

Differential Pressure Detectors (Meter Bodies)

Model KDP/KFDB

User's Manual

Azbil Corporation

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Chapter 1. DESCRIPTION

1-1. GENERAL

The differential pressure detector (meter body) accepts a differential pressure through its high and low pressure connection ports, converts the differential pressure into a torque force by its center section to which the high and low pressures are applied through respective diaphragms, and feeds a torque via its torque tube to a pneumatic transmitter (Model KDP) or a pneumatic controller (Model KFDB).

Some models of detectors have a flange incorporated with diaphragm for connection of the high pressure line.

1-2. MODELS

Measured Pressures or Type of Instrument	Model Numbers of Instruments Used in Conjunction	Operator's Manual Used in Conjunction
Standard Type, High/Medium Differential Pressures	Models KDP11/22 Models KFDB11/22	OM2-5220-1101 (KDP) OM2-6220-0000 (KFDB)
Standard Type, Low Differential Pressures	Model KDP33 Model KFDB33	
Standard Type, Very Low Differential Pressures	Model KDP44 Model KFDB44	
Flange Type	Models KDP61/62 Models KFDB61/62	
Remote-sealed diaphragm Type	Models KDP71/72 Models KFDB71/72	
High Working Pressure Type	Models KDP81/82 Models KFDBS1/82	

1-3. INSTRUCTIONS FOR INSTRUMENTS (TRANSMITTERS AND CONTROLLERS) USED IN CONJUNCTION

For the instructions for instruments used in conjunction, refer to respective Operator's Manuals which cover the operating principles, service and unit replacement procedures, and calibration and adjustment procedures of these instruments.

Chapter 2. STRUCTURES OF METER BODIES

2-1. EXTERNAL VIEWS

Although external views of meter bodies differ by models as shown in Fig. 2-1, the bracket mounting section and instrument connection section are identical for models 11/22, 71/72, and for models 33/44, 81/82.

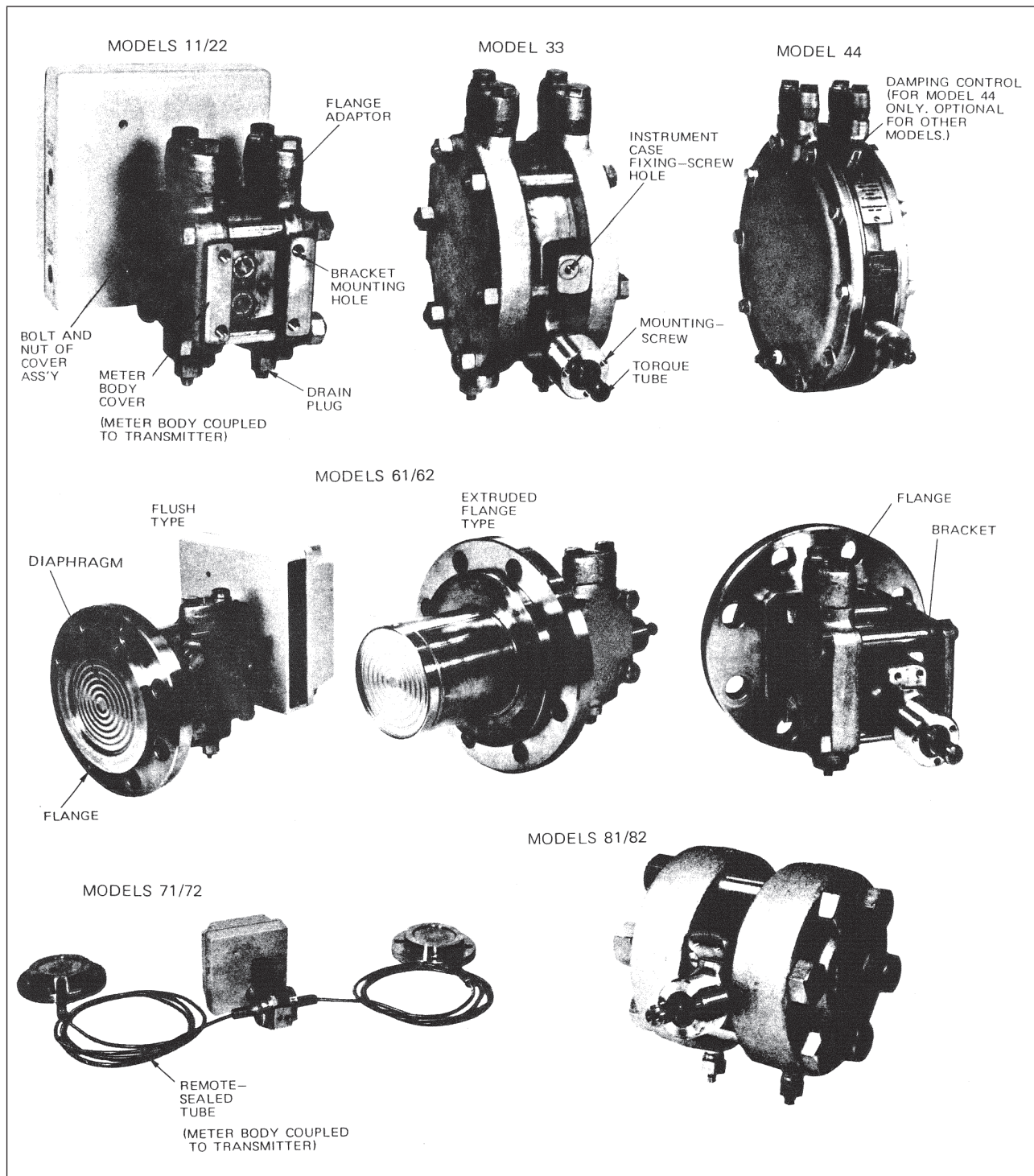


Fig. 2-1. External Views of Meter Bodies

2-2. STRUCTURES AND OPERATING PRINCIPLES

The structures and operating principles of the meter bodies are covered in this section.

2-2-1. Models 11/12, 33, and 81/82

- (a) The high and low process pressures (HP and LP) are fed via diaphragms (1) and (2) to the center section (oil filled section) of the meter body. The HP acts on the differential pressure detecting bellows from the right hand side (3) and the LP from the left hand side (4). When in the equilibrium state (zero differential pressure state), identical forces are exercised on both sides of the differential pressure detecting bellows (5).
- (b) As the pressure of the HP side rises thereby increasing the differential pressure, the differential pressure detecting bellows moves leftward. The movement of the bellows is fed as a torque via the torque arm to the beam of the transmitter.

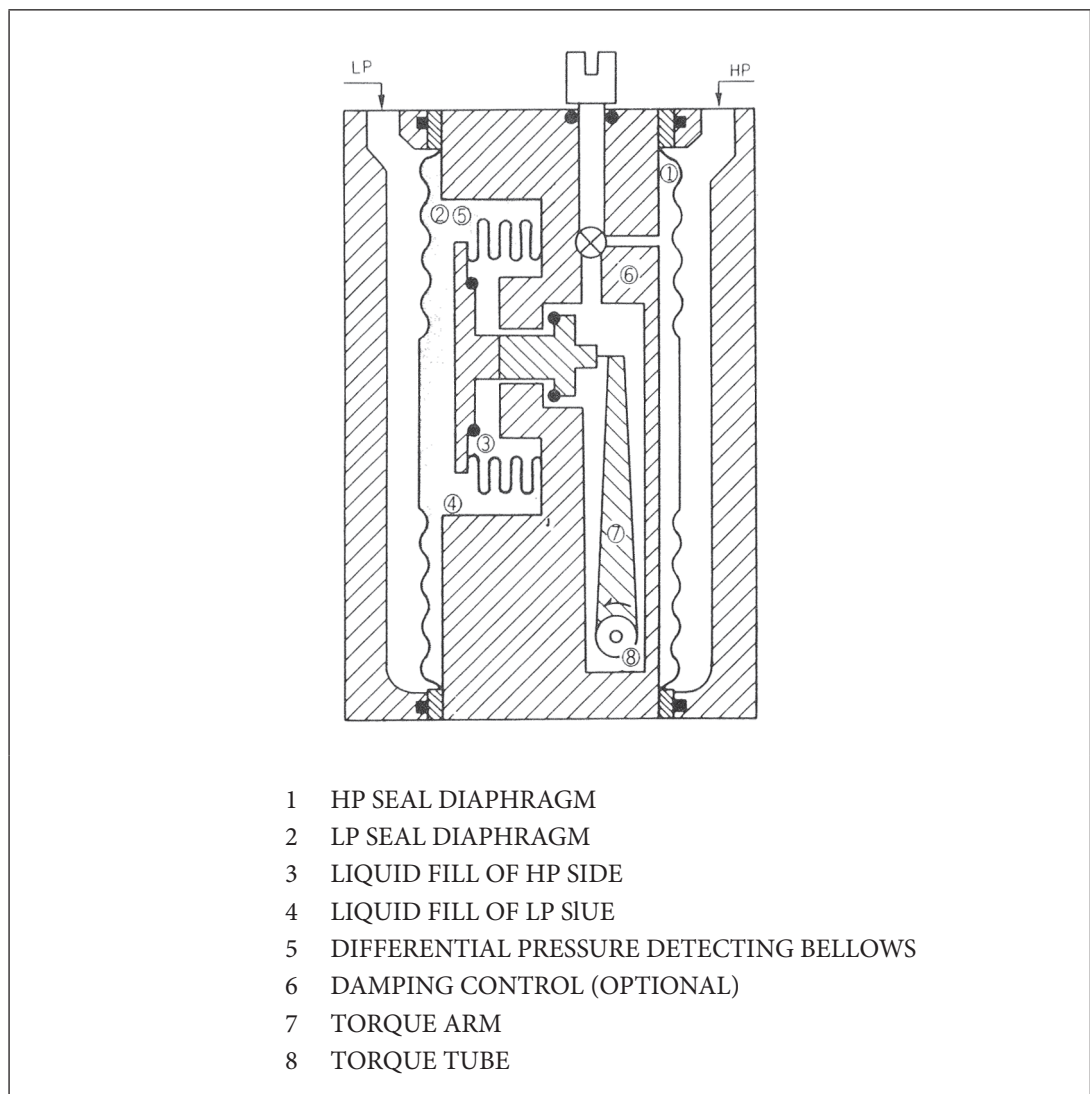


Fig. 2-2. Operating Principle of Meter Body

2-2-2. Model 44

- (a) The high and low process pressures (HP and LP) are fed via the diaphragms and supports (1) to the center section (silicone filled section) (2) of the meter body. The HP acts on the pressure detecting diaphragm from the right hand side and the LP from the left hand side. When in the equilibrium state (zero differential pressure state), identical forces are exercised on both sides of the differential pressure detecting diaphragm.
- (b) As the pressure of the HP side rises, the support moves leftward. The liquid fill flows through the damping control (3). The movement of the diaphragm is fed as a torque via the torque arm (4) to the beam of the transmitter.

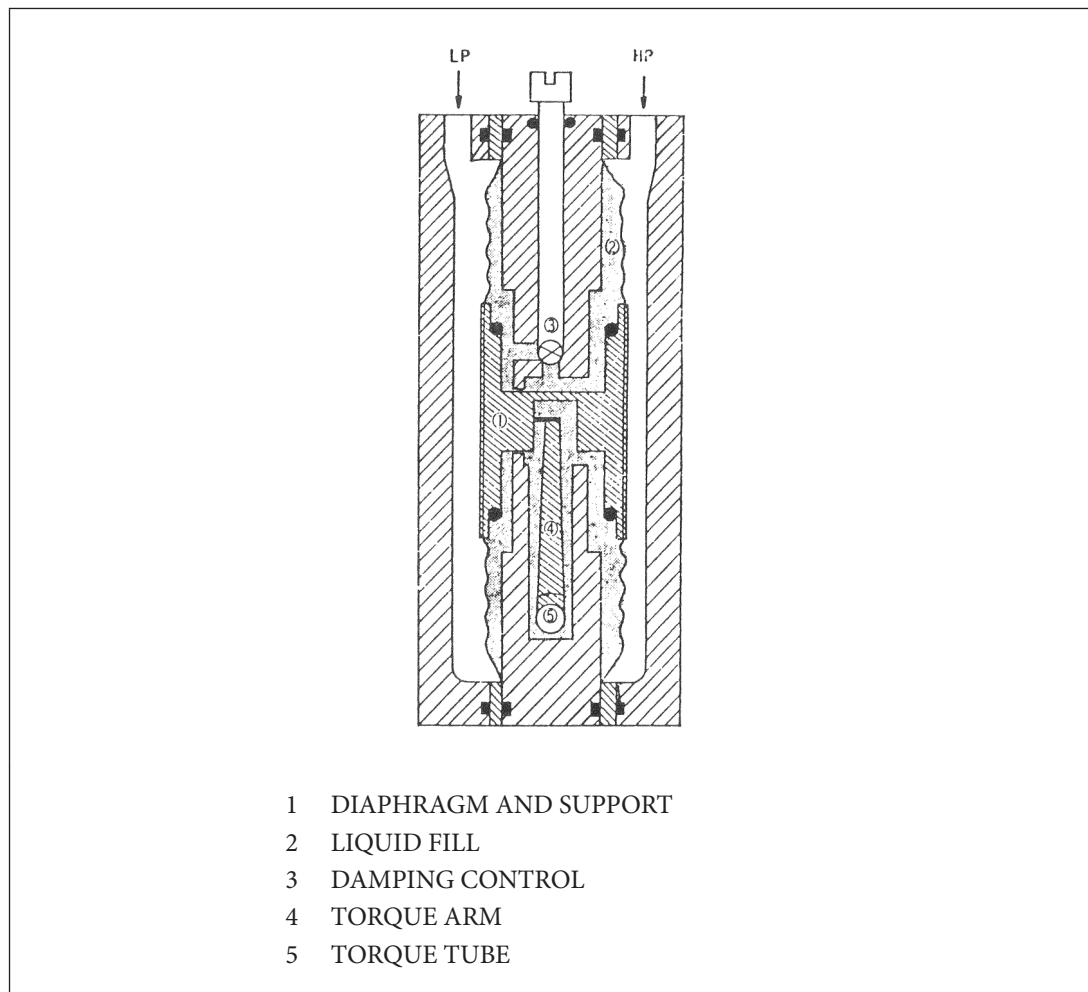


Fig. 2-3. Operating Principle of Meter Body

2-2-3. Models 61/62

- (a) The high and low process pressures (HP and LP) are fed via diaphragms (2) and (11) to the center section (silicone filled section) of the meter body. A pressure which is proportional to the liquid head in the process vessel is fed via the seal diaphragm (2) and liquid fill to the bellows (5) at the center section of the meter body.
- (b) The bellows (5) moves in proportion to the liquid head pressure. The movement of the bellows is fed as a torque via the plunger (6) and torque arm (7) to the beam of the transmitter.

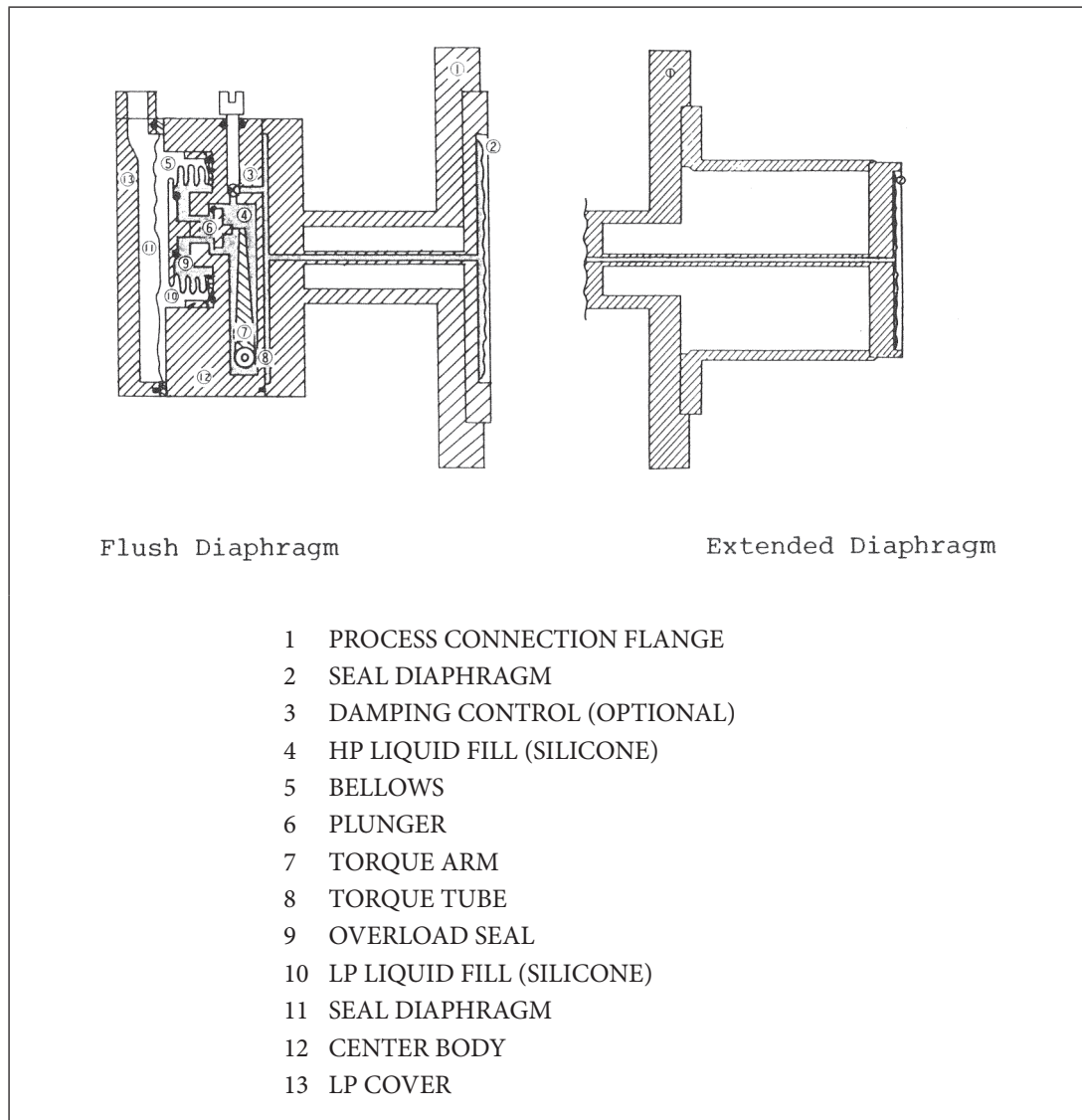


Fig. 2-4. Operating Principle of Meter Body

2-2-4. Models 71/72

- (a) The high and low process pressures (HP and LP) are fed via diaphragms (2) to the center section (silicone filled section) (11) of the meter body. The HP is fed via the seal diaphragm (2) and liquid fill (4) to the bellows (5) at the center section of the meter body. The LP is fed via the seal diaphragm (2) and liquid fill (10) to the bellows (5).
- (b) The bellows (5) moves in proportion to the differential pressure between HP and LP. The movement of the bellows is fed as a torque via the torque rod (8) to the beam of the transmitter.

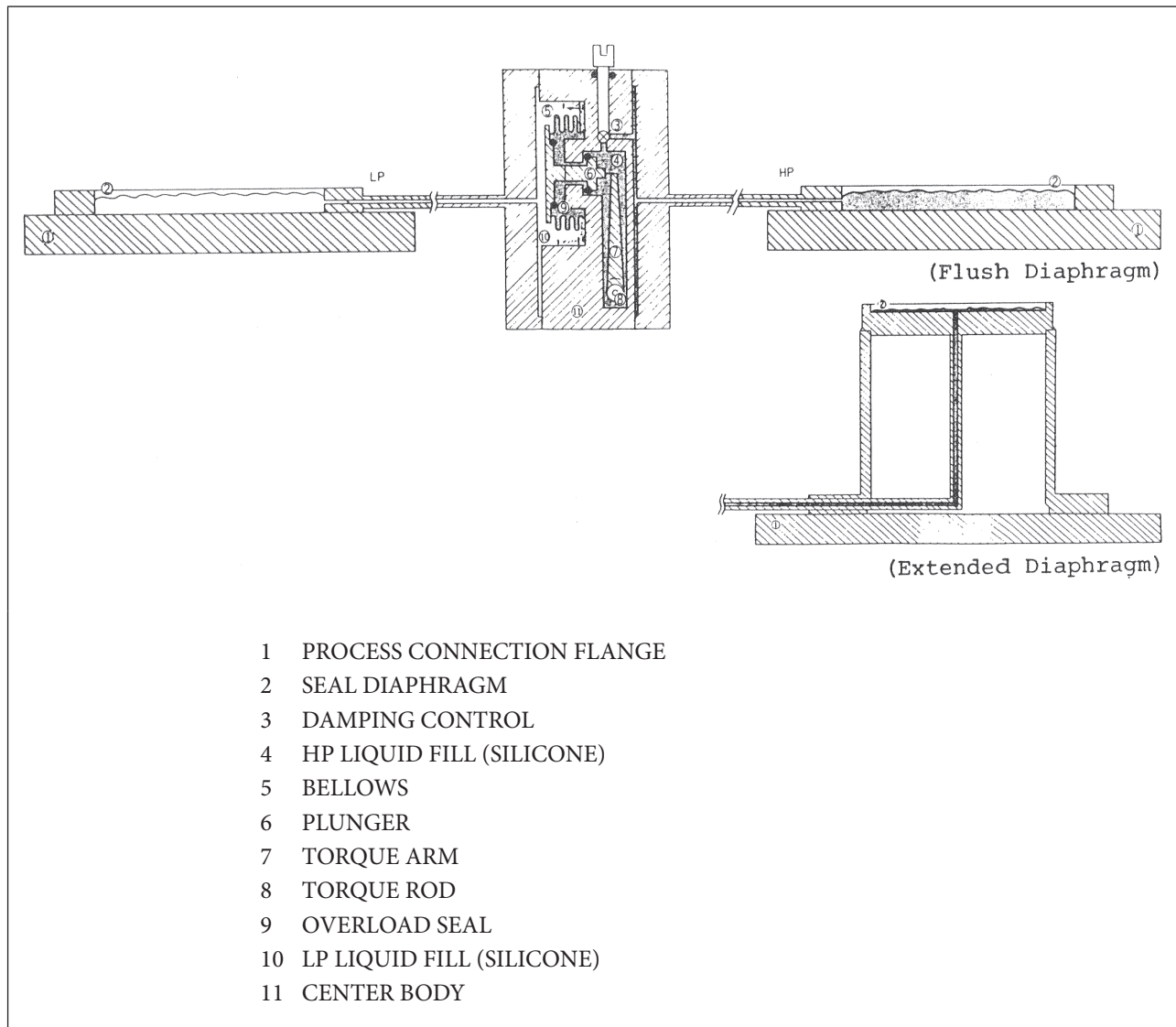


Fig. 2-5. Operating Principle of Meter Body

Chapter 3. INSTALLATION

3-1. GENERAL

The meter body (detector), together with the instrument (transmitter) coupled to it, can be installed on a 50 mm pipe stanchion by using the accessory bracket and U-shape bolt.

Model 61/62 meter body can be installed simply by fixing its flange to the process.

3-2. BRACKET AND BOLTS

There are two types of mounting brackets. The bracket and bolts for installation are supplied accompanying each meter body.

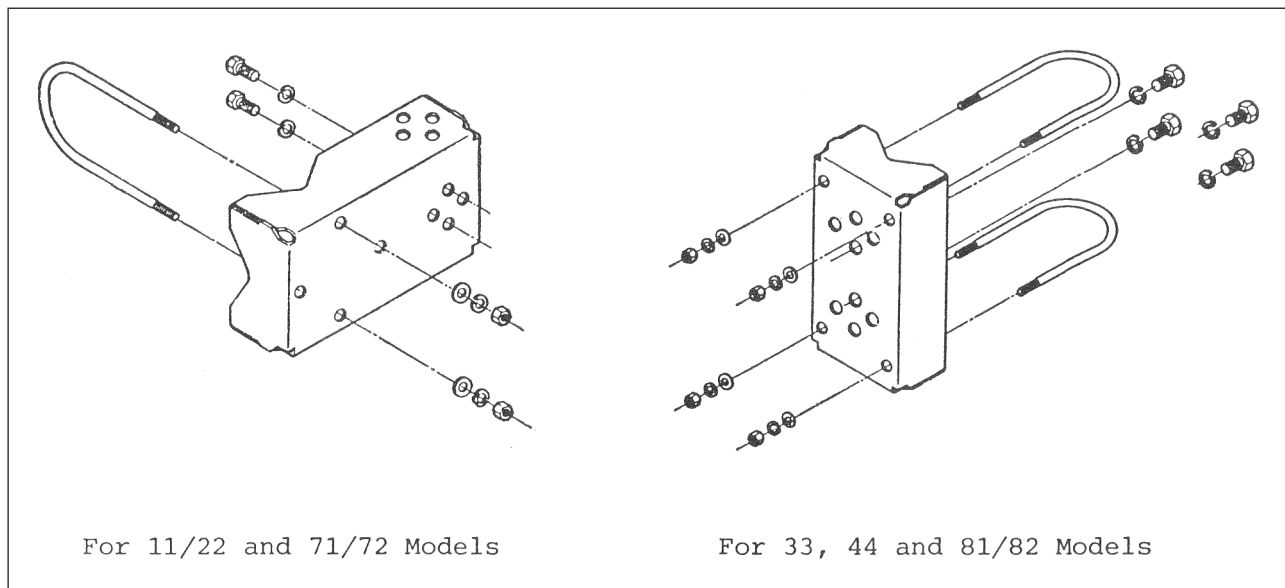


Fig. 3-1. Mounting Brackets

3-3. PLACE OF INSTALLATION

When selecting a place of installation for the instrument, take into consideration the matters related to instrument inspection, maintenance, longevity, and operation safety as follows:

- (1) Select a place where temperature change is small (within the limits of -30°C to $+80^{\circ}\text{C}$).
Avoid a place where the instrument is exposed to high temperature by radiation from a source of heat.
When water is measured, pay attention to freezing which may cause damage to the meter body. Provide appropriate means to guard against freezing.
- (2) Select a place where is reasonably free from humidity and vibration.
- (3) Be sure to provide spaces for inserting a screwdriver for adjustment and span change.

3-4. INSTALLATION METHOD

Install the meter body in such attitude that its diaphragm or bellows planes are made vertical.

3-4-1. Installation of Regular-type Meter Body

The meter body, together with the transmitter coupled to it, can be installed in either one of the following methods:

- Pipe stanchion mount
- Process pipe mount

In either case, fix the meter body to a 50 mm vertical or horizontal pipe using the mounting bracket and U-shape bolt. Fix the pipe securely to a foundation so that the pipe does not sway. (See Fig. 3-3)

To install the meter body on a process pipe line, prepare brackets for mounting the 50 mm pipe to the process pipe. (See Fig. 3-2)

When installing a remote-sealed type of meter body, exercise care not to sharply bend or twist the capillary tube and not to damage the diaphragm.

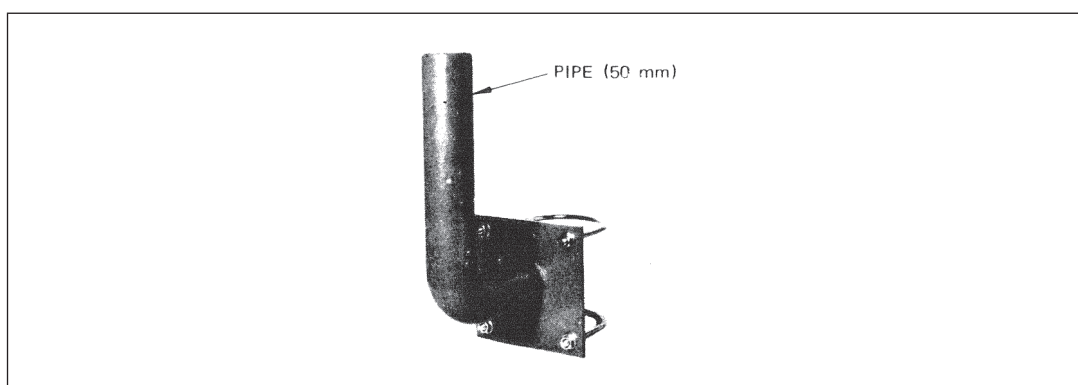


Fig. 3-2. Example of Line Mount Bracket

Note: When installing the transmitter (meter body) on a 50 mm pipe, note that the order of mountings (transmitter, bracket, and 50 mm pipe) differs depending on the mounting direction.

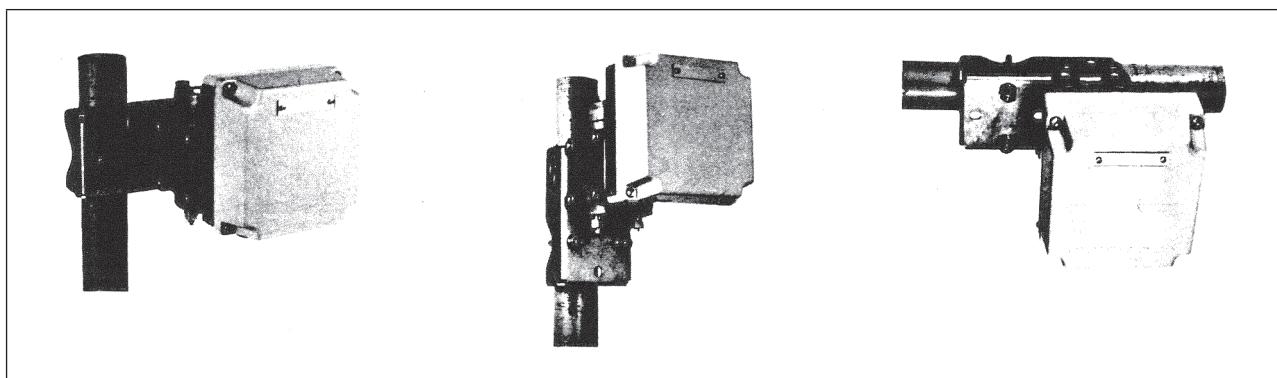


Fig. 3-3. Installation Examples

3-4-2. Installation of Model 61/62/71/72

Connect the detector flange to a process flange*. Tighten the bolts uniformly. The center of the flange represents the zero point of the liquid level. (See Fig. 3-5) If the zero point is raised, the head increases by a corresponding amount.

* Flange gaskets are to be prepared by customer.

When using a semi metallic gasket or a rubber gasket, select an one whose shape is such that it will not be brought into contact with the detector diaphragm (95 mm dia.).

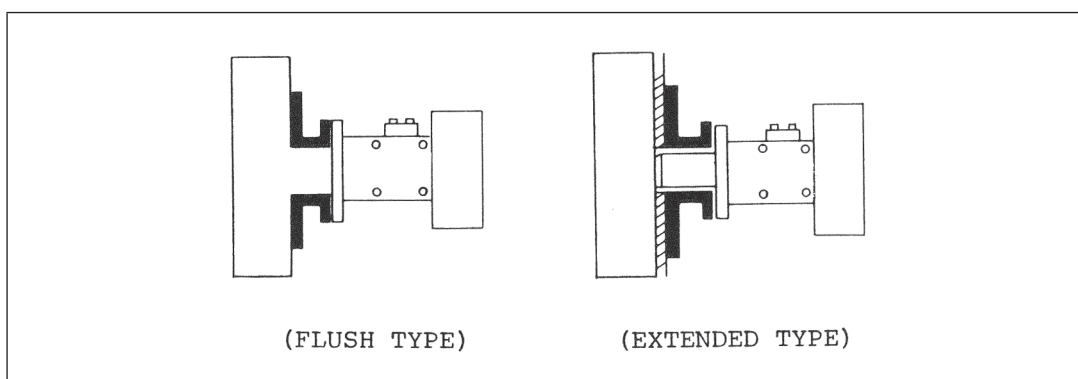


Fig. 3-4. Connection to Process Vessel

3-4-3. Mounting Attitude

When the meter body is incorporated with a vent provision, install it in such attitude that vent can be fully done. Entrapped drain and other foreign matter remaining in the meter body will adversely affect measurement.

It is ideal to install the meter body so that its diaphragm or bellows planes are made vertical. After installation is over, perform ZERO adjustment*.

* Refer to the section for calibration.

When a diaphragm pressure receiver type of meter body (Models 61/62, 71/72) is used for liquid level measurement, the zero point will be as shown in Fig. 3-5. Calculate the output referring to the dimensions and calibrate the instrument accordingly.

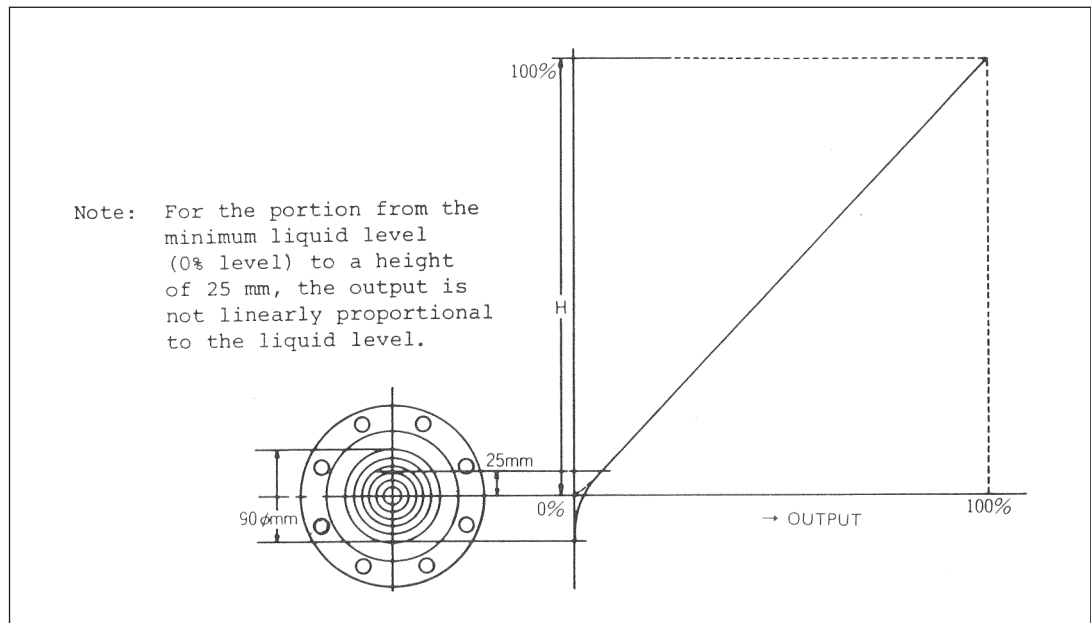


Fig. 3-5. Zero Point of Diaphragm

Note: For the portion from the minimum liquid level (0 % level) to a height of 25 mm, the output is not linearly proportional to the liquid level.

3-5. PRESSURE PIPING

3-5-1. Models 11/22/33/44/81/82

- (1) Piping method (tapping pressure connection method) may differ depending on the installation position of the instrument and the conditions of the process pipe line. In general, a manifold piping method or a manifold valve method is used. (The manifold valve is available as an option.)

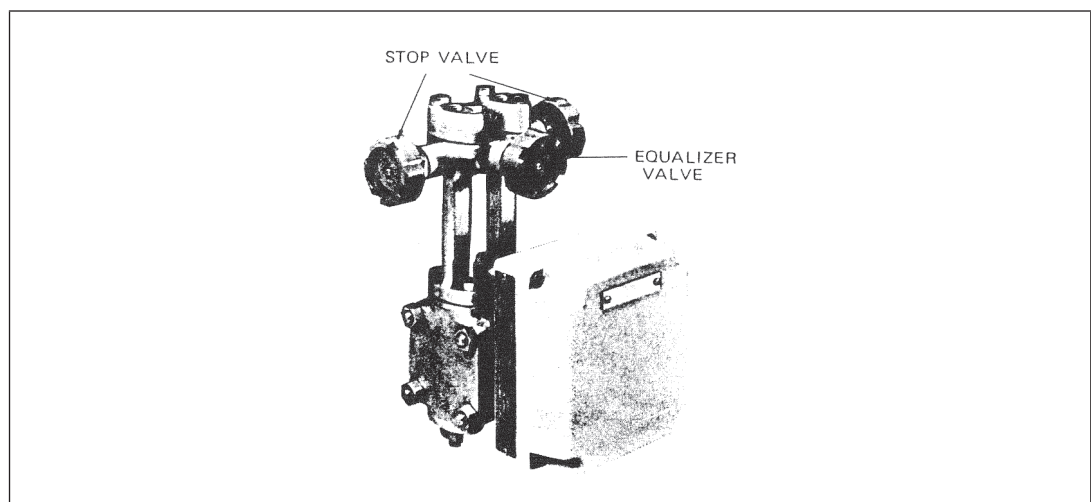


Fig. 3-6. Manifold Valve

- (2) When in flow measurement and the meter body is installed lower than the pipe line, it is recommended to provide blow pipes.

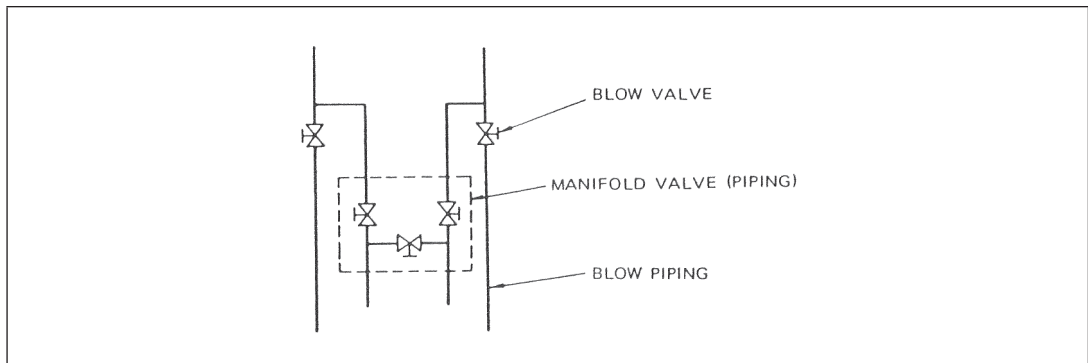


Fig. 3-7. Blow Piping

- (3) For the pressure connection piping from the pressure tap position to the transmitter, provide a gradient so that drain is returned through the tapping position to the process line.
- (4) Regarding the process pressure connection ports of the meter body, the high pressure side (HP) is located to the right and the low pressure side (LP) to the left as viewed from the front of the meter body (transmitter).
If the high pressure side and low pressure side are required to be used in the reverse from the viewpoint of piping, use a Reverse Unit*.

* The Reverser Unit is available as an option. This unit cannot be used for Model 81/82.

- (5) For the pipes for pressure tapping from the process pipe, use pressure pipes of appropriate schedule number and nominal thickness. A typical example in 1/2-inch Schedule 80 steel pipe. For measurement of water or steam, copper pipes are used in general. Examples of pressure piping are shown in Fig. 3-8.

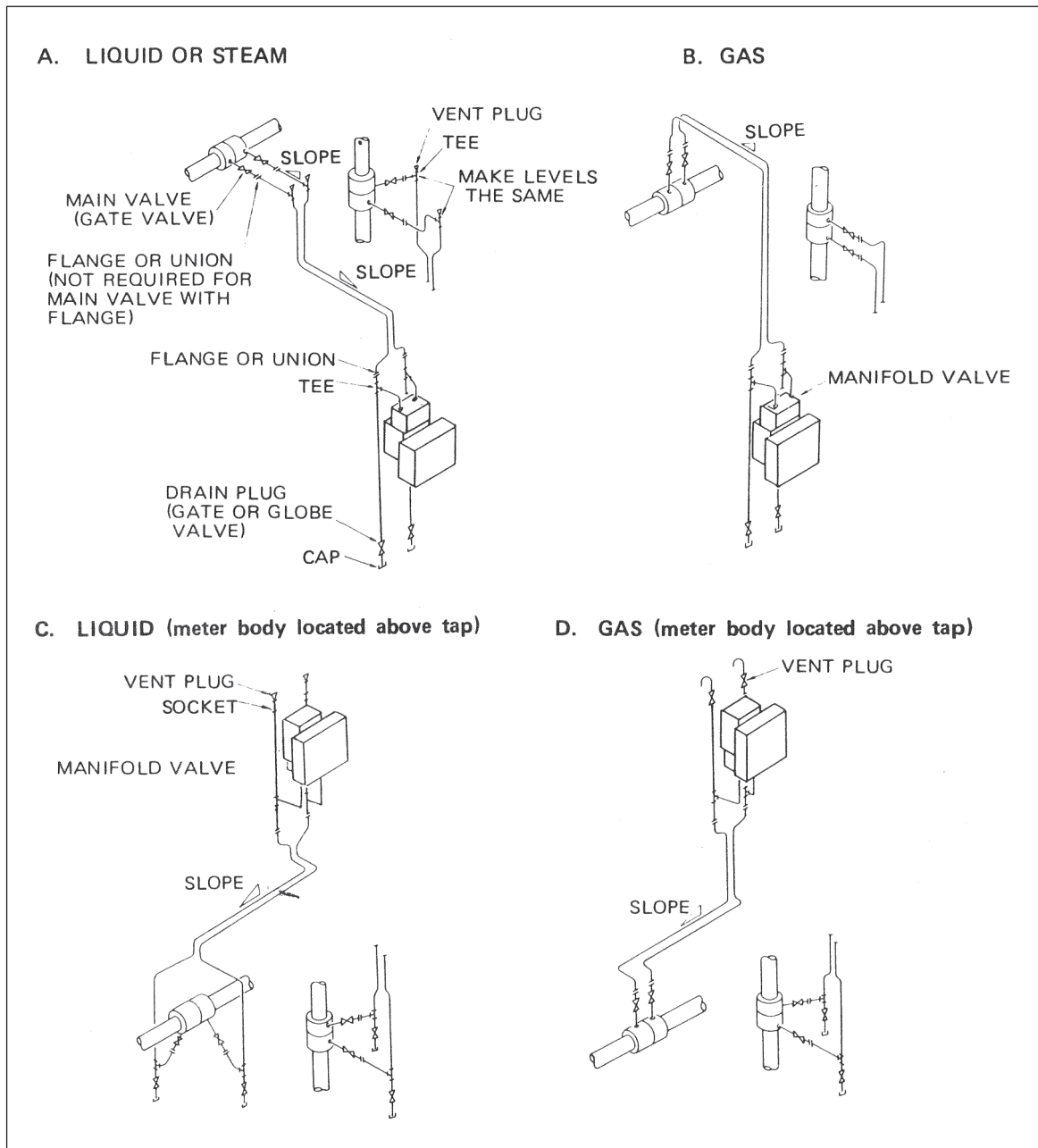


Fig. 3-8. Pressure Piping for Flow Measurement

(6) To change connections to process:

If it is required to change process connections (vent and drain) between upper and lower positions, remove the two flanges of the connection ports and also the plugs of vent and drain, and change the positions between upper and lower. (Refer to the overall dimension drawings.)

(7) Pressure tapping methods:

For tapping methods of process pressures, refer to the illustrations given in this section. The "H" is the high pressure side of the meter body and the "L" is the low pressure side. They are marked on the meter body.

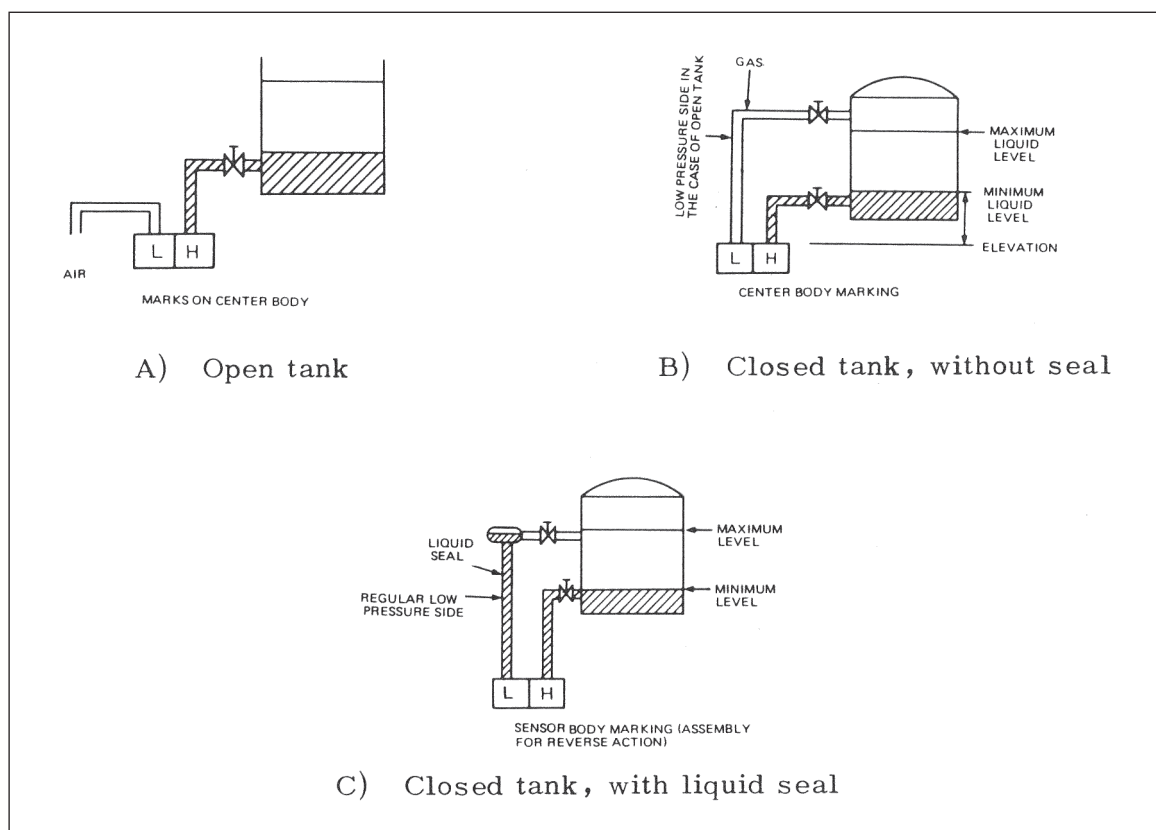


Fig. 3-9. Connections of Pressure Pipes for Liquid Level Measurement

The liquid level corresponding to the difference between the 0 % level and the center of the meter body is given from the beginning. In the case of A or B shown in Fig. 3-9, make compensation (provide an elevation) for the corresponding amount and set the output at 0.2 to 1.0 kgf/cm² for liquid level 0 to 100 %. In the case of C, a pressure corresponding to the head of the seal liquid is applied to the low pressure side to the state of A or B and consequently the high/low relationship between the H side and L side of the meter body is in the reverse. Therefore, compensation (suppression) should be made for the seal liquid head for the difference between 100 % level position and 0 % level position. For "elevation" and "suppression", refer to Section 3-6.

3-5-2. Connection of Flange Type Meter Body to Process

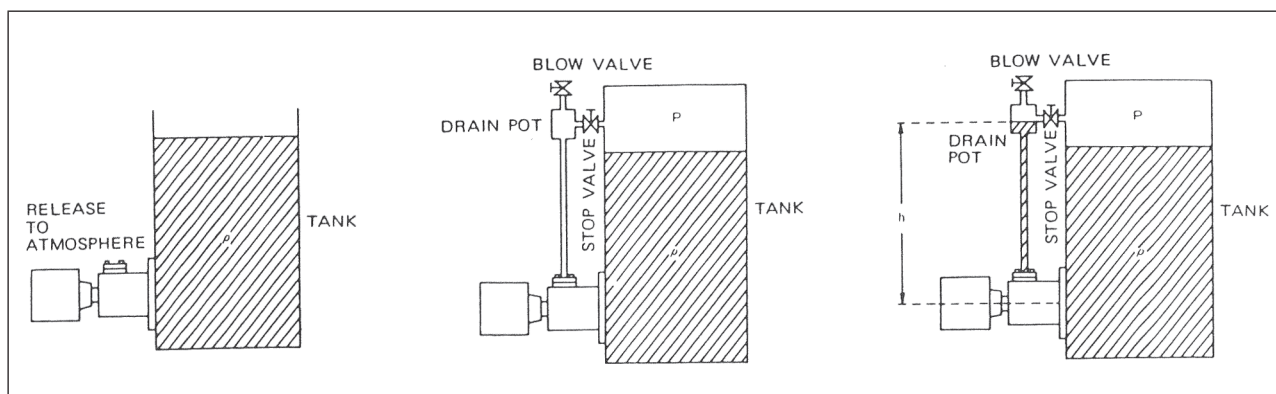


Fig. 3-10. Process Connections of Model 61/62 for Liquid Level Measurement

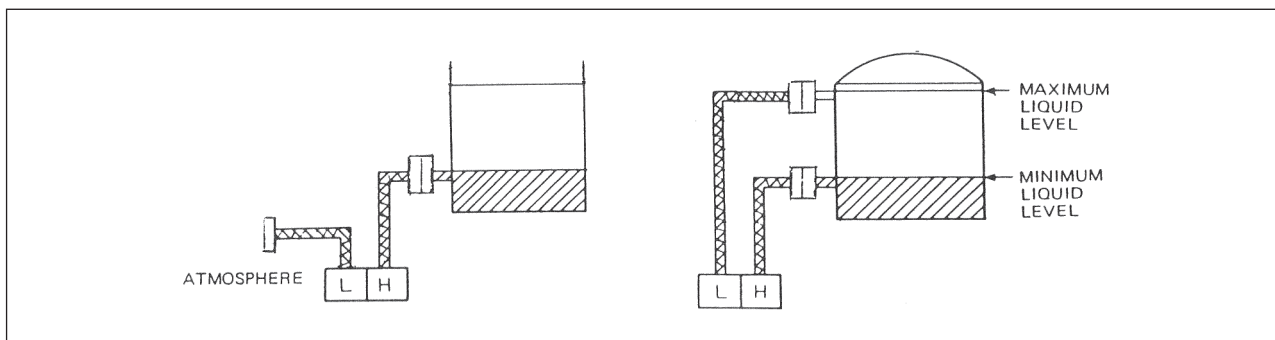


Fig. 3-11. Process Connections of Model 71/72 for Liquid Level Measurement

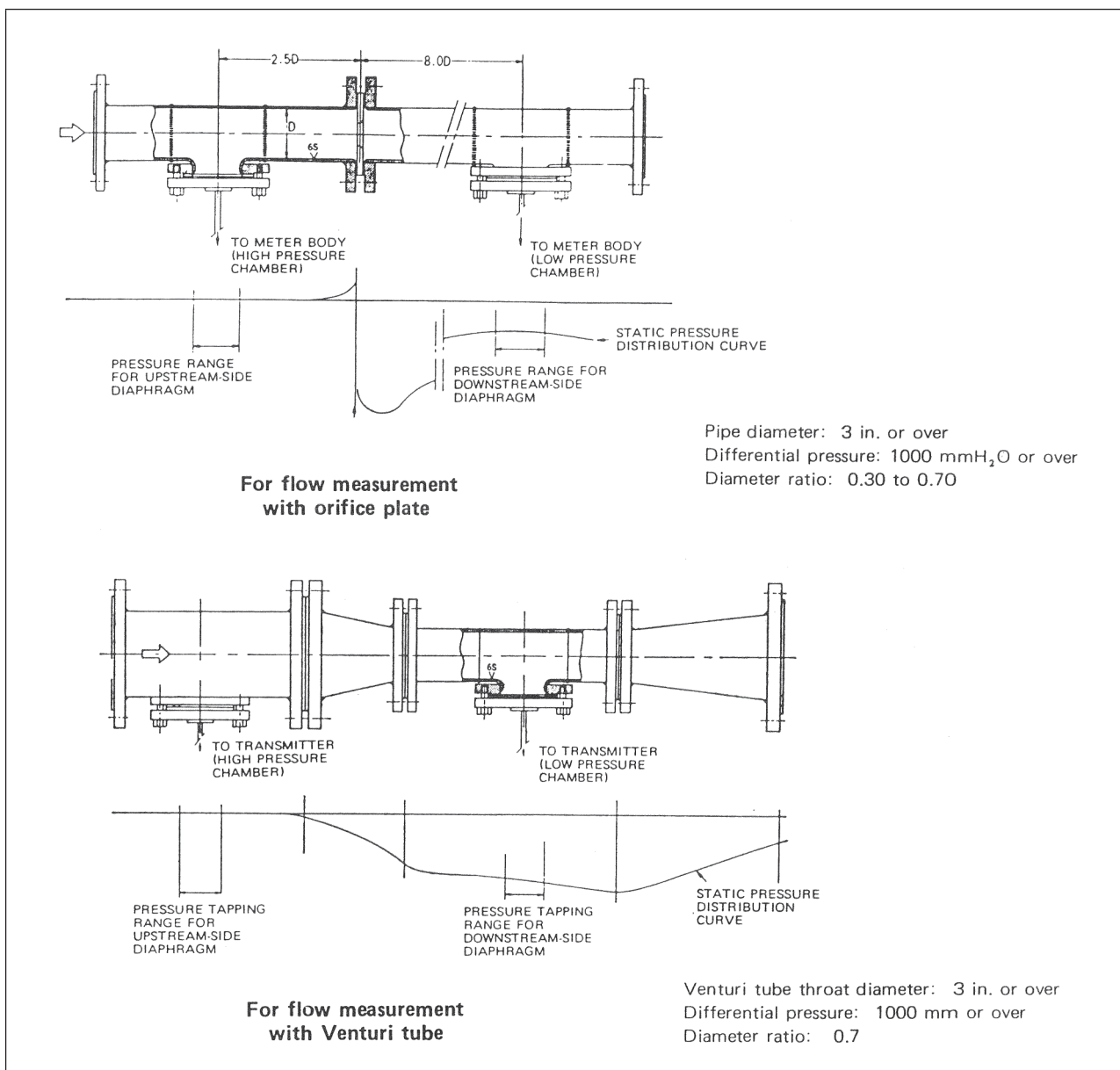


Fig. 3-12. Pressure Tapping for Model 71/72 for Flow Measurement

- (1) Fix the flanges of the meter body to those of the process side by using gaskets and bolts. Be sure to uniformly and securely tighten the bolts in order to prevent leak. Lay the capillary tubes in such manner that they are less subjected to large temperature change. Fix them so that they do not move.

- (2) Regarding the flange of the low pressure side when in level measurement of an open tank, fix it securely at a position where it will be less subjected to temperature change and mechanical vibration. Position the LP side flange at a height lower than that of the minimum liquid level.

Regarding the seal diaphragm, protect it so that it is not damaged and pay attention so that no drain is entrapped on it and no dust is collected on it.

- (3) For flow measurement, tapping for the differential pressure must be done in the "pipe tap" system. Therefore, locate the high-pressure-side tap at a location of $2.5D$ (D denotes the inside diameter of the process pipe) from the upstream side of the orifice and locate the low-pressure-side tap at a location of $8D$ from the downstream side of the orifice.

The tapping connection is of a 3-inch flange connection type. The flanges of the extension seal type of meter body can be directly used as the tapping flanges.

3-6. ELEVATION AND SUPPRESSION

3-6-1. Definitions of Elevation and Suppression

The terms "elevation" and "suppression" as used in this publication are defined as follows:

Elevation: Synonymous with "suppressed zero range"
An input range whose low end value is higher than zero.
For example, a range of 20 to 100.

Suppression: Synonymous with "elevated zero range"
An input range whose low end value is lower than zero.
For example, a range of -20 to 0.

3-6-2. Setting of Elevation/Suppression

For setting of elevation/suppression, refer to Section "CALIBRATION AND ADJUSTMENT" of Operator's Manual for Pneumatic Transmitter OM2-522-000.

Note: The specific-gravity of the liquid fill of Models 71/72 is 0.935 at 20 °C. (For temperature compensation, use a factor of $0.001/^{\circ}\text{C}$)

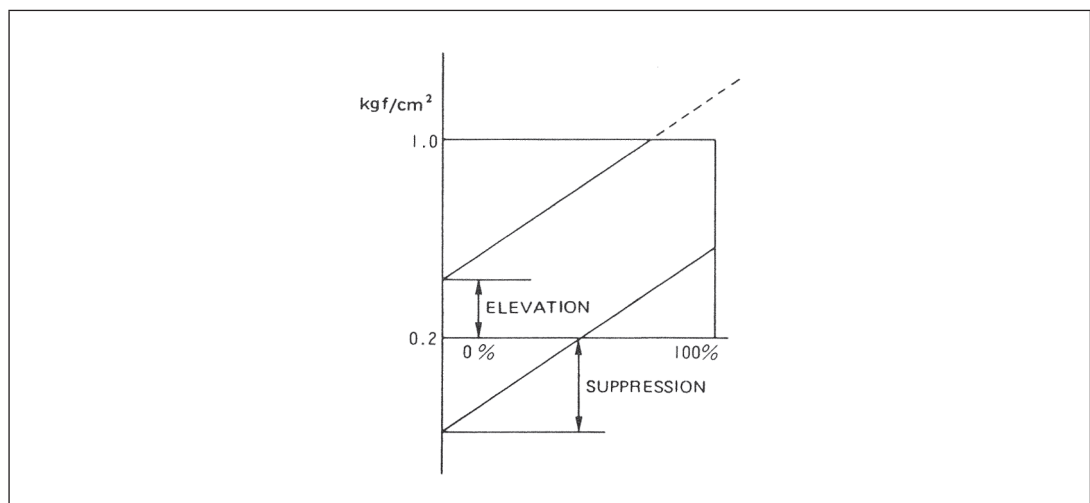


Fig. 3-13. Elevation and Suppression

	Open Tank	Closed tank (without seal liquid)	Close tank (with seal liquid)
11, 22, 33, 44, 81, 82	Provide suppression corresponding to differential level between zero liquid level and center of pressure receiver multiplied by specific-gravity of liquid measured. Ⓐ		Provide suppression by amount corresponding to measuring liquid level multiplied by specific-gravity of measured liquid (seal liquid).
61, 62	No elevation/suppression is needed if the imaginary zero liquid level* conforms with center position of diaphragm of flange connection section. * Refer to Section 3-4-3 If the zero liquid level is higher than center position of diaphragm, provide elevation by an amount corresponding to the height multiplied specific-gravity of liquid measured. Ⓑ		Subtract from suppression the difference between zero liquid level and center position of diaphragm as elevation. Ⓒ
71, 72	Provide elevation by an amount corresponding to difference between center positions of HP and LP flange diaphragms multiplied by specific-gravity of seal liquid. When zero liquid level is higher than center position of HP flange diaphragm, add as elevation an amount corresponding to the height multiplied by specific-gravity of measured liquid. Ⓓ	Provide suppression by an amount corresponding to difference between center position of HP and LP flange diaphragms multiplied by specific-gravity of seal liquid. When zero liquid level is higher than center position of HP flange diaphragm, subtract from the above suppression an amount corresponding to the height multiplied by specific-gravity of measured liquid as elevation. Ⓔ	Not applicable

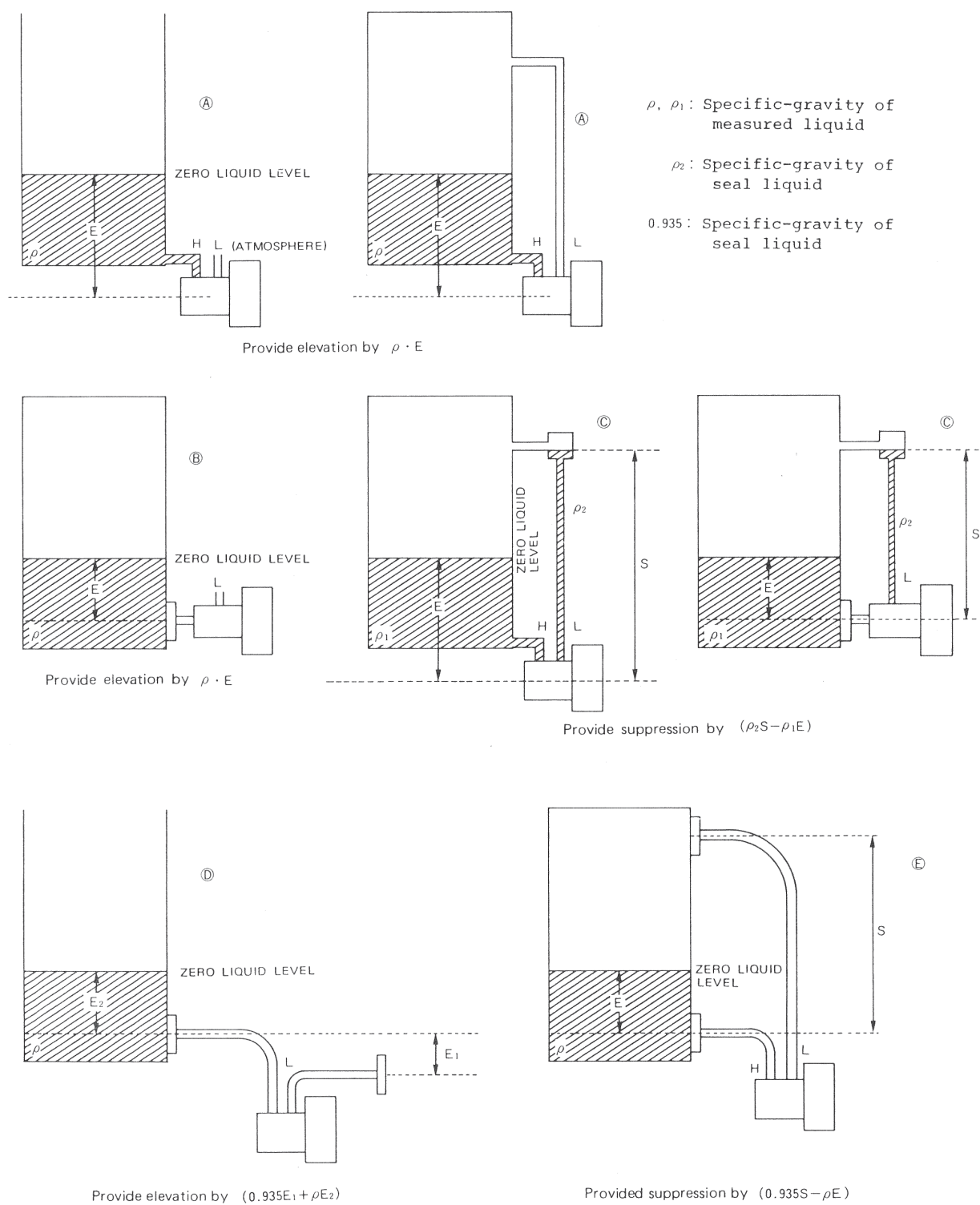


Fig. 3-14. Calculation of Elevation/Suppression Values

Chapter 4. OPERATION METHOD

The meter body, together with the transmitter coupled to it, starts operating as the air supply and process input are fed to it. (It is recommendable to check the operation of the transmitter before starting the running operation.)

4-1. DIFFERENTIAL PRESSURE (FLOW) TRANSMISSION

The operation method (start up procedure) here is described assuming that manifold valves and blow piping are prepared as shown in Section 3-5-1 of Part "Chapter 3. INSTALLATION." Of Model 71 or 72, operation is ready when its installation is over.

- (1) Check that piping is correctly done.
- (2) Unless self drain or self vent piping is done, liquid or gas will be entrapped in the measuring chambers and pressure connection pipes, thereby causing measurement errors. Be sure to drain out or vent out such liquid or gas. The same applies regardless of whether manifold valves are used or manifold piping is done. For the procedure, refer to Part "Chapter 5. INSPECTION AND MAINTENANCE."
- (3) Zero point check:
When the instrument has become the measuring state, set a receiver instrument and check and adjust the zero point as follows: Of the manifold valves, close the stop valves of both high and low pressure sides and then open the equalizer valve.
Next, open the stop valve of the high pressure side alone so that the process pressure of the high side alone is applied to both high and low pressure chambers of the meter body. Under this state, check the zero point. After the zero point check is complete, close the equalizer valve and then open the stop valve of the low pressure side.
- (4) Operating procedure:
To start operating the meter body from the state that all valves are closed, open or close them in the due order as noted in the following:
 - (1) Open the equalizer valve.
 - (2) Open the stop valve of low pressure side tapping-pipe and the stop valve of low pressure side of manifold.
 - (3) Open the stop valve of high pressure side tapping-pipe and the stop valve of high pressure side of manifold.
 - (4) Close the equalizer valve.

4-2. LIQUID LEVEL TRANSMISSION

The operation method (start up procedure) here is described assuming that the meter body is installed as shown in Sections 3-5-1 Fig. 3-9 and 3-5-2 of Part "Chapter 3. INSTALLATION". No operation procedure is needed for the process connections with flanges (diaphragms). Of Model 71 or 72, operation is ready when its installation is over.

- (1) Check that piping is correctly done.
- (2) Unless self drain or self vent piping is done, liquid or gas will be entrapped in the measuring chambers and pressure connection pipes, thereby causing measurement errors. Be sure to drain out or vent out such liquid or gas. For the procedure, refer to Part "Chapter 5. INSPECTION AND MAINTENANCE."
- (3) Zero point check:
When the instrument has become the measuring state, set a receiver instrument and check and adjust the zero point.
- (4) Open the stop valves and start operating the instrument. When seal liquid is used, full the low pressure side tapping-pipe with seal liquid.

Chapter 5. INSPECTION AND MAINTENANCE

For routine inspection and maintenance, pay attention to the following:

5-1. CHECK FOR LEAK FROM PIPING

Check that there is no leak in the piping from the pressure tap points to the meter body. If any loose connections are found, tighten them securely.

5-2. BLOW AND CLEANING OF METER BODY AND PIPING

To maintain constantly the instrument at its best performances meeting its specification accuracy, keep clean the meter body and its piping. If sediment or other foreign matters are entrapped in the pressure chambers of the meter body, measuring errors may be caused. To blow and clean the meter body and piping, proceed as mentioned in the following.

5-2-1. Blow Procedure

5-2-1-1. When No Blow Pipes are Provided

- (1) Close the stop valve of the high pressure side tapping pipe and that of the high pressure side of the manifold valve.
- (2) Check that the equalizer valve is closed.
- (3) Close the stop valve of the low pressure side tapping pipe and that of the low pressure side of the manifold valve.
- (4) Slowly open the both side vent plugs to release pressure. And shut them.
- (5) Open the stop valve of the high pressure side of the manifold valve and that of the high pressure side tapping pipe.
- (6) Open the equalizer and blow the piping via the high pressure side vent plug.
- (7) Close the equalizer valve, the stop valve of the high pressure side of the manifold valve, and that of the high pressure side tapping pipe.
- (8) Open the stop valve of the low pressure side of the manifold valve and that of the low pressure side tapping pipe.
- (9) Open the equalizer valve and blow the piping from the low pressure side vent hole.
- (10) Close all valve.
- (11) Start operating the instrument following the procedure explained in Part "Chapter 4. OPERATION METHOD."

5-2-1-2. When Blow Pipes are Provided (See Fig. 3-7 of Section 3-5, Part "Chapter 3. INSTALLATION.")

- (1) Close the stop valve of the high pressure side of the manifold valve.
- (2) Close the stop valve of the low pressure side of the manifold valve.
- (3) Slowly open the blow valves of both high and low pressure sides to drain out sediment or other entrapped substance.
- (4) Close the blow valves of both high and low pressure sides.
- (5) Open the stop valve of the low pressure side of the manifold valve.
- (6) Open the stop valve of the high pressure side of the manifold valve.

5-2-1-3. Blow of Model 61/62 Liquid Level Meter

- (1) For an open tank liquid level meter, drain out liquid by loosening the drain plug at the bottom of the low pressure side cover at appropriate intervals.
- (2) For a closed tank liquid level meter of gas sealed type, at first close the stop valve of the low pressure side tapping-pipe and then open the blow valve to vent gas at appropriate intervals.
- (3) For a closed tank liquid level meter of liquid sealed type, check the seal liquid level and replace seal liquid at appropriate intervals.
To replace seal liquid, proceed as follows: Close the stop valve of the low pressure side tapping-pipe, open the blow valve, and loosen the drain plug to drain out seal liquid. Next, tighten the drain plug, feed seal liquid from the valve for blow until seal liquid overflows from the blow valve, close the blow valve, and then open the stop valve.

5-2-2. Cleaning of Meter Body

After the blowing of the piping as described in 2.1 is over, clean the meter body as described below. Of Models 71/72 and 61/62, clean only the diaphragms outside of flanges.

- (1) Remove the covers of the meter body by removing their clamping-bolts.
- (2) Clean the diaphragm and the insides of the covers using soft brush and detergent. When doing this, be extremely careful not to deform or damage the diaphragm.
- (3) When reassembling the covers, replace gaskets with new ones as required. (Refer to 3-4-2)
- (4) Fix the clamping-bolts of the covers with the specified tightening torques as shown in the following table.

Model	Tightening torque (kgf·cm)		Material of Clamping-bolts
	When new gasket is used	When gasket is re-used	
11/22, 61/62	450	300	Chrome molybdenum steel
33	450	300	Chrome molybdenum steel
44	200		Chrome molybdenum steel
81/82	1400		Chrome molybdenum steel

5-2-3. Notes for Use in Freezing Season

When the transmitter used for measurement of water or other freezable liquid is paused in a freezing season or area, loosen the drain plugs and drain out liquid from the pressure chambers to prevent freezing.

Terms and Conditions

We would like to express our appreciation for your purchase and use of Azbil Corporation's products.

You are required to acknowledge and agree upon the following terms and conditions for your purchase of Azbil Corporation's products (system products, field instruments, control valves, and control products), unless otherwise stated in any separate document, including, without limitation, estimation sheets, written agreements, catalogs, specifications and instruction manuals.

1. Warranty period and warranty scope

1.1 Warranty period

Azbil Corporation's products shall be warranted for one (1) year from the date of your purchase of the said products or the delivery of the said products to a place designated by you.

1.2 Warranty scope

In the event that Azbil Corporation's product has any failure attributable to azbil during the aforementioned warranty period, Azbil Corporation shall, without charge, deliver a replacement for the said product to the place where you purchased, or repair the said product and deliver it to the aforementioned place. Notwithstanding the foregoing, any failure falling under one of the following shall not be covered under this warranty:

- (1) Failure caused by your improper use of azbil product (noncompliance with conditions, environment of use, precautions, etc. set forth in catalogs, specifications, instruction manuals, etc.);
- (2) Failure caused for other reasons than Azbil Corporation's product;
- (3) Failure caused by any modification or repair made by any person other than Azbil Corporation or Azbil Corporation's subcontractors;
- (4) Failure caused by your use of Azbil Corporation's product in a manner not conforming to the intended usage of that product;
- (5) Failure that the state-of-the-art at the time of Azbil Corporation's shipment did not allow Azbil Corporation to predict; or
- (6) Failure that arose from any reason not attributable to Azbil Corporation, including, without limitation, acts of God, disasters, and actions taken by a third party.

Please note that the term "warranty" as used herein refers to equipment-only-warranty, and Azbil Corporation shall not be liable for any damages, including direct, indirect, special, incidental or consequential damages in connection with or arising out of Azbil Corporation's products.

2. Ascertainment of suitability

You are required to ascertain the suitability of Azbil Corporation's product in case of your use of the same with your machinery, equipment, etc. (hereinafter referred to as "Equipment") on your own responsibility, taking the following matters into consideration:

- (1) Regulations and standards or laws that your Equipment is to comply with.
- (2) Examples of application described in any documents provided by Azbil Corporation are for your reference purpose only, and you are required to check the functions and safety of your Equipment prior to your use.
- (3) Measures to be taken to secure the required level of the reliability and safety of your Equipment in your use

Although azbil is constantly making efforts to improve the quality and reliability of Azbil Corporation's products, there exists a possibility that parts and machinery may break down. You are required to provide your Equipment with safety design such as fool-proof design,*1 and fail-safe design*2 (anti-flame propagation design, etc.), whereby preventing any occurrence of physical injuries, fires, significant damage, and so forth. Furthermore, fault avoidance,*3 fault tolerance,*4 or the like should be incorporated so that the said Equipment can satisfy the level of reliability and safety required for your use.

*1. A design that is safe even if the user makes an error.

*2. A design that is safe even if the device fails.

*3. Avoidance of device failure by using highly reliable components, etc.

*4. The use of redundancy.

3. Precautions and restrictions on application

3.1 Restrictions on application

Please follow the table below for use in nuclear power or radiation-related equipment.

	Nuclear power quality*5 required	Nuclear power quality*5 not required
Within a radiation controlled area*6	Cannot be used (except for limit switches for nuclear power*7)	Cannot be used (except for limit switches for nuclear power*7)
Outside a radiation controlled area*6	Cannot be used (except for limit switches for nuclear power*7)	Can be used

*5. Nuclear power quality: compliance with JEAG 4121 required

*6. Radiation controlled area: an area governed by the requirements of article 3 of "Rules on the Prevention of Harm from Ionizing Radiation," article 2 2 4 of "Regulations on Installation and Operation of Nuclear Reactors for Practical Power Generation," article 4 of "Determining the Quantity, etc., of Radiation-Emitting Isotopes," etc.

*7. Limit switch for nuclear power: a limit switch designed, manufactured and sold according to IEEE 382 and JEAG 4121.

Any Azbil Corporation's products shall not be used for/with medical equipment.

The products are for industrial use. Do not allow general consumers to install or use any Azbil Corporation's product. However, azbil products can be incorporated into products used by general consumers. If you intend to use a product for that purpose, please contact one of our sales representatives.

3.2 Precautions on application

you are required to conduct a consultation with our sales representative and understand detail specifications, cautions for operation, and so forth by reference to catalogs, specifications, instruction manual, etc. in case that you intend to use azbil product for any purposes specified in (1) through (6) below. Moreover, you are required to provide your Equipment with fool-proof design, fail-safe design, anti-flame propagation design, fault avoidance, fault tolerance, and other kinds of protection/safety circuit design on your own responsibility to ensure reliability and safety, whereby preventing problems caused by failure or nonconformity.

- (1) For use under such conditions or in such environments as not stated in technical documents, including catalogs, specification, and instruction manuals
- (2) For use of specific purposes, such as:
 - * Nuclear energy/radiation related facilities
[When used outside a radiation controlled area and where nuclear power quality is not required]
[When the limit switch for nuclear power is used]
 - * Machinery or equipment for space/sea bottom
 - * Transportation equipment
[Railway, aircraft, vessels, vehicle equipment, etc.]
 - * Antidisaster/crime-prevention equipment
 - * Burning appliances
 - * Electrothermal equipment
 - * Amusement facilities
 - * Facilities/applications associated directly with billing
- (3) Supply systems such as electricity/gas/water supply systems, large-scale communication systems, and traffic/air traffic control systems requiring high reliability
- (4) Facilities that are to comply with regulations of governmental/public agencies or specific industries
- (5) Machinery or equipment that may affect human lives, human bodies or properties
- (6) Other machinery or equipment equivalent to those set forth in items (1) to (5) above which require high reliability and safety

4. Precautions against long-term use

Use of Azbil Corporation's products, including switches, which contain electronic components, over a prolonged period may degrade insulation or increase contact-resistance and may result in heat generation or any other similar problem causing such product or switch to develop safety hazards such as smoking, ignition, and electrification. Although acceleration of the above situation varies depending on the conditions or environment of use of the products, you are required not to use any Azbil Corporation's products for a period exceeding ten (10) years unless otherwise stated in specifications or instruction manuals.

5. Recommendation for renewal

Mechanical components, such as relays and switches, used for Azbil Corporation's products will reach the end of their life due to wear by repetitious open/close operations.

In addition, electronic components such as electrolytic capacitors will reach the end of their life due to aged deterioration based on the conditions or environment in which such electronic components are used. Although acceleration of the above situation varies depending on the conditions or environment of use, the number of open/close operations of relays, etc. as prescribed in specifications or instruction manuals, or depending on the design margin of your machine or equipment, you are required to renew any Azbil Corporation's products every 5 to 10 years unless otherwise specified in specifications or instruction manuals. System products, field instruments (sensors such as pressure/flow/level sensors, regulating valves, etc.) will reach the end of their life due to aged deterioration of parts. For those parts that will reach the end of their life due to aged deterioration, recommended replacement cycles are prescribed. You are required to replace parts based on such recommended replacement cycles.

6. Other precautions

Prior to your use of Azbil Corporation's products, you are required to understand and comply with specifications (e.g., conditions and environment of use), precautions, warnings/cautions/notices as set forth in the technical documents prepared for individual Azbil Corporation's products, such as catalogs, specifications, and instruction manuals to ensure the quality, reliability, and safety of those products.

7. Changes to specifications

Please note that the descriptions contained in any documents provided by azbil are subject to change without notice for improvement or for any other reason. For inquiries or information on specifications as you may need to check, please contact our branch offices or sales offices, or your local sales agents.

8. Discontinuance of the supply of products/parts

Please note that the production of any Azbil Corporation's product may be discontinued without notice. After manufacturing is discontinued, we may not be able to provide replacement products even within the warranty period.

For repairable products, we will, in principle, undertake repairs for five (5) years after the discontinuance of those products. In some cases, however, we cannot undertake such repairs for reasons, such as the absence of repair parts. For system products, field instruments, we may not be able to undertake parts replacement for similar reasons.

9. Scope of services

Prices of Azbil Corporation's products do not include any charges for services such as engineer dispatch service. Accordingly, a separate fee will be charged in any of the following cases:

- (1) Installation, adjustment, guidance, and attendance at a test run
- (2) Maintenance, inspection, adjustment, and repair
- (3) Technical guidance and technical education
- (4) Special test or special inspection of a product under the conditions specified by you

Please note that we cannot provide any services as set forth above in a nuclear energy controlled area (radiation controlled area) or at a place where the level of exposure to radiation is equivalent to that in a nuclear energy controlled area.

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