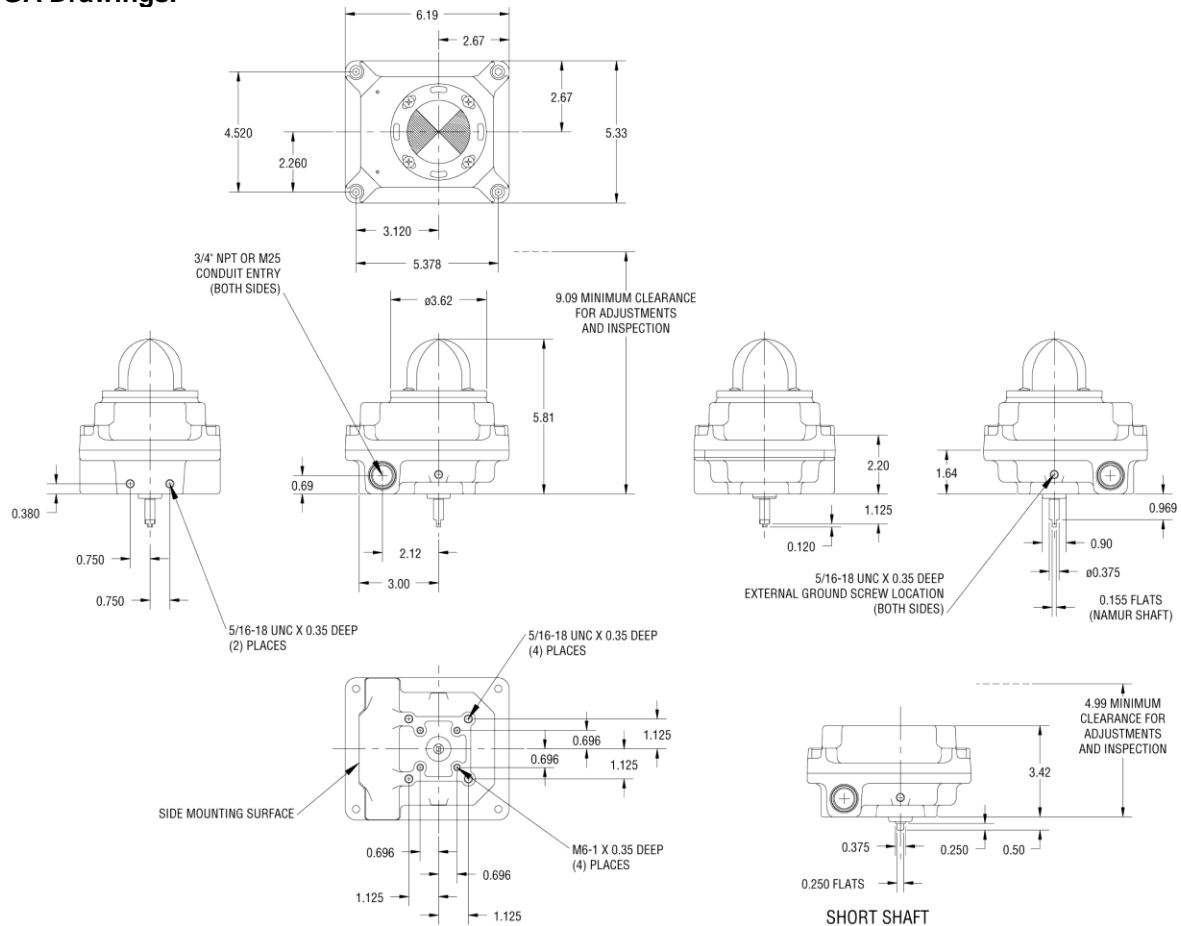
| Part                   | Materials                                    |
|------------------------|--|
| Housing/Cover          | Aluminum w/Dichromate & Polyester Powdercoat |
| Shaft                  | Stainless Steel                              |
| Cams/Splines           | Nylon  |
| UltraDome and Rotor    | Polycarbonate                                |
| Terminal Block         | Nylon – Buchanan TBS Series                  |
| Internal Brackets      | Stainless Steel or Plated Steel              |
| All Internal Fasteners | Stainless Steel or Plated Steel              |
| All External Fasteners | Stainless Steel                              |
| UltraDome              | Lexan or Ektar™                              |
| Rotor                  | Polycarbonate                                |

- If the equipment is likely to come into contact with aggressive substances, then it is the responsibility of the user to take suitable precautions that prevent it from being adversely affected, thus ensuring that the type of protection provided by the equipment is not compromised.

## Max Safe Gaps:

| Flamepath                       | Maximum Gap (mm) | Comment                  |
|---------------------------------|------------------|--------------------------|
| Cover and base                  | 0.038            | Flanged joint            |
| Operating rod and cover bushing | 0.088            | Cylindrical spigot joint |
| Cover and bushing               | 0.00             | Interference fit         |
| Operating rod and base bushing  | 0.088            | Cylindrical spigot joint |
| Base and bushing                | 0.00             | Interference fit         |

## GA Drawings.





# USER INSTRUCTIONS

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To find your local Flowserve representative please use the Sales Support Locator System found at [www.flowserve.com](http://www.flowserve.com)

Or call : 1-931-432-4021

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