# ONYX VALVE COMPANY

# MODEL DEC

# Installation & Maintenance

Dual Pinched (D), Electric Actuator(E), Closed Body(C)

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## STORAGE

Correct storage procedures extend valve life. The rubber sleeve in the valve is perishable. Ideal storage conditions are 50˚F and 60% relative humidity.

1. Keep valves and spare sleeves as cool as possible. They can be stored in an unheated area but allow maximum ventilation in storage areas subject to high ambient summer temperatures. Truck trailers and storage sheds become incredibly hot during summer months. Avoid such locations.

2. Avoid sunlight. Ultra-violet light accelerates the deterioration of rubber. Leave the valve in its box. If not feasible to box the valve, cover the sleeve with black plastic.

3. Avoid ozone. DO NOT STORE valve near active electrical equipment. For long-term storage, coat the face and inside the sleeve twice yearly with silicone spray or liquid.

## DESIGN CRITERIA

The **maximum process temperature** that the valve can tolerate is based on the elastomer used to fabricate the sleeve.

| **Poly Isoprene** | **Chloroprene** | **EPDM Ethylene Propylene** | **Nitrile** | **Butyl** | **Fluorocarbon** |
|---|---|---|---|---|---|
| **PGR** Pure Gum Rubber | **Neoprene** | **Nordel** | **Buna-N** | **Butyl** | **Viton** |
| -30°→+180° F<br>-34°→+82° C | -20°→+220° F<br>-29°→+104° C | -40°→+300° F<br>-40°→+150° C | -30°→220° F<br>-34°→104° C | -30°→+225° F<br>-34°→+106° C | -15°→+375° F<br>-26°→+190° C |

The **maximum safe process pressure** that the valve sleeve and housing can tolerate is based on valve size and flange rating. For Onyx model DEC valves with 150# flanges maximum process pressure:

| Size | 2 | 2½ & 3 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 24 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $P_{max}$ psi | 200 | 175 | 150 | | | 100 | | 75 | | | | | |

Notes:

1. Higher pressure ratings are available on special order.

2. This is the maximum safe pressure that the valve body can safely handle. The actuator is sized to close against the line pressure stipulated on the customer's PO and in most cases is significantly lower than max rated housing pressure shown here. Check name tag on the valve for maximum operating pressure based on actuator available thrust.

## INSTALLATION:

1. **Safety considerations.**

   a) Leakage: Consider the possibility of leakage due to improper tightening of flange bolts. Pinch valves handle abrasive fluids; it is reasonable to expect the rubber sleeve to eventually wear out. Precautions should be taken where liquids may spray out or drip down onto electrical equipment or plant personnel, or combustible fluid may drain into a dangerous area.

   b) After shut down: Pinch valves can hold pressure in a system for a considerable length of time. Means should be provided to safely relieve pressure and drain lines.

2. **Flanges:**

   a. Onyx pinch valves are designed to work with standard ANSI 150# (or 300#) flanges.

   b. No gasket is required; the sleeve face *is* the gasket.

   c. Make sure the inside edges of mating flanges are filed or ground smooth. Any sharp edges on the inside corner of mating flanges will cut the rubber sleeve causing premature failure.

   d. Valve flanges have through holes and are designed to have an ANSI hex (not heavy hex) nut behind the flange. Flange bolts must be inserted from the mating flange side.

   e. Use **flat face flanges**. Do NOT use raised face flanges. Raised face flanges cut into the rubber sleeve damaging it.

   f. Flange bolts must be installed through the mating flanges. Flange bolts can **not** be inserted from the valve side of the flange assembly.

3. **Inspection:** Inspect the valve before installation. Report any shipping damage before installation. DO NOT INSTALL A VALVE KNOWN TO HAVE BEEN DAMAGED IN SHIPMENT. Check inside the valve to make sure no foreign objects are present.

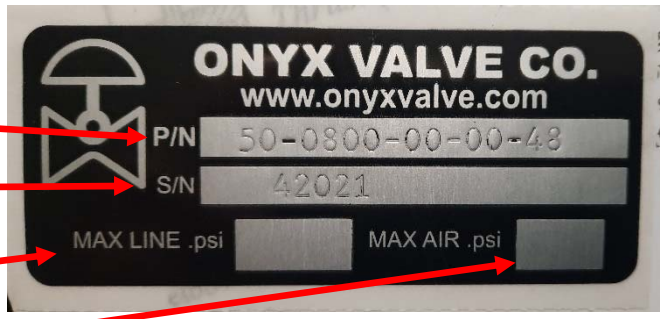
4. **Identification:**

   **Part**#. Use this number when ordering spare/replacement parts.

   Serial#

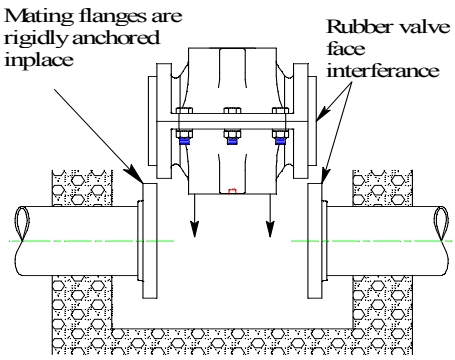
   This is the pressure that the valve was tested at the factory prior to shipping.

   Does not apply to electric valves.



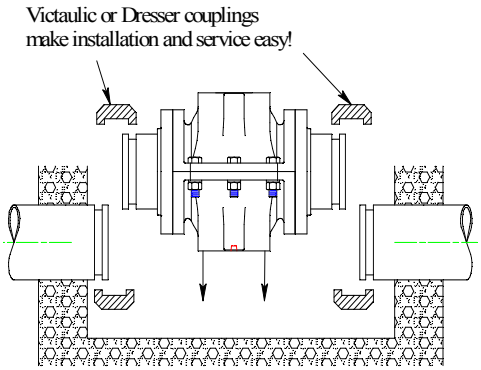
5. **Design considerations:**

**a.** If the valve is at the end of a pipe run, you must install a flange ring on the discharge end of the valve to seal the air properly.




**b.** Design the installation so the valve can be removed and reinstalled later.

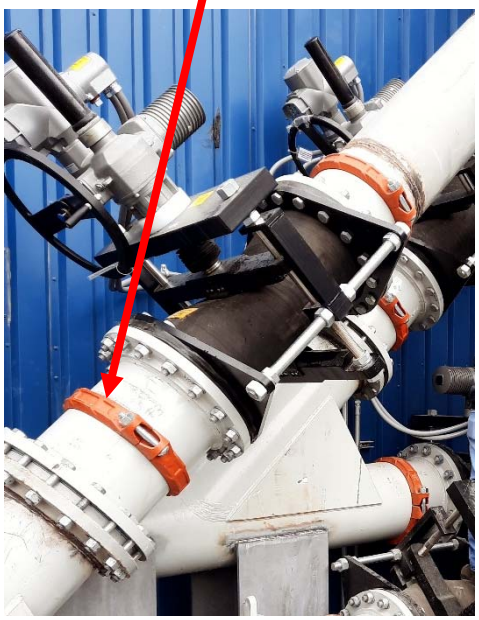
Pinch valve sleeves wear out and have to be replaced. The rubber sleeve is molded longer than the housing to provide enough compression in the rubber to prevent leaks. If mating pipe flanges are rigidly anchored in concrete or welded in place, you might be able to remove the valve from the line but there will be hell to pay when you attempt to reinstall it. The protruding rubber faces of the sleeve will thwart any attempt to get the valve back into place.



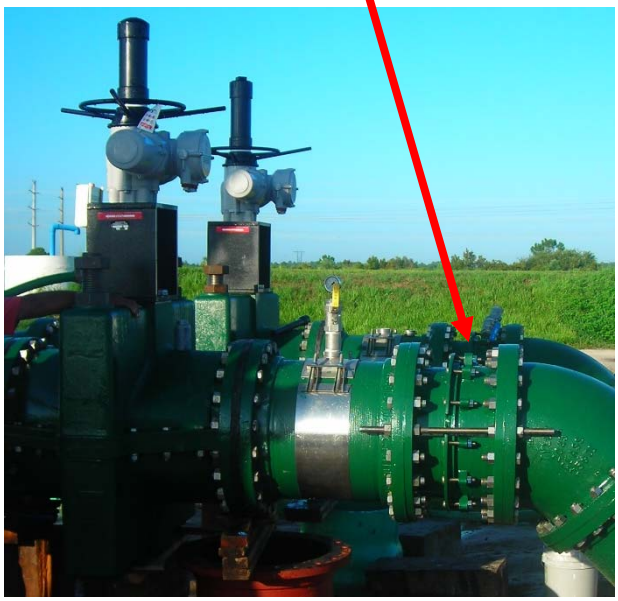

**c.** Using a Victaulic or Dresser coupling will facilitate removal and makes it easy to reinstall the valve later.

By using split couplings, the mating flanges can be attached to the valve first and tightened prior to installation. Then the entire assembly can be dropped into place and secured with the split couplings.

Victaulic couplings.



Dresser coupling

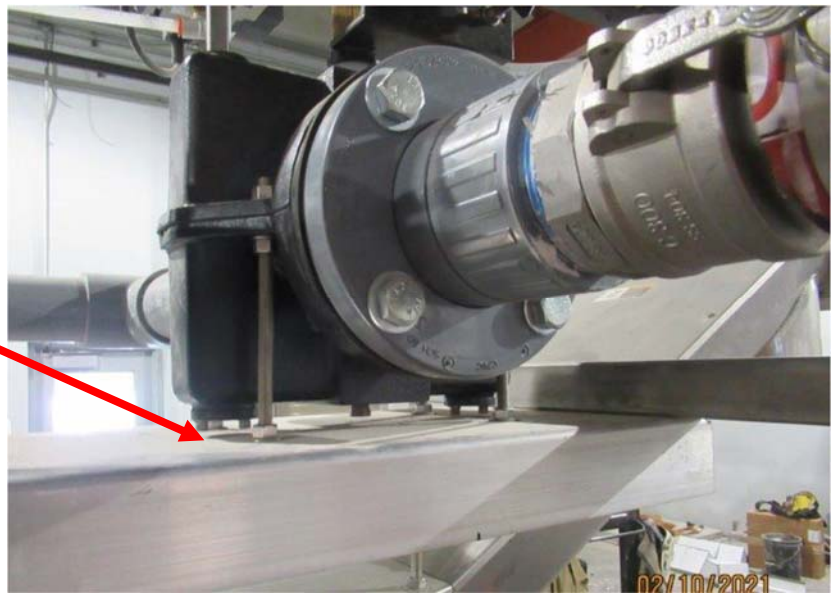


d. When installing series-D pinch valve make sure there is ample clearance for guide rods. These are the two rods that slide in and out of the lower housing to raise and lower the pinch bar. Make

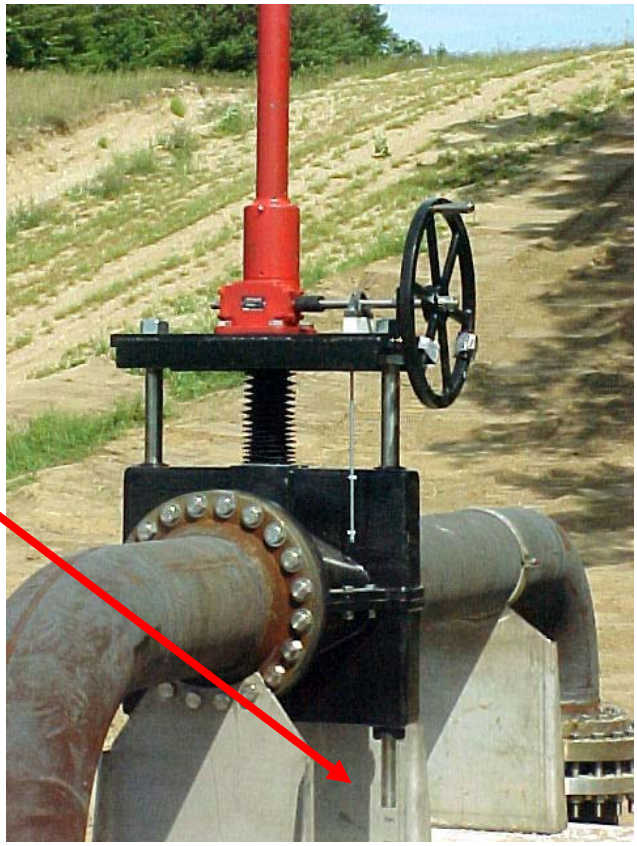
sure there is sufficient clearance **under the valve** for these rods to extend all the way without hitting anything. Check catalogue literature for required clearance dimension.

Wrong ➡

Insufficient clearance under the valve. The first time you attempt to open the pinch valve the rods are going to crash into the support beam.




Good design. Note generous clearance under the valve for guide rods.



e. On valves **for modulating service**: Allow at least 2-pipe diameters straight run into throttling valves as a minimum.

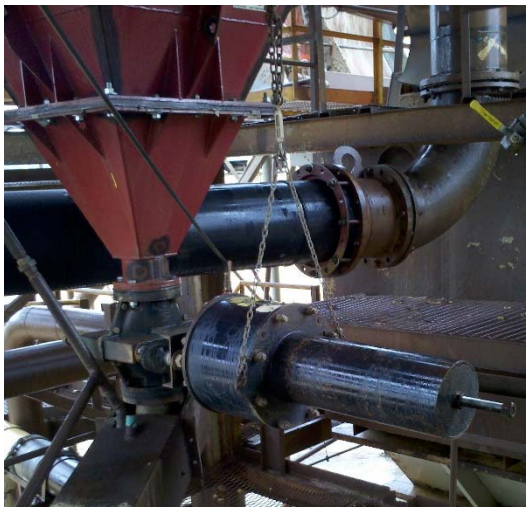
Good ⬇

Better ⬇


f. Valves for **On/Off service** can be connected directly to adjacent pipe fittings without straight run in or out.

g. Orientation: There are 4-ways to install a pinch valve. 1 thru 3 are good. #4 is bad.

| 1. Valve upright in horizontal pipe. Works with liquid and dry bulk applications. | 2. Valve is 90° from vertical in horizontal pipe. This is OK with liquids. Do **NOT** install this way on **dry bulk** conveying. | 3. Valve is in vertical pipe. Works well with both liquid and dry material. |
|---|---|---|



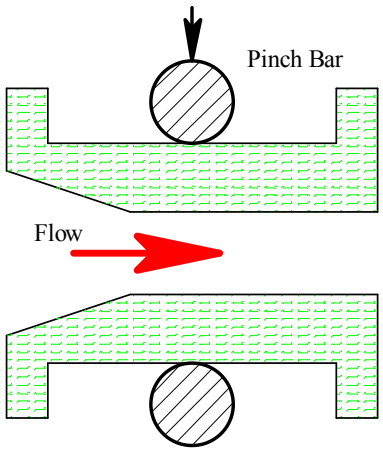
4. **BAD:** Valve at an intermediate angle between vertical and horizontal. Don't do this.

h. Locate the valve where it can be reached for service and sleeve replacement. Allow access by technicians who may have to calibrate automatic valves. Allow access to the auxiliary hand wheel if valve was so equiped.

i. Be sure pipeline is clean. Foreign material left in the pipeline can damage valves. Clean the mating flanges of adjacent pipe. Remove any old gasket material.

j. Most pinch valves can be installed with flow in either direction.

   i. The exception: modulating valves with Trumpet Mouth (Taper-Inlet-Only) design. In this case there will be a Flow Arrow on the valve showing correct flow direction. The correct flow direction is always from the tapered end towards the non-tapered end.




k. Do not install valve next to a source of extreme heat.

6. **Installation tips:**

a. Close valve prior to installation.

b. Make sure adjacent pipe is properly aligned.

c. Adjacent pipe must have sufficient travel to insert valve and draw tight to compress sleeve faces; valve will not stretch.

d. Coat faces of valve sleeve with silicone lubricant to facilitate installation and later removal of the valve and to preserve the resiliency of the rubber.

e. Bolt valve into pipeline. Snug up the bolts gently in a crisscross pattern. It may be necessary to re tighten bolts later after the rubber has taken set.

| **BOLT TORQ IN FT-LB** | | | |
|---|---|---|---|
| FLANGE | # BOLTS | PINCH & DUCKBILL VALVES | |
| | | 1ST HIT * | 2ND HIT * |
| 1 | 4 | 30 | 50 |
| 1.5 | | | |
| 2 | | | |
| 2.5 | | 35 | 55 |
| 3 | | 45 | 65 |
| 4 | 8 | | |
| 5 | | | |
| 6 | | 50 | 70 |
| 8 | | | |
| 10 | 12 | 50 | 80 |
| 12 | | | |
| 14 | | 60 | 95 |
| 16 | 16 | | |
| 18 | | | |
| 20 | 20 | 65 | 150 |
| 24 | | | |
| 30 | 28 | 75 | 175 |
| 36 | | | |

**Electrical hook up.**

Safety:

**Warning!** High voltages may be present inside the electric actuator.

Turn off all power before proceeding with wiring.

All wiring must be performed by a qualified electrician in accordance with local and national electrical codes.

Failure to heed this warning could result in injury, death, and/or damage to equipment.

a. Wiring: Connect power and control wiring to appropriate terminals inside the actuator wiring compartment.

b. Refer to wiring diagram supplied with valve actuator for correct wiring sequence.

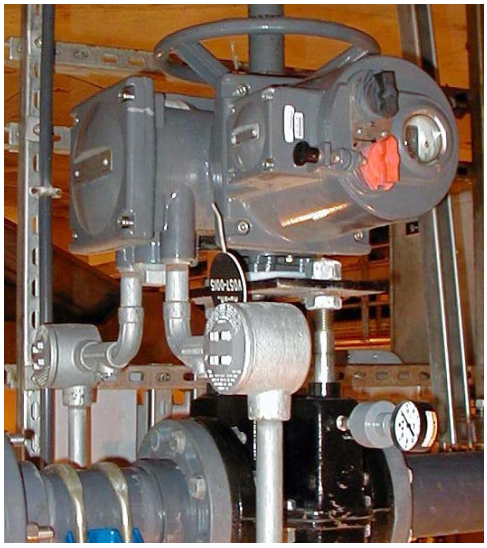
c. Refer to instruction manual supplied with actuator for details of operation related to the electric actuator.

d. On the model DEC pinch valve, ***the actuator moves as the valve operates.*** Actuator travel equals half nominal valve size, e.g.: on a 10" valve, the actuator moves up & down 5 inches.

ii. Use flexible conduit.
iii. Do NOT use rigid conduit.

⬅ GOOD.
Flexible conduit allows actuator to move up and down.

Bad ➡
Rigid conduit will break actuator enclosure first time the valve cycles.



7. **MAINTENANCE.**

a. Lubrication Schedule:

i. At start up: Construction activities can create a lot of abrasive dust so it's a good idea clean and oil the stem and guide rods at start up.

ii. Once a year: Clean and oil the stem and guide rods. Pump a few OZ of wheel bearing grease into the drive tube followed by a few drops of heavy gear oil.

1-Spray stem & rods with WD-40.

2-Spray lower guide rods with WD-40

3-Wipe clean with a soft rag.

4-spray with WD-40 again but this time do not wipe it off. Allow oil to soak into bearings.

5-Once a year pump a few ounces of wheel bearing grease into the drive tube.

6-Once a year pour a few drops of gear oil into the drive tube.

Recommended Grease: Texas Refining Corp #880 Crown & Chassis, any grade.

Recommended Gear Oil:

8. **Startup.**

a. Every Onyx electric actuated valve is tested at final assembly.

   i. The valve is flanged and pressurized to max working pressure stated on Order Acknowledgement + 10%.

   ii. Electric actuator is powered up.

   iii. Limit switches are set here at the factory. Don't monkey with them.

   iv. Torque limits are set here at the factory.

   v. Positioners and position re-transmitters are calibrated here at the factory and should not require any adjustment in the field.

   vi. Actuator is operated for 15 minutes. Amp draw and temperature rise are checked in ensure that they are within specified limits.

   vii. Valve should be plug & Play. You should only have to connect electric power and command signals and valve should be ready to operate.

b. When you start an electric actuated valve – especially electric valves in modulating service – you should monitor valve operation for the first few hours to insure that you are not exceeding the actuator's rated duty cycle.

9. **Duty Cycle**

Pneumatic actuators can cycle at high speed, continuously, with no mandatory rest period. **Electric actuators cannot operate this way.**

Electric actuation eliminates the capital costs associated with air compressors and the danger of frozen air lines is eliminated. However, electric actuators have specific limitations which must be observed during design, start up, tuning, and operation.

**Electric actuators are inherently fixed speed.** When you command the actuator to move to a new position, it immediately jumps to its design speed; it travels at a constant rate to the target then stops abruptly. This complicates tuning. You have to set your controller with enough dead-band to tolerate overshoot that results from the inertia of the motor and drive train.

On electric actuators in **modulating** service, you're faced with this trade off: A fast actuator minimizes lag time but over-shoots the target causing instability problems. A slower actuator minimizes over-shoot and is more stable. The sweet spot for electric actuators in modulating service is in the range of 13 to 26 RPM, maybe a bit faster up to 40 RPM as a maximum.

For **on-off** service, you want maximum speed. Sleeve wear is caused primarily by turbulence that occurs when the valve is in the near-closed position. Moving the valve as quickly as possible through this transition zone maximizes sleeve life. Actuators for On-Off service should operate between 54 and 108 RPM.

**An electric actuator can only operate for a limited amount of time without overheating.** Electric actuators have what is known as an "**IEC – S4 - 25% x 15 minute x 600 start/hr**" duty cycle rating. What this means in English:

The actuator can run no more than **25%** of the time. If the actuator runs for 1 minute, it needs 3 minutes to cool back down. If it runs for 4 minutes, it needs 12 minutes to cool down.

The actuator can run continuously for more no more than **15 minutes** at a time. If you force the actuator to run without a rest, shortly after 15 minutes the thermal switches in the motor windings pop, forcing the actuator off-line for 45 minutes until it cools back down. Electric actuators with a longer run time are available, for example, a 30-minute duty cycle. ***These cost more.***

You can start and stop the electric actuator no more than **600 starts** every hour. Every time you start the actuator moving, it pulls a higher current than its rated run current. This elevated amperage turns into heat that eventually burns out motor starters and windings. You can order an electric actuator with a higher duty cycle, for example, 1200 starts per hour is available. ***These cost more.***

What can go wrong tuning the control loop with an electric actuator:

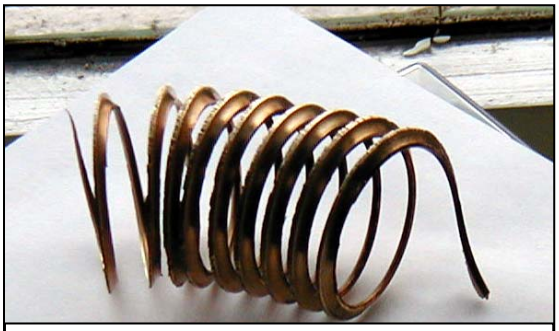
a. **Too much gain:** Inside your SCADDA system is a unique PID module dedicated to controlling every modulating valve in the plant. This PID module has to be "tuned" to match each individual valve's response characteristic. To do this, the programmer in charge of the SCADDA system adjusts the gain in the PID module. The natural tendency is to crank up the gain (also known as reducing dead band) in the PID module. This improves accuracy. However, **increasing the gain forces the electric actuator to cycle more frequently.**

b. **The valve port is oversized.** In this situation, the valve seems to control the flow well enough, but even at maximum flow it never goes more than 20% open. When the valve operates close to the seat the high velocity accelerates sleeve wear, requiring more frequent sleeve replacement. The sweet spot is 15% to 90% open. **Operating too close to the seat** (< 20% Open) makes flow control unstable, **forcing the actuator to cycle more frequently.**

**Forcing the electric actuator to cycle frequently invariably leads to a bad end:**

i. The threads in the drive nut become worn down to the point where the root area is insufficient to withstand the thrust load; they rupture in a classic shear failure. The threads come out of the drive nut like a slinky.

ii. Frequently cycling generates heat. Cross a certain threshold and the actuator commits self-immolation burning out the motor and starter.



*The dreaded "Slinky "effect: This used to be the threads in an electric actuator drive nut.*

There are "continuous duty" electric actuators available that can run non-stop. Continuous duty electro-hydraulic actuators command a ***substantial*** price premium.

A special case: **Large** (over 8") **electric** actuated **modulating** valves equipped with **1-phase** actuators. This situation is frequently plagued by operational problems. Users fail to recognize the

amp draw that these actuators require. Wiring must be sufficiently large to handle high current loads incurred during the "start' portion of every cycle. In many of these applications a standard 15-Amp circuit breaker won't cut it and a 20-Amp breaker may be marginal. The constant jogging required to modulate valve position stresses wiring, breakers, and starters. If your wiring can not sustain specified voltage during starting, the motor will burn out in short order. For example:

c. An AUMA SAR-14.2 at 13 RPM output, 1-phase 120 VAC actuator has a run current of 12 Amps, but a **starting current of 21 Amps**. Every time you jog the valve to a new position, your breaker and wiring has to tolerate this load.

d. An EIM model M2CP - 12 RPM output 1-phase 120 VAC has a lot of torque, but it has a **Peak Amp draw between 45 and 119 Amps** depending on motor size.

## 10. **SLEEVE REPLACEMENT**

**WARNING:** Prior to attempting for sleeve replacement, the valve must be in open position. Failure to having the valve in open position could result in equipment damage and/or serious personal injury.

1. Relieve process pressure and drain process line.

2. Turn off electric power. Disconnect electric lines. Label and record connections so the valve can be reconnected in the same manner.

3. Remove valve from process line.

4. Keep the valve in the open position by having the valve stem retracted.

5. Keep the valve in the open position.

   Disassemble valve bonnet assembly (#2) by removing bonnet bolts, nuts, and washers (#2A, 2B, 2C).

6. Separate upper and lower bonnet halves (#2).

7. Remove positive opening tabs from lower pinch bar (#10) by removing bolts, nuts and washers (#8A, 8B, 8C).

8. Remove the lower pinch bar by removing hex nuts (#23A) from the guide rods (#23).

9. Turn **the manual hand wheel override** of electric actuator clock wise to push the sleeve clear of the upper bonnet. If the valve is equipped with POF tabs, drive the pinch bar out far enough to access the POF hardware.

10. If sleeve (#1) is provided with positive opening tabs (integrally molded tabs bolted to the pinch bar), follow steps 'a' through 'e' below. If no positive opening tabs are provided, proceed directly to step 11.

    a) Remove bolts, nuts and washers that secure the positive opening tabs to the pinch bars (#8A, 8B, 8C). The sleeve (#1) is now free from the pinch bars (#9 & 10). Discard old sleeve. Prepare new sleeve for installation.

b) Punch holes through the positive opening tabs using a gasket or pliers type punch. The diameter of the holes in tabs should be approximately equal to hole diameter in pinch bar.

c) Positive opening tab holes must be in proper alignment with respect to the flange face holes, or there will be hell to pay when you reinstall the 10.

d) Replace tab bolts, nuts and washers (#8A, 8B & 8C). Use flat washers on every hole. If you replace bolts (#8A), cut or grind flush with nut (#8C) so bolts do not puncture sleeve in closed position.

e) Trim the tabs even with the top surface of the pinch bar.

11. Coat the stem (#7) where it passes through the bearing with a light application of grease or machine oil.

12. Insert new sleeve and reattach the lower pinch bar. Replace the nuts on the guide rods.

13. Replace the lower bonnet. Apply a coat of valve seal to the mating flanges of the bonnet halves. Bonnets are matched and must be oriented as they were originally or guide rods will not line up properly.

    Replace bonnet hardware (#2A, 2B & 2C).

14. Reinstall valve in process line.

15. Reconnect electric lines.

## Stop Collar Adjustment

Any time you replace the valve sleeve or perform any other maintenance on the model DEC valve you should check the Stop Collar (#7A) position.

**What this collar does:**

The Stop Collar insures that the valve closes precisely on Center-Line. If the valve does not close on Center-Line, this will place undue stress on the sleeve leading to premature sleeve failure.

**What goes wrong?**

a) The Stop Collar works loose and slides too far up the stem, or...

b) The Stop Collar disappears for some mysterious reason.

c) If the Stop Collar is either missing or out of adjustment, when the valve attempts to close, due to the weight of the Electric Actuator the Lower Pinch Bar (#10) just sits on the ribs inside the valve housing and never moves. The Upper Pinch Bar (#9) starts moving in the downward direction, but, instead of stopping at Center-Line it continues through its target and moves all the way to the bottom of its stroke. Now you have over-stretched the rubber sleeve on the ventral surface line and you rip the flanges out of the sleeve. This generally doesn't happen right away, but closing the valve a few hundred cycles beyond where its designed to close will eventually tear the sleeve apart.

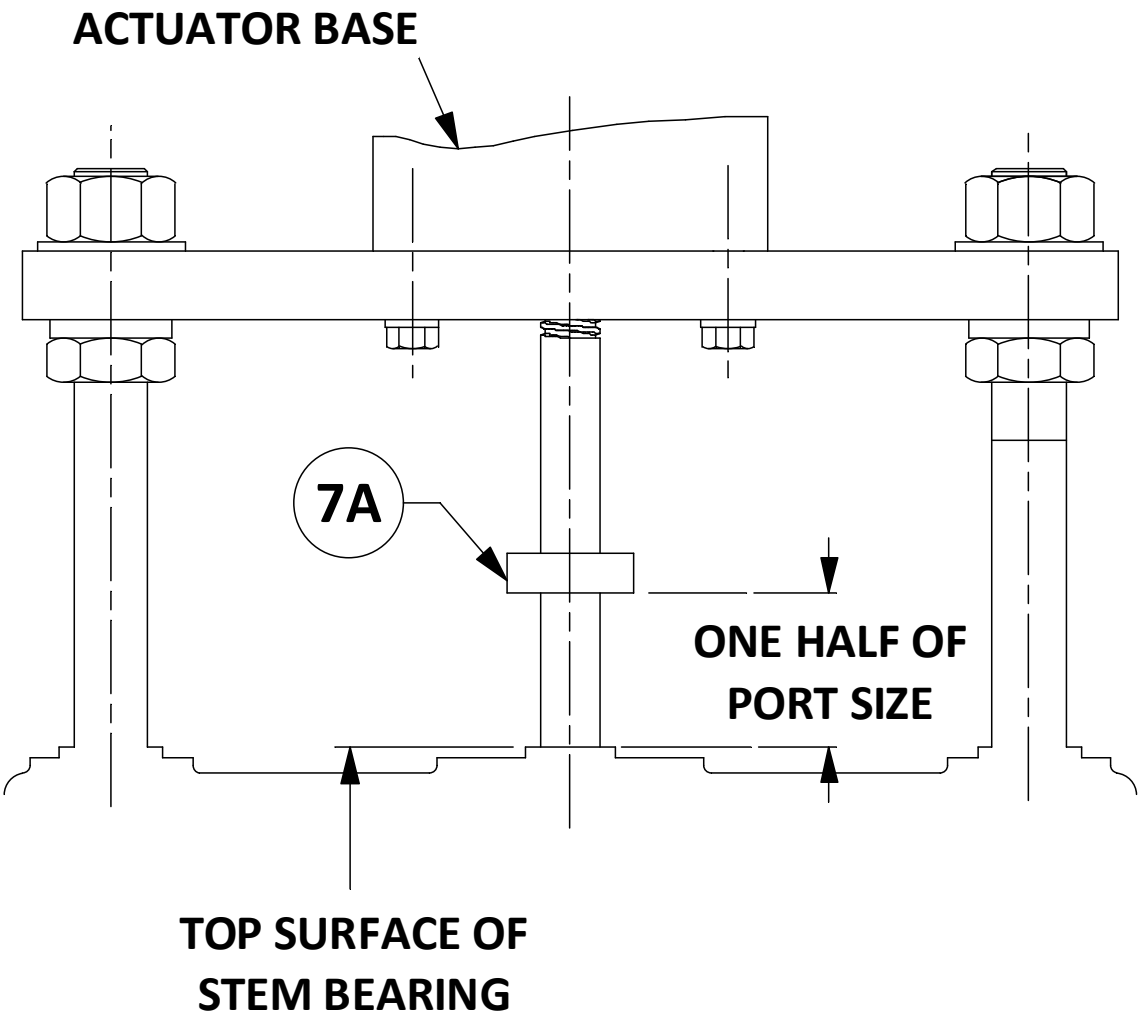
d) Check: Make sure that the actuator is wired through a **flexible conduit**. Connecting rigid conduit to the electric actuator inhibits the required vertical travel, causing the Stop Collar to slid out of position on the valve stem.

**Where should the Stop Collar be positioned?**

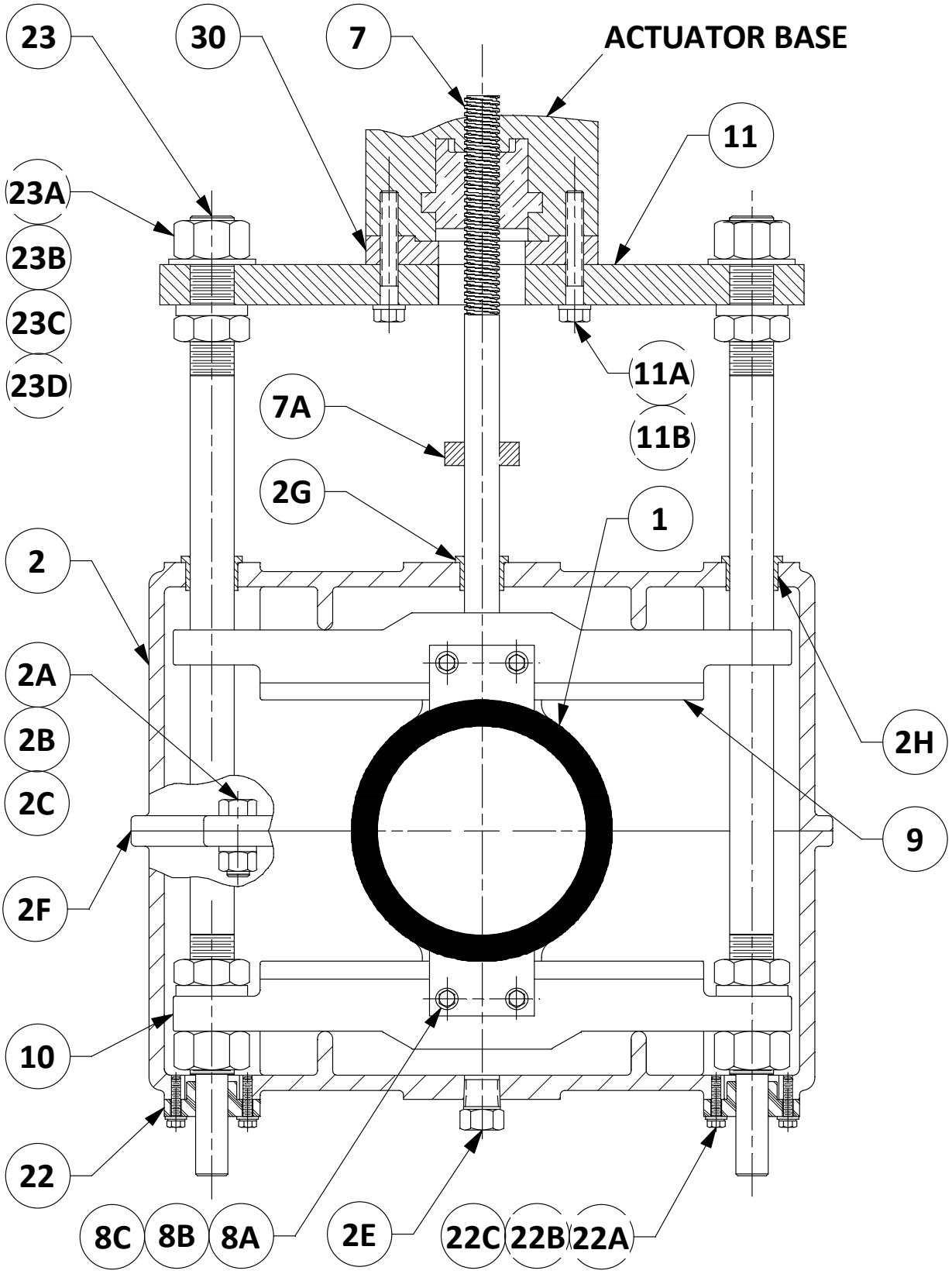
The Stop Collar (#7A) should be firmly clamped to the Valve Stem (#7) so that – when the valve is in the full **OPEN** position – the gap between the bottom surface of the Collar and the top surface of the Stem Bearing is = ½ valve port size. For example:

If you have a 3" full port valve, there should be a 1½" gap.

If you have a 10 x 6 valve (10" body x 6" Port) there should be a 3" gap.


ACTUATOR BASE
7A
ONE HALF OF
PORT SIZE
TOP SURFACE OF
STEM BEARING

| Item | Description |
|---|---|
| 1 | Sleeve |
| 2 | Bonnet Assembly |
| 2A | Bolt, bonnet |
| 2B | Lock Washer, bonnet |
| 2C | Nut, bonnet |
| 2E | Plug, bonnet |
| 2F | Sealant, bonnet |
| 2G | Bearing, Stem |
| 2H | Bearing, Guide rod, upper |
| 7 | Valve stem |
| 7A | Mechanical Stop |
| 8A | Bolts, P.O.F. |
| 8B | Washer, P.O.F. |
| 8C | Nuts, P.O.F. |
| 9 | Upper Pinch Bar |
| 10 | Lower Pinch Bar |
| 11 | Yoke |
| 11A | Bolts, Yoke-Actuator |
| 11B | Lock Washers, Yoke-Actuator |
| 22 | Bearing, Guide Rod, Lower |
| 22A | Bolt, Lower Bearing-Bonnet |
| 22B | Flat Washer, Lower Bearing |
| 22C | Lock Washer, Lower Bearing |
| 23 | Guide Rods |
| 23A | Nut, Guide Rod |
| 23B | Washer, Guide Rod |
| 23C | Lock Washer, Guide Rod |
| 23D | Jam Nut, Guide Rod |
| 30 | Spacer, Yoke-Actuator |


23
30
7
ACTUATOR BASE
11
23A
23B
23C
23D
11A
11B
7A
2G
1
2
2A
2B
2C
2H
9
2F
10
22
8C
8B
8A
2E
22C
22B
22A

**Trouble Shooting:**

| **Symptom:** | **Diagnosis** | **How to fix:** |
|---|---|---|
| Process fluid is leaking out from around the stem and guide rods. | Sleeve is ruptured | Replace sleeve. See page-15 |
| Process fluid is leaking through valve when it's supposed to be fully closed. Limit switch shows valve is in full closed position. | Wire draw failure through sleeve. | Replace sleeve. See page-15 |
| Leaking through valve seat when valve is supposed to be fully closed. Limit switch shows valve is **not** in full closed position. | Either the actuator limit switch or the actuator torque setting is not correct | Refer to Actuator I&M. |
| Actuator is running but valve is unable to open or close.<br>Aux hand wheel can't move the valve either. | Actuator drive nut is stripped. | Replace the output drive nut in the electric actuator. See p-13 for why this happened. |


**Questions?**

Contact **Onyx Valve Company**

Tel: 856-829-2888
Fax: 856-829-3080

**e-mail: david@onyxvalve.com**

# ONYX VALVE CO

## WARRANTY

The following statement of our Warranty and Claims Policy is intended to assist our customers in understanding the terms of our warranty, the circumstances under which we will honor claims, and the procedure for making claims.

1 Warranty on Products Manufactured by Us.

We warrant Products manufactured by us to be free from defects in material and workmanship for a period of one year from the date of shipment from our factory or warehouse.

Our liability under this warranty or in connection with any other claim relating to our Products is limited to the repair, or at our option, the replacement or refund of the purchase price of any products or parts or components which are returned to us freight prepaid which are defective in material or workmanship. Products or parts or components that are repaired or replaced by us will be returned to our customer freight collet.

With regards to rubber components, Onyx Valve does not guarantee resistance to erosion, abrasion or other sources of failure, nor does Onyx Valve guarantee a minimum length of service or that the product shall be fit for any particular service.

2. Products of Other Manufacturers.

We make no warranty with regard to any products not manufactured by us. The only warranty that attaches to such Products is that warranty, if any, of the manufacturer of such Products. Our Customer Service Department should be consulted if our customers have questions as to whether particular products are covered by our warranty or are separately warranted by their manufacturers.

3 Limitation of Liability.

The only warranty that we make to our customers is that summarized above.

WE DO NOT MAKE ANY OTHER EXPRESS WARRANTIES OR ANY IMPLIED WARRANTIES, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE OR USE.

In addition, we do not assume and we expressly disclaim any liability for (i) any special, indirect, incidental, or consequential damages which anyone may suffer as the result of the sale, delivery, servicing, use, or loss of use, of any Product, or (ii) any charges or expenses of any nature that are incurred without our express written consent.

Our total liability under our warranty or in connection with any claim involving any Product is expressly limited to the purchase price of the Product in respect of which damages are claimed.

Failure of purchaser to give prompt written notice of any alleged defect under this guarantee forthwith upon its discovery, or use, and possession thereof after an attempt has been made and completed to remedy defects therein, or failure to return product or part for replacement as herein provided, or failure to install and operate said products and parts according to instructions furnished by Onyx Valve, or failure to pay entire contract price when due, shall be a waiver by purchaser of all rights under these representations. All orders accepted shall be deemed accepted subject to this warranty which shall be exclusive of any other or previous warranty, and shall be the only effective guarantee or warranty binding on Onyx Valve.

4. What Is Not Covered By Our Warranty; Types of Damages and Claims For Which We Are Not Responsible.

The following are examples of the kinds of defects which are not covered by our warranty: defects which are caused by improper installation, improper or abnormal use or operation, or improper storage or handling; defects caused by our customer's failure to perform normal preventive maintenance; defects caused by the use of replacement parts not manufactured or supplied by us; defects caused by repairs by persons not authorized by us; defects caused by modifications or alterations made by our customer, and any damage to our Product occurring while it is in our customer's possession. Since these are examples and not a complete list, we suggest that our customers contact our Customer Service Department if they have any questions concerning the scope of our warranty.

Additional costs incurred by our customers because of delays in delivery are consequential damages for which we are not responsible.

Risk of loss or damage to our Products passes to our customer when we tender our Products to the carrier. Although we cannot process transit damage claims with any carrier on a customer's behalf, we will provide reasonable assistance to our customers when such claims arise.

5. Consultations with Customers.

When so requested, our engineers and other personnel may consult with our customers concerning our Products. While our employees offer their best judgment on any question, the ultimate responsibility for selecting that Product which will perform the functions and applications desired by the customer rests with the customer. As noted above, we make no warranty, express or implied, as to the fitness of any Product for any particular purpose or use.

6. How to Make a Claim.

Within the limits of the terms and conditions set forth on our quotation and acknowledgment forms and in this Warranty and Claims Policy, we will honor reasonable and justified claims when adequate evidence is provided to show that our Product was defective.

Whenever a customer has a claim concerning a Product, the customer should contact the Customer Service Department. CUSTOMERS SHOULD NOT RETURN ANY PRODUCTS OR PARTS OR COMPONENTS TO US WITHOUT FIRST CONTACTING US.

When contacting us, customers should have the following information available:

1. Customer name, location, purchase order number and date of purchase.
2. Serial number.
3. Product/Model number.
4. Equipment installation date.
5. Equipment failure date.
6. Application or service of unit.
7. Details of claim.

We shall have the option of requiring the return of the defective product to our factory, with transportation charges prepaid, to establish the claim and our liability shall be limited to the repair or replacement of the

defective product, F.O.B. our factory. Onyx Valve Co will not assume costs incurred to remove or install defective products nor shall we incur back charges or liquidated damages as a result of warranty work.

We will notify the customer whether it will be necessary to return the Product or part or component to us. If so, we will issue the customer an "AUTHORIZED RETURN GOODS NUMBER" that must be attached to the Product or part or component before returning it. All items returned to us must be returned freight prepaid.

If we determine that the Product or part or component is defective and that the defect is covered by our warranty, we will, as explained above, correct the defect or refund the purchase price.

Customers should promptly inspect all Products upon delivery. Customers must make claims for shortages within 20 days after the date of shipment from our factory or warehouse. We suggest that shortages be noted on the bill of lading or packing list, which should then be sent to our Customer Service Department for verification.

All other claims must be submitted within 60 days after the date of shipment from our factory or warehouse, or in the case of an alleged breach of warranty, within 60 days after the date within the warranty period on which the defect is or should have been discovered.

Claims may not be deducted from payments made to us unless we have so agreed in writing in advance.