installation, operation and maintenance of Color-Port® water level gages

The Yarway Color-Port® water gage assembly is used to determine water level in pressure containing vessels. It consists of the following major components:

1. Gage assembly—The basic Color-Port® gage assembly (Fig. 1) consists of a trapezoidal stainless steel body with non-parallel front and back faces to which are attached individual covers holding the port assemblies.

2. Tie-bar—Includes upper and lower Welbloc gage valves which provide isolation of the gage for servicing, and a connection for draining of the gage (Fig. 1).

3. Illuminator—A device which provides an electric lamp source and color discernible viewing. Red and green light (via the illuminator) enter the gage. Because of the difference in index of refraction of water and steam, only the color corresponding to the contents of the gage can pass through and be seen. Green will indicate water and red will indicate steam.

PRINCIPLE OF OPERATION

1. Operation—Water level gages use the principle of a liquid seeking a common level between two connected vessels. The top of the gage glass is connected to the steam space of the vessel. The bottom of the gage is connected below the normal water level of the drum. This arrangement will allow the liquid in the gage glass seek a level indicative of the level in the vessel.

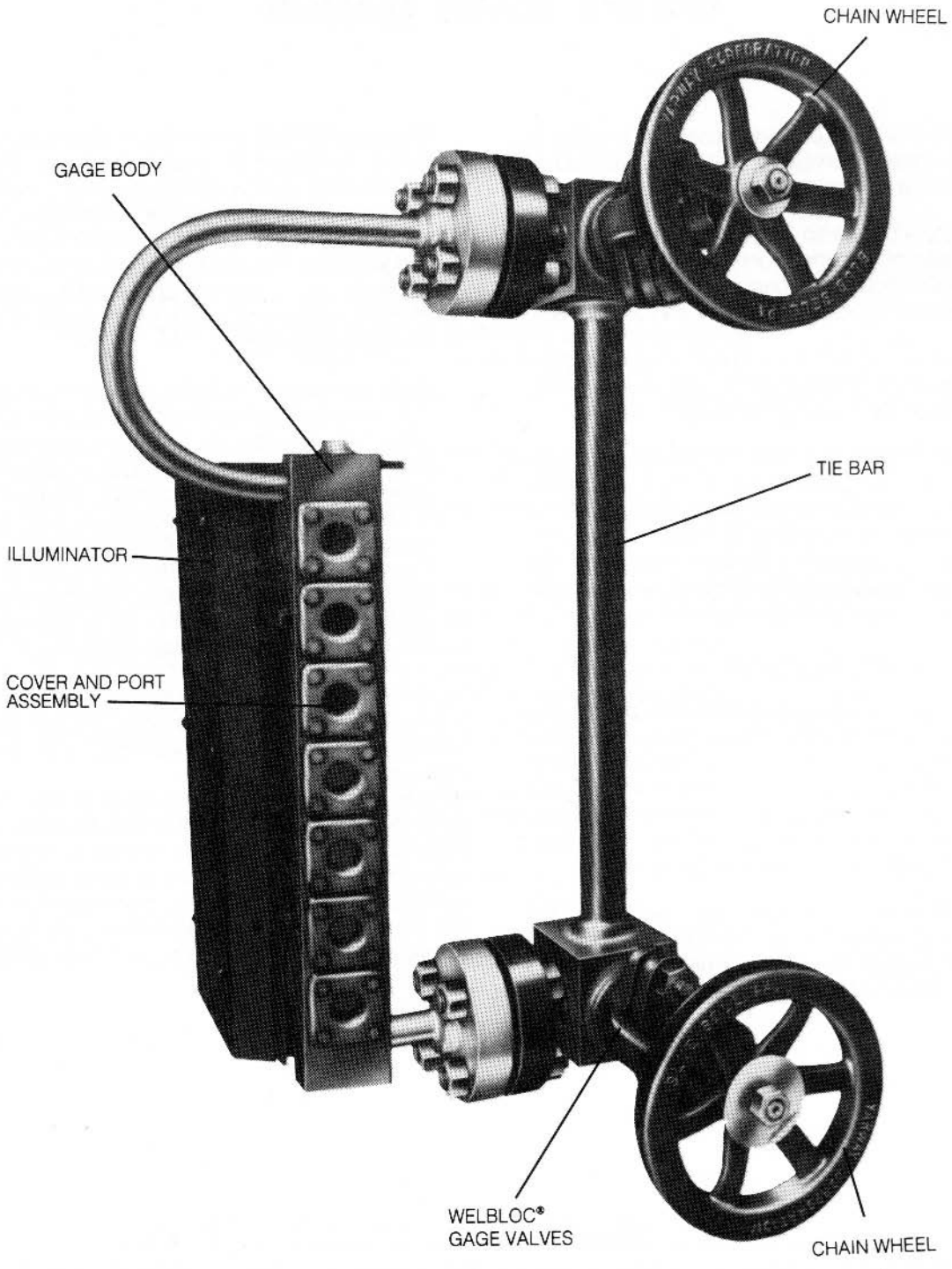
2. Accuracy—The water in the gage glass is cooler than the water in the vessel and is therefore more dense. This results in a gage water level which is lower than the true water level in the vessel. The operator must be cautioned to look for other conditions which may also lead to variations in gage glass levels. Plugged connection lines will cause abnormal level readings which can be corrected by proper washdown. Steam leaks will reduce the pressure in the steam space of the gage and will cause the water level in the gage to rise. Steam leaks should be properly corrected to prevent damage to the gage gasket seating surface as well as to prevent false readings.

3. Glass and mica—At boiler pressures above 300 psig, high temperature water will corrode unprotected gage glass. Yarway protects the gage glass from corrosive attack by installing a thin sheet of ruby mica on the inner face of each port; however, this protection is not permanent. Continual exposure to high temperature, high pressure water will also corrode the mica shield. The rate at which this corrosion occurs is significantly less than that of glass, and is dependent upon a number of factors. Generally, the higher the operating temperature, the higher the rate of attack.

Yarway recommends each customer establish a preventative maintenance schedule which insures the mica-gasket-glass assembly is replaced previous to the dissolution of the mica shield.

In-service gages that have glass which appears white or is opaque, should be isolated immediately and the mica-gasket-glass assembly should be replaced before returning to service. Should any question develop on the condition of the gage glass, the procedure given under the section on preparation for washdown, auxiliary service or gage inspection should be used to evaluate port glass condition.

WARNING: Failure to promptly replace the mica-gasket-glass assembly that appears white or opaque can result in catastrophic failure of the glass with violent discharge of hazardous high velocity steam. The discharge of high velocity steam can result in personal injury and property damage may occur.


CHAIN WHEEL
GAGE BODY
TIE BAR
ILLUMINATOR
COVER AND PORT
ASSEMBLY
WELBLOC®
GAGE VALVES
CHAIN WHEEL

INSTALLATION OF GAGE SYSTEM

CAUTION: Gage should not be subjected to acid wash cleaning. Gage must be isolated from this process or replaced with a boil out gage during startup or cleaning.

1. If the gage is furnished with an alarm water column, water column, circulating tie-bar and/or gage isolation valves, they should be installed on the proper connections prescribed for the vessel. Any unused connections on the circulating tie-bar and on some models of Welbloc valves furnished with multi-connections should be sealed using the plugs furnished.

2. Gages furnished with Welbloc isolating valves (see Fig. 4) are installed as follows:

   a. Insert gaskets into groove of large groove face flanges and mount gage (large tongue face flange) with studs and nuts provided.

   b. Mount the chain wheels (9) on valve stems using nuts (16) and washers (19) furnished. The lower chain wheel should be mounted with the hub to the outside, so that the upper chain hangs to the outside and clear of the lower chain wheel.

3. Gages furnished with stuffing box (S/B) isolating valves (see Fig. 5) are installed as follows:

   a. Remove upper & lower nipple stuffing box packing glands (11A) from the valves.

   b. Install packing gland (11A) and bottom ring (7) on top gage nipple. Install packing gland (11A) on lower gage nipple.

   c. Install the packing on the upper and lower gage nipples in the sequence specified in the packing instructions supplied with the packing.

   d. Insert the gage into the upper S/B valve first, and then the lower S/B valve.

   e. Rotate the gage to the desired viewing angle, install and tighten the upper and lower packing glands to the valves.

   f. Mount the chain wheels (9) on valve stems using nuts (16) and washers (19) furnished. The lower chain wheel should be mounted with the hub to the outside, so the upper chain hangs to the outside and clear of the lower chain wheel.

OPERATING INSTRUCTIONS

Placing Gage in Service

1. Start up Procedure.

   a. Open the gage drain valve fully.

   b. Open upper and lower isolation valves if provided.

   c. Crack the upper gage valve.

   d. Crack the lower gage valve.

   e. Allow the gage to heat without pressure buildup for 10 minutes.

   f. Gradually close the drain valve and allow the pressure to build up slowly in the gage for about 15 to 20 minutes.

   g. Close the gage drain valve tightly.

   h. Fully open the upper and lower gage valves.

   i. Gage is now in service.

PREPARATION FOR WASHDOWN, SERVICING GAGE AUXILIARIES OR GAGE INSPECTION

Before performing any service or inspection on gages under pressure the procedure given below is recommended to evaluate port condition. This includes gage washdown procedures, inspection and adjustment of Auxiliaries (Illuminator, Fiber-Port, etc.).

The following procedure is recommended to prevent exposure of personnel to pressurized gages with ports that require replacement.

1. Close upper and lower isolation valves.

2. Close upper and lower Welbloc/stuffing box gage valves.

3. Crack open drain valve(s) to slowly depressurize gage. When gage is depressurized, open drain valve(s) fully.

4. Remove Color-Port viewing device (Hood, Direct View Hood, Fiber-Port, etc.) and Illuminator.

5. Visually check mica-gasket-glass assembly for a white or opaque appearance. Check each port from both sides of the gage. Use a flashlight for illumination. A white or opaque appearance is an indication that the protective mica shield has been penetrated. The mica-gasket-glass assemblies must be replaced before placing the gage back in operation. Continued operation of gages with white or opaque appearance can result in harm to personnel from catastrophic failure of glass and violent discharge of hazardous high velocity steam.

WASHDOWN PROCEDURE

The level gage connecting pipes, valves and internal passageways must be kept free from obstructions caused by sediment and rust deposits in order for the gage to provide the proper level indication. Additionally, sediment buildup on the mica can mask the true water level. To minimize the influence of sediment buildup, gage washdown is recommended. Yarway recommends the following washdown procedures:

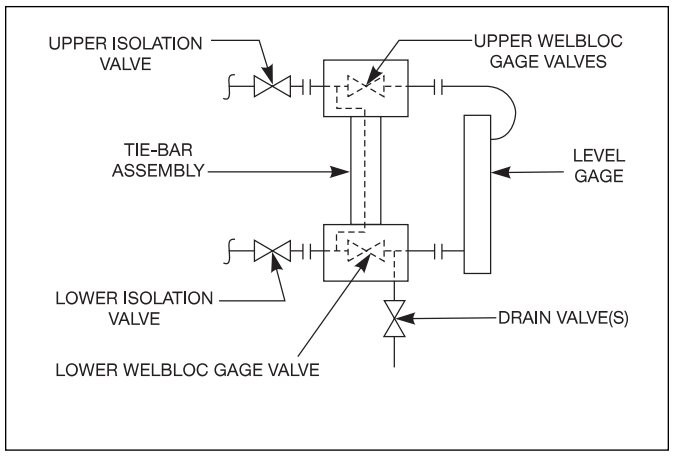


Fig. 2A: Gages with Tie-Bar, Welbloc Gage Valves and Isolation Valves.

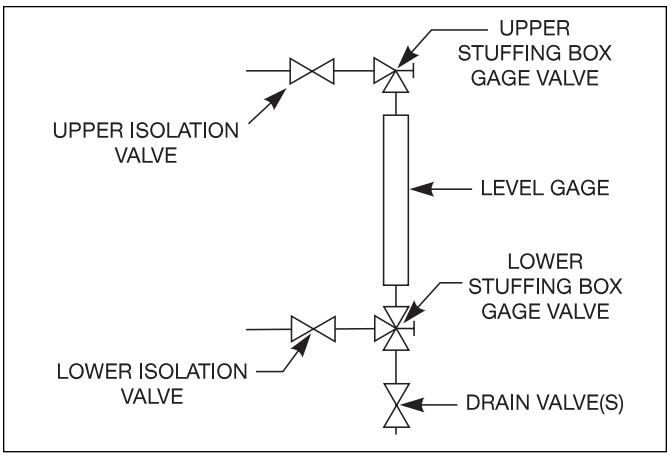


Fig. 2B: Gages with Stuffing Box (S/B) Gage Valves and Isolation Valves.

GAGES WITH TIE-BAR, WELBLOC GAGE VALVES AND ISOLATION VALVES (Fig. 2A)

1. Open the upper and lower isolation valves.
2. Close upper and lower gage valves.
3. Slowly open drain valve(s)–water in gage will drain.
4. Close drain valve and slowly open lower gage valve. Water level in gage will rise to the top. Open lower gage valve completely.
5. Slowly open drain valve(s). Water level in gage will lower as flow rate through lower gage valve connecting pipe increases. This will clear sediment from lower gage valve and connecting lines.
6. Close the drain valve. Water level in gage will again rise to the top of the gage.
7. Close the upper isolation valve and open upper gage valve completely. Close lower gage valve; then, slowly open the drain valve. This will clear the tie-bar and the gage with boiler feedwater. Slowly close the drain valve.
8. Open the upper isolation valve completely. Re-open the drain valve slowly until a substantial flow rate is established through the gage. This will purge the upper gage connecting lines and the gage with a mixture of steam and feedwater. Slowly close drain valve.
9. Open the upper and lower gage valves and upper and lower isolation valves. Check the gage for cleanliness. Repeat procedure if necessary.

Completion of steps 6, 7, and 8, in order, give progressively increased cleaning action. The procedure may be stopped after step 6 or 7 by skipping to step 9 once the gage is clean.

GAGES WITH STUFFING BOX (S/B) GAGE VALVES AND ISOLATION VALVES (Fig. 2B)

1. Open upper and lower isolation valves if provided.
2. Close upper gage valve.
3. Open lower gage valve.
4. Slowly open drain valve(s). Water level in gage will lower as flow rate through lower gage valve and connecting pipes increases. This will clear sediment from lower gage valve and connecting lines.
5. Close the drain valve. Water level in gage will again rise to top of gage.
6. Close the lower gage valve and open the upper gage valve completely. Re-open drain valve slowly until a substantial flow rate is established through the gage.
7. Close the drain valve completely.
8. Open the lower gage valve. Check the gage for clearness. Repeat procedure if necessary.

Objects which cannot be cleared by the above procedure will require removal of the gage from the boiler connections.

HOW TO SERVICE COLOR-PORT® WATER GAGE Fig. 4651N or F, 4587F, 4591F & 4595F

Servicing the Ports

Yarway recommends servicing the gage disconnected from the boiler piping and resting in a horizontal position on a workbench. Gages serviced in this manner, where particular attention is given to body groove and port cleanliness, as well as sealing gasket positioning, have performed better than those gages serviced while connected to the boiler piping.

If a gage must be serviced while still installed on the boiler, particular attention must be given to: 1) the cleanliness and integrity of the body grooves, 2) the cleanliness and position of the replacement port assemblies, 3) the proper positioning of the sealing gaskets in the body grooves during tightening of the cover cap screws.

1. Isolate the gage and remove pressure before starting to disassemble the gage. Follow the procedure in section "Preparation for washdown, servicing gage auxiliaries or gage inspection".

2. Turn off the electrical power to the illuminator. Carefully remove and set aside the illuminator and viewing assembly. Remove the gage assembly from the boiler connection lines.

3. Loosen and remove the cap screws (10). Use a 3/8" size socket wrench.

4. Remove the viewing port assembly completely. Figures 3B & 3C show a cross section. Retain the cover (2), spring cones (4), washer (5), and retaining spring (8). Discard the used cushion gasket (6) and the used glass-mica-gasket-clip ring assembly (7, 11, 9 and 3).

CLEANING AND INSPECTION OF PARTS

The semi-circular sealing surfaces in the gage body must be restored to as-new condition. Care must be used to retain or restore the controlled dimensions of the parts to maintain the correct sealing forces as created by the spring cones.

1. Clean and dry the gasket sealing surface of the gage body. Use a solid-type stainless steel wire-end brush, Yarway P/N 301160, attached to an electrical drill. No damage is permitted to the sealing surface. Inspect carefully for marks or residual material, above or below the surface, that could cause leakage.

2. Carefully clean and dry the contact surfaces of the cover (2) inside and where it contacts the gage body. Clean the surface of the gage body contacted by the cover, and clean the surface of the washer (5) to remove all traces of the cushion gasket (6).

3. Inspect the condition of the cover (2) for distortion due to previous over-tightening of bolts or indentation from spring cone contact. Place the cover over its contact surface on the body. The cover and body must make firm, flat contact. Manually check for rocking of the cover on the body surface. Replace cover if damaged.

4. Inspect the condition of the gage body for evidence of previous over-tightening of bolts. Check the gasket seal surface for cleanliness and polished finish. Contact Yarway if damage is found on the gage body.

5. Inspect the spring cones. Replace them if they are damaged or corroded or if the spring cone stack height is below .285 inch (7.25mm). See Fig. 3A.

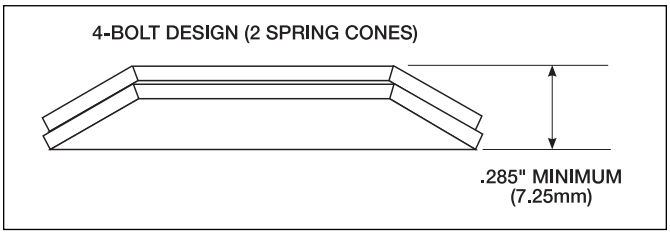


Fig. 3A

6. Inspect the replacement parts. A repair port kit, Yarway P/N 923321, is furnished as a package consisting of a glass (3), mica (9), sealing gasket (11), held together in a clip ring (7), plus a cushion gasket (6).

7. The replacement parts are clean and dry as supplied. Handle the kit by holding it on the outer diameter; avoid touching the face of the mica or permitting moisture, dirt, chips, or other foreign matter to adhere to the parts. Cleanliness and dryness of the parts are most important.

REASSEMBLING THE PORT

CAUTION: Grease, dirt, finger prints and moisture will affect port life and visibility.

1. Lightly lubricate the cap screw (10) threads with high temperature anti-seize compound.

2. Place spring cone(s) (4) *properly oriented* into the cover (2). See Figs. 3B and 3C. Note that the conical shape touches the cover on the large diameter and makes contact with the flat washer (5) on the smaller inside diameter.

3. Place the flat washer (5) on top of, and in contact with the spring cone(s) (4).

4. Place the cushion gasket (6) in contact with the flat washer (5).

5. Install the retaining spring (8) into the cover. See Fig. 1.

6. Taking the repair kit as an assembly (glass, mica, sealing gasket, clip ring) insert it directly into the retaining spring and into contact with the cushion gasket (6). See Figs. 3B and 3C.

7. Inspect for assurance of proper assembly and clean parts. The sealing gasket (11) should be firmly *centered* in the clip ring (7). CAUTION: Handle the glass, mica, gasket and clip ring assembly by the edges only. When installing, do not touch or apply pressure directly on the gasket or mica.

8. *Keep moisture from entering between the mica and the glass to prevent premature failure.*

PARTS/MATERIALS

Use only genuine Yarway replacement parts for Yarway products. The use of substitutes will result in risk to personal safety or poor product performance.

4-BOLT DESIGN

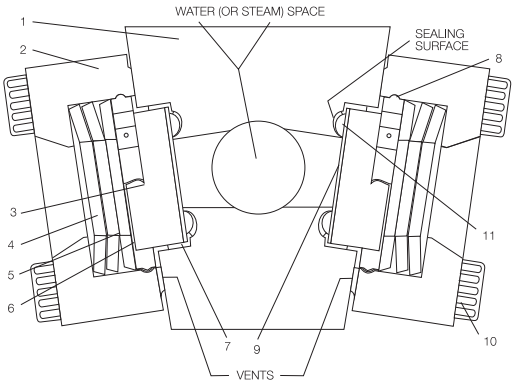
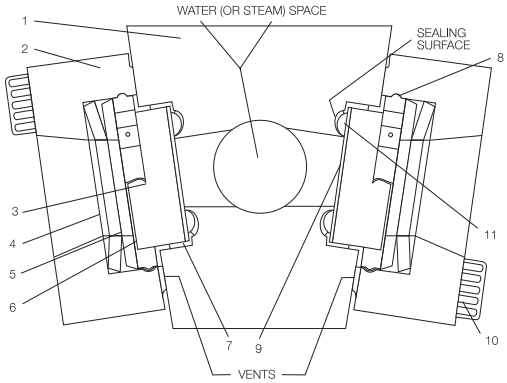


Fig. 3B

2-BOLT DESIGN



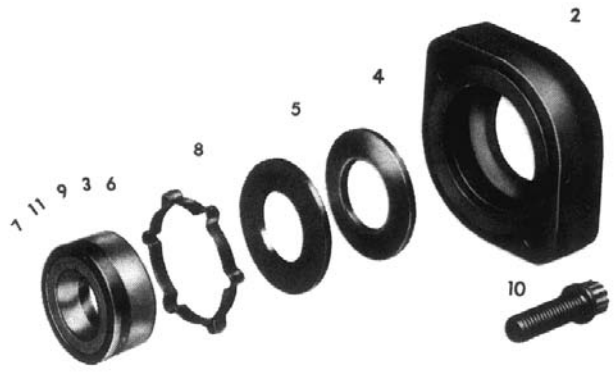


Fig. 3C

9. Reassemble the viewing port assembly, centering the sealing gasket in the body groove. Locate the vent in the horizontal direction, toward the narrow side of the gage body.

10. Tighten the cap screws (10) uniformly with 3/8" socket wrench until metal-to-metal contact is just made, then tighten to 30 to 35 ft/lb (40.7 - 47.5 N•m). Do not use a power wrench. Further tightening may damage the cap screws, body or cover.

GAGE VALVE SERVICE

A special set of tools has been designed to efficiently recut worn or damaged seats in Welbloc and Stuffing Box Gage Valves (Figs. 4 & 5). Yarway Instruction Manual 959593 includes instructions for removal and installation of the yoke bushing which must be followed.

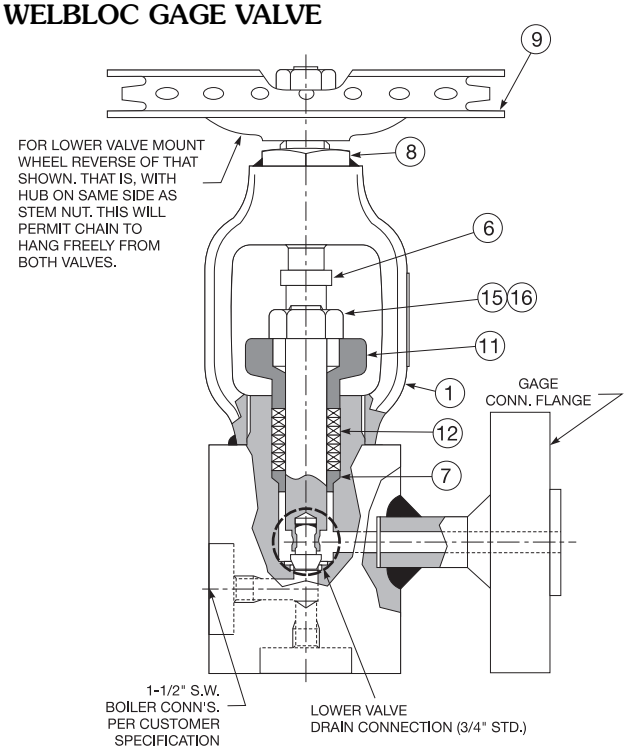
HEATING UP AND RESTORING TO SERVICE

Follow the instructions in “Operating Instructions, Placing Gage In Service”.

Item No.	Part Name
1	Gage Body
2	Cover
3	Glass*
4	Spring Cone(s)
5	Washer
6	Cushion Gasket*
7	Clip Ring*
8	Retaining Spring
9	Mica*
10	Cap Screws
11	Sealing Gasket*

*Furnished in kit - P/N 923321
Groove clean up tool – (stainless wire brush) PN-301160

WELBLOC GAGE VALVE



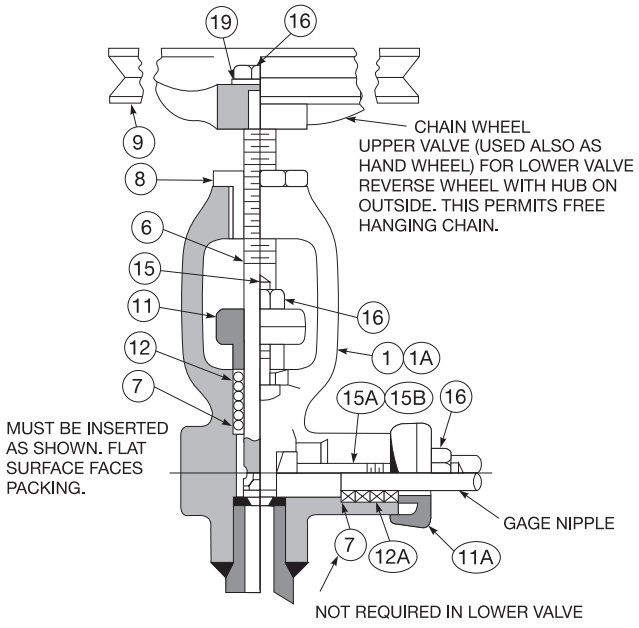
UPPER LEFT HAND VALVE SHOWN. FOR RIGHT HAND VALVE THE GAGE CONN. IS ON OPPOSITE SIDE TO THAT SHOWN. LOWER VALVE IS SIMILAR BUT HAS DRAIN CONN. AT BOTTOM.

Item	Description	Remarks
1	Upper Valve Body L.H. or R.H.	Specify Fig. No., Pressure & Handing
2	Lower Valve Body L.H. or R.H.	Specify Fig. No., Pressure & Handing
6	Stem & Disc Assembly	Order as complete Assembly only
7	Bushing - Stuffing Box	
8	Bushing - Yoke	
9	Chain Wheel	
11	Gland	
12	Packing for Stem	
14	Chain for Wheels	Specify Length
15	Studs	
16	Nuts	
19	Washer	
20 20A	Pulls for Chain	Right Hand Left hand
WB-1	Seat Tool	P/N 959591-01
	Cutter No. 10	P/N 018564-01

To Order—Flange Gaskets, Bolts and Nuts—Specify Valve Figure No. and Pressure Class.

FIG. 4

STUFFING BOX (S/B) GAGE VALVE



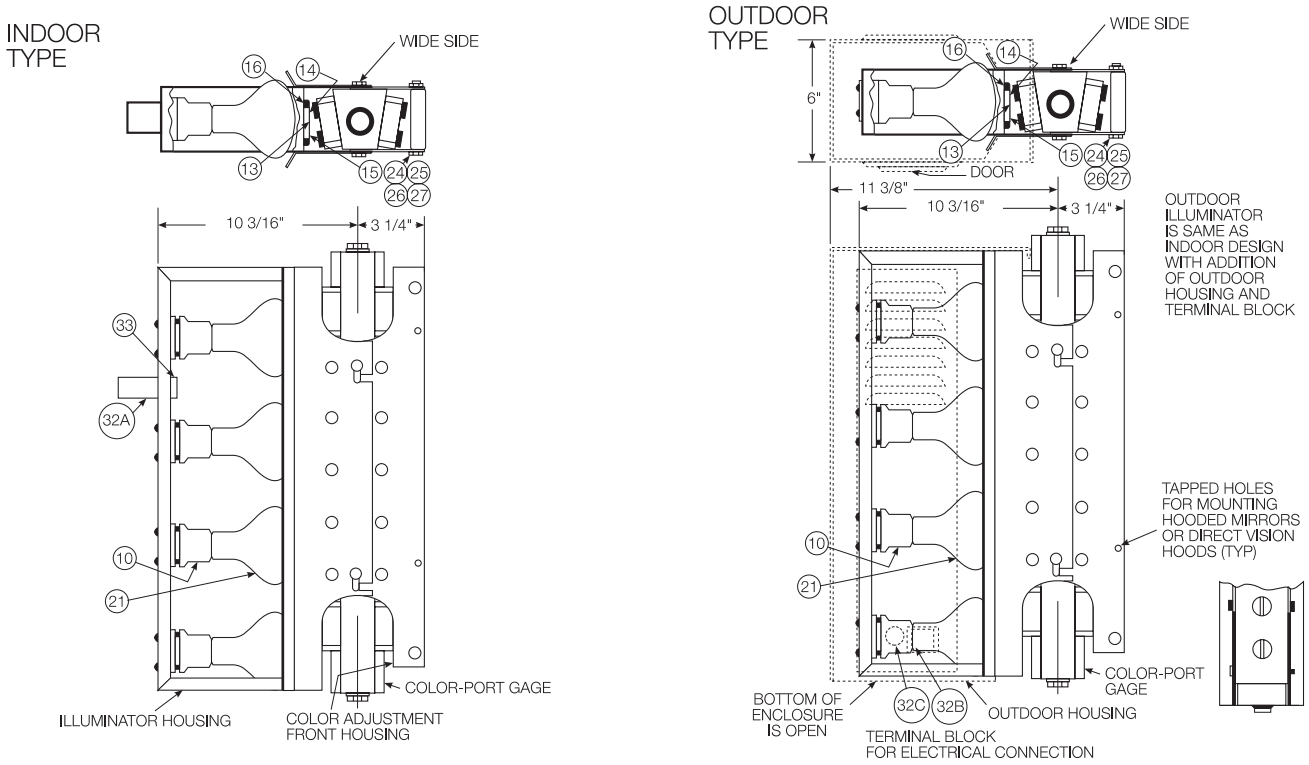
UPPER GAGE VALVE SHOWN—LOWER GAGE VALVE SIMILAR BUT HAS SOCKETWELD DRAIN CONN. (3/4" STD.)

NOTE—WHEELS (9), NIPPLE PACKING (12-A) AND BOTTOM RING (7) ARE PACKED SEPARATELY FOR ASSEMBLY IN FIELD.

Item	Description	Remarks
1	Valve - Upper Complete	
1A	Valve - Lower Complete	
6	Stem Assembly	Stem & Disc Furnished as Ass'y.
7	Ring Bottom	
8	Bushing, Yoke	
9	Chain Wheel	
11	Gland - Stem	
11A	Gland - Nipple	
12	Packing - Stem	
12A	Packing - Nipple	
14	Chain for Wheels	Specify Length
15	Bolt for Stem Gland	
15A 15B	Bolt for Nipple Gland	Lower Valve Upper Valve
16	Nut - Hex	
19	Washer	
20	Pulls for Chain	
SB-2	Seat Tool	P/N 959951-02
	Cutter No. 10	P/N 018564-01

FIG. 5

STANDARD ILLUMINATORS FOR COLOR-PORT GAGES INDOOR AND OUTDOOR TYPES



PARTS COMMON TO ALL ILLUMINATORS

Item	Description
10	LAMP HOLDER (SOCKET)
13	GLASS DIVIDER BAR
14	GREEN GLASS
15	RED GLASS
16	CLIP - GLASS
21A	LAMP - 75 WATT (120V)
21B	LAMP - 80 WATT (230V)
24	SCREW ADJUSTMENT
25	NUT - HEX
26	WASHER
27	COTTER PIN
32A	CONNECTOR - ELECTRIC (INDOOR)
32B	TERMINAL BLOCK (OUTDOOR)
32C	GROUNDING LUG
33	RECEPTACLE

VISIBILITY

12-1/2"	(5-Port)
15-1/2"	(7-Port)
18"	(7-Port)
21"	(9-Port)
29-1/2"	(11-Port)
35"	(13-Port)
38"	(14-Port)
49-1/2"	(18-Port)

FIG. 6

VISUAL SYSTEM ACCESSORIES

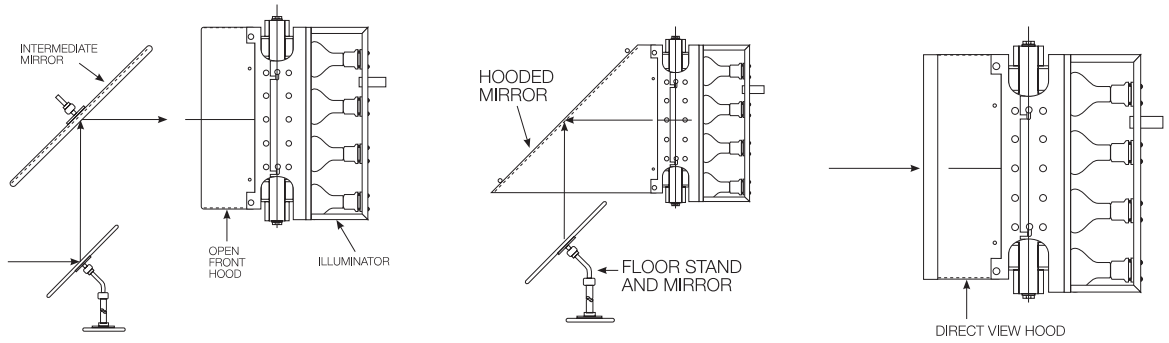
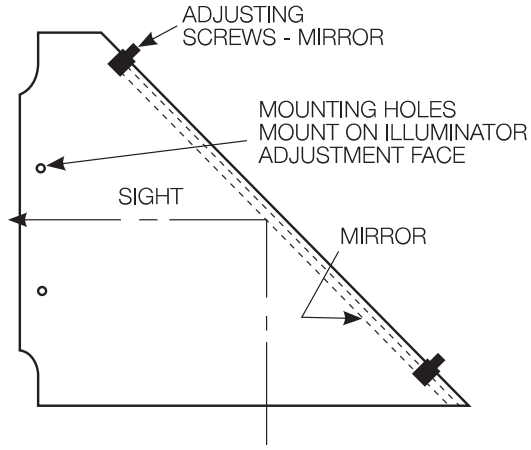


FIG. 7

HOODED MIRRORS FOR ALL COLOR-PORT WATER GAGES



IF MIRROR REPLACEMENT IS REQUIRED, PURCHASE LOCALLY. MIRROR ONLY IS NOT SUPPLIED BY YARWAY AS A PART.

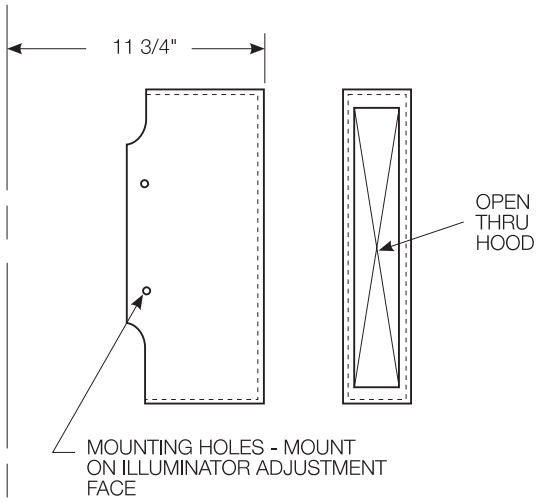
MIRROR MAY BE MOUNTED ON EITHER FACE OF GAGE

Gage Vision	No. of Ports Each Side
12-1/2"	5
15-1/2"	7
18"	7
21"	9
29-1/2"	11

HOODED MIRROR INDOOR AND OUTDOOR USE

FIG. 8

OPEN FRONT HOOD (FOR MIRROR SYSTEM) FOR ALL COLOR-PORT GAGES

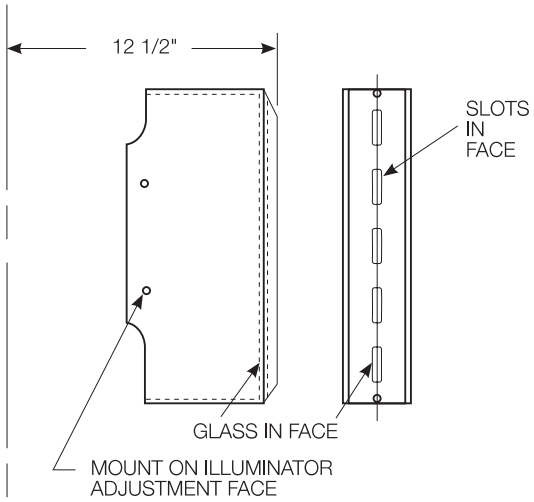


HOOD MAY BE MOUNTED ON EITHER FACE OF GAGE

Gage Vision	No. of Ports Each Side
12-1/2"	5
15-1/2"	7
18"	7
21"	9
29-1/2"	11
35"	13
38"	14
49-1/2"	18

FIG. 9

DIRECT VIEW HOOD (FOR DIRECT VIEWING) FOR ALL COLOR-PORT GAGES

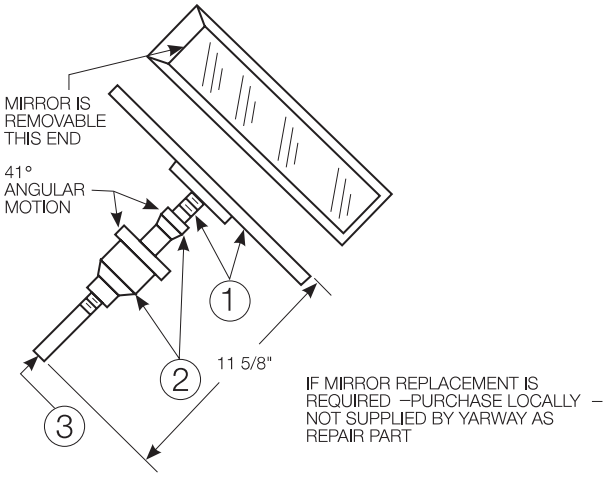


HOOD MAY BE MOUNTED ON EITHER FACE OF GAGE

Gage Vision	No. of Ports Each Side
12-1/2"	5
15-1/2"	7
18"	7
21"	9
29-1/2"	11
35"	13
38"	14
49-1/2"	18

FIG. 10

INTERMEDIATE MIRROR FOR ALL COLOR-PORT GAGES

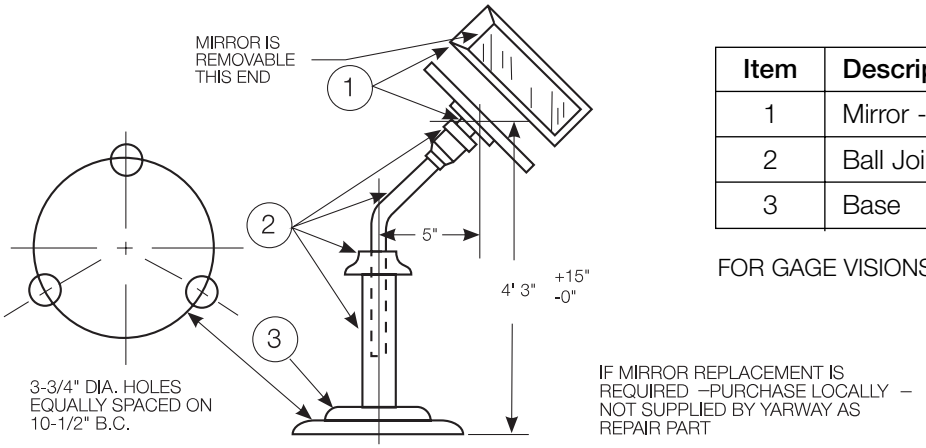


Item	Description
1	Mirror - Frames & Pipe
2	Ball Joint
3	Nipple (6" Lg. - T.O.E.)

FOR GAGE VISIONS 12-1/2" TO 29-1/2" ONLY.

FIG. 11

FLOOR STAND AND MIRROR FOR USE WITH ALL TYPE GAGES



Item	Description
1	Mirror - Frames & Pipe Sup. Comp. Only
2	Ball Joints Pipes - Cap Sup. Comp. Only
3	Base

FOR GAGE VISIONS 12-1/2" TO 29-1/2" ONLY.

FIG. 12

INSTALLATION AND ADJUSTMENT OF COLOR-PORT® GAGE ILLUMINATOR

All instructions should be read and thoroughly understood before starting any installation. Only qualified, experienced personnel who are familiar with the equipment and have read these instructions should install this equipment.

IMPORTANT: Failure to follow the instructions could result in a malfunction of the illuminator and the loss of the ability to read the liquid level in the Color-Port®Gage. any failure of the Color-Port Gage resulting in leakage can cause severe personal injury or electrical shock to personnel. Property damage may occur as a result of a failure.

DANGER: Always wear safety glasses and other required appropriate safety equipment when installing, servicing and operating the illuminator.

DESIGN RATINGS

Yarway standard illuminators are designed to mount easily on Color-Port Gages and are available for indoor and outdoor use. The standard illuminator rating is 120/230 VAC.

DANGER: Check the line voltage going to the illuminator before starting the installation. The line voltage must match the voltage of the lamps that will be installed. Exceeding the rated limits can cause serious personal injury.

INSTALLATION

Only qualified, experienced personnel who are familiar with the equipment and have read and understood these instructions should install this equipment.

DANGER: Do not install this illuminator to a Color-Port Gage until the gage has been permanently mounted and tested in accordance with the gage instructions. The gage must be at ambient temperature and relieved of all internal pressure. Failure to do so may cause personal injury.

1. Attach color adjustment front housing to the Color-Port Gage using the screws in the side of the gage.
2. Install the green and red glass strips in the illuminator housing. Be certain the green glass strip is installed on the same side as the wide side of the gage as shown in Fig. 6.

   DANGER: Wear protective safety glasses and gloves when handling the red and green glass strips. Failure to handle the glass strips properly can result in personal injury.
3. Install illuminator housing over color adjustment front housing and tighten the screws to prevent removal.
4. Install the lamps that have been shipped with the illuminator housing.

   DANGER: Wear protective safety glasses and gloves when handling the lamps. Failure to handle the lamps properly can result in personal injury. Check the lamps shipped with the illuminator. Be certain the lamp voltage matches the line voltage to the illuminator.
5. If provided, install outdoor housing over illuminator housing as shown in Fig. 6.

ELECTRICAL INSTALLATION

All electrical installations should be performed by a qualified electrician and comply with all applicable codes.

DANGER: Failure to follow the above may cause serious personal injury or electric shock to personnel.

1. Check the line voltage to ensure it matches the voltage of the installed lamps.
2. Make proper electric connections to the electrical connector (32A) provided with the indoor type illuminator following all applicable codes.
3. When installing the outdoor type illuminator, provide the electric connection between the terminal block (32B), grounding lug (32C) and the power source.
4. Energize the lamps to ensure all lamps light and there is sufficient light output over the visible length of the Color-Port Gage.

ILLUMINATOR ADJUSTMENT

The illuminator may be adjusted when the vessel is out of service and the water level at normal operating level or when the vessel has been restored to service in accordance with the gage operating instructions.

DANGER: When adjusting the illuminator with the vessel at operating conditions, personnel must wear protective safety glasses and gloves. Failure to do so may result in personal injury.

1. Turn the adjustment screws (24) to obtain the best red color in top ports and green color in the bottom ports as judged from the ultimate location of the observer.
2. If the front adjustment slots are not in a vertical position the top and bottom adjustment screws (24) may be turned equally in opposite directions to approach vertical. Do not exceed two full turns.
3. When the best image is obtained, tighten lock nuts (25) to maintain proper adjustment.

IMPORTANT: To obtain best image, cleanliness of gage glass, gage ports and lamps is essential.

VISUAL SYSTEM ACCESSORIES

Visual system accessories are available to view or transmit the Color-Port Gage image to other locations.

The accessories are either mounted directly to the color adjustment front housing or used as shown in Figs. 7 through 12.

DANGER: When handling the accessories, personnel should wear protective safety glasses and gloves. Failure to handle the accessories that include mirrors properly can cause serious personal injury.

www.tycoflowcontrol.com

963035 REV. J DCN 10045 3/97 1M 997

Printed in U.S.A.