

DURABILITY & PRECISION

FLAT GLASS GAUGES & VALVES FOR PROCESS LEVEL MEASUREMENT by KENCO



FEATURING *NEW* REFLEX & TRANSPARENT ARMORED LEVEL GAUGES

ENGINEERED LIQUID LEVEL SOLUTIONS



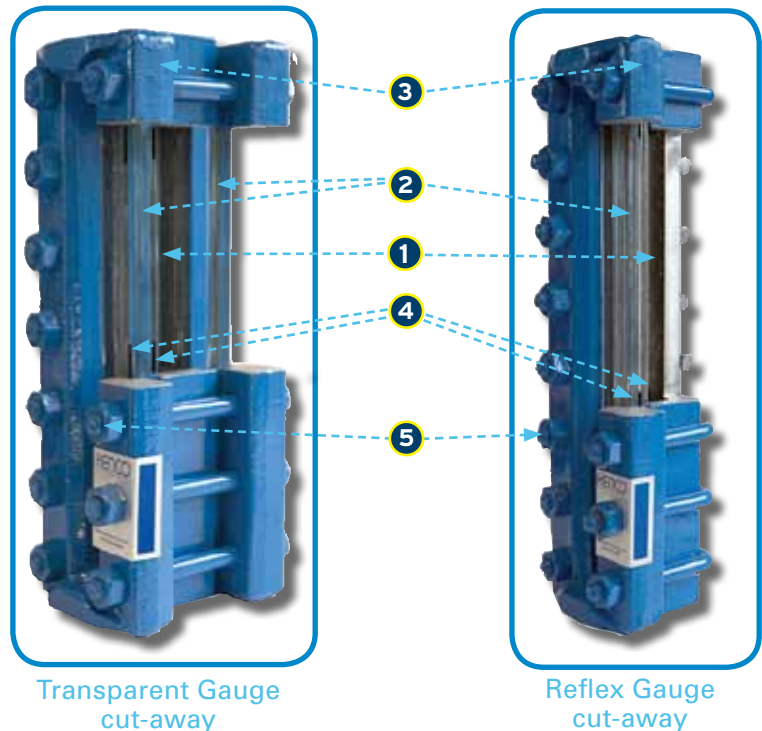
www.kenco-eng.com

FLAT GLASS GAUGES

KENCO Flat Glass Gauges are used where direct visual observation of process fluids is required. These gauges are suitable for a wide range of applications with pressures up to 4000psig @ 100°F, and temperatures up to 750°F @ 2300psig. KENCO gauges are available in a wide variety of construction materials, connections and other options to meet most specifications.

There are five main components common to all flat glass gauges:

- 1 Chamber**
Center of the gauge, and is the part that primarily contains the process fluid. It is machined from bar stock. The gasket seat is recessed for lateral support, and easy positioning.
- 2 Glass**
Provides the visual interface between the process fluid and the outside.
- 3 Cover**
Protects the glass, and provides the compression surface for sealing the gauge. The cushion seat is surfaced for lateral support and easy positioning.
- 4 Gasket/Cushion**
Provides for a seal between the chamber and glass (gasket), and protects the glass from mechanical stresses from the cover (cushion). For a given gauge, the gasket and cushion are normally the same material.
- 5 Bolts/Studs/Nuts**
Provides a uniform compression load to the gauge for pressure sealing.



REFLEX & TRANSPARENT STYLES

Reflex gauges have a single piece of glass, mounted on one side of the chamber. This piece of glass is flat on the outside, and has a series of prisms on the inside, facing the process fluid. When light strikes the portion of the glass covered by a liquid, the light is reflected from the back of the chamber. This area appears “black”. When light strikes the glass where no liquid is present, the prisms reflect the light directly out of the gauge. This area appears “silvery”. Reflex gauges provide an excellent way to measure clear, or difficult to see fluids.

The “silvery” / “black” interface is easy to see from several feet away. Transparent gauges have two pieces of glass on opposite sides of the chamber. Light enters the gauge from one side, and the level is viewed from the other. Transparent gauges are useful when the actual liquid characteristics need to be seen. They are also commonly used for liquid-liquid interfaces. Mica shields can be used in transparent gauges to protect the glass in steam environments. Kel-F shields should be used in corrosive environments.

WHY USE FLAT GLASS GAUGES

Flat Glass Gauges have been in use for over 100 years. They give you the ability to directly view the process fluid under temperature/pressure conditions that would render most other level technologies useless. Their construction is very robust, and reliable. They define the term “simple to use”. . . after installation, the only tool you will need is your eyes. Flat Glass Gauges are relatively inexpensive as compared to most other level technologies.

Other features:

- They do not need electrical power to operate. This can be a great advantage in the case of a power outage.
- Simple to install. . .no calibration is necessary.
- Can be used as a reference to check, or calibrate, other level technologies.
- Pressure rating from vacuum to 4000 psig.
- Temperature rating from -50°F–750°F (Carbon Steel) / -150°F–750°F 316 (Stainless Steel)
- Not affected by the chemical or electrical properties of the process liquid. Specific gravity, dielectric, conductivity, surface turbulence, vapor, foam, etc. no longer needs to be considered.

FLAT GLASS GAUGES vs. TUBULAR GLASS GAUGES

KENCO offers a wide range of Flat Glass and Tubular Gauges. With all of those choices, one of the basic questions is: *Should I use Flat Glass or Tubular Glass Gauges?* The answer is fairly simple. If the process pressure is under 500psig and the process temperature is under 400°F, tubular style gauges should be considered. KENCO tubular gauges shield the glass on all four sides to virtually eliminate glass breakage, and tubular gauges are even more cost effective than flat glass gauges. Regardless of the style chosen, KENCO’s high quality gauges will provide you with many years of reliable service.

MEDIUM PRESSURE FLAT GLASS GAUGES

KENCO Medium Pressure Flat Glass Gauges are versatile enough for most common process conditions. Standard carbon steel gauges meet the requirements of NACE MR0175. Unlike other manufacturers, there is no additional charge for NACE.

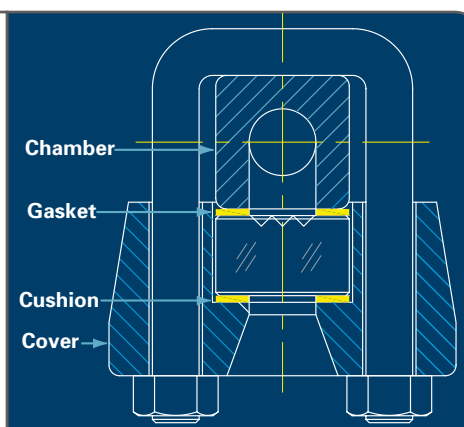
All materials meet or exceed ASTM specifications. Model KMR Reflex Gauges can reach process pressures up to 3000psig. Model KMT Transparent Gauges can handle pressures up to 2000psig. See the Ratings' tables below for specific information about a particular gauge size.

While these gauges are not specifically designed for steam service, the Model KMR gauges will perform at saturated steam pressures up to 300WSP. The Model KMT will perform at saturated steam pressures up to 600WSP, depending upon gauge size. Mica shields are recommended for Model KMT when used in steam. Shields cannot be used with Reflex Gauges.

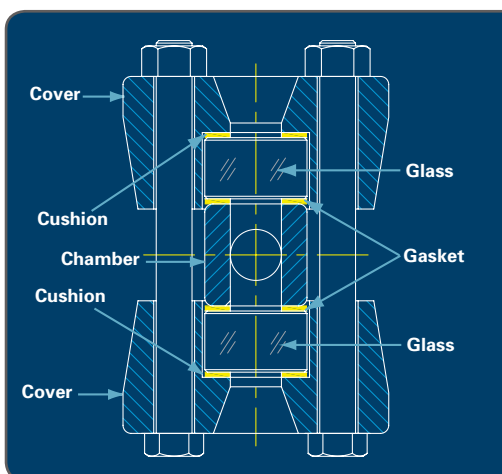
REFLEX GAUGE (MODEL KMR)

Pressure / Temperature Ratings									
GLASS SIZE									
°F	1	2	3	4	5	6	7	8	9
100	3000	2875	2750	2625	2500	2375	2250	2125	2000
200	2735	2620	2505	2395	2280	2165	2050	1940	1825
300	2660	2550	2440	2325	2215	2105	1995	1885	1775
400	2565	2460	2355	2245	2140	2035	1925	1820	1715
500	2425	2325	2225	2120	2020	1920	1820	1720	1620
600	2215	2125	2030	1940	1845	1755	1660	1570	1480

SATURATED STEAM RATING: 300 WSP



TRANSPARENT GAUGE (MODEL KMT)



Pressure / Temperature Ratings									
GLASS SIZE									
°F	1	2	3	4	5	6	7	8	9
100	2000	1875	1750	1625	1500	1375	1250	1125	1000
200	1825	1710	1595	1480	1370	1255	1140	1025	910
300	1775	1665	1555	1445	1335	1220	1110	995	885
400	1715	1610	1500	1395	1285	1180	1070	960	855
500	1620	1520	1415	1315	1215	1115	1010	910	810
600	1480	1385	1295	1200	1110	1015	925	830	735
SATURATED STEAM USING MICA SHIELDS									
	600	600	600	600	550	500	450	400	350

HIGH PRESSURE FLAT GLASS GAUGES

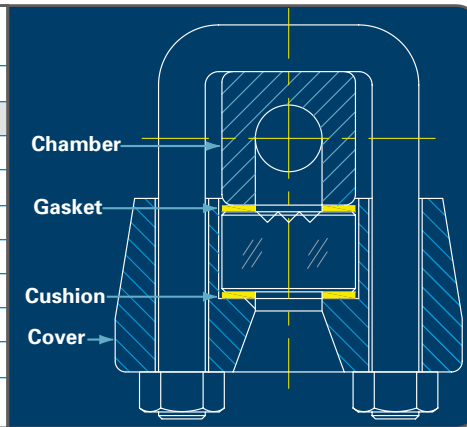
KENCO High Pressure Flat Glass Gauges have a superior rugged design for the most demanding process conditions. Standard carbon steel gauges meet the requirements of NACE MR0175. Unlike other manufacturers, there is no additional charge for NACE.

All materials meet or exceed ASTM specifications. Model KHR Reflex Gauges can reach process pressures up to 4000psig. Model KHT Transparent Gauges can handle pressures up to 3000psig. See the Ratings' tables below for specific information about a particular gauge size.

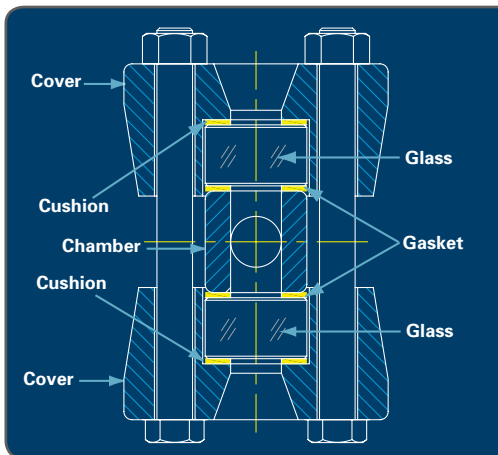
While these gauges are not specifically designed for steam service, the Model KHR gauges will perform at saturated steam pressures up to 300WSP. The Model KHT will perform at saturated steam pressures up to 750WSP. Mica shields are recommended for Model KHT when used in steam. Shields cannot be used with Reflex Gauges.

REFLEX GAUGE (MODEL KHR)

Pressure / Temperature Ratings									
°F	GLASS SIZE								
	1	2	3	4	5	6	7	8	9
100	4000	4000	4000	4000	4000	4000	4000	4000	4000
200	3890	3890	3890	3890	3890	3890	3890	3890	3890
300	3790	3790	3790	3790	3790	3790	3790	3790	3790
400	3700	3700	3700	3700	3700	3700	3700	3700	3700
500	3470	3470	3470	3470	3470	3470	3470	3470	3470
600	3080	3080	3080	3080	3080	3080	3080	3080	3080
750	2300	2300	2300	2300	2300	2300	2300	2300	2300
SATURATED STEAM RATING: 300 WSP									



TRANSPARENT GAUGE (MODEL KHT)



Pressure / Temperature Ratings									
°F	GLASS SIZE								
	1	2	3	4	5	6	7	8	9
100	3000	3000	3000	3000	3000	3000	3000	3000	3000
200	2920	2920	2920	2920	2920	2920	2920	2920	2920
300	2850	2850	2850	2850	2850	2850	2850	2850	2850
400	2780	2780	2780	2780	2780	2780	2780	2780	2780
500	2600	2600	2600	2600	2600	2600	2600	2600	2600
600	2310	2310	2310	2310	2310	2310	2310	2310	2310
750	1700	1700	1700	1700	1700	1700	1700	1700	1700
SATURATED STEAM USING MICA SHIELDS									
	750	750	750	750	750	750	750	750	750

GAUGE INFORMATION

GAUGE LENGTHS (Inches)

# of Gauge Sections	Section /Glass	Visible Length	Overall Length	Minimum Side C-C Connection Length Includes Model KMVR Valves		# of Gauge Sections	Section /Glass	Visible Length	Overall Length	Minimum Side C-C Connection Length Includes Model KMVR Valves	
				1/2" NPT	3/4" NPT					1/2" NPT	3/4" NPT
				1	11					3.750	5.250
12	4.750	6.250	4.500		4.875	37	33.750	35.250	33.500	33.875	
13	5.750	7.250	5.500		5.875	38	38.625	40.125	38.375	38.750	
14	6.750	8.250	6.500		6.875	39	40.875	42.375	40.625	41.000	
15	7.875	9.375	7.625		8.000	4	47	45.500	47.000	45.250	45.625
16	9.125	10.625	8.875		9.250		48	52.000	53.500	51.750	52.125
17	10.250	11.750	10.000		10.375		49	55.000	56.500	54.750	55.125
18	11.875	13.375	11.625		12.000	5	57	57.250	58.750	57.000	57.375
19	12.625	14.125	12.375		12.750		58	65.375	66.875	65.125	65.500
2	23	13.000	14.500	12.750	13.125	6	59	69.125	70.625	68.875	69.250
	24	15.000	16.500	14.750	15.125		68	78.750	80.250	78.500	78.875
	25	17.250	18.750	17.000	17.375	7	69	83.250	84.750	83.000	83.375
	26	19.750	21.250	19.500	19.875		78	92.125	93.625	91.875	92.250
	27	22.000	23.500	21.750	22.125	8	79	97.375	98.875	97.125	97.500
	28	25.250	26.750	25.000	25.375		88	105.500	107.000	105.250	105.625
	29	26.750	28.250	26.500	26.875	9	89	111.500	113.000	111.250	111.625
					98		118.875	120.375	118.625	119.000	
						99	125.625	127.125	125.375	125.750	

GAUGE VOLUMES

Glass Size #	KMR & KMT Gauges				KHR & KHT Gauges			
	REFLEX		TRANSPARENT		REFLEX		TRANSPARENT	
	in ³	cm ³	in ³	cm ³	in ³	cm ³	in ³	cm ³
1	2.20	36	2.97	49	2.13	35	2.78	46
2	2.82	46	3.79	62	2.75	46	3.60	59
3	3.44	56	4.61	76	3.37	55	4.42	73
4	4.05	66	5.43	89	3.98	65	5.24	86
5	4.75	78	6.34	104	4.61	76	5.96	98
6	5.51	90	7.36	121	5.37	88	6.98	115
7	6.21	102	8.29	136	6.07	100	7.71	127
8	7.21	118	9.63	158	7.07	116	9.05	149
9	7.67	125	10.26	168	7.53	123	9.68	159
	C = 0.373 in ³ C = 6.1 cm ³		C = 0.373 in ³ C = 6.1 cm ³		C = 0.373 in ³ C = 6.1 cm ³		C = 0.161 in ³ C = 2.64 cm ³	

To find the volume of multiple sections, multiply the number of sections by the volume of the single section in proper units, then add the constant "C" times the number of sections minus one.

ORDERING SYSTEM

Flat Glass Level Gauge

REQUESTED BY: _____ COMPANY: _____

ADDRESS: _____ CITY: _____ STATE: _____ ZIP: _____

PHONE: _____ FAX: _____ EMAIL: _____

K				
K=KENCO Flat Glass Gauge	Gauge Type	Gauge Style	Gauge Sections	Glass Size
	M=Medium Pressure H=High Pressure	R=Reflex T=Transparent	1 6 2 7 3 8 4 9 5	1 6 2 7 3 8 4 9 5

Material of Construction	Connection Location	Process Connection Size	Process Connection Type
C=Carbon Steel W=Stainless Steel (Wetted) A=Stainless Steel X= Special (Please Specify Above)	E=End R=Side (Right) L=Side (Left) B=Back	50=1/2" 75=3/4" 1=1" 15=1-1/2" 2=2" 3=3" 4=4" 6=6" 8=8"	N=FNPT S=Socket Weld (Female) A=150# ANSI Flange B=300# ANSI Flange C=600# ANSI Flange D=900# ANSI Flange E=1500# ANSI Flange F=2500# ANSI Flange

GAUGE CONSTRUCTION MATERIALS

Flat Glass Level Gauge

Part	Carbon Steel (NACE) Construction Code "C"	SS Wetted Construction Code "W"	SS Construction Construction Code "A"	Optional Materials Construction Code "S"
Cover	Carbon Steel	Carbon Steel	316 SS	304/304L Duplex SS® Alloy 20® Monel® Hastelloy-C® Hastelloy-B®
Chamber	Carbon Steel	316/316L SS	316/316L SS	304/304L Duplex SS® Alloy 20® Monel® Hastelloy-C® Hastelloy-B®
Glass	Borosilicate	Borosilicate	Borosilicate	Aluminosilicate (Transparent Only)
Gasket	Non-Asbestos	Non-Asbestos	Non-Asbestos	PCTFE (Kel-F) Teflon® (25% glass filled, virgin) Grafoil w/ 316 SS insert
Cushion	Non-Asbestos	Non-Asbestos	Non-Asbestos	PCTFE (Kel-F) Teflon® (25% glass filled, virgin) Grafoil w/ 316 SS insert
U-Bolt / Stud	Alloy Steel	Alloy Steel	316 SS	Galvanized Steel
Nut	Alloy Steel	Alloy Steel	316 SS	Galvanized Steel

GAUGE ILLUMINATORS

To improve the visibility of fluid contained in a KENCO Transparent Level Gauge, a specially sized illuminator can be used. The illumination is provided by extra bright Green LED's (Light Emitting Diodes). This light is brighter than ordinary incandescent light bulbs, consume less power, and can last 200 times longer, with an estimated life of 100,000 hours. The Illuminator mounts directly onto the transparent gauge without the need for loosening the bolts on the gauge. The power supply is contained inside a NEMA 4X enclosure. The unit is 115Vac/230Vac powered and draws less than 150mA of current.

The Model KLI Illuminator is UL Listed and CSA Certified for Class I, Division 1, Group B, C & D defined hazardous areas.

Model Configuration

KLI - □ - □ - □

Size (See Table Below) _____

Power Supply _____

Options _____

Input Power

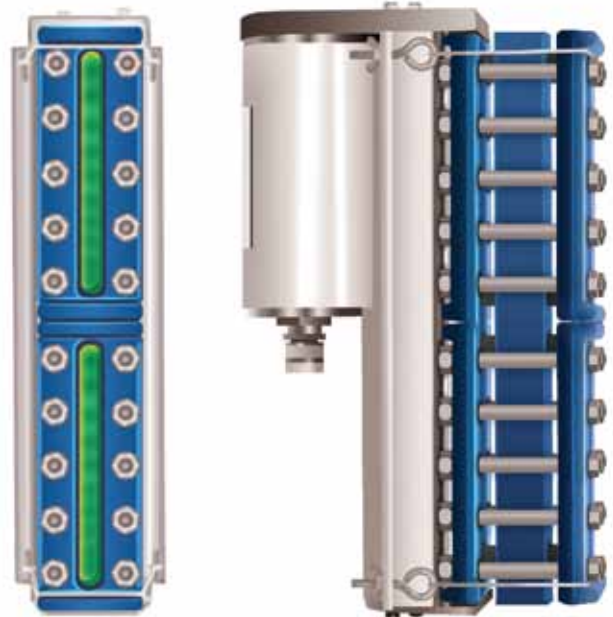
Description	Code
115Vac	115AC
230Vac	230AC

Options

Description	Code
None	0
Remote P.S.	1

Provide Cable length for Option #1

MODEL	Overall Length "A"	
	Inches	mm
KLI-15	10.8	274
KLI-16	12.1	306
KLI-17	13.2	335
KLI-18	14.8	376
KLI-19	15.6	395
KLI-23	15.9	405
KLI-24	17.9	455
KLI-25	20.2	513
KLI-26	22.7	576
KLI-27	24.9	633
KLI-28	28.2	716
KLI-29	29.7	754
KLI-36	33.3	846
KLI-37	36.7	932
KLI-38	41.6	1055
KLI-39	43.8	1113
KLI-47	48.4	1230
KLI-48	54.9	1395
KLI-49	57.9	1471



Technical Specifications

Power Supply..... 115/230Vac @ 50/60 HZ	Ambient Temperature..... -40°F (-40°C) to 150°F (65°C)
Power Consumption..... <150 mA @ 115Vac	LED Estimated Life..... 100,000 hours
Supply Connection..... 3/4 NPT	Certification..... UL1203, UL913, CSA 22.2 CL I, DIV 1, Groups B, C, & D NEMA 4X & 8

OTHER GAUGE ACCESSORIES

FROST PROOF EXTENSION

The KENCO Frost-proof Extension is used in low temperature applications where frost has a tendency to build up on the gauge. This extension prevents frost from covering the window, maintaining visibility at all times.

The Frost-proof Extension consists of a clear, plastic block that is in direct contact with the glass, and extends beyond the cover so that frost build-up does not block the glass.

Mounting is easy, and can be added to any Reflex or Transparent gauge in the field. The extension can be installed or removed for cleaning while the gauge is in service.

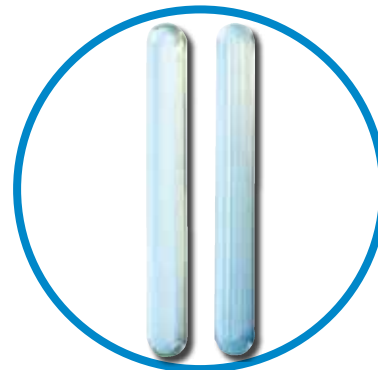


FROST-PROOF EXTENSION

GAUGE GLASS OPTIONS

KENCO supplies tempered borosilicate glass as standard in all Flat Glass Gauges. Borosilicate glass is suitable for most chemicals, and is good for temperatures ranging from -425°F to 600°F. The tempering process improves the thermal shock resistance of the glass.

Aluminosilicate glass is offered as an option in Transparent gauges for higher temperature applications. It offers less thermal expansion, as compared to borosilicate glass. Aluminosilicate glass is good for temperatures ranging from -425°F to 750°F. However, due to the added cost, it is only recommended for temperatures between 600°F to 750°F.



BOROSILICATE GLASS

GLASS SHIELDS

For corrosive or steam applications, KENCO offers shields to extend the life of the glass in Transparent gauges. The shields are made from either PCTFE (Kel-F) or Mica. Mica shields are recommended for steam service. Kel-F shields should be used in corrosive fluid applications. The shield is placed on the process side of the glass. This would interfere with the optical effect of Reflex glass. Shields can only be used with Transparent gauges.



MICA GLASS SHIELDS

THERMAL INSULATORS AND GAUGE SCALES

KENCO offers a wide variety of methods to heat or cool gauges in order to maintain the temperature of the process in the gauge. Internal & external heating/cooling tubes, and insulation blankets are available. Gauge scales can be supplied to provide a numerical reference to the level being measured. Contact KENCO for more information.

FLAT GLASS GAUGE VALVES (GAUGE COCKS)

KENCO Gauge Cocks are designed for use with KENCO Flat Glass Gauges, or gauges from any other manufacturer. All valves are "Offset Pattern" design. This provides for gauge connections that are offset 0.875" from the centerline of the vessel connections. This allows the gauge to be cleaned by removing vent/drain plugs from the valve. All materials meet or exceed ASTM specifications.

PRESSURE/TEMPERATURE RATINGS:

- Model KMVx Valves are rated to 2500psig @ 100°F; 1400psig @ 750°F.
- Model KHVx Valves are rated to 4000psig @ 100°F; 1500psig @ 750°F; KHVx valves also carry a steam rating of 600 WSP.

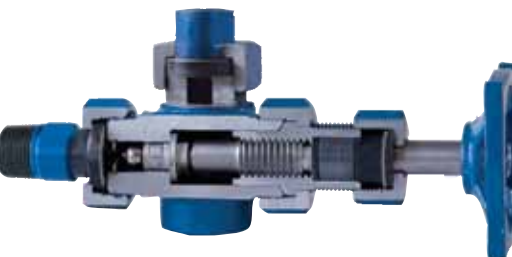
Series KMV Valve Standard Features:

- Safety Shut-off Ballchecks (Horizontal)
- Integral Bonnet
- Gauge Connection
 - Model KMVR – Rigid
 - Model KMVU – Union
- Union Vessel Connection
- Integral Seat



Series KHV Valve Standard Features:

- Safety Shut-off Ballchecks (Horizontal)
- Union Bonnet
- Gauge Connection
 - Model KHVR – Rigid
 - Model KHVU – Union
- Union Vessel Connection
- Threaded Renewable Seat



VALVE CONNECTION OPTIONS

Feature	KMVR		KMVU		KHVR		KHVU	
	Std	Opt	Std	Opt	Std	Opt	Std	Opt
Bonnet								
Integral	X	N/A	X	N/A	N/A		N/A	
Union	N/A		N/A		X	N/A	X	N/A
Gage Connection								
Union (1/2" FNPT)	N/A		X		N/A		X	
Union (1/2" MNPT)				X				X
Union (3/4" FNPT)				X				X
Union (3/4" MNPT)				X				X
Rigid (1/2" FNPT)	X		N/A		X		N/A	
Rigid (3/4" FNPT)		X				X		
Socketweld (1/2" Female)		X		X		X		X
Socketweld (1/2" Male)		X		X		X		X
Socketweld (3/4" Female)		X		X		X		X
Socketweld (3/4" Male)		X		X		X		X
Flanged		X		X		X		X
Vessel Connection								
Union (1/2" FNPT)		X		X		X		X
Union (1/2" MNPT)		X		X	N/A	X		X
Union (3/4" FNPT)		X		X		X		X
Union (3/4" MNPT)	X		X		X		X	
Socketweld (1/2" Male)		X		X		X		X
Socketweld (3/4" Male)		X		X		X		X
Socketweld (1" Male)		X		X		X		X
Flanged		X		X		X		X
Vent/Drain Connection								
1/2" FNPT	X		X		X		X	
3/4" FNPT		X		X		X		X
Ball Check								
Horizontal (Both Valves)	X	N/A	X	N/A	X	N/A	X	N/A
Seat								
Integral	X	N/A	X	N/A	N/A		N/A	
Renewable	N/A		N/A		X		X	
Handwheel								
Standard Threads	X	N/A	X	N/A	X		X	
Quick Closing Threads	X		X			X		X

ROUGHING DIMENSIONS

To determine the maximum end connected gauge length for a given center-to-center dimension:

$$\text{Max. Gauge Length} = \left(\begin{array}{c} \text{Center to Center} \\ \text{Dimension} \end{array} \right) - (\text{Dimension A} + \text{Connection Nipples})$$

This calculation is valid for End Connected Gauges with 1/2" NPT connections.

For side connected gauges, refer to the section on "Gauge Length". Then add 1.75" if the gauge offset is outside the vessel center-to-center dimensions, or subtract 1.75" if the gauge offset is inside the vessel center-to-center dimensions.

VALVE MODEL #	A' DIMENSION	CONNECTION NIPPLES
KMVR	3.500	1.500
KMVU	5.875	1.500
KHVR	3.500	1.500
KHVU	5.875	1.500

ORDERING SYSTEM

Flat Glass Level Gauge Valves

REQUESTED BY: _____ COMPANY: _____

ADDRESS: _____ CITY: _____ STATE: _____ ZIP: _____

PHONE: _____ FAX: _____ EMAIL: _____

K

K=KENCO Flat Glass Gauge Valves

Valve Type

MV=Medium Pressure
HV=High Pressure

Gauge Connection Style

R=Rigid
U=Union

Material of Construction

C=Carbon Steel
W=Stainless Steel (Wetted)
A=Stainless Steel
X=Special (Please Specify Above)

Gauge Connection Size

50=1/2"
75=3/4"

Gauge Connection Type

N=FNPT
M=Union (MNPT)
W=Union (FNPT)
T=Socket Weld (Male)
A=150# ANSI Flange
B=300# ANSI Flange
C=600# ANSI Flange
D=900# ANSI Flange
E=1500# ANSI Flange
F=2500# ANSI Flange

Vessel Connection Size

50=1/2"
75=3/4"
1=1"
15=1-1/2"
2=2"
3=3"
4=4"
6=6"
8=8"

Process Connection Size

M=Union (MNPT)
W=Union (FNPT)
T=Socket Weld (Male)
A=150# ANSI Flange
B=300# ANSI Flange
C=600# ANSI Flange
D=900# ANSI Flange
E=1500# ANSI Flange
F=2500# ANSI Flange

