

KENCO ENGINEERING COMPANY

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MODEL KWR AND KWT WELD PAD STYLE FLAT GLASS GAUGE INSTALLATION/OPERATION INSTRUCTIONS

GENERAL DESCRIPTION

Kenco Flat Glass Gauges are simple, rugged instruments engineered and constructed in the USA to give you accurate liquid level readings for the life of the vessel. To ensure long life, only the best materials are utilized. From the forged steel gauge covers and chamber material to the bolts, all made in the USA. In order to control the quality of each component, all parts are machined on precision CNC equipment in Kenco Engineering's state of the art manufacturing facility, located in Tulsa, OK. After machining, each part is carefully inspected before being assembled to the final product in the specialized work cell, designed and built specifically for Kenco Flat Glass Gauges. All this means that Kenco Engineering is able to supply the highest quality Flat Glass Gauge products in the world while providing them to you, our customer in the fastest time available. Like any instrument, Kenco Flat Glass 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.

This instruction sheet covers Kenco weld pad style gauges in both Reflex and Transparent configurations.

PART NUMBER GUIDE for KENCO WELD PAD STYLE FLAT GLASS GAUGES:

ORDERING GUIDE:	
CODE	CODE DESCRIPTION
GAUGE TYPE: KW WELD PAD	
GAUGE STYLE: R REFLEX T TRANSPARENT	
NUMBER OF GAUGE SECTIONS: 1 1 GAUGE SECTION 2 2 GAUGE SECTIONS 3 3 GAUGE SECTIONS 4 4 GAUGE SECTIONS	
GLASS SIZE: 1 THRU 9 FOR 1 GAUGE SECTION 3 THRU 9 FOR 2 GAUGE SECTIONS 6 THRU 9 FOR 3 GAUGE SECTIONS 7 THRU 9 FOR 4 GAUGE SECTIONS	
MATERIALS:	
A1 316 S.S. CHAMBER, 316 S.S. COVER W/O SHIELD	
A2 304 S.S. CHAMBER, 316 S.S. COVER W/O SHIELD	
C1 A36 C.S. CHAMBER, A350 C.S. COVER W/O SHIELD	
C2 1018 C.S. CHAMBER, A350 C.S. COVER W/O SHIELD	
C3 A516 C.S. CHAMBER, A350 C.S. COVER W/O SHIELD	
W1 316 S.S. (WETTED) W/O SHIELD	
W2 304 S.S. (WETTED) W/O SHIELD	
K1 316 S.S. CHAMBER, 316 S.S. COVER W/MICA SHIELD	KWT ONLY
K2 304 S.S. CHAMBER, 316 S.S. COVER W/MICA SHIELD	KWT ONLY
L1 A36 C.S. CHAMBER, A350 C.S. COVER W/MICA SHIELD	KWT ONLY
L2 1018 C.S. CHAMBER, A350 C.S. COVER W/MICA SHIELD	KWT ONLY
L3 A516 C.S. CHAMBER, A350 C.S. COVER W/MICA SHIELD	KWT ONLY
M1 316 S.S. (WETTED) W/MICA SHIELD	KWT ONLY
M2 304 S.S. (WETTED) W/MICA SHIELD	KWT ONLY
G1 316 S.S. CHAMBER, 316 S.S. COVER W/KEL-F SHIELD	KWT ONLY
G2 304 S.S. CHAMBER, 316 S.S. COVER W/KEL-F SHIELD	KWT ONLY
H1 A36 C.S. CHAMBER, A350 C.S. COVER W/KEL-F SHIELD	KWT ONLY
H2 1018 C.S. CHAMBER, A350 C.S. COVER W/KEL-F SHIELD	KWT ONLY
H3 A516 C.S. CHAMBER, A350 C.S. COVER W/KEL-F SHIELD	KWT ONLY
J1 316 S.S. (WETTED) W/KEL-F SHIELD	KWT ONLY
J2 304 S.S. (WETTED) W/KEL-F SHIELD	KWT ONLY

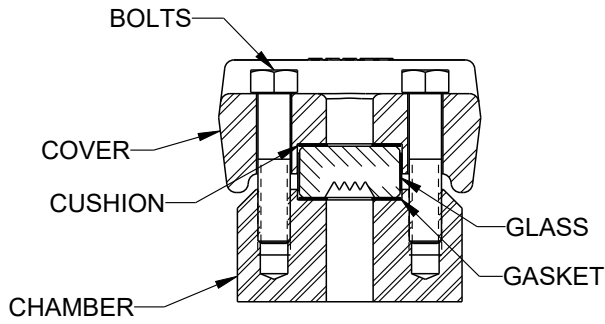
CHAMBER VISUAL CONFIGURATION: H TWO HOLE (RECOMMENDED FOR REFLEX GLASS) S FULLY SLOTTED (RECOMMENDED FOR TRANSPARENT GLASS)
OPTIONAL MACHINED RADIUS SIZE (TO MATCH VESSEL CURVATURE) (LEAVE BLANK FOR GAUGES WITH NO MACHINED RADIUS): (IN INCHES ROUNDED TO TWO DECIMAL PLACES AND THE NEAREST 1/16".) 2.00" MINIMUM 12.00" MAXIMUM

INSPECTION & DELIVERY

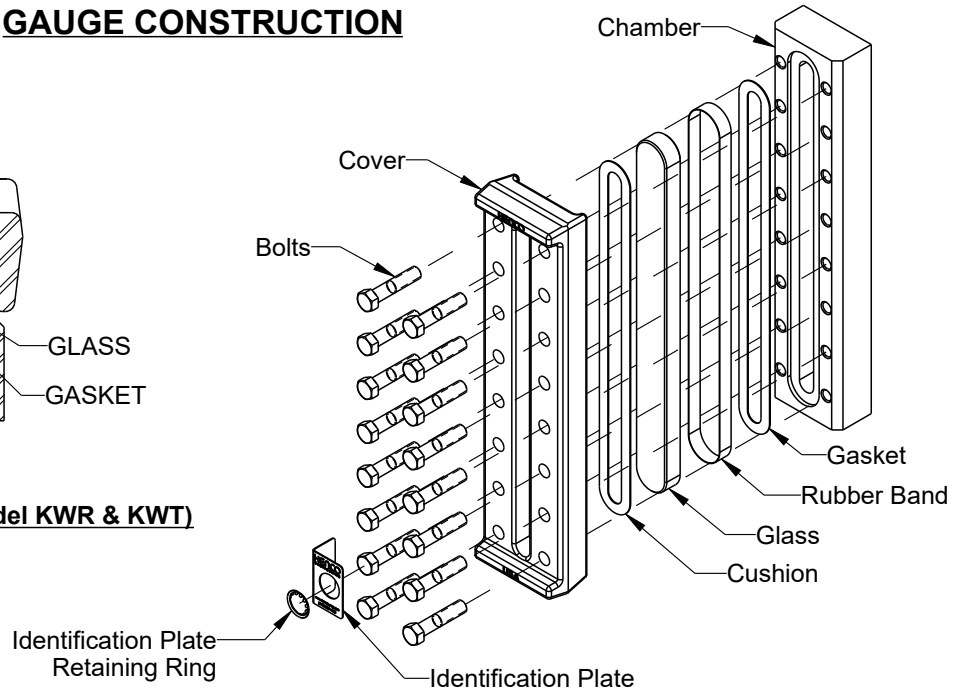
Upon receiving the gauge(s), check all components carefully for any damage that may have incurred during shipping. If found, notify the shipping company immediately of any such damage and request a damage inspection. Confirm that the gauge model number(s) (located on the nameplate) match the order and application conditions. Also, confirm that the gauge materials are compatible with the process media and the environmental conditions around the gauge.

CAUTION - Kenco Gauges are not to be used for indicating the level of lethal substances as defined by ASME Section VIII

GAUGE CONSTRUCTION



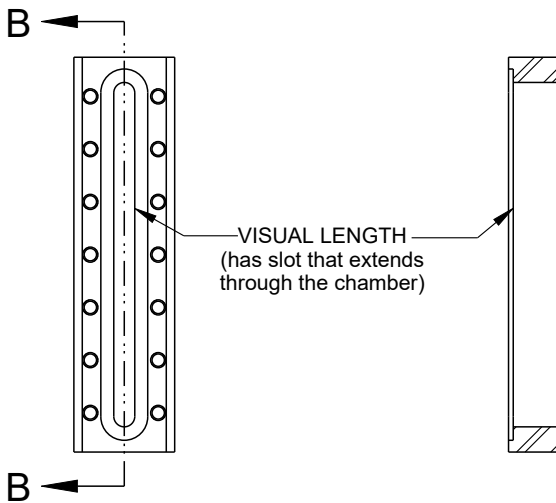
Weld Pad Gauge (Model KWR & KWT)



CHAMBER VISUAL CONFIGURATION OPTIONS:

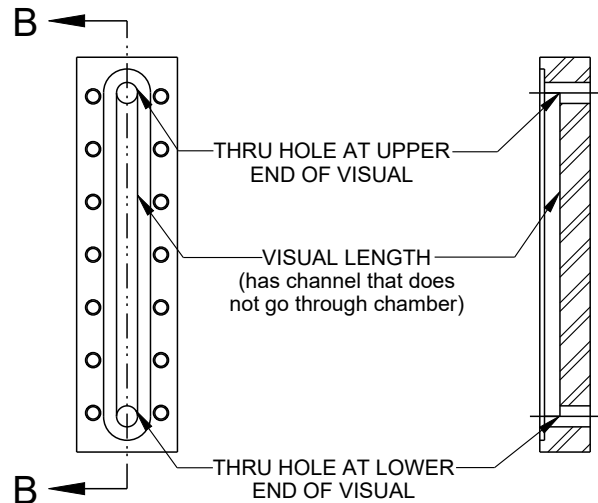
Kenco weld pad chambers can be configured with a visual length that is either fully slotted or has a channel connected with holes at the top and bottom. The fully slotted version is best for applications with viscous liquids, liquids with solids or for viewing the interfaces of two different liquids. The two hole version provides additional reinforcement for a stronger installation. These two configuration options are shown below. Typically when using the fully slotted version the vessel will be fully slotted as well. Likewise when using the two hole version the vessel will have two holes instead of a slot. Ultimately, either chamber can be welded to a vessel that is fully slotted or has two holes. The best vessel configuration for the application must be determined by the vessel designer and fabricator.

FULLY SLOTTED CHAMBER OPTION



- Visual length is fully slotted and extends through the chamber
- Provides the best visual inspection of the fluid in the vessel
- Excellent for viewing the interface of two different liquids
- Recommended for use with transparent glass but can be used with reflex glass on vessels that are not fully slotted.

TWO HOLE CHAMBER OPTION



- Visual slot is a channel that does not go through the chamber. Liquid travels through the holes and into the channel
- Provides reinforcement for a stronger installation
- Typically the vessel is drilled instead of slotted
- Reflex glass recommended

KWR(T) CHAMBER WELDING INSTRUCTIONS:

- Kenco KWR(T) gauges are shipped with gauge glass and gaskets installed in gauge and the assembly loosely held together with zipties. Using this method protects the glass and gaskets during shipping yet makes the chamber gasket easy to remove without damage (it is not necessary to remove the cushion from the cover).
- 1.) Disassemble the gauge by cutting the zipties holding the gauge together and carefully lift the cover off of the glass. The cushion may be lightly stuck in the cover. This is fine as it has not been compressed by the bolts. Leave the cushion in the cover. Now remove the glass and handle with great care as discussed in the Maintenance and Reassembly sections of this document. Carefully remove the gasket from the chamber taking care not to bend or crease it. Lay these components aside until the chamber is welded in place and ready for reassembly.
 - 2.) Place chamber in desired location on vessel and mark the visual slot or hole location. The visual slot is 5/8" wide so at a minimum a fluid transfer hole with a diameter of 5/8" is required at the start and end of the visual for proper operation. The fluid transfer hole or slot can be approximately 1/2" larger (1-1/8") if access to the inside of the vessel is available and a back seal weld on the chamber is desired.

CAUTION - When an application requires the tank to be slotted rather than simply drilled due to a viscous media, for visual reasons or any other application requirement it is important to understand the following:

- Standard Weld Pad Gauges will withstand the pressure loads inside the gauge itself but they are not designed to replace the strength lost in the wall of the vessel/tank where the slot or holes are cut.
- The gauge manufacturer has no control over the loading that the vessel/tank will impose on the gauge, therefore it is impossible for the gauge manufacturer to provide a pressure rating for a weld pad gauge.
- It is the responsibility of the installer to verify the strength required and provide any additional reinforcement to the tank if needed.

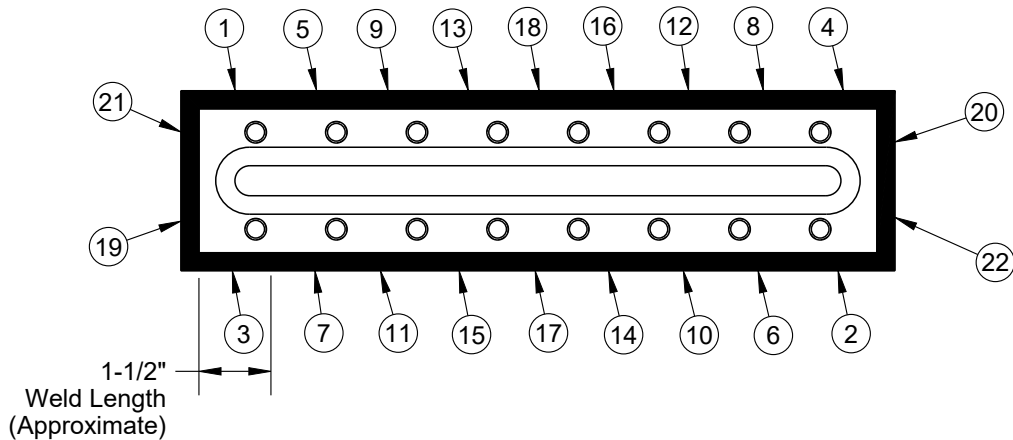
- 3.) The installer must decide what type and size of weld is required for the application. If a bevel weld is desired, grind or machine the bevel needed on the perimeter of the chamber before welding. Take care not to scratch, ding or damage the gasket surface.
- 4.) With the transfer holes/slot in place and the chamber properly prepared for welding, position the chamber over the holes/slot and tack weld in place.

Caution - Care must be taken when welding chamber to prevent distortion to the gasket surface. Several small welds made with cooling time allowed between each one will minimize the heat transferred to the chamber and reduce the chances of gasket surface distortion. Only qualified personnel with experience in ASME BPV code welding should perform this task. Kenco Engineering cannot be held responsible for chambers damaged due to welding.

- 5.) As an added precaution against distortion, the gauge can be temporarily assembled with a 3/4" x 1-1/4" steel spacer in place of the glass and gaskets. When installing the steel spacer, torque the bolts to 25-30 ft-lbs. This procedure is highly recommended as it greatly adds to the rigidity of the chamber during the welding process. If you do not have any spacers or the proper material to make them, Kenco Engineering keeps spacers in stock that are machined to length and ready for installation.

Caution - Never weld a KWR(T) Gauge with the glass and gaskets in place! Damage to both the glass and gaskets will occur. If welding the chamber assembled with a steel spacer, make sure the gauge is assembled with only the steel spacer and no gaskets. The gaskets could be damaged if subjected to the heat of the welding process.

- 6.) Using an approximate weld length of 1 to 1-1/2 inches, weld the chamber in place by alternating from side to side and end to end as shown in the illustration below. Allow cooling time between each weld until the entire perimeter of the chamber is welded. The weld length is a recommendation only. It is the responsibility of the installer to select the best method that he/she feels will work for them, based on the situation and the installer's experience. The number of welds will also vary from what is shown as they are dependent on both the weld length and the length of the gauge.



WELD LENGTH AND ALTERNATING SEQUENCE
(RECOMMENDATION ONLY)

DISASSEMBLY / REASSEMBLY AFTER WELDING:

- 1.) After gauge has cooled to ambient temperature, remove bolts, cover(s) and steel spacer(s) if used.
- 2.) Check gasket surface of chamber and verify that it is flat, smooth and free of any knicks, dings or scratches that could prevent sealing. Gasket surface should be flat within .002" over the entire area. If any area is found to be out of flat by more than .002" the gasket seat will need to be resurfaced with a stone.
- 3.) Reassemble the gauge following the procedure shown on page 5 and 6. The only deviation from this procedure is that scraping the gasket and cushion surfaces of the chamber and cover are not required and should not be performed. Make sure to note the proper bolt torque for the glass and gaskets used and follow this procedure very carefully. Also note the glass handling procedures to avoid any knicks, scratches or cracks to the glass.

OPERATION

CAUTION - Rapidly filling a vessel/tank with a hot fluid can cause glass breakage and / or possible injury to personnel. Gauges should be brought into service slowly.

Always warm up a gauge slowly when it is used with a vessel containing hot fluid. Be careful and open the shut off valves to the vessel/tank very slowly. Wait until the gauge is fully warmed up before completely opening the valves feeding the vessel/tank. Kenco uses tempered glass designed to withstand thermal shock. However, additional loads that you cannot measure are imposed on the glass during installation and resistance to thermal shock is reduced accordingly. This procedure also applies to cold fluids.

For high pressure and/or 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 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 before leaving the site.

CAUTION - Bolt torque is vital to the proper operation of a flat glass gauge. Because gaskets compress over time, bolt torque should be checked after the gauge is installed but before it is put into operation (see Page 6). Bolt torque should also be checked after the first few hours of operation.

CAUTION - Gauges should always be isolated from the process system by draining and relieving pressure in the vessel/tank before doing any bolt torque or maintenance checks.

MAINTENANCE

The following is a step-by-step procedure for maintaining your Kenco Weld Pad Style Flat Glass Gauges:

A. Inspection of Glass:

Look at the glass regularly for any signs of clouding or scratching. In new processes the glass should be inspected daily until the need for replacement becomes apparent. This will help establish the routine inspection / maintenance cycle.

To examine for scratches, shine a very bright concentrated light at a 45° angle. Anything that glistens brightly should be inspected closely. Any scratch which catches your fingernail, any star or crescent shaped mark which glistens is cause for replacement. If inner surface (process side) appears cloudy or roughened and will not respond to cleaning procedures (see next section for details), this is an indicator of chemical attack and, if severe, is cause for replacement.

B. Cleaning of Glass:

Keep glass clean using commercial glass cleaners (e.g. Windex, Bon-Ami). If these don't seem to work, a dilute solution of Hydrochloric (muriatic) acid can be used. Observe safety rules when handling these dangerous 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.

CAUTION - DO NOT attempt to clean the glass while the gauge is in operation.

C. Receiving and storing Glass:

Upon receiving replacement glass, inspect containers and glass for shipping damage. Keep glass in original box until ready for use. If glass is to be inspected, unwrap and re-wrap carefully, avoiding bumping or sliding polished face across any other object (including table tops).

D. **Disassembly:**

Prior to any disassembly of the gauge, first be sure that the gauge is relieved of all internal pressure and that the gauge is at ambient temperature. Loosen end bolts first, working from opposite ends toward the center.

CAUTION - Failure to relieve pressure may result in a sudden release of internal pressure, which can cause physical injury, and/or glass breakage.

E. **Reassembly Guidelines:**

Note: See the section on "GAUGE CONSTRUCTION" (Page 2) for the location of the parts discussed below.

Kenco Gauges use Borosilicate glass, tempered to increase its bending stress resistance. This glass has a low coefficient of thermal expansion and is more resilient to thermal shock than other glasses. Nevertheless, like any glass it is much stronger in compression than it is in tension. Since bending imparts tension stresses on the glass, care should be taken not to impose any bending on the glass or to set up any local stresses. The following points should be observed to ensure long life:

- Check with the Maintenance Supervisor or Engineer for the proper glass to be used in the gauge. Check box and glass labels or markings against the gauge pressure and temperature ratings.
- The glass, gaskets, cushions and bolts should not be reused, even when they appear in perfect condition. Replace with new parts. Bolts will stretch when retorqued, thereby weakening them. Glass deforms under pressure from the chamber and cover. Even though a used piece of glass may look perfect, it is not as reliable as a new one. Best practice is to always use a new glass.
- The glass should be seated on a flat surface with a suitable gasket on the seating surface to avoid subjecting the glass to stress concentrations which result from poor loading. It should be clamped in place with a flat cover plate that is uniformly loaded, as described in the "Reassembly Procedures".
- The Glass should not be in contact with any metal surfaces.
- For Transparent gauges used in steam service, use mica shields between the glass and the gasket on the chamber (process) side.
- For Reflex gauges, the prism on the glass must always face the chamber, or wetted side of the gauge.

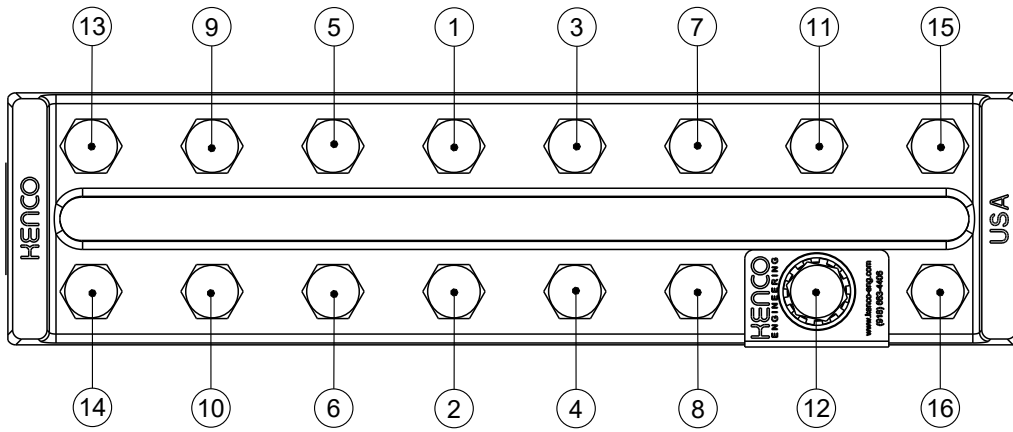
F. **Reassembly Procedure:**

- 1.) Before reassembly, clean the gauge chamber and cover gasket surfaces thoroughly with a soft metal scraper, preferably brass. Be sure all burrs and bits of old gasket are removed. Gouged or scarred gasket surfaces should be refinished in a milling machine (cover) or with a stone (chamber). Depressions in the gasket surface will cause low gasket compression and can lead to leaks. High points in the gasket surface will result in high glass stresses and probable early glass failure.
- 2.) Because of the vertical placement of the chamber, it is a good idea to have the bolts ready to install before placing the cover on the chamber. Make sure the threads of the bolts are clean and apply a light coat of oil to the threads. If bolts are stainless steel or if gauge will be operating at more than 150° F, use Molykote or a similar molybdenum disulfide lubricant.
- 3.) Place a rubber band (supplied if using Kenco glass repair kit) around the glass prior to placing it in the cover pocket to prevent glass to metal contact. Place glass cushion and then glass in cover pocket. For Reflex gauges, make sure smooth side of the glass faces the pocket in the cover (prism on glass must be on the wetted side of the gauge!). Make sure glass is centrally located in cover pocket. Since the gauge must be reassembled in the vertical position, great care must be taken to ensure there is no glass to metal contact.

CAUTION - The glass must not be in contact with any metal part of the gauge after assembly. Doing so would impart all shock transmitted to gauge straight to the glass and could result in premature glass failure.

- 4.) Lay gasket (typically the same part as the cushion) on the glass, making sure it is centrally located. While holding the glass and gasket in place, carefully lift the cover and position it over and onto the chamber pocket. Take care during this process to ensure the gasket remains in its centrally located position on the glass. Make sure there is no glass to metal contact with the cover or chamber pocket and that the gasket is properly seated in the chamber.
- 5.) Now install the bolts prepared earlier finger-tight in the sequence shown in the sketch on page 6. After all bolts are installed finger tight, tighten with a torque wrench in the same sequence. Tighten the bolts in five foot pound increments until the recommended torque value is met (see torque specifications in chart on page 6). Once torque value is met, repeat tightening sequence at final torque value until bolts no longer move or move less than 1/16 of a turn. This procedure puts an even loading on the glass. Having a helper to hold the cover assembly in position while a second person installs the bolts is highly recommended.
- 6.) With all of the bolts properly torqued, place the Identification tag over the second bolt from the bottom on either the left or right side of the gauge, depending on the tag. Secure the tag with the included retaining ring. Refer to the tag installation instructions, on page 7 for details on the tag installation procedure.

BOLT TORQUE SEQUENCE



GASKET MATERIAL	GRAPHOIL	NON-ASBESTOS	PURE AND 25% GLASS FILLED TEFLON	PCTFE (KEL-F) SHIELDS
GAUGE	TORQUE SPECIFICATION (FT LBS)			
KWR	32	32	20	N/A
KWT	32	32	20	20

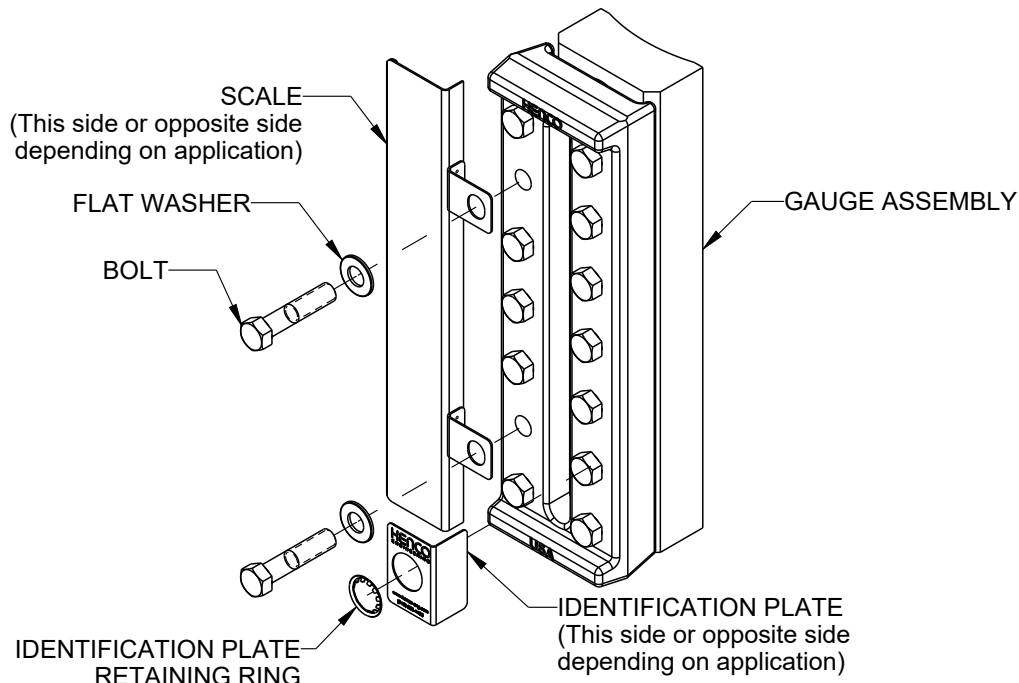
7.) New gaskets tend to become permanently compressed after a short time in service. This causes slight leaks and/or an apparent loosening of the bolts. Therefore, re-torque bolts to the original value after the gauge has been in service for a few hours (depressurize gauge before retorquing).

RECOMMENDED SPARE PARTS

If a gauge is in need of rebuild and it is deemed in rebuildable condition, Kenco Engineering stocks the repair kits needed to return the glass, gaskets, nuts and bolts to factory new specifications. Consult Kenco for kit information or visit our website at www.kenco-eng.com.

INSTALLATION OF SCALE AND IDENTIFICATION PLATE

All Kenco weld pad gauges come with an identification plate. The ID plate may be mounted on either the left or right side of the gauge, depending on the application. Gauge scales (if applicable) are special ordered to be mounted on either the left or right side of the gauge. When installing the scale, make sure to mount it to the correct side of the gauge so that the scale is properly oriented. Scales should be installed when the gauge is first assembled and all of the bolts are installed finger tight. This ensures the proper bolt torque sequence can be met resulting in an evenly applied clamp loading on the glass. Make sure to install the flat washers on the bolts as shown. After the scale is installed and all of the bolts are properly torqued, install the ID plate with the included retaining ring. Refer to the ID plate installation instructions (Pg. 7) for details.



INSTRUCTIONS FOR INSTALLATION OF IDENTIFICATION TAG

Note: At no point should any kind of hammer be used on the tag installation! Hammering on the gauge poses a risk of damaging the glass. KENCO Engineering cannot be held responsible for damage to the gauge due to improper tag installation.

Note: Tag can be placed on either left or right side of the gauge depending on selected options. Tag installation instructions below reflect left side mounted tag option.



Figure 1

1). Locate the tag and remove the backing from the adhesive strips.



Figure 2

2). Center the tag over the head of the second bolt from the bottom (see note for which side). Carefully lay the tag over the bolt and apply pressure to stick the tag to the gauge cover.



Figure 3

3). Center the retaining ring on top of the bolt head with the tag. Make sure the teeth of the retaining ring are pointed upward as show. Ring will not install properly if placed upside down.



Figure 4



Figure 5

4). Position either an open end or crescent wrench as shown in the photos above. Make sure the wrench opening is wide enough and centered so that it will clear the head of the bolt as the retaining ring is pushed on. Using hand force only, push down until the ring is fully engaged around the bolt head.

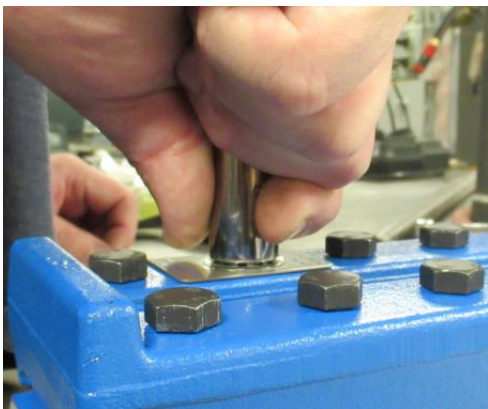


Figure 6

5). Finish seating the retaining ring by placing a 5/8" socket over the bolt head as shown in Fig.6 . Using hand force only, push down on the socket until the ring is fully seated against the face of the tag.



Figure 7

7). Once tag is fully installed it should appear as shown in figure 7.