

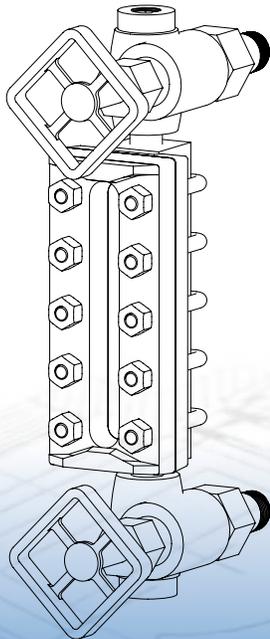
<b>JOHN C. ERNST LLC.</b> 21 Gail Ct, Sparta, NJ. 07871	<b>Doc. No.: SIM.0H13B.001</b>		Replaces: E48044-B	
	Date: 18-JAN-21	Created By: NPH	Approved By: JCW	Rev: --



*PROCESS OBSERVATION SOLUTIONS*

# ARMORED GAUGES

INSTALLATION, OPERATION & MAINTENANCE MANUAL  
 FOR SERIES: **H13B**



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## PRODUCT QUICK SPECS.

Gasket Material	Glass Size	Wetted parts material steel or stainless steel Non-Steam Ratings			
		Reflex		Transparent	
		100°F	550°F	100°F	550°F
Graphite or Non-Asbestos	1	3270 PSIG	2397 PSIG	2000 PSIG	1440 PSIG
	2	3140 PSIG	2300 PSIG	1850 PSIG	1362 PSIG
	3	3000 PSIG	2202 PSIG	1750 PSIG	1265 PSIG
	4	2880 PSIG	2107 PSIG	1600 PSIG	1175 PSIG
	5	2750 PSIG	2007 PSIG	1500 PSIG	1080 PSIG
	6	2630 PSIG	1910 PSIG	1350 PSIG	987 PSIG
	7	2510 PSIG	1815 PSIG	1250 PSIG	900 PSIG
	8	2390 PSIG	1720 PSIG	1100 PSIG	800 PSIG
	9	2250 PSIG	1625 PSIG	1000 PSIG	712 PSIG

*Limited to Glass & Gasket Ratings  
Steam Pressure with Standard Gaskets 300 PSIG*

# 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 gauge, resulting in leakage, property damage, and/or physical injury to personnel.

## NOTICE

John C. Ernst does not have any control over the manner in which its gauge is handled, installed or used. John C. Ernst cannot and will not guarantee that a gauge is suitable or compatible for the user's specific application.

## ⚠ WARNING

Contained fluids may be pressurized and can exit vessel connections unexpectedly due to apparatus or material failure. Safety glasses should be worn when installing a liquid level gauge. Failure to follow instructions could result in serious physical injury.

## Features and Specifications

John C Ernst Gauges are used to allow direct visualization of liquid in vessels, by peering into the glass. It is possible to monitor color, clarity and level of gas/liquid interface. With a competitive range of models for any application from pure water to highly corrosive chemicals and from cryogenic fluids to superheated steam. Like any instrument John C. Ernst gauges must be installed, operated and maintained with reasonable care and due regard for the application, and the environment, if they are to give accurate readings over a long life.

## Design Ratings at Maximum and Minimum Operating Temperatures

To determine the maximum allowable working pressure for a specific temperature within the design limits, see page i for "Product Quick Specs", refer to a John C. Ernst product drawing, or the specific design limits of the John C. Ernst LLC. design product proposal.

# II. INSPECTION

## Receiving Inspection

Upon receipt of the gauge, check all components carefully to ensure that damage did not occur. If damage is evident or suspected, do not attempt installation. Instead notify the shipping company immediately of any such damage and request a damage inspection. Retain packaging in event due to transport.

## 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.
4. Confirm that the gauge nameplate's model number and pressure/temperature ratings match the application condition.

## ⚠ DANGER

John C. Ernst Gauges are not to be used for indicating the level of lethal substances as defined by ASME Section VIII.

## ⚠ WARNINGS

Failure to follow instructions could result in a malfunction or breakage of the indicator, resulting in fluid escaping from the unit and fragmenting glass.

Always wear safety glasses when installing, servicing or operating sight flow indicators.

Failure to follow precautions can result in personal injury.

## ⚠ CAUTION

Prior to installation, the information on the nameplate should be compared with the proposed service conditions of the system. Should any discrepancies be noted, immediately contact the factory advice.

 **WARNING:** Cancer and Reproductive Harm - [www.P65Warnings.ca.gov](http://www.P65Warnings.ca.gov)

### III. INSTALLATION

#### ⚠ CAUTION

Only qualified experienced personnel who are familiar with their industry's equipment and thoroughly understand the implications of the tables and all the instructions should install these sight plugs. Failure to read and comply with the following instructions could result in personal injury or property damage.

#### ⚠ CAUTION

Gauges should always be isolated from the process system by closing the upper then lower isolation valves, and draining the gauge to relieve pressure before doing any bolt torque or maintenance checks.

#### Before Installation:

- Avoid imposing pipe strains on the gauge on the gauge chamber, connect and mount gauge so that it does not support the piping.
- Differential thermal expansion between the vessel and gauge can impose severe mechanical loads on the gauge, especially if the vessel contains hot or cryogenic liquids. To prevent these, install an expansion loop between the gauge and vessel, or use a reasonably long run of piping.
- Support brackets should be considered for gauges over 4 feet (122 cm) in length, or over 100 lbs (45 Kg) in weight, especially if the gauge is exposed to vibration. Support brackets will prevent overloading the

connecting valves and piping, also prevent damage to the gauge from excessive vibration.

- Always provide isolation valves between the gauge and vessel. John C. Ernst Gauge Valves with automatic ball checks are recommended to provide protection against physical injury and loss of product if glass breakage occurs. These also provide a means to isolate the gauge during maintenance.
- Bolt torque is vital to proper operation of a flat glass (armored) gauge. Due to gasket compression over time, bolt torque should be checked, before the gauge is installed, then rechecked after the first few hours of operation.

#### Extreme Temperatures

To avoid re-torquing the nuts and bolts in especially hot or cold applications, spring washers can be used under the nuts or bolts to maintain gasket load. A kit is most likely required as to the bolting is too short in standard gauges.

#### Vacuum Service

All glass gauges are suitable for vacuum service as long as the gauge does not contain a PCTFE Shield.

#### Differential Temperature Service

To prevent thermal gradients from stress-loading or relaxing gasket clamping load, which may cause leaks, uniformly insulate the gauge to ensure that all components remain the same temperature.

### IV. OPERATION

Always warm up a gauge slowly when it is used with a vessel containing hot fluid.

#### Valve Opening Procedure

1. Partially open top (gas side) valve 1/4 to 1/2 turn.
2. Slowly open bottom (liquid side) valve 1/4 to 1/2 turn.
3. The gauge level should rise to equalize with the tank level. Wait for the gauge level to stop rising before proceeding.
4. Fully open the top and bottom valves.

#### ⚠ CAUTION

Failure to properly open ball check valves could result in the seating of the ball checks, thereby blocking the flow of the fluid into the gauge and causing an incorrect gauge level reading.

#### ⚠ WARNING

Partially open valves could result in the seating of the ball checks, potentially resulting in physical injury to personnel and loss of process fluid.

Tempered glass, the standard, is designed to withstand thermal shock. However, additional loads that you cannot measure are imposed on the glass during installation and

the resistance to thermal shock is reduced accordingly. This procedure also applies to cold fluid fluids.

#### ⚠ CAUTION

When hydrostatic testing, the pressure and temperature should never exceed the advertised rating of the lowest rated component of the assembly.

#### ⚠ WARNING

Gauges must be brought into service slowly to avoid excessive shock or stress on the glass. Rapid pressurization of the gauge can cause glass to break resulting in a sudden release of pressure, causing serious personnel injury.

#### ⚠ CAUTION

While the gauge glass is in operation, the isolation valves must be fully opened. A partially open valve will prevent the automatic ball checks from seating which could result in personal injury to personnel and loss of product, if gauge glass fails.

During system shutdown it is best to leave the isolation valves open so that as the gauge cools, it depressurizes along with the rest of the system. Keeping the valves

closed during shutdown can trap high pressure liquid in the gauge.

For high pressure and/or high temperature applications, a viewing system of mirrors should be used to protect personnel from physical injury in the event of glass breakage.

Gauges should be isolated periodically and the bolt torque checked to prevent leaks. This is especially important on gauges used in intermittent operation, or varying service

conditions. When putting a gauge into service, always check for leaks and be certain the shutoff valves are fully open with all vents and drains closed before leaving the site.

Gauges in low temperature service need to be brought into service slowly. To prevent thermal shock, slightly open the shutoff valves carefully to allow the gauge to reach temperature, then wait until the gauge has cooled before opening fully.

## V. MAINTENANCE

### **⚠ WARNING**

Do NOT proceed with any maintenance unless the gauge has been relieved of all pressure or vacuum, has been allowed to reach ambient temperature, and has been drained or purged of all media. Failure to do so can cause serious injury to personnel.

The following step-by-step procedure for maintaining your gauge.

#### ➤ *Inspection of glass:*

Inspect the glass regularly for any signs of clouding or scratching. In new processes the glass should be inspected routinely until the need for replacement becomes apparent.

### **⚠ WARNING**

Regular and careful attention must be given to the cleaning and inspection of glass. Glass that is etched or scratched is weakened and may break under pressure. Design ratings are no longer valid for sight windows with weakened or damaged glass. Failure to replace damaged glass can cause serious personal injury to personnel.

To examine for scratches, shine a very bright concentrated light at a 45° angle. Anything that glistens is cause for replacement. If the inner surface (process side) appears cloudy or roughened and will not respond to cleaning procedures (see below), this is an indicator of chemical attack, if severe, is cause for replacement.

#### ➤ *Cleaning of Glass:*

Keep glass clean using commercial glass cleaner (e.g. Windex, Bon-Ami). If these do not seem to work, a dilute solution of hydrochloric (muriatic) acid can be used. Observe safety rules when handling these chemicals. Cleaning should be done without removing the glass. This may require recirculation of cleaning materials if the process side of the glass is not accessible. Never use harsh abrasives, wire brushes, metal scrapers, or other things which could scrape the glass.

#### ➤ *Receiving and Storing Glass:*

Upon receiving replacement glass, inspect the con-

tainer and glass for shipping damage. When inspecting glass, unwrap and rewrap carefully. Avoid contact of the polished faces with any object (including table tops). Keep the glass in its original box until ready to use. Take care not to bend mica when handling, and avoid touching the face of the mica shield. Store it with the glass in the original box to protect against accidental breakage.

### **Steam Service Cleaning**

Proper cleaning of gauges in steam service is vital for performance and service life. The glass must be kept clean to ensure visible media level in the chamber accurately represents the media level in the boiler. If not properly cleaned, the glass can appear to show a normal media level when the boiler may be operating in a "low" or "low-low" water condition. A stain or coating can develop on the inside of the gauge glass where it is in contact with the boiling water. After time, this stain gives the appearance of water. Also, the connecting lines to the gauge may become clogged with sediment, causing an apparent normal level when it could be low. After performing the blow-down procedure, if the level does not return to normal levels promptly, the connecting piping may be clogged and require cleaning.

### **Blow-Down Procedure**

Note that the frequency and method of blow-down may affect service life and performance of glass level gauges. Blow-down should be conducted on a routine basis, or as necessary based on water quality. Conducting blow-down more often than required to keep glass clean can lead to premature mica and glass wear, and eventually leakage or glass failure.

1. Close both (top) steam and (bottom) water valves between the boiler and the gauge.
2. Open bottom drain valve fully.
3. Slightly open the bottom valve to clean the pipe and valve of any blockage or sediment. Once clear, close the bottom valve.
4. Slightly open the top valve and allow a **gentle** rush of steam to pass through the gauge. The steam **shall not pass** for longer than 20 seconds.

**Continued on Next Page** ➤

5. Close the top valve.
6. Inspect the gauge to ensure that all foreign matter is flushed from the glass or mica.
7. If the gauge is not visually clean repeat steps 3 and 4.
8. Closes the drain valve, open the top valve a quarter to a half turn, then the same for the bottom valve. Slowly bringing the equipment back to its normal operating level. Once level has equalized, fully open both valves. See **Section IV Operation** for further instruction.
9. When bringing the gauge into service, liquid should quickly enter the glass gauge. This indicates that the lines are free of sludge, sediment or scale buildup.

### Disassembly

Prior to any disassembly of the gauge, first be sure that the gauge is relieved of all internal pressure, and the temperature is ambient. Failure to do this may result in a sudden release of pressure and/or glass breakage.

Secure gauge on a workbench longer than the unit, and sufficiently wide enough to lay out components as they are removed.

1. Lay gauge on its side.
2. While holding gauge firmly against the workbench, loosen nuts starting at both ends of each section working your way to the center of the section.
3. Return gauge to its back, remove nuts, washers and nameplate.
4. Tap covers with a rubber mallet as needed to loosen and remove.
5. Remove cushions, glass, gaskets and shields.
6. On Transparent gauges, tap chamber or remaining covers with rubber mallet to break loose and remove remaining components.
7. Destroy and dispose of all used glass, cushions, shields and gaskets. Under no circumstances should used components be reused or installed in a gauge.

### Glass Seating Inspection

Clean the glass seating surface on the chamber and cover with a soft metal scraper (brass is recommended) to remove all burs, rust, and remnants of the previous gaskets and cushions. Exercise care to avoid gouging or scarring the seating surfaces. Seating surfaces must maintain a flatness within 0.002 inch (0.05 mm) and a surface finish of 62 to 250 AARH (Arithmetic Average Roughness Height). If the flatness falls beyond stated flatness tolerance on any seating surface the gauge should be replaced. Do not machine glass seating surfaces to achieve flatness tolerance, the chamber and cover are designed for a critical thickness for rated pressures & temperatures.

#### **⚠ WARNING**

Do NOT under any circumstances reuse glass, gaskets, cushions and shields since they may cause high stress points resulting in glass breakage. If reused, this can result in serious personal injury to personnel.

### Reassembly

If all glass seating areas are found within 0.002 inch (0.05 mm) flatness tolerance, proceed with new glass, gaskets and cushions. Refer to Exploded View on page 6.

1. Clean threads on bolts and nuts to remove paint, rust and scale. Apply a light coat of oil or a copper-based anti seize grease to the threads.
2. For transparent gauges, insert bolts through half the cover and layout covers along the bench, side by side, with the chamber. Use chamber to space covers and line them up with vision slots.
3. For reflex and Belleville reflex style gauges, layout covers along the bench side by side, with chamber.
4. For transparent Belleville style gauges, thread nuts on stud, place two washers pointed end toward nut, insert stud through each cover and layout covers along bench, side by side, with chamber. Use chamber to space covers and line them up with vision slots.
5. Install one cushion in each cover.
6. Place glass centered in each cover.
7. Install shields, if used, and then gasket on glass being careful components are centered.
8. Place chamber carefully making sure all components are aligned and centered with vision slot.
9. Continue with either Reflex or Transparent gauge instructions below.

### Reflex gauge

1. Install U-bolts in place by tapping as needed with rubber hammer, being careful not to lose alignment with vision slot.
2. Turn over assembly onto the backside of the U-bolts.
3. Assemble nameplate, washer and nuts to U-bolts. Tighten nuts with fingers.
4. Using a torque wrench, tighten in 5 ft-lb (7 N-m) increments. Follow the sequence until the torque value shown is reached.

### Transparent gauge

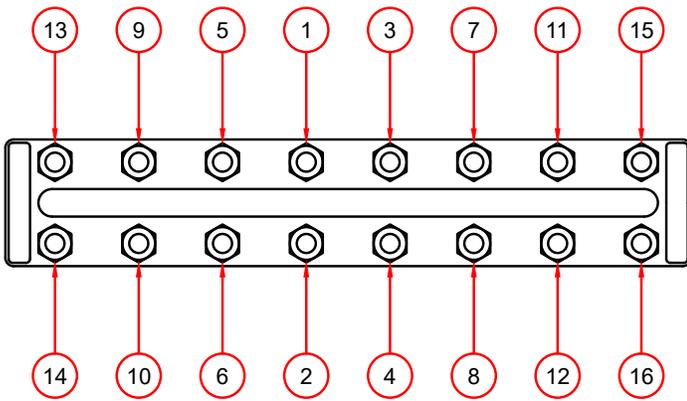
1. Install gaskets and shields, if used, centered on vision slots.
2. Place glass centered on gasket or shields, if used.
3. Install one cushion on each piece of glass.
4. Install covers in place being careful to maintain components' alignment inside.
5. Install nameplate washer and nuts to bolts. Using a torque wrench, tighten in 5 ft-lb (7 N-m) increments. Follow the sequence until the torque value shown is reached.

#### Torque Value

for all Gasket Materials

32 ft-lbs (43 N-m)

## TORQUE PATTERN



### **Hot Torquing Procedure**

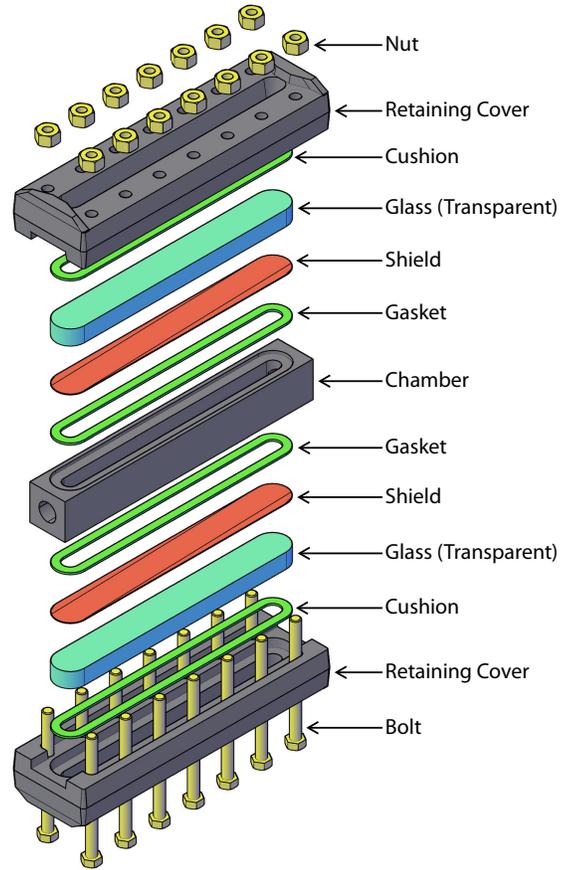
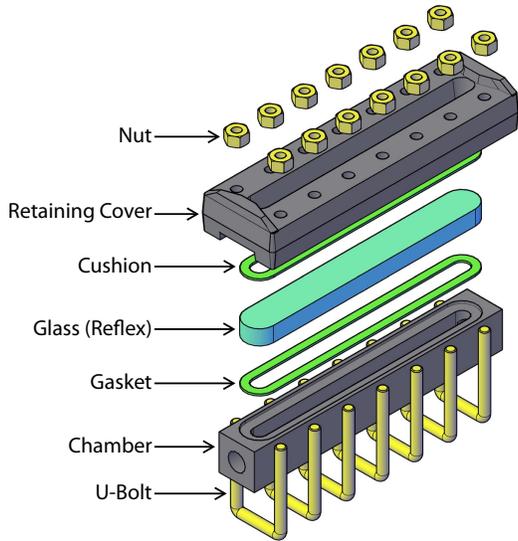
When a new glass gauge is installed in high temperature service and it is not equipped with spring washers, a hot torque procedure must be performed. This ensures that all bolting and components are properly seated for optimum performance. This procedure must also be performed after any maintenance is done to the equipment.

All work must be done by a qualified technician. All plant rules and procedures must be followed, including any lock out / tag out requirement.

The hot torque procedure should be performed as follows:

1. The gauge should be in service long enough for the equipment to reach operating temperature, or at least 200° F (93° C).
2. Upon reaching the desired temperature, isolate the glass gauge from service.
3. Fully open the drain valve to evacuate pressure and process fluid from the gauge.
4. Immediately re-torque the gauge nut to the values stated above. There should be rotation of approximately 1/8th of a turn or more. The proper torque pattern is also diagrammed above.
5. If there is no movement in the nut/bolt, the equipment was not heated properly. Repeat the procedure.
6. Once the hot torque procedure is completed, close the drain valve and return the equipment to service. Carefully check for any equipment leaks and verify proper operation of the glass gauge.

# VI. SPARE PARTS INDEX



# 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. 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.**

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