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MODEL KMR, KMT, KHR AND KHT 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 medium and high pressure gauges in both Reflex and Transparent configurations.

PART NUMBER GUIDE for KENCO FLAT GLASS GAUGES

Gauge Type	Gauge Style	No. of Gauge Sections	Glass Size	Material	
KH = High Pressure KM = Medium Pressure	R = Reflex T = Transparent	1 2 3 4 5	6 7 8 9	1 Thru 9 - 1 section 3 Thru 9 - 2 Sections 6 Thru 9 - 3 Sections 7 Thru 9 - 4 & 5 Sections 8 and 9 - 6 to 9 Sections	A = 316 Stainless Steel w/o Shield C = Carbon Steel w/o Shield W = 316 S.S. (Wetted) w/o Shield K = 316 S.S. w/Mica Shield L = Carbon Steel w/Mica Shield M = 316 S.S. (Wetted) w/Mica Shield G = 316 S.S. w/Kel-F Shield H = Carbon Steel w/Kel-F Shield J = 316 S.S. (Wetted) w/Kel-F Shield

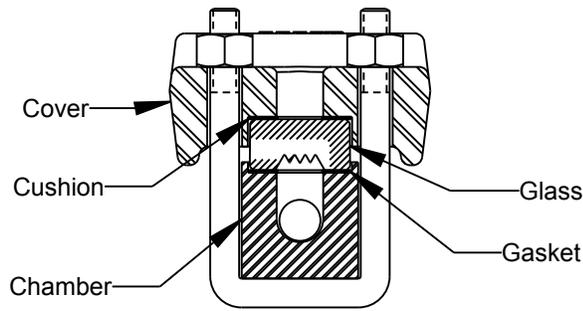
Connection Location	Connection Size	Connection Type	Center to Center Gauge Distance
B = Back E = End L = Left R = Right	50 = 1/2" 75 = 3/4" 10 = 1" (Flange Only) 15 = 1-1/2" (Flange Only) 20 = 2" (Flange Only) 30 = 3" (Flange Only) 40 = 4" (Flange Only) 60 = 6" (Flange Only) 80 = 8" (Flange Only)	N = FNPT S = Socket Weld (Female) A = 150 LB R.F. Flange B = 300 LB R.F. Flange C = 600 LB R.F. Flange D = 900 LB R.F. Flange E = 1500 LB R.F. Flange F = 2500 LB R.F. Flange G = 150 LB R.T.J. Flange H = 300 LB R.T.J. Flange J = 600 LB R.T.J. Flange K = 900 LB R.T.J. Flange L = 1500 LB R.T.J. Flange P = 2500 LB R.T.J. Flange	Leave Blank for End Connections (3 Place Decimal Rounded to Nearest 1/32")

INSPECTION & DELIVERY

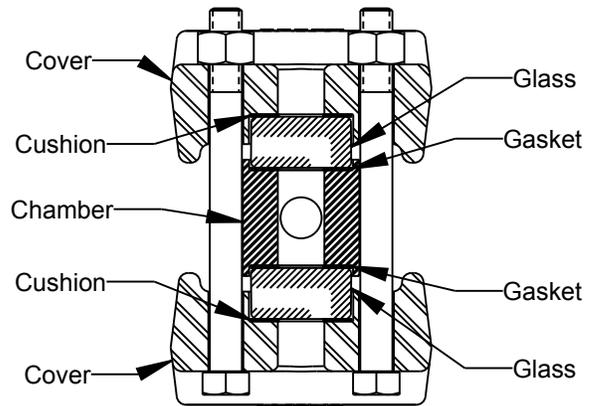
Upon receiving the gauge(s), check all components carefully for any damage that may have incurred during shipping. If found, notify the shipping company immediately of any such damage and request a damage inspection. Confirm that the gauge model number and pressure/temperature ratings (located on the nameplate) match the 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

GUAGE CONSTRUCTION



Reflex Gauge (Model KMR & KHR)



Transparent Gauge (Model KMT & KHT)

BEFORE YOU INSTALL GAUGE CONSIDER THE FOLLOWING:

- To avoid imposing pipe strains 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 four feet or more in length or over 100 pounds in weight, especially if the gauge is exposed to vibration. These support brackets will prevent overloading the connecting valves and piping and prevent damage to the gauge from excessive vibration.
- Always provide shutoff valves between the gauge and the vessel. Kenco Flat Glass Gauge Valves with automatic ball check valves are recommended to provide protection against physical injury and loss of product if glass breakage should occur. These valves also provide a means to isolate the gauge for maintenance.
- 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 MAINTENANCE). Bolt torque should also be checked after the first few hours of operation.

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

OPERATION

CAUTION - Rapid opening of connecting valves 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. Being careful to open the shut off valves very slowly, wait until the gauge is fully warmed up before completely opening the valves. 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.

During system shutdown it is best to leave the shut off valves open so that as the gauge cools it depressurizes along with the rest of the system. Keeping valves closed during shut down can trap high pressure liquid in the gauge. 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 and be certain the shut off valves are fully open with all vents and drains closed before leaving the site.

CAUTION - While the gauge is in operation, the shut off valves must be fully open. A partially open valve will prevent the automatic ball checks from seating, which could result in physical injury to personnel and loss of product.

MAINTENANCE

The following is a step-by-step procedure for maintaining your Kenco 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:

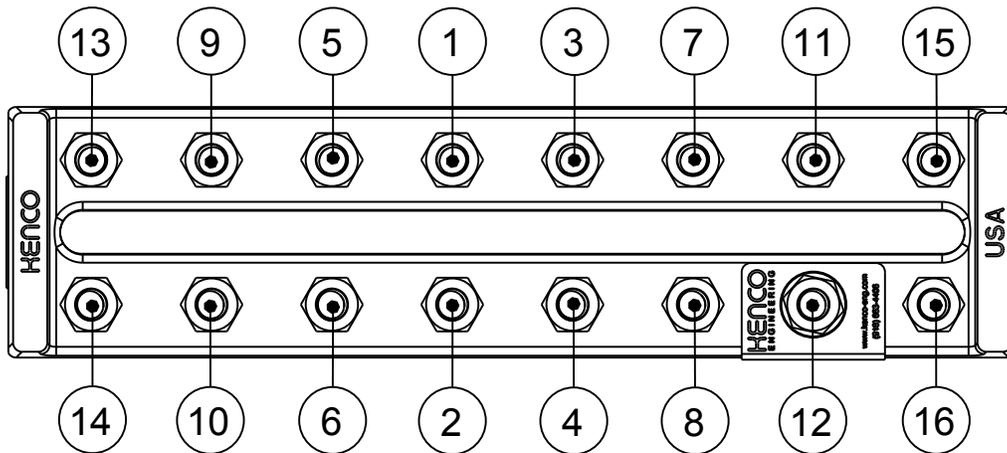
- Check with the Maintenance Supervisor or Engineer for the proper glass to be used in the gauge. Check box and glass labels or markings against the gauge pressure and temperature ratings.
- The glass, gaskets, cushions and bolts should not be reused, even when they appear in perfect condition. Replace 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" below.
- 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 (or you can return the chamber and covers to Kenco for refinishing). 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.) Place a rubber band (supplied if using Kenco glass repair kit) around the glass prior to placing it in the chamber pocket to prevent glass to metal contact. Place glass gasket and then glass in chamber pocket. For Reflex gauges, make sure prism on glass faces the pocket in the chamber (prism on glass must be on the wetted side of the gauge!). Make sure glass is centrally located in chamber pocket. This process is best performed with the gauge laying horizontal on a bench. The gauge can be reassembled in the vertical position but greater care must be taken to ensure no glass to metal contact.

CAUTION - The glass must not be in touch 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.

- 3.) Replace the gauge covers as follows:
 - a.) Lay cushion (typically the same part as the gasket) on glass, making sure it is centrally located, and then set cover down on top of glass. Take care during this process to ensure the cushion is not disturbed and remains in it's centrally located position on the glass. Make sure there is no glass to metal contact with the cover pocket.
 - b.) Clean bolt and nut threads and apply a light coat of oil to the threads and face of nut that will contact cover. If nuts and bolts are stainless steel, or if gauge will be operating at more than 150° F, use Molykote or a similar molybdenum disulfide lubricant.
 - c.) Tighten the nuts finger-tight in the sequence shown in the sketch below, and then tighten with a torque wrench in the same sequence. Tighten the nuts in five foot pound increments until the recommended torque value is met (see torque specifications in chart below). Once torque value is met, repeat tightening sequence at final torque value until nuts no longer move or move less than 1/16 of a turn. This procedure puts an even loading on the glass.



GASKET MATERIAL	GRAPHOIL	NON-ASBESTOS	PURE AND 25% GLASS FILLED TEFLON	PCTFE (KEL-F) SHIELDS
GAUGE	TORQUE SPECIFICATION (FT LBS)			
KMR	32	32	20	N/A
KMT	32	32	20	20
KHR	42	42	20	N/A
KHT	42	42	20	20

- d.) 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.

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.