OPERATION & MAINTENANCE INSTRUCTIONS
DIFFERENTIAL PRESSURE INDICATOR — 105 / 106

A DESCRIPTION

The models **105 & 106** are all-metal Differential Pressure Gauges capable of operating at low differential pressures that is suitable for full service applications in high pressure systems. The gauge has a multiple stack diaphragm capsule (in model 105) or a single bellows (in model 106) sensor and a torque tube motion output. The sensor carries a direct acting equalizing valve that fully protects it from over pressure in either the high to low or the low to high direction up to the full static working pressure of the system.

The compact integral design of the models 105 & 106 results in a simple, basic design that is reduced to essential and necessary elements with a high output motion and rugged construction.

DETAILS OF CONSTRUCTION

The sensor assembly is mounted between two pressure housings. One housing is the high side pressure inlet, the second is the low side pressure inlet. The motion of the sensor rotates a hermetically sealed torque tube that operates an output shaft that drives an external indicator and switch (es), when specified.

The indicating mechanism of the models 105 & 106 Differential Pressure Gauges is contained in a weatherproof dial housing, that is solidly bolted and sealed to the differential pressure sensor unit. The output shaft from the sensor bellows projects into the dial housing. The shaft is linked to a sensitive jewelled pointer movement through a lever arm on the shaft. The linkage is a light small diameter polished wire which results in low friction and a self aligning feature. The pointer movement is a standard pattern low-ratio gear movement with jewelled bearings on the pinion and segment shafts. It can be easily adjusted for calibration of span and linearity. The input shaft lever arm is also adjustable for linearity.The cover lens seals against a cushioned gasket in the dial housing.

SPECIAL FEATURE

The sensor is provided with an Over Pressure relief Valve (OPV). When the Differential pressure exceeds 130 % of the range the OPV opens up and equalises the pressure between High pressure & Low pressure. similarly when low pressure exceeds the sensor rating the OPV opens up and equalises the pressure between High pressure & Low pressure.

B SPECIFICATIONS

	Model 105	**Model 106**
Pressure Housing	Investment Casting	Investment Casting
Sensing Element	Multiple Diaphragm Capsule	Seamless Bellows
Dial Size	6" Nominal	6" Nominal
Dial Pattern (STD)	Black letters on White	Black letters on White
Dial Pattern (LLC)	White letters on Black	White letters on Black
Pointer	Narrow Tip	Narrow Tip
Zero Adjust	Dial Adjustment	Dial Adjustment
Dial Housing	Die Cast Aluminium (Std.) 304 SS (Optional)	Die Cast Aluminium (Std.) 304 SS (Optional)
Lens	Shatter Proof Glass	Shatter Proof Glass
Mounting	Panel or 2" Pipe or Wall	Panel or 2" Pipe or Wall
Proceess Ports	1/4" NPTF @ Top & Bottom with one pair plugged	1/4" NPTF @ Top & Bottom with one pair plugged
Switching (LLC) Option	Refer Catalogue	Refer Catalogue

C OPERATING LIMITATIONS

Our Warranty of the Differential Pressure Unit will not apply if the following limitations are exceeded :

TEMPERATURE

(–) 60° F. to + 200° F

PRESSURE

Units are capable of line pressures up to the MWP (printed on the dial) without damage or permanent change in calibration.

PULSATION

Rapid pressurisation can cause severe damage to the sensing element. Rapid pressure change (either increase or decrease) can be described as a change in pressure occurring fast enough to drive an instrument in less than a second. If the DPI gauge is to be subjected to pulsation, make sure the externally adjustable pulsation dampener (Snubber) is adjusted correctly to prevent damage to the instrument. All instruments are shipped with the Snubber trimm ¼ turn open. Use a screwdriver to adjust this trimm until the proper dampening effect is obtained. Approximately 1½ turns is fully open. The Snubbers are provided at both ports. Severe pulsation will affect the accuracy of the instrument

VIBRATION AND SHOCK

Do not subject instrument to severe mechanical vibration or hydraulic shock, unless the unit has been specially ordered for such severe operating conditions.

D INCOMING INSPECTION

UNPACKING

Check for shipping damage to cartons and contents. Check contents against shipping order, contents should include

(1) Material itemised on order and

(2) Installation instruction.

IMPORTANT : When called for on order, the gauge is pre-cleaned for special application and sealed in a clear plastic bag. Check for special installation instructions before breaking the seal on the sealed bag.

E LOCATION

- Locate the gauge such that it is easily accessible from ground level.
- Select a reasonably vibration-free location where ambient temperature does not exceed operating temperature limits.
- Do not locate the instrument near vents or bleed holes discharging corrosive vapors or gases.
- In Liquid Measurement locate the gauge below the primary element to permit entrapped air or gas to be vented into the flow line.
- For Steam and Gas Measurement place the gauge above the flow line to facilitate condensate draining.
- The distance between the primary device and the gauge shall be as short as possible. For distances up to 50 feet use 1/4" or 3/8" pipe or tubing. For runs 50 to 100 feet use 1/2" pipe or tubing. Distances exceeding 100 feet are not recommended. The recommended distance limitation does not apply if an air-purge system is used.

G MOUNTING

The Instrument is adapted for mounting as :

(a) Panel Mounting

(b) Pipe Mounting for 2" Pipe on stanchion or Wall.

The instrument is supplied with a mounting bracket suitable for both wall & 2" Pipe mounting.

The instrument must be approximately level for proper operation.

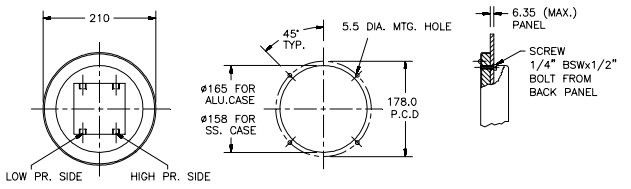
Since Switching Type Instruments work on very sensitive optical sensing it is recommended that the instrument is mounted such that direct sunlight or direct light source do not impinge on the front of dial. Preferable to provide a canopy.

FLUSH OR PANEL MOUNTING

Remove the gauge cover and provide a hole in the panel as per the mounting dimensions. Mount the gauge with the foue M5 mounting studs & nuts. Orient the axes of the dial for readability and appearance and wrench tighten the retaining nuts. Replace the gauge cover. Torque screws evenly to avoid overstressing lens window on the gauge.

WALL MOUNTING

Drill four mounting holes on wall to match the 71.5 mm pitched mounting holes of the bracket. Secure instrument with bolts and nuts.



BACK VIEW PANEL CUTOUT MOUNTING DETAIL

FLUSH PANEL MOUNTING

PIPE MOUNTING

Mount the instrument onto a 2" Pipe using the pair of " U " bolts & nuts and secure the instrument & orient the gauge as required and tighten the bolts firmly. Ensure rigidity.

CAUTION : **Do not orient by turning or grasping the indicator case.**

H CERTAIN PRACTICES SHOULD BE FOLLOWED ON ALL FLOW AND LIQUID LEVEL D.P GAUGE PIPING

- ❖ Make up all joints using a suitable pipe joint compound to reduce measurement errors caused by leaks in the pipe joints.
- ❖ Slope all piping at least 1 inch per linear foot to avoid liquid or gas entrapment.
- ❖ If process media exceeding 200° F (93°C) is to be measured, provide 2 feet of un-insulated piping between the primary device and the D.P Gauge for each 100° F (37.8°C) in excess of 200° F.
- ❖ Install a valve manifold connecting the D.P Gauge and the differential pressure source to facilitate operation and checking of the D.P Gauge. Locate shutoff and bypass valves to be readily accessible to the operator from the front of the instrument.. The shutoff valve should be the first valve from the process line or vessel.
- ❖ D.P Gauge have two pairs of 1/4" NPT pressure connections.

I INSTRUMENT START UP

IMPORTANT : *Prior to placing the instrument in service, perform the following operations*

- ❑ Since the bellows may have taken a slight "set" due to possible extended periods of storage prior to installation, it is advised that the first time the D.P Gauge is used and prior to actual operation, the unit be exercised to ensure correct indications. To exercise the unit, sequentially apply maximum and minimum differential pressure to the high pressure side for at least ten cycles.
- ❑ Open up the Front Bezel and the Dial Lens and **remove the sponge** placed beneath the pointer. Pressurisation without removal will lead to Pointer shift from its original position.
- ❑ Although the D.P.Gauge is a seamless Rupture-proof bellows type instrument, care should be taken not to subject the instrument to unnecessary shock or over range pressure during startup .Connect a **Three valve manifold Block** . Make sure block and bypass valves are closed when beginning start-up procedures.
- ❑ Check manifold and piping for leakage by opening the block valves, one shutoff valve and the bypass valve to pressurize the instrument. Then close the shutoff valve and by pass valve to pressurize the instrument. If pointer travels upscale, then it indicates leak in low pressure piping; & if pointer travels downscale, then it indicates leak in high pressure piping.
- ❑ Zero check the instrument. To do this, close the block valves and open the bypass valve. This equalises the pressure on both sides of the instrument. If the instrument does not indicate zero, set pointer to zero by rotating Dial by loosening the zero Adjust Screw on the Dial & re-tighten it after Zero adjustment.
- ❑ **TO CHECK CALIBRATION**

  First zero the instrument at atmospheric pressure & connect a calibration instrument such as Swiscal Digital Portable Manometer to the high pressure connection of the Gauge. The low pressure connection is vented to atmosphere. With the help of an aspirator bulb or regulated air source apply increasing pressures of 20, 50, 80 and

100 percent, of full-scale differential to the HP housing. Exercise care to **always** approach the desired scale reading from the low D/P side; if you overshoot and drop back to the reading, your calibration will be incorrect. Repeat the procedure, by reducing pressure and stopping at the same scale readings, now taking care to always approach readings from the high D/P side. Compare D.P Gauge readings with the Master Gauge.

Inconsistent readings may be the result of the pointer dragging against the scale plate. To inspect for this condition, remove the lens. The end of the pointer should be no closer to the scale plate than 1/32 inch throughout its arc of travel. If necessary, bend the pointer away from the scale by gently pulling on the outer end.

If indications are within specified tolerances, **no further** calibration is required.

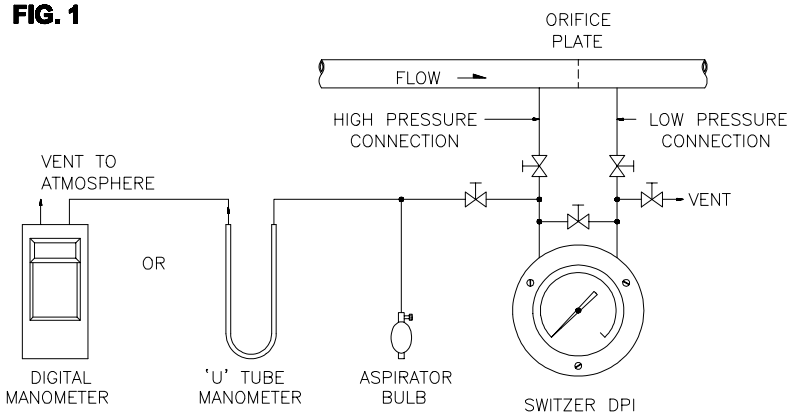
If instrument readings are outside specified tolerances, re-calibration is required. Send the instrument to factory.

❑ **To Set the Switch Actuation**

The Switch setting are to be done after opening up the bezel. With a screw driver adjust the positioning of the set pointer in the arrow direction marked up on the dial. Before commissioning check up the functioning of the switching action during the calibration check explained above.

After instrument has been checked to read correctly, replace lid and/or glass assembly.

FIG. 1



TYPICAL SCHEMATIC ARRANGEMENT FOR CALIBRATION OF D.P. GAUGES

J INSTRUMENT INSTALLATION RECOMMENDATIONS

- Rapid pressurization can cause severe damage, to the sensing element, in all types of pressure instruments. Modest quality instruments (± 2 to 5% full scale accuracy) are usually unaffected by this type abuse because of their relatively simple design. More sophisticated instruments (± 1 % full scale accuracy, or better) are quite likely to be damaged by rapid pressurization or over range.

- Most better quality instruments have an over range protection mechanism built into them, but since they are mechanical in design, they cannot be relied on to react in time to protect the instrument against such a rapid change in pressure. (This is one reason rupture disks, in addition to pressure relief valves, are required on some pressure vessels.

- As explained earlier the simplest method of avoiding this problem (for differential pressure instruments) is by installation, and proper use of, a three valve manifold . Opening the equaliser valve, prior to opening one or both of the block valves, will tend to insure that pressure is applied simultaneously to both sides of the sensing element.In addittion to this arrangement the snubbers supplied along with the instrument offers a back up protection.

- As a general practice wherever possible, instruments should be located at a higher elevation than the process connections on the equipment, or process device, on which they are being installed. Frequently, when trouble is encountered, it is found that the instrument has been installed at an elevation below the process connections, allowing particulate matter to flow by gravity into the instruments, resulting in erratic performance or complete malfunction. If for viewing properties, or other reasons, the above recommended location is impractical, there is an alternative procedure. Provide either a “pigtail” loop, or a “dropleg” (U–tube manometer configuration) in the tubing between the instrument and the process connections. Since most instruments do not have flow through them, such an installation practice will insure that solids will not be moved, by gravitational force, into the instrument.

  However a more detailed line up procedures for typical & special installations are presented in Figures 2 through 14.

  Use the diagram most applicable for specific requirement as a guide.

K D.P.GAUGE PIPING DIAGRAMS

FIG. 2

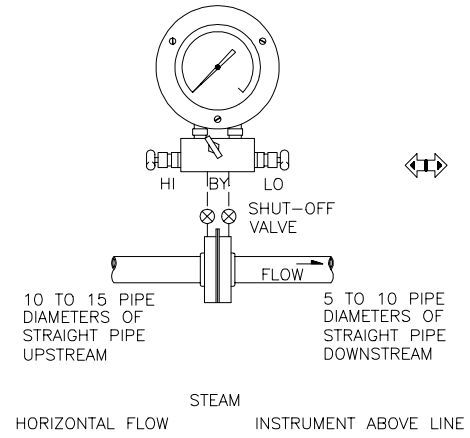


FIG. 3

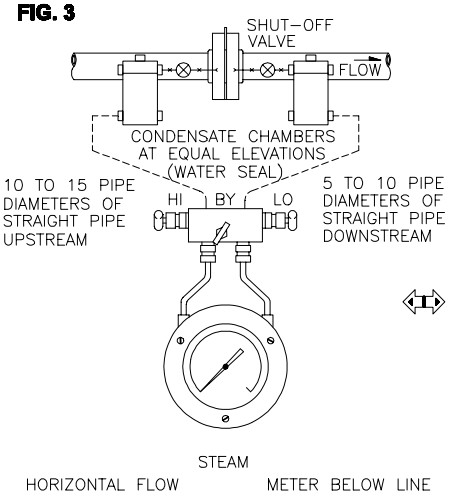
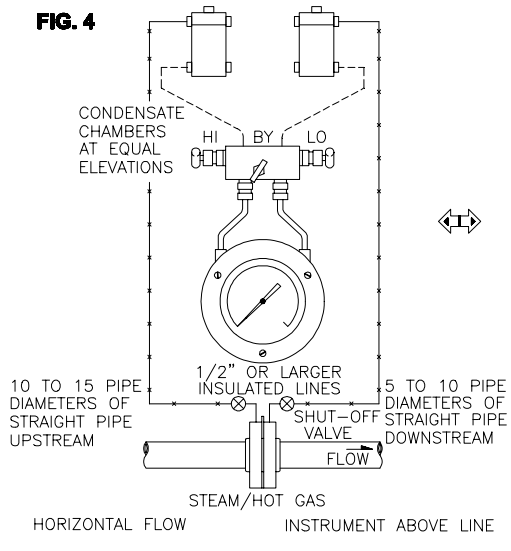


FIG. 4



FOR STEAM SERVICE (FIG.2)

START UP

Recommended when Instrument located above primary element and where self draining is possible& for operating temperature upto 200°F

1. Whatever the location of the meter body, make all primary element taps at or near top of pipe
2. Close block valves & vent valves (if used). Open bypass valve and shut-off valves.
3. Slowly and simultaneously open block valves, then close shut-off valves.
4. Slowly and simultaneously open shut-off valves.
5. Close bypass valve for D/P reading.

If D.P.Gauge to be located below the primary element, see fig 3.

For higher temperatures, see Fig. 4.

FOR STEAM SERVICE (FIG.3)

START-UP

Reccomended when Instrument located below primary element and for operating temperature upto 200°F

NOTE

To prevent overheating during instrument blow-down, monitor the temperature by placing your hand on the pipe between the D.P.gauge and the vent valves.

1. Close shut-off valves and vent valves (if used). Open by pass valve and block valves.
2. Remove side and fill plugs from condensate chambers.
3. Fill piping and instrument chambers with water by pouring into fill port in both condensate chambers to the level of the side plugs.Instrument chambers and piping must be free of bubbles. When instrument and piping are completely full, pointer will rest at zero.
4. Install plugs in ports of condensate chambers.
5. Slowly and simultaneously open shut-off valves then close.
6. Check for leaks as explained in clause I.
7. Slowly and simultaneously open shut-off valves.
8. Close bypass valve for D/P reading.

FOR STEAM or HOT GASES (FIG.4)

START-UP

Recommended when Instrument located above primary element and for operating temperature greater than 200°F.

See clause " H " and then follow steps in Fig.3.

FIG. 5

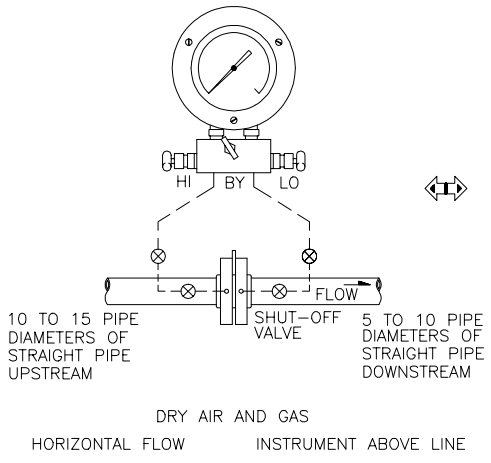


FIG. 6

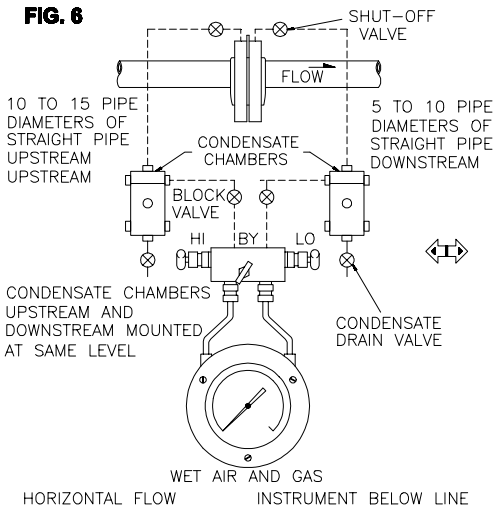
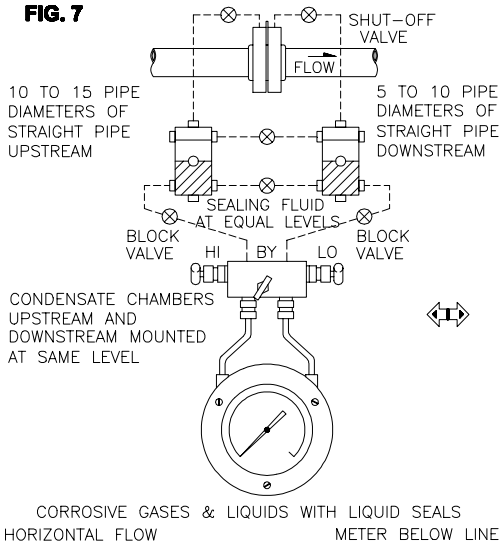


FIG. 7



FOR GAS SERVICE (FIG.5)

START-UP

Recommended when Instrument located above primary element and where self draining is possible NOT recommended when hydrates are present

1. Whatever the location of the meter body, make all primary element taps at or near the top of the pipe.
2. Open manifold valves and bypass valve, open one block valve and one shutoff valve to pressurise instrument.
3. Then close block valve and bypass valve .
4. Check for leaks as explained in clause I.
5. Open bypass valve, open block valves and slowly open both shutoff valves simultaneously.
6. Close bypass valve for D/P reading.

   If hydrates are present, or the instrument to be located below the primary element, see fig.6.

FOR GAS SERVICE (FIG.6)

START-UP

Recommended when hydrates or heavy solids are present. Piping diameter not less than ½". Drain valves are required

1. through 5. Follow steps in Fig. 5.
7. Drain condensate chambers of hydrates at regular intervals.

CORROSIVE FLUIDS (FIG.7)

START-UP

Recommended when the flowing medium is highly corrosive, contains solids in suspension, is highly volatile, Or for some other reason would damage the instrument. Use 109 Model with liquid or chemical seals to prevent the medium entering the instrument.

LOCATION FOR SEALS

Place as close as possible to the primary element to reduce the length of piping filled with process fluid.

On high temperature applications, locate the seal at least 36" from the primary element shutoff valves to prevent overheating.

NOTE : When measuring liquids, locate pressure taps at or near BOTTOM of pipe. Diaphragm type Seals can be used in place of condensate Chambers (eliminate steps 2 through 6).

1. Close shutoff valves; open manifold valves and block valves.
2. Remove fill and side plugs from seal pots.
3. Fill seal pots, piping and meter housings with the immiscible seal fluid by pouring into upper fill ports.Instrument housings, tubing and seal ports must be filled to seal pot side ports with bubble-free liquid. Pointer will indicate zero when both high and low pressure chambers are filled equally.
4. Install side plugs and close all valves.
5. Slowly open each shutoff valve alternately until fill port (skip this step in **gas application**)
6. Replace fill plugs.
7. Check for leaks as explained in clause I.
8. Open manifold valves and block valves, then SLOWLY open both shutoff valves simultaneously.
9. Close bypass valve for D/P reading.

FIG. 8

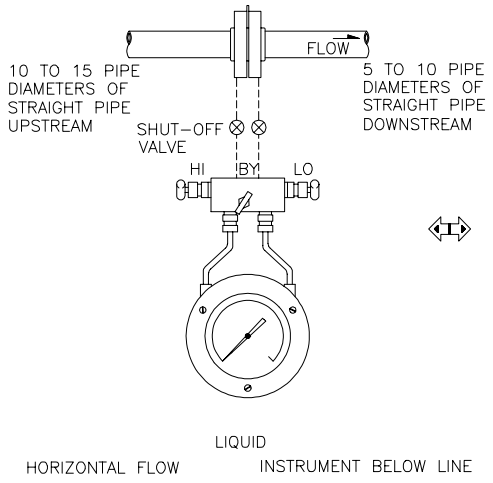


FIG. 9

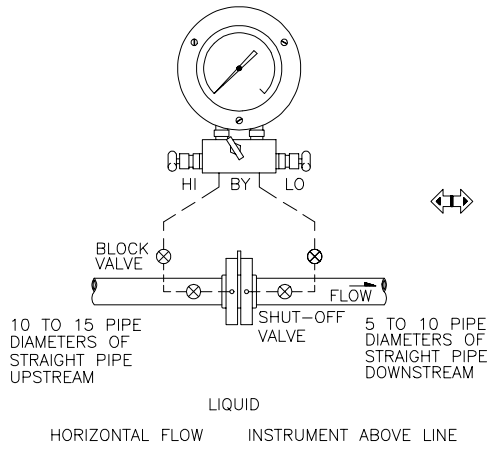
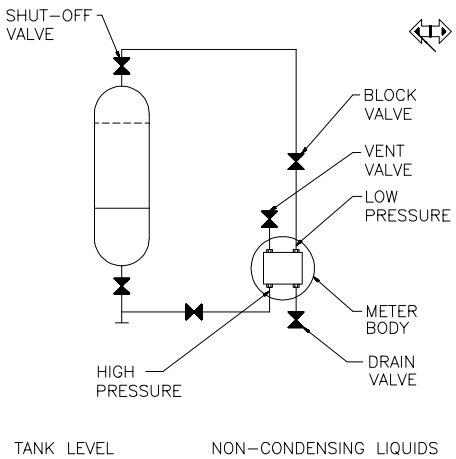


FIG. 10



FOR LIQUID SERVICE (FIG.8)

START-UP

Recommended when the flowing medium volatile or gassy liquids.

Make all primary element taps at or near bottom pipe.

CAUTION: Maximum operating temperature permissable 200°F(93°C). For higher temperature media, follow as explained in clause H. With hot or gassy fluids, disconnect instrument and fill both Housings and piping though manifold with process fluid cooled to below 200°F, then reconnect. Open block valves, bypass valve, and one shutoff valve.

1. Alternately crack drain vales (connected to lower instrument body ports) until liquid, free of bubbles, spills out both ports.
2. Close both drain valves and shutoff valve.
3. Pointer should indicate zero. If not, and no leaks are detected, the housings and/or piping are not completely full of bubble-free liquid. Repeat steps 1 through 4 until pointer remains stationary at zero.
4. Open both shutoff valves, close bypass valve for D/P reading.

FOR LIQUID SERVICE (FIG.9)

START-UP

Recommended for use when sediments are present or when meter cannot be mounted below line. Where sediments are NOT present, make primary element taps at or near bottom of pipe. Periodically inspect and clean instrument lines.

NOTE : Where process fluid is gasy or system is subject to numerous no- flow conditions and instrument cannot be mounted below line, install automatic air bleed fittings in top meter body parts or at high point of instrument lines.

1. Open both block valves, bypass valve and one shutoff valve.
2. Alternately crack vent valves or loosen plugs from top ports of instrument body housings until liquid, free of bubbles, spills out of both upper meter body ports.
3. Close vent valves or replace plugs and close shutoff valve.
4. Pointer should indicate zero. If not, and no leaks are detected, the housings and/or piping are not completely full of bubble-free liquid. Repeat steps 1 through 4 until pointer remains stationary at zero.
5. Open both shutoff valves, close bypass valve for D/P reading.

FOR COOL LIQUID SERVICE (FIG.10)

START-UP

Recommended for use with water, oil, or other media which will not condense in low pressure piping.

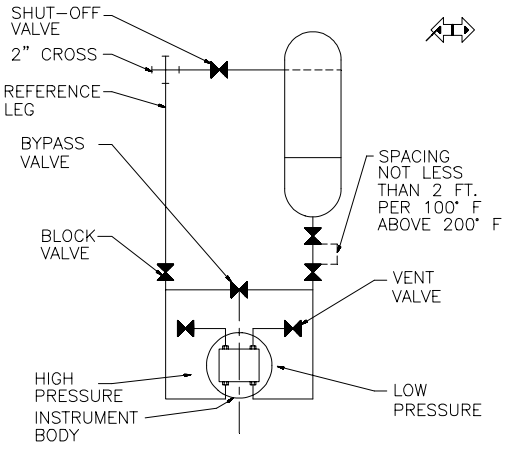
For hot (volatile) liquids, see Fig.11.

Mount instrument centerline level with lower tank reading point. If instrument is mounted below lower tank reading point, install a reference leg per Fig.9, a bubbler system per Fig.12, an aspirator bulb.

NOTE : Do not share fill or vapour return lines with instrument piping.

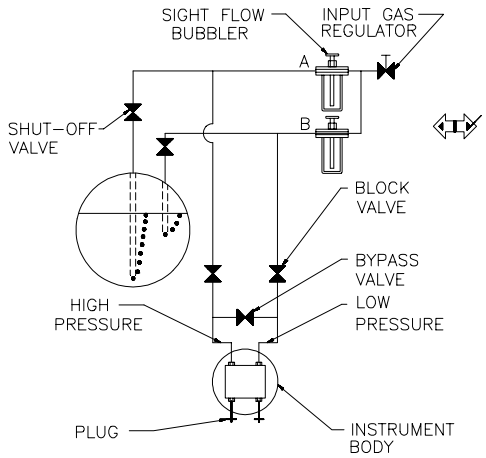
1. Close all valves; open high pressure block valve and crack high pressure vent valve
2. Slowly open bottom (high pressure) shut-off valve. When bubble free liquid spills from high pressure vent valve, close vent valve. Open low pressure block valve slowly open top (low pressure) Shutoff valve. Crack low pressure drain valve to drain any condensation and reclose.

FIG. 11



TANK LEVEL COOL OR VOLATILE LIQUIDS
INSTRUMENT BELOW TANK WITH REFERENCE LEG

FIG. 12



SPECIFIC GRAVITY CHANGES/TANK LEVEL COOL LIQUIDS
INSTRUMENT INSTALLED WITH BUBBLER SYSTEM

FOR COOL or HOT LIQUID SERVICE

START-UP

Recommended for use to cancel out the "dead leg" (piping from tank bottom to centerline of meter body) when meter is mounted below tank. Process medium can be used as reference leg seal fluid if it will condense in the leg under all conditions. Otherwise, a non-miscible seal fluid must be used.

CAUTION : If bypass valve is opened at any time when the tank liquid level is below maximum, the reference leg must again be filled.

NOTE : Do not share fill or vapour return lines with instrument piping.

FOR COOL LIQUID SERVICE (FIG.11)

1. Partially fill reference leg by opening bottom shutoff valve, both block valves and bypass valve.
2. Crack vent valves on meter body housings; close when clear, bubble-free liquid flows out.
3. Close bypass and block valve on reference leg.
4. Remove plug from side port in 2inch pipe cross connection used for reference level reservoir, and fill the leg by opening block valve and cracking the bypass valve until bubble-free liquid spills out.
5. Close bypass valve.
6. Replace plug in cross
7. Slowly open upper shutoff valve.

HOT (VOLATILE) LIQUIDS (FIG.11)

CAUTION : Maximum meter operating temperature is 200°F. See clause H before proceeding.

1. Close shutoff valves; open both block valves, vent valves, and by pass valve.
2. Remove plug from top port in 2" pipe cross. Use process liquid (cooled to below 200°F) or other suitable seal fluid, and fill both high and low pressure housings through cross until it runs out vent valves bubble free.
3. Close HP vent valve and bypass valve. Fill reference leg and replace Plug.
4. Crack LP (bottom) shutoff valve until fluid flows bubble-free from LP vent, and re close. AVOID danger of scalding from hot liquid.
5. Slowly open both shutoff valves.

FOR COOL (NON-VOLATILE) LIQUID SERVICE (FIG.12)

START-UP

NOTE : Do not share fill or vapour return lines with instrument piping.

SPECIFIC GRAVITY : For use to determine specific gravity changes in a process medium.

1. Set bubbler input gas regulator at a pressure slightly higher than process vessel pressure.
2. Open shutoff valves and block valves. Close bypass valve.
3. Adjust sight bubblers for equal gas flow to each tube, approximately one bubble per second. Continous bubbling is necessary.

FOR LIQUID LEVEL

Recommended for use whenever solids or sludge are present, or when instrument must be mounted above tank bottom.

1. Delete LP sight flow bubbler (B)
2. On a pressurised tank, line up the LP port directly to upper tank connection. On a vented tank, vent the LP port to atmosphere.
3. Follow steps 1 through 3 under "Specific Gravity".

FIG. 13

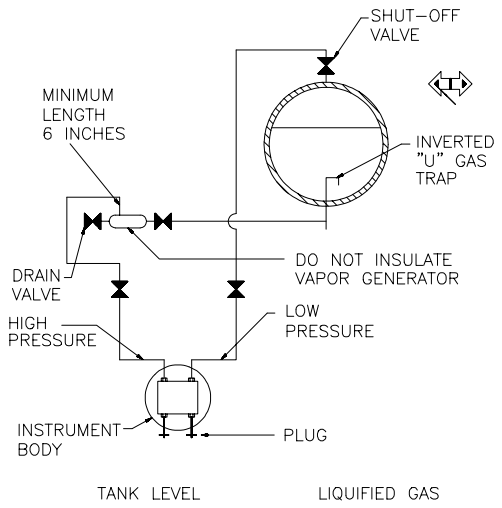
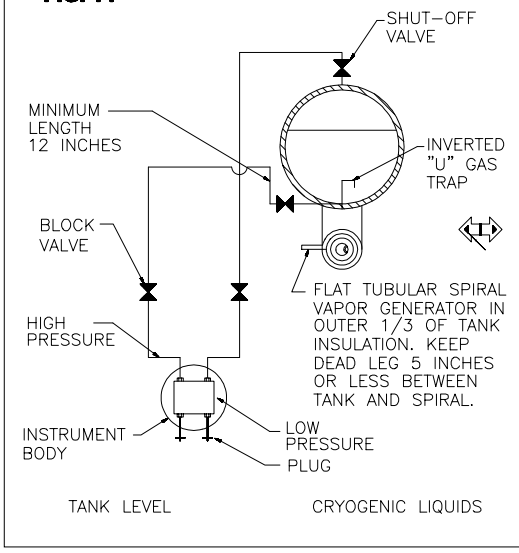


FIG. 14



FOR LIQUID GASES SERVICE (FIG.13)

START-UP

Recommended for use with CO, Butane, Propane, Freon, and other liquified gases warmer than–150°F (–101°C). Meter may be mounted above or below tank.

Vapour generator is a 12" length of 1" to 1½" diameter pipe; avoid traps or pockets between vapour generator and tank. Install inverted "U" gas trap inside tank. Do not insulate piping below lower shutoff valve. Do not share fill or vapor return lines with meter piping.

1. Close block valves.
2. Open drain valve and loosen meter housing drain plugs to remove all liquid from system. Replace plugs.
3. Close drain valve and slowly open bottom shutoff valve to allow liquid to enter gas generator.
4. Open upper shutoff valve and block valves.

FOR CRYOGENIC LIQUID SERVICE (FIG.14)

START-UP

Recommended for use with Oxygen, Nitrogen, and Agron. Instrument may be mounted above or below tank. Vapour generator is a spiral of 3/8" turbing. Install an inverted "U" gas trap inside tank. Do not share fill and vapour return lines with meter piping.

CAUTION : Instrument designed for use with Oxygen are specially cleaned and packaged, and MUST be kept clean. No organic compounds, oil, grease, dirt, or scale of any kind can be tolerated in an oxygen installation.

1. Close block valves. Loosen instrument body drain plugs to remove all liquid from system. Replace Plugs.
2. Slowly open HP (bottom) shutoff valve to allow liquid to flow through gas generator.
3. Open LP (top) shutoff valve, and open block valves.

L FINAL ADJUSTMENT

It is advisable **to recheck** instrument zero and to test the operation of the bypass valve **after** the D.P. Gauge **has been placed** i**n service and fully subjected to differential pressure, line pressure, and process/ambient temperature**.

CAUTION : Never zero check when only one block valve is shut. In gas flow service, **a standing wave effect** in the process line can displace the indicator; the displacement could be assumed to be an erroneous reading.

1. With the instrument subjected to differential pressure and in service, observe the position of the pointer on the scale and use this reading as a reference for checking the effectiveness of the bypass valve on the instrument piping manifold. Close the H.P block valve. (Note that when checking instrument zero where seal pots are involved, the primary element shutoff valve is used instead of the meter body valve on the piping manifold). If the pointer moves from the reference position towards zero, it indicates that the bypass valve on the piping manifold is leaking and must be replaced. If the pointer remains in the reference position, the bypass valve is functioning properly.
2. Open the bypass valve on the instrument piping manifold. The pointer should go to zero on the scale. If the instrument does not indicate zero, check for gas or liquid entrapment in the lines or in the D.P. Gauge (depending on the orientation of the piping layout and service). If necessary, adjust the pointer by turning the dial to bring the pointer to zero reference.
3. Adjustment of the Pulsation Dampener

CAUTION : Never try to remove the pulsation dampener adjusting screw. **Serious injury** can result if adjustment screw is removed with the instrument under pressure. When an increase in dampening is required, as **indicated by a quivering** movement of the instrument pointer, turn the damping screw clockwise until the pointer just stops its oscillation. Do not over-adjust. (See "Operating Limitations-Pulsation" explained earlier). **Further damping** will decrease the speed of response and introduce unnecessary time lag into the measuring system. Recheck instrument zero.

M TROUBLESHOOTING

If trouble occurs, it is recommended that the routine shown below in tabular form be followed :

TROUBLE	POSSIBLE SOURCE	MALFUNCTION	REMEDY
Low or No Indication	Primary Element or Differential Pressure Source	Orifice installed backwards, or oversize. Flow blocked upstream from run. Loss of liquid in reference leg (liquid level). Density changes in process medium or Reference leg.	Replace orifice, or install properly. Clean out run or open valve. Refill reference leg. Refill reference leg with liquid of same density as process medium.
	Piping from Primary Element.	Pressure tap holes or piping plugged. Bypass valve open or leaking. Liquids or gases trapped in piping. Block or shutoff valves closed. Piping leaks, high pressure side.	Clean out piping. Close bypass valve (s) Replace Vent Piping. Open block or shutoff valves. Repair leaks.
	Bellows Unit	End housings filled up with solids restricting bellows movement. Gas trapped in housing in liquid service or Liquid trapped in housing in gas service. High pressure housing gasket leaks. Instrument tampered with.	Clean out housings. Vent or drain housing. Replace gasket. Return bellows unit assembly for repairs.
	Movement Mechanism	Loose linkage arms or movement. Out of calibration. Corrosion or dirt in mechanism. Pointer loose.	Tighten or replace. Recalibrate. Clean or replace. Tighten or replace
High Indication	Primary Element Piping from Primary Element to Instrument	Orifice partially restricted or too small. Leak in low presure piping. Incorrect hook-up for tank level Indications.	Clean out or replace. Repair. See Meter Piping Diagrams and Final Adjustment .
	Bellows Unit	Gas trapped in low pressure housing in Liquid service or liquid trapped in high pressure housing in gas service. Low-pressure housing gasket leaks. Range Spring broken. Instrument tampered with.	Vent or drain housing. Replace Gasket. Replace Range Spring. Return bellows unit assembly for repairs.
	Movement Mechanism	Loose linkage arms or movement. Out of Calibration.	Repair or replace. Recalibrate.
Erratic Indication	Primary Element Piping from Primary Element to Instrument	Flow pulsating. Liquid trapped in gas piping or Gas bubble in liquid piping. Vapor generator incorrectly installed. Reference leg gassy or liquid Vapourising. Obstructed bourdon travel.	Adjust pulsation dampener. Remove (See startup instructions) Repipe. See piping instructions and diagrams. See Instrument Body Inspection and Cleaning .
	Bellows Unit	Gas trapped in high-pressure or low-pressure housing. Loose Range Spring	Remove (See Meter Piping Diagrams). Tighten and adjust (See Range Changes)
	Movement Mechanism	Movement dragging or dirty. Pointer dragging on scale plate.	Adjsut and clean. Adjust.

N MAINTENANCE

Periodic inspection and cleaning of the D.P .Gauge is standard recommended practice. Recalibration, unless required because of a defective component or workmanship, is also considered a normal maintenance function.

REMOVING THE INSTRUMENT FROM SERVICE

1. Close the H.P. primary element shutoff valve.
2. Open bypass vale in the line between the seals (where applicable)
3. Close the low pressure primary element shutoff valve.
4. Close the high pressure meter body shutoff valve on the piping manifold.
5. Open the bypass valve on the piping manifold.

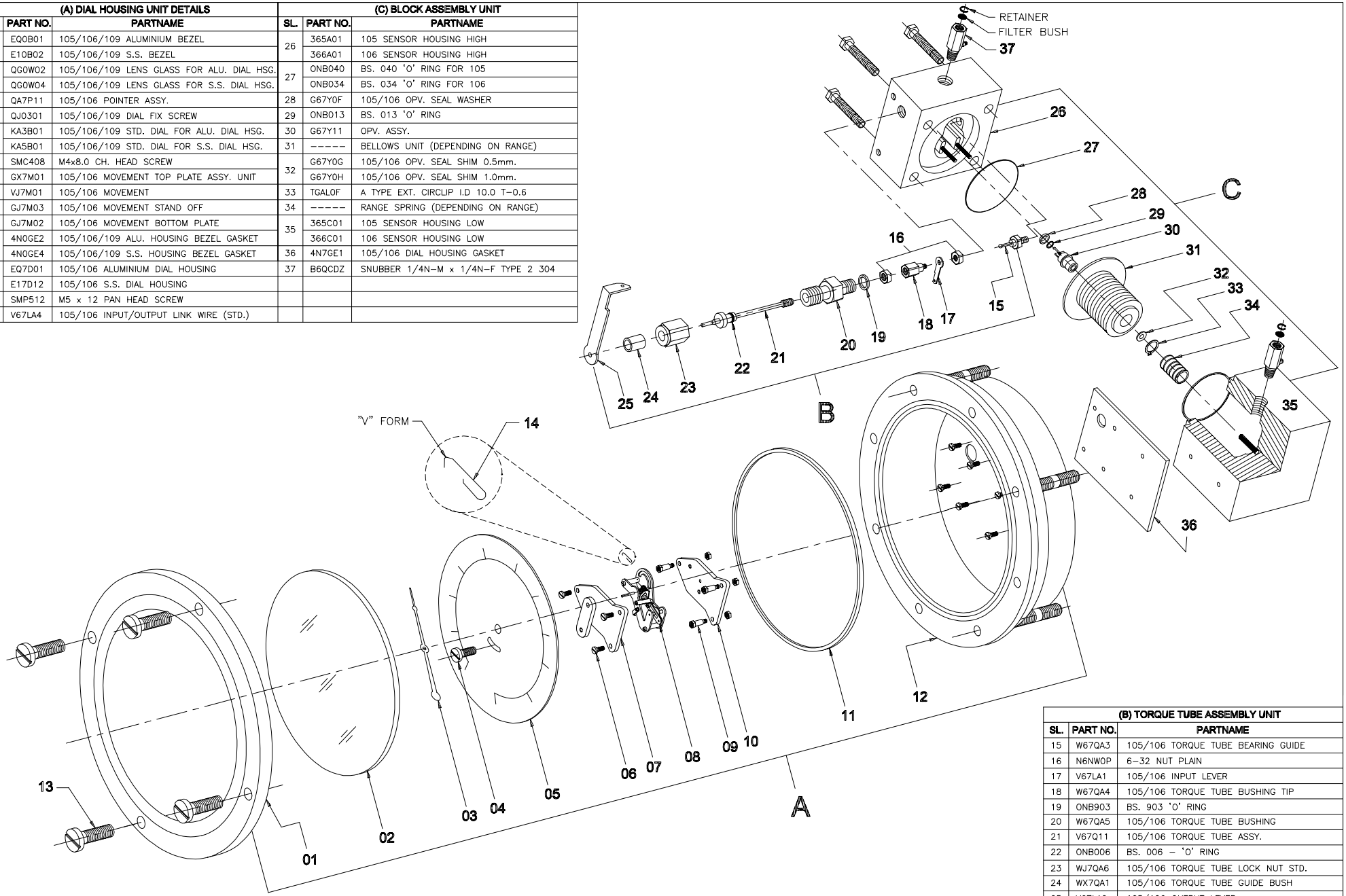
INSTRUMENT INSPECTION & CLEANING

When instruments are used in services where **solids or semi-solids** can accumulate, the meter body housing and bellows will require periodic inspection and cleaning. This can be performed as follow. Also refer the Assembly breakdown Drawing.

1. Remove instrument from service,as described above.
2. Open up the Dial unit ,remove pointer using pointer puller, then the dial.
3. Carefully remove the **link wire** at the Torque Tube end without disturbing the movement.
4. Detach the Dial Housing slowly from the Sensor Housing unit without removing or disturbing the Torque Tube output lever by slowly passing the Dial Housing over the Torque Tube through the hole in the housing.
5. Carefully and slowly remove High & Low housingsby removing the four M12 / M10 bolts.If accumulation of process material is extensive, removing the housings too rapidly can damage bellows convolutions.
6. Carefully remove the Range Spring located on its I.D on the OPV Shim.
7. Do not disturb and remove the bellows from its position.
8. Rest the High Body on its bottom surface with the bellows upright.
9. With a blunt smooth rod 3 mm Ø push the rubber ball against the force of ball retainer spring located behind the ball and then flush the OPV with water to clean up the accumulations inside it. If necessary use a suitable solvent but compatible to the seal Material.
10. Similarly clean up both the High & Low Housings by flushing. Use a solvent, if possible, to remove the accumulations.
11. After cleaning up, replace the Range spring by locating it on the OPV Shim.
12. Re-fix the Low Housing on to the High Housing without disturbing or damaging the bellows & tighten the four bolts with sufficient torque of 80 lbs-in enough to prevent leaks. Ensure that High & Low Housing edges are alligned at surface where the Dial Housing seats, and ‘ O’ Ring is in place.
13. Re-fix the Dial Housing back in position . Ensure that the gaskets are in position at the joint of Dial Housing and the Bellows Unit and all the screws fixing it are tight or else will lead to failure of weather proofness.
14. Carefully ride the “V” of the Link wire into the hole of the bent portion of the Output lever attached to the Torque tube.The linkage should be so positioned that the “ V ” of the wire is free in the hole without creating any friction at the point of rest.
15. It is also advisable to clean up the movement as well with Acetone to remove dirt and greasiness. Ensure effective cleaning at gear teeth.

(A) DIAL HOUSING UNIT DETAILS		
SL.	PART NO.	PARTNAME
01	EQ0B01	105/106/109 ALUMINIUM BEZEL
	E10B02	105/106/109 S.S. BEZEL
02	QG0W02	105/106/109 LENS GLASS FOR ALU. DIAL HSG.
	QG0W04	105/106/109 LENS GLASS FOR S.S. DIAL HSG.
03	QA7P11	105/106 POINTER ASSY.
04	QJ0301	105/106/109 DIAL FIX SCREW
05	KA3B01	105/106/109 STD. DIAL FOR ALU. DIAL HSG.
	KA5B01	105/106/109 STD. DIAL FOR S.S. DIAL HSG.
06	SMC408	M4x8.0 CH. HEAD SCREW
07	GX7M01	105/106 MOVEMENT TOP PLATE ASSY. UNIT
08	VJ7M01	105/106 MOVEMENT
09	GJ7M03	105/106 MOVEMENT STAND OFF
10	GJ7M02	105/106 MOVEMENT BOTTOM PLATE
11	4N0GE2	105/106/109 ALU. HOUSING BEZEL GASKET
	4N0GE4	105/106/109 S.S. HOUSING BEZEL GASKET
12	EQ7D01	105/106 ALUMINIUM DIAL HOUSING
	E17D12	105/106 S.S. DIAL HOUSING
13	SMP512	M5 x 12 PAN HEAD SCREW
14	V67LA4	105/106 INPUT/OUTPUT LINK WIRE (STD.)

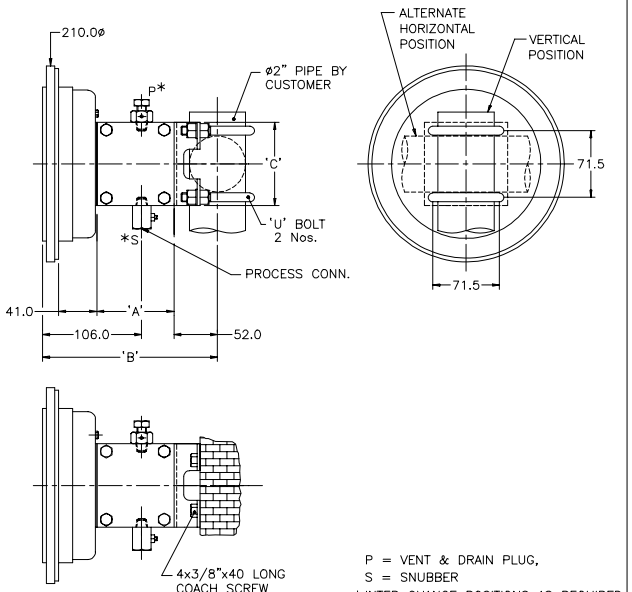
(C) BLOCK ASSEMBLY UNIT		
SL.	PART NO.	PARTNAME
26	365A01	105 SENSOR HOUSING HIGH
	366A01	106 SENSOR HOUSING HIGH
27	ONB040	BS. 040 'O' RING FOR 105
	ONB034	BS. 034 'O' RING FOR 106
28	G67Y0F	105/106 OPV. SEAL WASHER
29	ONB013	BS. 013 'O' RING
30	G67Y11	OPV. ASSY.
31	-----	BELLOWS UNIT (DEPENDING ON RANGE)
32	G67Y0G	105/106 OPV. SEAL SHIM 0.5mm.
	G67Y0H	105/106 OPV. SEAL SHIM 1.0mm.
33	TGAL0F	A TYPE EXT. CIRCLIP I.D 10.0 T-0.6
34	-----	RANGE SPRING (DEPENDING ON RANGE)
35	365C01	105 SENSOR HOUSING LOW
	366C01	106 SENSOR HOUSING LOW
36	4N7GE1	105/106 DIAL HOUSING GASKET
37	B6QCDZ	SNUBBER 1/4N-M x 1/4N-F TYPE 2 304



(B) TORQUE TUBE ASSEMBLY UNIT		
SL.	PART NO.	PARTNAME
15	W67QA3	105/106 TORQUE TUBE BEARING GUIDE
16	N6NW0P	6-32 NUT PLAIN
17	V67LA1	105/106 INPUT LEVER
18	W67QA4	105/106 TORQUE TUBE BUSHING TIP
19	ONB903	BS. 903 'O' RING
20	W67QA5	105/106 TORQUE TUBE BUSHING
21	V67Q11	105/106 TORQUE TUBE ASSY.
22	ONB006	BS. 006 - 'O' RING
23	WJ7QA6	105/106 TORQUE TUBE LOCK NUT STD.
24	WX7QA1	105/106 TORQUE TUBE GUIDE BUSH
25	V67LA2	105/106 OUTPUT LEVER

105/106 MODEL DPI (NON SWITCHING TYPE) - WALL & PIPE MOUNTING ARRANGEMENT

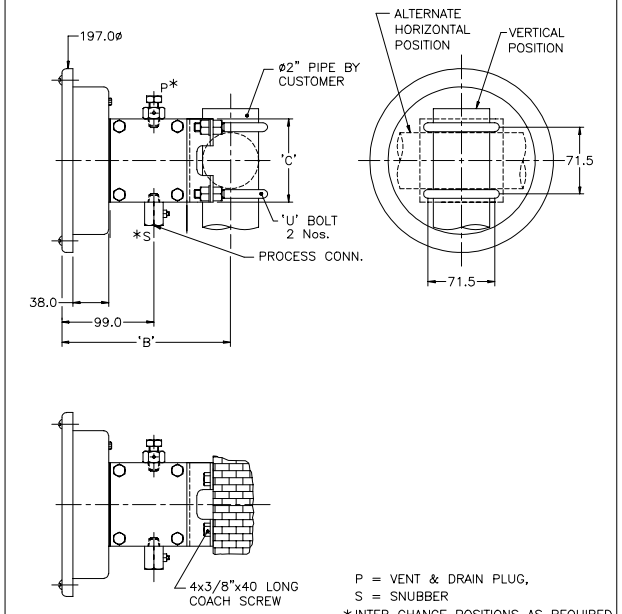
ALUMINIUM CASE



P = VENT & DRAIN PLUG,
S = SNUBBER
* INTER CHANGE POSITIONS AS REQUIRED.

106	82.35	192.0 ±2	76.0
105	94.75	205.0 ±2	95.0
MODEL	DIM 'A'	DIM 'B'	DIM 'C'

S.S CASE

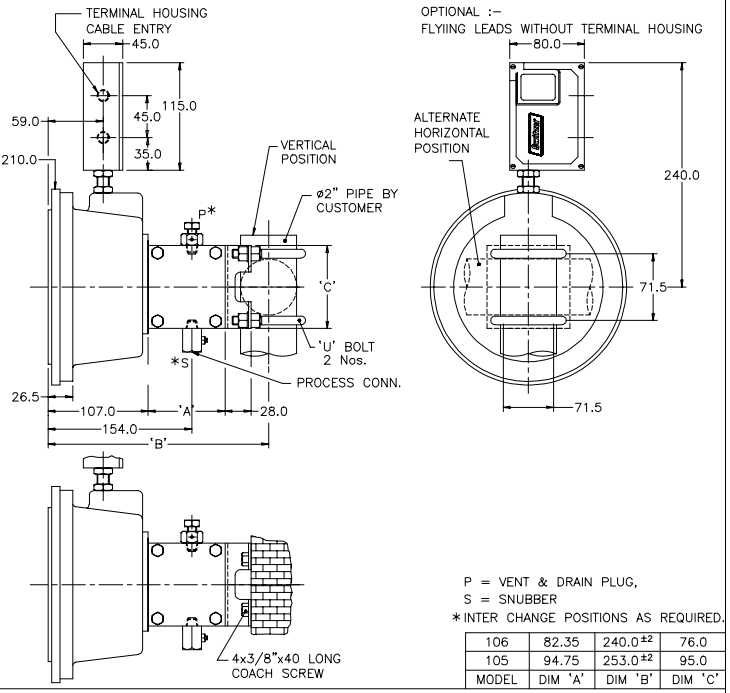


P = VENT & DRAIN PLUG,
S = SNUBBER
* INTER CHANGE POSITIONS AS REQUIRED.

106	82.35	184.0 ±2	76.0
105	94.75	197.0 ±2	95.0
MODEL	DIM 'A'	DIM 'B'	DIM 'C'

105/106 MODEL DPI (SWITCHING TYPE) - PIPE & WALL MOUNTING ARRANGEMENT

ALUMINIUM CASE

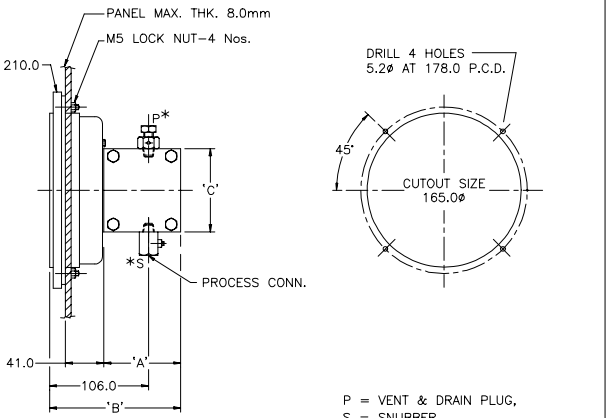


P = VENT & DRAIN PLUG,
S = SNUBBER
* INTER CHANGE POSITIONS AS REQUIRED.

106	82.35	240.0 ±2	76.0
105	94.75	253.0 ±2	95.0
MODEL	DIM 'A'	DIM 'B'	DIM 'C'

105/106 MODEL DPI (NON SWITCHING TYPE) - FRONT PANEL MOUNTING ARRANGEMENT

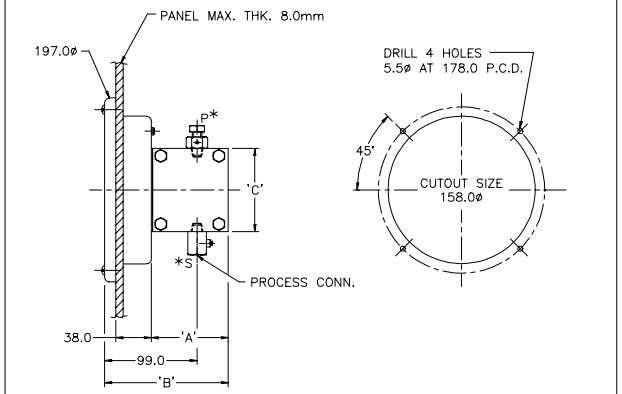
ALUMINIUM CASE



P = VENT & DRAIN PLUG,
S = SNUBBER
* INTER CHANGE POSITIONS AS REQUIRED.

106	82.35	140.0 ±2	76.0
105	94.75	153.0 ±2	95.0
MODEL	DIM 'A'	DIM 'B'	DIM 'C'

S.S CASE

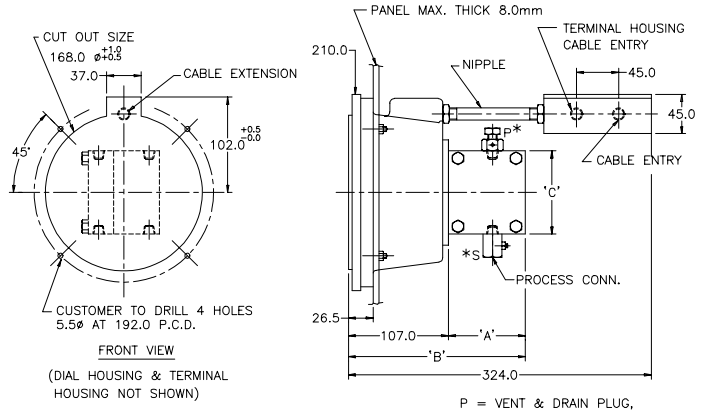


P = VENT & DRAIN PLUG,
S = SNUBBER
* INTER CHANGE POSITIONS AS REQUIRED.

106	82.35	133.0 ±2	76.0
105	94.75	145.0 ±2	95.0
MODEL	DIM 'A'	DIM 'B'	DIM 'C'

105/106 MODEL DPI (SWITCHING TYPE) - FRONT PANEL MOUNTING ARRANGEMENT

ALUMINIUM CASE



P = VENT & DRAIN PLUG,
S = SNUBBER
* INTER CHANGE POSITIONS AS REQUIRED.

106	82.35	190.0 ±2	76.0
105	94.75	202.0 ±2	95.0
MODEL	DIM 'A'	DIM 'B'	DIM 'C'