

JOHN C. ERNST LLC. 21 Gail Ct, Sparta, NJ. 07871	Doc. No.: SIM.00M12.001	Replaces: E30024	
Date: 08-AUG-19	Created By: NPH	Approved By: JCW	Rev: --

JOHN C. ERNST LLC
PROCESS OBSERVATION SOLUTIONS

FLOW METERS

INSTALLATION, OPERATION & MAINTENANCE MANUAL
FOR SERIES: **M12**



TABLE OF CONTENTS

I. INTRODUCTION	1
FEATURES AND SPECIFICATIONS	
DESIGN RATINGS AT MAXIMUM AND MINIMUM OPERATING TEMPERATURES	
II. INSPECTION	1
RECEIVING INSPECTION	
END USER'S RATING INSPECTION	
III. INSTALLATION	1
PRECAUTIONS	
SAFETY CONSIDERATIONS	
CHANGING THE DIAL ORIENTATION	
<i>ABS HOUSING</i>	
<i>ALUMINUM HOUSING</i>	
<i>EITHER HOUSING</i>	
INSTALLING	
<i>THREADED BODIES</i>	
<i>WAFER STYLE BODIES</i>	
IV. OPERATION	2
PRE-OPERATIONAL CHECK	
HYDROSTATIC TEST	
PREVENTATIVE MAINTENANCE	
CHECKING ZERO	
CHECKING THE POINTER PRELOAD	
V. MAINTENANCE	3
COARSE ZERO ADJUSTMENT	
FINE ZERO ADJUSTMENT	
FLOW CALIBRATION	
CLEANING OF PRESSURE PORTS	
ADJUSTMENT OF REED SWITCHES	
TROUBLESHOOTING	
<i>POINTER FLUCTUATION</i>	
<i>ZERO SHIFT</i>	
<i>SLUGGISH METER RESPONSE</i>	
VI. CORRECTION FACTORS	4
LIQUID SERVICE	
COMPRESSED GAS SERVICE	
LIMITED WARRANTY	5
GENERAL PRESERVATION	5

PRODUCT QUICK SPECS.

Available Materials/Connections	
Material	Connection
Bronze	1/2" - 3" NPT
Monel	
Stainless Steel	
Bronze	1/2" - 8" Wafer
Monel	
Stainless Steel	

Typical Ratings		
Option	Description	Ratings
(None)	Standard	180 PSI @ 212°F
H	High Pressure	400 PSI @ 212°F
T	High Temperature	180 PSI @ 350°F
H & T	Both of above	400 PSI @ 350°F

Available Options	
Option	Description
A	Viton Seals
B	EPR Seals
B2	TFE Seals
C	S.G. Calibration
D	Gasketed Meter Case
E	Non-Standard Flow Rate
ES	Low Flow Option
F	Aluminum Housing with Plastic Dial Crystal
F2	Aluminum Housing with Glass Dial Crystal
G	Custom Scales & Dials
H	400 PSIG Service
I	Compressed Gas Service
K	Saturated Steam Service
N	Ammonia Service
P	Panel Mount Meter Case
RW3	Digital readout of flow rate & total
R2	Remote Readout - Bronze
R3	Remote Readout - 316SS
T	High Temp Service - 350°F
V	Viscosity Calibration
W	4-20 mA DC Linear Output Transmitter
W2	4-20 mA DC Non-Linear Output Transmitter
W3	4-20 mA DC Transmitter 2 Wire
X	Two Set Point Relays (High/Low)
Y	0-1000 Hz Frequency Output
Z	Options W, X and Y combined
1S2	1 Reed switch SPDT
2S2	2 Reed switch SPDT

I. INTRODUCTION

This manual is a guide for the responsible personnel installing, operating and maintaining these items. It is imperative that instructions are read and understood thoroughly before attempting any installation, operation and maintenance. Failure to follow any of these instructions could result in a malfunction or failure of the flowmeter, resulting in leakage, property damage, and/or physical injury to personnel.

Features and Specifications

These threaded and wafer style flow meters measure flow rate by sensing the pressure differential created across the flow nozzle which is machined into the body of the flowmeter. A pair of matched, opposed bellows sense the

differential pressure and drive a mechanical linkage to indicate flow rate directly on the dial. (When fitted with a blind transmitter or digital display readout, the bellows and mechanical linkage are replaced with a solid state differential pressure sensor.)

Design Ratings at Maximum and Minimum Operating Temperatures

To determine maximum allowable working pressures at specific temperatures, the user should refer to 'Quick Product Specs', the flowmeter drawing, and the specific design limits on the John C. Ernst LLC. product proposal. All ratings are limited to the Material & Gasket pressure & temperature limitations.

II. INSPECTION

Receiving Inspection


Upon receipt of the flowmeter, check all components carefully to ensure that damage did not occur. If damage is evident or suspected, do not attempt installation.

End User's Rating Inspection

The user(s) must confirm that:

1. The operating conditions described in the purchase order agree with the actual operating conditions at the installation site.

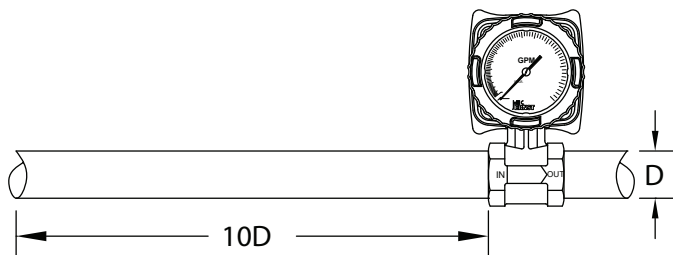
2. The materials of construction at the installation site are within the application data shown on the John C. Ernst Company Drawing or product proposal.
3. The materials of construction of the gauge valves are compatible with both the contained fluid and surrounding atmosphere in the specific application.

 **WARNING:** Cancer and Reproductive Harm - www.P65Warnings.ca.gov

III. INSTALLATION

Precautions

Select a site which is convenient for viewing and which provides service access to the front and rear of the flowmeter. Note that the dial can be ordered in any orientation at 90 degree increments and can be easily re-oriented in the field. See "**Changing the Dial Orientation**" in the installation section. The site selected should provide at least 10 pipe diameters of straight meter size pipe between the flow meter inlet and any upstream fitting such as elbow, tee or valves. There are no special requirements for the downstream connections to the meter.



Note that the flow meters are calibrated based on schedule 40 pipe connections. Tubing and hoses that do not have the same ID as pipe, should be moved to pipe at least 10 pipe diameters upstream of the flowmeter to achieve rated accuracy.

Avoid placing the flow meter where it will be subjected to water hammer and mount the flowmeter rigidly to minimize shock or vibration.

Flow meters installed outdoors or exposed to splashing liquids should be ordered with a gasketed case.

NOTICE

Protect from freezing liquids.

Safety Considerations

CAUTION

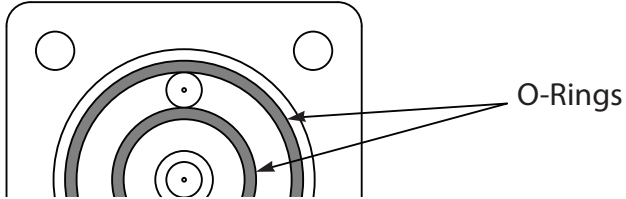
Do not exceed the pressure and temperature limits marked on the nameplate of the flow meter. Although each flow meter is pressure tested to 150% of nameplate rating, overpressure may cause injury, leaking or flow meter damage.

Temperature ratings are determined by the effects on the mechanical linkage, elastomer seals and electronics (if electronics are fitted). If temperature ratings are exceeded, the flow meter may be damaged or fail. Contact the factory for application assistance for expanded temperature operation.

Changing the Dial Orientation

Note the flow direction arrows on the body. If necessary, change the dial facing direction by removing the four screws holding the body to the housing. **Do not remove** the two screws holding the housing to the cell block assembly.

Position the housing at any 90 degree position. Replace the four screws taking care not to pinch the o-ring seals.



Changing from Horizontal to Vertical or Vertical to Horizontal

ABS Housing

Remove the lens by rotating counter-clockwise by hand. Do not remove the pointer. Move the dial forward gently by prying with a small knife at the 12:00 o'clock position. Rotate the dial to the desired viewing position and push the dial into position. There are 4 locating indents on the dial edge and housing to position the dial at 90 degree increments.

Aluminum Housing

Using a small screwdriver blade to lift the end of the retainer ring up and out of the housing recess, remove the retainer ring and dial crystal. Do not remove the pointer. Remove the two screws holding the dial and rotate the dial to the desired viewing position. Reinstall the screws to hold the dial in position. It may be necessary to shorten the screws to approximately 1/8" (3mm) to avoid contact with gear movement.

Either Housing

Re-zero the flow meter using the **FINE ADJUSTMENT** procedure on page 3.

Installing Threaded Bodies

Make up thread joints using a suitable sealant. Be sure threads are clean and free of burrs before making up joint.

Wafer Style Bodies

Install the flow meter between mating flanges. Take care to center the gaskets so that they do not protrude at all into the pipeline which will cause significant error.

IV. OPERATION

Pre-Operational Check

- Assure that all installation procedures have been completed.
- Check to determine that all connections are pressure tight.

Hydrostatic Test

- Take all precautions necessary to handle the possibility of leakage during the test.
- Pressure test assembly to 1/2 the required pressure, and repair any leakage before proceeding.

Preventative Maintenance

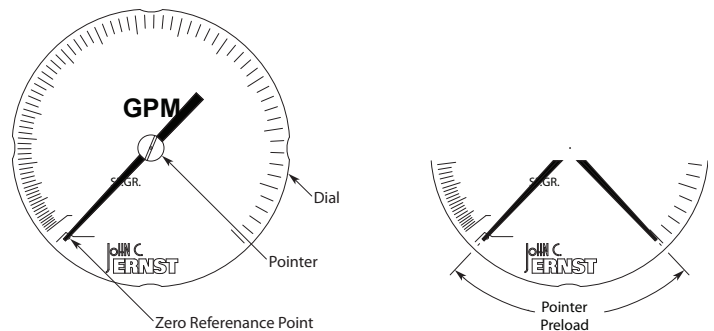
The flow meter does not require routine lubrication or service of any kind. Keep the interior of the flow meter housing clean and free of dust, moisture, oils or corrosive materials. Protect the flow meter from dripping or splashing corrosives or solvents which may attack meter exterior and eventually damage the internal mechanism.

Checking Zero

Water hammer or pressure surges can displace the bellows and cause the zero to shift. If the pointer does not return to the zero reference point when flow through the meter is zero, or if the pointer does not move away from the zero reference point at 12-15% of full scale flow, then check the zero adjustment as follows:

- Stop flow.
- Remove the lens.

- Observe the position taken by the pointer. When properly adjusted, the pointer should point to the zero reference point as shown in Below.
- If the pointer is positioned within 1/2" (12mm) of zero reference point, then follow **FINE ADJUSTMENT** procedure to re-zero flow meter.
- If the pointer is positioned more than 1/2" (12mm) from the zero reference point, then follow the **COARSE ADJUSTMENT** procedure.



Checking the Pointer Preload

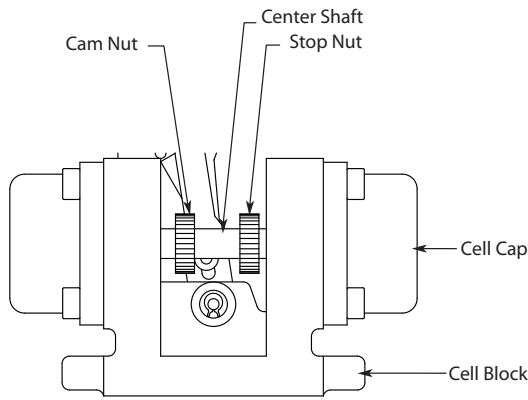
If the fine adjustment has been performed repeatedly, the pointer return spring preload should be checked. Manually rotate the pointer counterclockwise toward full scale. The pointer should stop at full scale. If the pointer goes beyond full scale, adjust with the cam nut following the **COARSE ADJUSTMENT** procedure. Otherwise, go to the **FINE ADJUSTMENT** procedure.

V. MAINTENANCE

Coarse Zero Adjustment

If necessary to restore spring preload, place a small screwdriver in the slotted pointer hub. Grip the pointer close to the hub on both sides of the hub and rotate the hub approximately one-quarter turn clockwise with respect to the pointer. Check preload by rotating the pointer counterclockwise toward full scale. When properly adjusted, the pointer should stop at full scale. Release the pointer. Using the cam nut, adjust the lever so that the pointer points to the zero reference point.

Check the position of the stop nut. Applying force to the stop nut, manually move the center shaft to the right (as seen from the rear) and make certain that the stop nut contacts the cell block when the pointer stops. If necessary, adjust the stop nut to stop the pointer near the 6 o'clock position. This is the factory set point.



NOTICE

The stop nut must stop the center shaft movement before the bellows hit the cell cap. If the bellows hit the cell cap, the bellows or cap can be damaged causing leaking or meter error.

Adjust the cam nut until the pointer points at the zero reference point. Gently tap the flow meter housing to overcome residual friction while making the adjustment.

Test for freedom of the pointer movement by rotating the pointer approximately 30 degrees and releasing. Pointer should return quickly to the zero reference point. Clean and reinstall the lens.

Fine Zero Adjustment

Note: If fitted with 4-wire transmitter or with reed switches, do not use this procedure. Do all adjustments with the coarse zero adjustment. Adjustment of the zero using this method will require re-calibration of the reed switches or transmitter.

Grip the pointer close to the hub on both sides of the hub and rotate the hub with respect to the pointer. The pointer

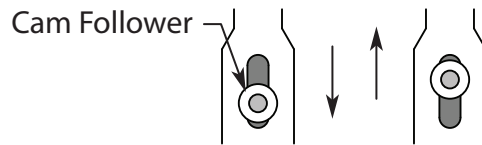
should aim directly at the "zero reference point" printed on the dial as shown.

Gently tap the flow meter housing to overcome residual friction while making the adjustment. Test for freedom of pointer movement by rotating the pointer approximately 30 degrees and releasing. Pointer should return quickly to zero reference. Clean and reinstall lens.

Flow Calibration

The orifice has been factory adjusted to provide the proper differential pressure for accurate flow meter operation. NIST traceable certifications are available when ordered prior to shipment or may be obtained by returning the flow meter for re-calibration. Field calibration may be verified using the following procedure:

- Check the zero adjustment of the pointer. Cycle the flow rate from zero to full scale three to four times and observe the pointer motion. Pointer should return to zero smoothly.
- Establish a known flow rate through the flow meter corresponding to approximately 90% of full scale and observe the flow meter indication. Move the cam follower up to decrease the pointer indication or down to increase the pointer indication.



- To move the cam follower up, rest a screwdriver on the cell block with the blade between the cell block and center shaft. Pry gently up on the cam follower. To move the cam follower down, place the screwdriver on top of the cam follower. With the blade resting against the case press gently down. Take care not to put excessive forward pressure on the cam follower to prevent the "C" clip on the pivot shaft from coming off. Re-zero the flow meter using the cam nut.
- Check flow meter indication at 50% of full scale. The flow meter should indicate actual flow rate within 3% of full scale. If meter does not indicate actual flow, consult factory.

Cleaning of Pressure Ports

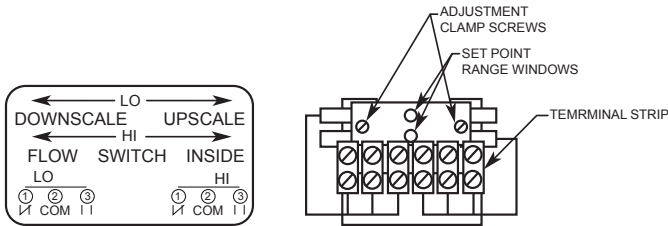
Remove the flow meter housing from the body by removing the 4 screws. Remove the pulsation snubbers from the body by inserting a small wood screw into the hole in the pulsation snubbers and gently pull them out. Clean the passages in the body and snubbers and reassemble. If you are unable to clean without further disassembly, the flow meter should be returned to the factory for service.

Reassemble the flow meter housing to the body in the desired viewing position. Take care to properly seat the inner and outer o-rings before tightening screws.

Adjustment of Reed Switches

Check the flow meter zero and correct if necessary using the coarse or fine zero procedure before proceeding. Connect continuity tester to N.O. contact. Loosen the switch clamp. Establish the desired flow rate for switch tripping. Slide the switch to the left most position. Range window should show a partial or complete green mark. Slowly slide to the right while monitoring N.O. contact. Switch will close.

Continue to slide to the right. Switch will open (false trigger). Continue to slide to right until switch closes again. Adjust by sliding to the right to raise set point, left to lower. Tighten clamp. *Note: Tiny adjustments may be required to reach the desired set point.*



Troubleshooting

Pointer Fluctuation

Mechanical fluctuation of the pointer is usually a symptom of excessive turbulence in the pipeline. This is frequently caused by valves or fittings installed too close to the flow meter inlet. If moving the meter is not practical, snubbers with smaller holes (heavy duty snubbers) can be installed to increase the mechanical dampening of the flow meter. (Pulsation snubbers are installed standard on all gas flow meters and on liquid flow meters unless ordered with viscosity correction.)

Zero Shift

The need to frequently re-zero the flow meter is an indication of excessive water hammer. Piping or operating procedures should be changed to reduce water hammer in order to prolong the life of the flowmeter.

Sluggish Meter Response

Sluggish flow meter response can be caused by inadequate pointer return spring preload or by clogging of the pressure passages with debris. To check spring preload, see **CLEANING OF PRESSURE PORTS**.

VI. CORRECTION FACTORS

Liquid Service

If the specific gravity of the fluid being metered differs from the value marked on the flowmeter dial, a correction factor, J, must be applied to the flow meter reading to obtain the actual flow rate.

Actual flow rate = J x flow meter reading where:

Sc = Specific Gravity for which the flow meter is calibrated

$$J = \sqrt{\frac{S_c}{S_a}}$$

Sa = Actual specific gravity of the fluid being metered

Example:

Flow meter, calibrated for water (specific gravity = 1.0) reads 12.5 GPM for a lubricating oil with a specific gravity of 0.85. What is the actual flow rate?

$$J = \sqrt{\frac{1.0}{0.85}} = \sqrt{1.1765} = 1.085$$

Therefore, actual flow = 1.085 x 12.5 = 13.56 GPM.

Compressed Gas Service

If the gas pressure or temperature varies from the values marked on the flow meter dial, then a correction factor, K, must be applied to the flow meter reading to obtain the actual flow rate.

Actual flow rate = K x flow meter reading where:

$$K = \sqrt{\left(\frac{(P_a + 14.7)}{(P_c + 14.7)}\right) \left(\frac{(T_c + 460)}{(T_a + 460)}\right)}$$

Pa = Actual gas pressure at inlet to flow meter, **PSIG**

Pc = Calibrated gas pressure marked on the flow meter dial, **PSIG**

Ta = Actual gas temperature at inlet to flow meter, **°F**

Tc = Calibrated gas temperature marked on the flow meter dial, **°F**

Example:

Flow meter calibrated for compressed gas air at 100°F and 80 psig, reads 100 SCFM at an actual temperature of 70°F and pressure of 85 psig. What is the actual flow rate?

$$K = \sqrt{\left(\frac{(85 + 14.7)}{(80 + 14.7)}\right) \left(\frac{(100 + 460)}{(70 + 460)}\right)}$$

$$K = \sqrt{(1.05)(1.06)} = 1.05$$

Therefore, actual flow rate = 1.05 x 100 = 105 SCFM.

LIMITED WARRANTY

Period of Coverage

The John C. Ernst LLC. expressly warrants products to the original purchaser to be free from defects in the material and workmanship for 12 months from date of shipment. John C. Ernst LLC. will, at its option, replace or repair any products which fail during the warranty period due to defective material or workmanship. Evaluations, repairs, and replacements will most often occur in Sparta NJ 07871 USA, or another facility determined by the John C. Ernst LLC.. The warranty does not cover costs required to transport warranted units to or from the John C. Ernst facility.

Limitations

The responsibility of the John C. Ernst LLC. is hereunder limited to repairing or replacing the product at its expense. This warranty shall not apply if the product has been disassembled, tampered with, repaired, subjected to misuse, neglect, accident, or otherwise altered in any way. The warranty does not guarantee products against normal wear, glass breakage, clouding, or corrosion. The John C. Ernst LLC. shall not be liable for loss, shipping costs, damage, or expenses related directly or indirectly to the installation or use of its products. It is expressly understood that the John C. Ernst LLC. is not responsible for damage or injury caused to other products, buildings, personnel, citizens, or property by reason of the installation or use of its products.

Advertised ratings apply only to units serviced with parts supplied by the John C. Ernst LLC. Use of parts during maintenance from other companies will void the warranty. Service must be done in accordance with the instructions of the product that is being serviced.

THIS IS JOHN C. ERNST, LLC's. SOLE WARRANTY AND IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED WHICH ARE HEREBY EXCLUDED, INCLUDING IN PARTICULAR ALL WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. WE WILL NOT BE LIABLE FOR INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES OF ANY NATURE.

How to get Warranty Service

Prior to submitting any claim for warranty service, the owner must submit proof of purchase, and obtain written authorization to return the product. All returns must be sent back with an MSDS for the application that the product was used in, and with a maintenance log of all service including inspections. Thereafter, the product shall be returned to the John C. Ernst LLC. with freight paid and packaged to prevent damage in transit. Should damage in transit occur the John C. Ernst LLC. will not be held liable.

GENERAL PRESERVATION

Recommended Practice for Long Term Storage of John C. Ernst Products

1. All units should be inspected upon receipt to ensure that no damage has been incurred during transit. If there has been damage, a claim should be filed with the carrier immediately. Units should be stored in an area protected from the elements and corrosive fumes, in a secure manner where they can neither fall nor be struck by other objects. Care should be taken to protect the glass and the end connections from damage. Avoid placing any objects directly on the glass(es) at any time.
2. Units should be checked to ensure that they contain no foreign matter and that the end connections are clean, undamaged, and in line with adjoining piping. Examine each glass carefully using a flashlight for any indications of chips, scratches, blemishes or cloudiness. Inspect for scratches, shining a bright concentrated light (powerful flashlight will suffice) at about a 45° angle. Any scratch that glistens and catches a fingernail, or star or crescent-shaped mark that glistens, is cause for replacement. Process surface that appears cloudy or roughened, after cleaning, is evidence of chemical attack and is cause for replacement. If any type of flaw is apparent, the unit should not be installed until the glass and gaskets have been replaced. Follow the torquing recommendations given by the gasket and piping manufacturers to achieve proper sealing pressures.
3. Some products are shipped unassembled, as they are to be welded into position and then assembled. Individual pieces should be carefully stored in a manner to avoid damage until installation. The glass requires special attention. It should not be stored or mixed with objects that may cause damage and should remain wrapped or boxed until assembly.
4. Gaskets frequently assume a compression-set over a period of time. Some materials, however, may compress/relieve or creep. Visually inspect the gaskets for gaps or looseness before start-up. If the gaskets are not compressed, adjust the unit gasket compression. Do not tighten any fasteners or clamps while the unit is in operation.
5. Periodic visual inspection should be made to ensure that no leaks are evident and that there is no clouding, scratching, or blemishing of the glass. Keep glasses clean using commercial glass cleaners. Cleaning should be done without removing glass. This may require recirculation of cleaning material if process side of glass is not accessible. Never use harsh abrasives, wire brushes, metal scrapers, or anything that may scratch the glass. Do not attempt to clean glasses while equipment is in operation.
6. Should leaking around the glass occur, first check the glass for damage. If the glass appears to be in good condition, the gasket seal should be checked, but only after the system pressure has been brought down to zero. If the gasket appears to be loose, or hardly compressed, the spacers must be adjusted. If the leak persists after repressurizing, disassemble and replace the gaskets.
7. Glass, shields and gaskets that have been removed, **MUST BE REPLACED**. Used parts may contain hidden damage. Induced stress in glass and de-tempering are NOT visible to the naked eye. Be sure that the replacement glass is proper for the service.
8. Inspect protective coating (if applied) for chipping.
9. Store within the temperature extremes of the nameplate or specification documents – do not expose to direct sunlight or other UV sources.
10. Products should be stored off of the floor on suitable skids, pallets, or racks and protected from dirt, debris, and exposure to direct sunlight, particularly to soft sealing surfaces.
11. Store in a cool dry place, room temperatures between 40°F - 80°F with a relative humidity level between 40 – 75%.
12. Store in dry areas, avoiding any contamination with any liquids. Products should be kept in a clean, heated, weather-tight (dry), well ventilated facility.
13. If a flanged product is to be stored for any extended period of time, the flange or end protector should be examined to ensure they are fastened securely, and any other open areas should be sealed to prevent any moisture damage.
14. Product assemblies with electrical components, pneumatic tubing, positioners, actuators, and other accessories should be protected from impact.
15. Useful Life When Stored:
 - a. Unit: Indefinite, based on ideal storage conditions.
 - b. Spare Gaskets: Indefinite, based on ideal storage conditions.
 - c. After 9 months, the torque of the bolting should be checked as the gasket relaxes. This should be done for units not in service as well as those installed in process.
 - d. The useful life of the material, when the storage conditions differ from the recommended factors is not known. It has been established, however, that room temperature has a significant influence on the shelf life of material.
 - e. Spare Gaskets should be stored flat.
16. Periodical checks at least every 6 months have to be carried out in the storage area to verify that the above mentioned conditions are maintained.

If there are any questions or concerns, please contact the John C. Ernst LLC. Sales Office at 888-943-5000.

Teflon® & Viton® are Registered Trademarks of the Chemours Company

