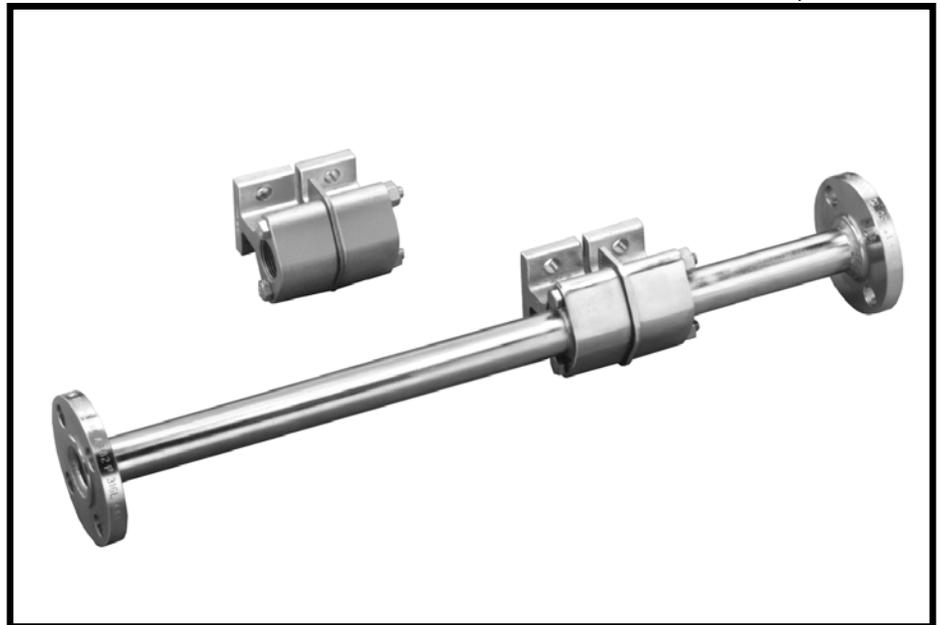


INSTRUCTION MANUAL

INTEGRAL ORIFICE FLOW ELEMENT with Upstream and Downstream Piping and Threaded Connections

1330L Series, Model A



IB-04H104_8

The Company

ABB Instrumentation is an established world force in the design and manufacture of instrumentation for industrial process control, flow measurement, gas and liquid analysis and environmental applications.

As a part of ABB, a world leader in process automation technology, we offer customers application expertise, service and support worldwide.

We are committed to teamwork, high quality manufacturing, advanced technology and unrivaled service and support.

The quality, accuracy and performance of the Company's products result from over 100 years experience, combined with a continuous program of innovative design and development to incorporate the latest technology.

The NAMAS Calibration Laboratory No. 0255(B) is just one of the ten flow calibration plants operated by the Company, and is indicative of ABB Instrumentation's dedication to quality and accuracy.

BS EN ISO 9001



St Neots -
Certificate No. Q5907
Stonehouse -
Certificate No. FM 21106

ISO 9001



Rochester, USA -
Certificate No. AQ-8618



EN 29001 (ISO 9001)



Lenno, Italy -
Certificate No. 90/90A



Stonehouse -
Certificate No. 0255

Use of Instructions

 **Warning.** An instruction that draws attention to the risk of injury or death.

 **Note.** Clarification of an instruction or additional information.

 **Caution.** An instruction that draws attention to the risk of the product, process or surroundings.

 **Information.** Further reference for more detailed information or technical details.

Although Warning hazards are related to personal injury, and **Caution** hazards are associated with equipment or property damage, it must be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process system performance leading to personal injury or death. Therefore, comply fully with all **Warning** and **Caution** notices.

Information in this manual is intended only to assist our customers in the efficient operation of our equipment. Use of this manual for any other purpose is specifically prohibited and its contents are not to be reproduced in full or part without prior approval of ABB Instrumentation.

Licensing, Trademarks and Copyrights

Hastelloy-C is a trademark of Haynes International, Inc; **LA-CO**
Oxytite is a trademark of Lake Chemical Co.

Health and Safety

To ensure that our products are safe and without risk to health, the following points must be noted:

1. The relevant sections of these instructions must be read carefully before proceeding.
2. Warning Labels on containers and packages must be observed.
3. Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given or injury or death could result.
4. Normal safety procedures must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and/or temperature.
5. Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
6. When disposing of chemicals, ensure that no two chemicals are mixed.

Safety advice concerning the use of the equipment described in this manual may be obtained from the Company address on the back cover, together with servicing and spares information.

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READ FIRST

WARNING

INSTRUCTION MANUALS

Do not install, maintain, or operate this equipment without reading, understanding and following the proper factory-supplied instructions and manuals, otherwise injury or damage may result.

RETURN OF EQUIPMENT

All flowmeters and equipment being returned to the factory for repair must be free of any hazardous materials (acids, alkalis, solvents, etc). A Material Safety Data Sheet (MSDS) for all process liquids must accompany returned equipment. Contact the factory for authorization prior to returning equipment.

Read these instructions before starting installation; save these instructions for future reference.

Contacting the Factory . . .

Should assistance be required with any of the company's products, contact the following:

Telephone:

24-Hour Call Center 1-800-HELP-365

E-Mail:

ins.techsupport@us.abb.com

1 INTRODUCTION

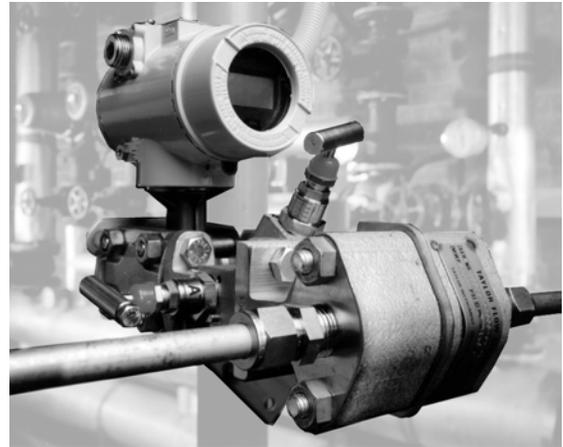
1.1 DESCRIPTION

The ABB Integral Orifice Flow Elements are primary measuring elements which sense fluid flow and develop a differential pressure as a function of the volume flow rate. This differential pressure is measured by an ABB differential pressure transmitter. The differential pressure measurement can be related to volume flow rate by using either a calibration report for the specific element or a standard flow equation applying to all integral orifice elements. A calibration report based on an ABB Flow Laboratory calibration is supplied with the element when specified on the order. Refer to **3.2 Accuracy** and **3.3 Flow Equations**.

The element connects directly to a standard differential pressure transmitter with a 2-1/8 inch center-to-center distance between the high and low pressure ports to make a complete flowmeter. The ABB transmitters which accept these flow elements are available with either electronic or pneumatic output.

The elements are available with several different orifice bore diameters to provide the required differential pressures over a wide range of flow rates. The orifice plate is removable, permitting the orifice bore to be changed in the field if the process requirements change. Elements with threaded connections have an optional cleaning for use on oxygen service applications.

On elements with piping, the upstream and downstream piping is welded to the body of the element. The piping is available in either 1/2-inch, 1-inch, or 1-1/2-inch sizes, and the pipe sections have flanged end connections with several flange options available. The pipe sections provide the minimum straight pipe length required for accurate measurement. The material of the orifice body, pipe, and flanges is type 316 SST.



1.2 EXPLANATION OF SERIAL AND CATALOG NUMBERS

The serial number stamped on the data plate consists of the catalog number and a sequential identification number. The catalog number describes the construction of the element. An X before the catalog number indicates that the element has been built to meet a customer's special requirements.

INTRODUCTION

BASIC CATALOG NUMBER

1330L - Integral Orifice Flow Element

ELECTRICAL CODE

Z - No Electrical Components

PIPE SIZE AND ORIFICE BORE

Refer to Table 1-1 for description of digits

UPSTREAM & DOWNSTREAM PIPING AND MATING FLANGE CONNECTIONS

- 0 - None
- 1 - Class 150 ANSI flanges / Sch 40 Pipe
- 2 - Class 300 ANSI flanges / Sch 40 Pipe
- A - Class 150 ANSI flanges / Sch 80 Pipe
- B - Class 300 ANSI flanges / Sch 80 Pipe

MATERIAL OF CONSTRUCTION

- 0 - Type 316 SST with Type 316 SST Orifice Plate
- 4 - Type 316 SST with Hastelloy C Orifice Plate

CALIBRATION

- 0 - Not Calibrated
- 1 - Water Calibration
- A - No Calibration w/ Factory Mounting of Transmitter
- B - Water Calibration w/ Factory Mounting of Transmitter

EXAMPLE:

Serial number 1330LZ21101-555A identifies an integral Orifice Flow Element with upstream and downstream piping. It has no electrical components (Z). The pipe size is 1 inch (2), the orifice bore in 0.020 inch (1) and the flange connection is Class 150 ANSI (1). The material of construction is Type 316 SST with Type 316 SST orifice plate (0) and the pipe section has been water calibrated (1). The sequential identification number is 555 and the design level is Model A.

1.3 TECHNICAL CHARACTERISTICS

ACCURACY

Refer to Table 1-2

MAXIMUM WORKING PRESSURE (Elements with Threaded Connections)

1/2 and 1-inch Elements: 3000 psig (21 000 kPa)

1-1/2-inch Element: 1500 psig (10 500 kPa)

MAXIMUM WORKING PRESSURE (Elements with Piping)

Refer to Table 1-3

GASKET MATERIAL

Silicate Ceramic Filled TFE

MAXIMUM OPERATING TEMPERATURE

300°F (149°C)

Table 1-1. Description of Pipe Size and Orifice Bore Digits of the Catalog Number

| Pipe Size and Orifice Bore Digit of Catalog No. | Pipe Size Inches | Orifices Inches | Orifices mm |
|---|------------------|-----------------|-------------|
| 01 | 1/2 | 0.020 | 0.51 |
| 02 | 1/2 | 0.035 | 0.89 |
| 03 | 1/2 | 0.065 | 1.65 |
| 04 | 1/2 | 0.113 | 2.87 |
| 05 | 1/2 | 0.150 | 3.81 |
| 06 | 1/2 | 0.196 | 4.98 |
| 07 | 1/2 | 0.270 | 6.86 |
| 08 | 1/2 | 0.340 | 8.64 |
| 09 | 1/2 | Special | - |
| 11 | 1 | 0.150 | 3.81 |
| 12 | 1 | 0.270 | 6.86 |
| 13 | 1 | 0.612 | 15.54 |
| 21 | 1 | 0.020 | 0.51 |
| 22 | 1 | 0.035 | 0.89 |
| 23 | 1 | 0.065 | 1.65 |
| 24 | 1 | 0.113 | 2.87 |
| 25 | 1 | 0.196 | 4.98 |
| 26 | 1 | 0.340 | 8.64 |
| 27 | 1 | 0.500 | 12.70 |
| 28 | 1 | 0.735 | 18.67 |
| 29 | 1 | Special | - |
| 31 | 1-1/2 | 0.500 | 12.70 |
| 32 | 1-1/2 | 0.612 | 15.54 |
| 33 | 1-1/2 | 0.750 | 19.05 |
| 34 | 1-1/2 | 0.918 | 23.32 |
| 35 | 1-1/2 | 1.127 | 28.63 |
| 39 | 1-1/2 | Special | - |

INTRODUCTION

Table 1-2. Accuracy in % of Flow Rate

| Orifice Bore Inches | Calibrated With Water in ABB Flow Lab* | Uncalibrated |
|---------------------|--|--------------|
| 0.02 thru 0.065 | ±0.5 | ±5 |
| 0.113 thru 0.500 | ±0.5 | ±2.0 |
| 0.612 thru 1.127 | ±0.5 | ±2.0 |

Table 1-3. Maximum Working Pressure at 100 F° (38 C°)

| Catalog No. | Flanges | psig | kPa |
|---------------|----------------|------|------|
| 1330LZ__0__ | None | | |
| 1330LZ__1,A__ | Class 150 ANSI | 275 | 1900 |
| 1330LZ__2,B__ | Class 300 ANSI | 720 | 4900 |

1.4 IDENTIFICATION OF MATERIAL AND ORIFICE BORE

The element body material is stamped on the body as shown in Figure 1-1. The orifice material and bore size are stamped on the orifice plate.

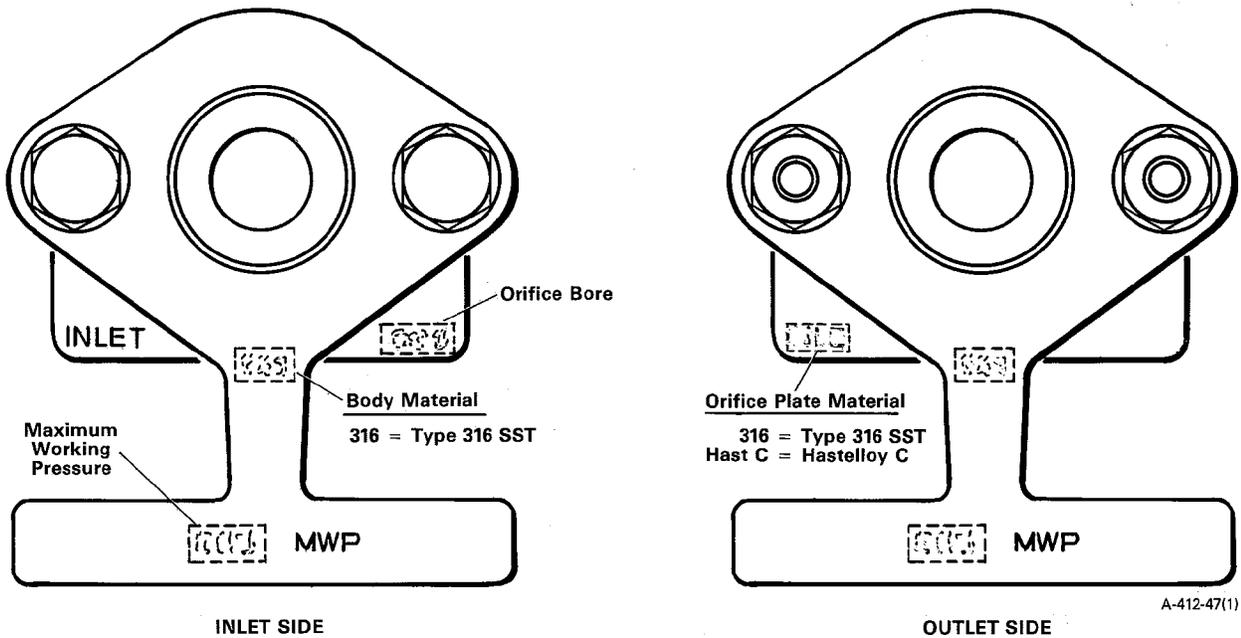


Figure 1-1. Identification Stamping

2 INSTALLATION

2.1 SELECTING A MOUNTING LOCATION

2.1.1 General

The recommended mounting location for the element is on a horizontal plane as shown in Figure 2-1. This location allows the integrally mounted differential pressure transmitter to be mounted in its recommended vertical position.

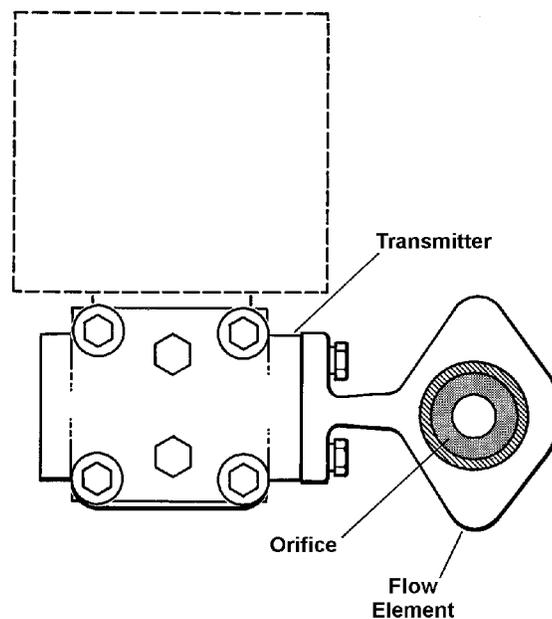


Figure 2-1. Horizontal Location of Flow Element

The element can be installed on a vertical plane as shown in Figure 2-2. However, care must be taken to ensure that the transmitter measuring element is properly vented. With the transmitter on its side, the lower flange cavity is difficult to vent. Gas bubbles in this chamber can cause excessive zero shifts. Routine zero checks can minimize, if not eliminate, this problem. In a vertical installation, the flow direction can be either up or down.

The required upstream and downstream straight pipe lengths are built into the element. No additional straight pipe run is required.

2.1.2 Straight Pipe Run Requirements

The integral orifice element with threaded connections must have a length of straight unrestricted pipe on the upstream and downstream side of the orifice inside the element. The recommended minimum straight length on the upstream side of the orifice depends on the pipe diameter, orifice diameter, and the fitting at the end of the straight run. Minimum upstream lengths are shown in Table 2-1. The recommended minimum length of downstream straight pipe run is 6 pipe diameters (6D) for all pipe fittings.

INSTALLATION

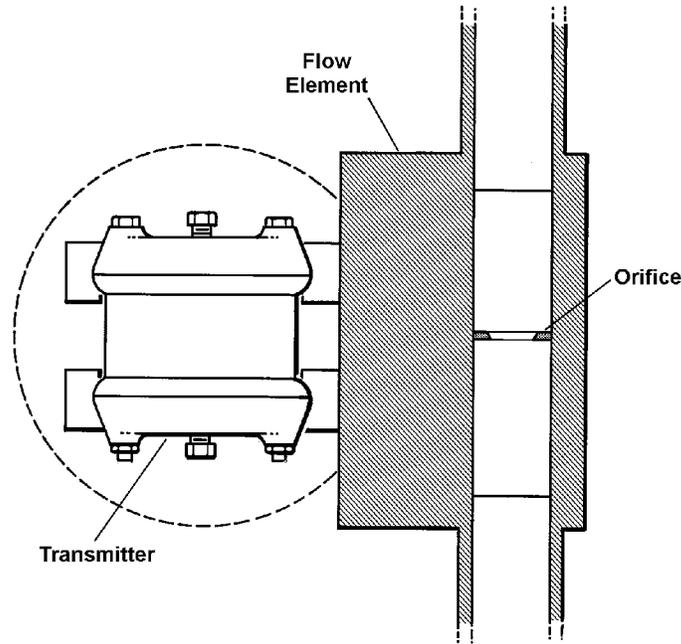


Figure 2-2. Vertical Location of Flow Element

Table 2-1. Minimum Upstream Straight Pipe Length Required for Various Flow Obstructions - Inches

| Pipe Size (inches) | Orifice Diam. Inches | Tee or Elbow | Reducer or Expander | Valves or Regulators | 2 Elbows on Different Planes |
|--------------------|----------------------|--------------|---------------------|----------------------|------------------------------|
| 1/2 | 0.020 | 6D | 8D | 16D | 14D |
| | 0.035 | | | | |
| | 0.065 | | | | |
| | 0.113 | 7D | 9D | 19D | 16D |
| | 0.150 | | | | |
| | 0.196 | | | | |
| | 0.270 | 9D | 10D | 28D | 22D |
| 1 | 0.340 | | | | |
| | 0.150 | 6D | 9D | 18D | 16D |
| | 0.270 | | | | |
| | 0.020 | 6D | 8D | 14D | 12D |
| | 0.035 | | | | |
| | 0.065 | | | | |
| | 0.113 | 6D | 8D | 18D | 16D |
| | 0.196 | | | | |
| | 0.340 | | | | |
| 0.500 | 12D | 12D | 19D | 22D | |
| 1-1/2 | 0.612 | | | | |
| | 0.735 | | | | |
| | 0.500 | 6D | 8D | 18D | 16D |
| | 0.612 | 6D | 8D | 20D | 17D |
| | 0.750 | 7D | 9D | 24D | 19D |
| 1-1/2 | 0.918 | 8D | 10D | 28D | 22D |
| | 1.127 | 13D | 13D | 36D | 30D |

D= 0.622 for 1/2-inch pipe size; 1.049 for 1-inch pipe size; 1.61 for 1-1/2-inch pipe size

2.2 INSTALLATION PRECAUTIONS FOR OXYGEN SERVICE ELEMENT

Elements with threaded connections have an optional cleaning for use on oxygen service applications. Integral orifice flow elements which have been specially cleaned for oxygen service are packed in protective plastic bags prior to shipment. To prevent possible contamination of the cleaned surfaces, do not remove the parts from the bags until the time of installation. Handle all specially cleaned parts with plastic (polyethylene) gloves. Do not contaminate these parts with oil, grease or any combustible material. If parts become contaminated, remove contamination with clean trichlorethylene.

All tools and equipment used for assembly and installation must be oil free and clean. To check cleaned surfaces and tools for possible contamination, use a long wave ultraviolet lamp.

When mounting the element in the process pipe line, do not use ordinary pipe dope or PTFE tape to seal process connections. The thread sealant must be approved for use in oxygen service. Seal process connections with Fluoramics, Inc. LOX-8 paste or equivalent.

 **CAUTION** When using PTFE tape, do not allow excess tape to protrude into the process stream. Excess tape can shred and break off, causing particle contamination inside the pipe.

2.3 MOUNTING AND DIFFERENTIAL PRESSURE CONNECTIONS

 **WARNING** Exceeding the maximum pressure rating of the element can cause personal injury and damage to equipment. Make sure that process pressure does not exceed pressure rating (MWP) stamped on data plate.

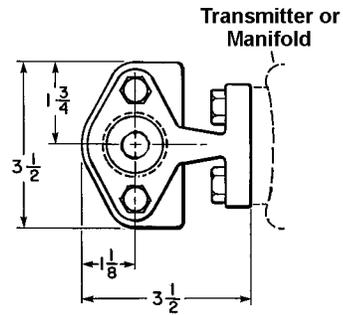
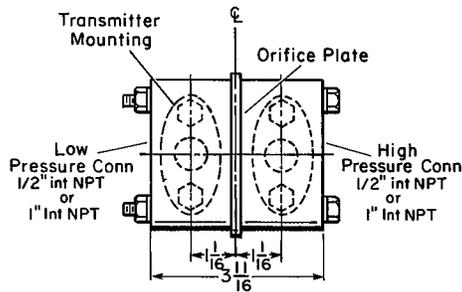
2.3.1 Elements with Threaded Connections

When mounting the element, be sure to orient it so that the flow enters from the side stamped INLET on the orifice plate, Figure 1-1. The high pressure port is on the inlet side of the element and must be connected to the high pressure side of the differential pressure transmitter.

 **WARNING** Maximum working pressure rating of element may be different than rating of transmitter. Exceeding the pressure rating can cause personal injury and damage equipment. Make sure that process pressure does not exceed lowest pressure rating of either the element or transmitter.

INSTALLATION

Mounting dimensions for the elements are shown in Figures 2-3 and 2-4. The element is supplied with two ring gaskets and four mounting screws for connection to a differential pressure transmitter at the high and low pressure ports.



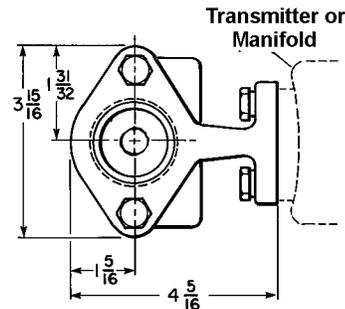
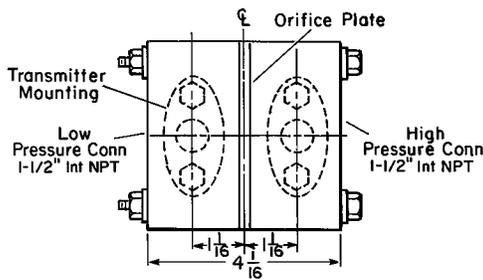
XB-1210-171(2)

| INCHES | mm |
|---------|--------|
| 1-1/16 | 26.99 |
| 1-5/16 | 33.34 |
| 1-31/32 | 50.01 |
| 3-15/16 | 100.01 |
| 4-1/16 | 103.19 |

All dimensions in inches.

For reference only;
not for construction

Figure 2-3. Mounting Dimensions for 1/2 Inch and 1 Inch Elements



XB-1210-170(1)

| INCHES | mm |
|---------|--------|
| 1-1/16 | 26.99 |
| 1-5/16 | 33.34 |
| 1-31/32 | 50.01 |
| 3-15/16 | 100.01 |
| 4-1/16 | 103.19 |
| 4-5/16 | 109.54 |

All dimensions in inches.

For reference only;
not for construction.

Figure 2-4. Mounting Dimensions for 1-1/2 Inch Elements

Remove all plastic shipping plugs from the element ports. Remove any foreign matter from the mating surfaces of the element and transmitter. Position the ring gaskets in the grooves on the mating surfaces of the element. Connect the element to the transmitter using the four mounting bolts supplied. Be sure the high pressure side of the transmitter is connected to the **INLET** side of the element. Tighten the four mounting bolts to a torque of 250 to 300 inch-lbs (28.2 to 33.9 Nm).

Mount the assembled transmitter and flow element in the pipe line. Refer to the transmitter instructions for additional mounting information. A union connection is required in the process line to permit installation of the element.

* NOTE If it is more convenient, the flow element can be mounted in the pipe line before connecting the transmitter to the element.

2.3.2 Elements with Upstream and Downstream Piping

When mounting the element, be sure to orient it so that the flow will be in the direction indicated by the arrow shown in Figure 2-5. Flow must enter the element at the upstream end; this is the end with the longer pipe section. The high pressure port is on the upstream side of the element and must be connected to the high pressure side of the differential pressure transmitter.

A gasket must be inserted between each element flange and its mating process flange. The flange gaskets are to be supplied by the customer. These gaskets should be of a type which will withstand the maximum process temperature and pressure which will resist corrosive attack by the process fluid. Gaskets may be selected in accordance with ANSI Standard B16.5, using the Group 1 type for raised face flanges.

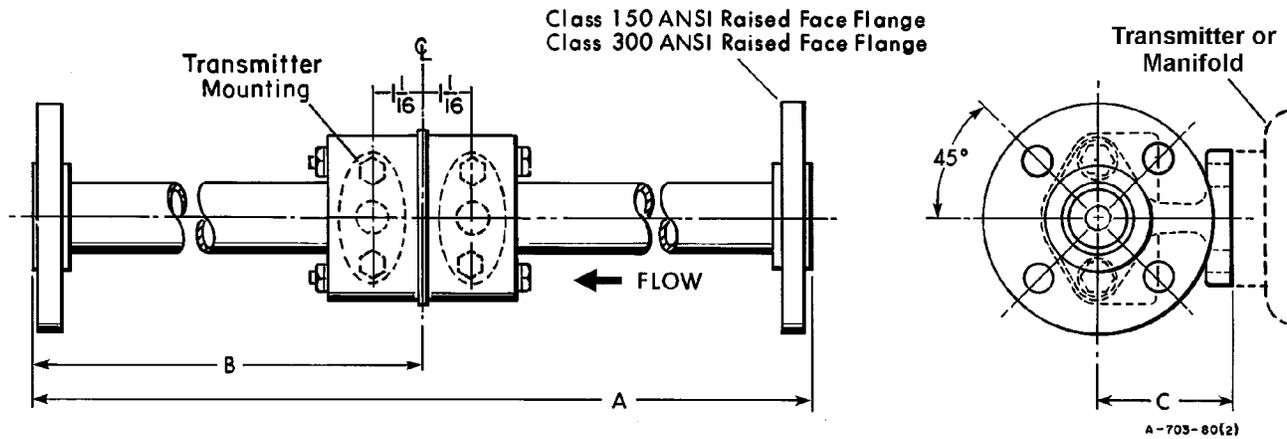
It is important that the flanges in the process pipe line be of the same class and type as the element flanges. The element flanges can be Class 150, Class 300, British Standard or DIN.

WARNING Maximum working pressure rating of element may be different than rating of transmitter. Exceeding the pressure rating can cause personal injury and damage equipment. Make sure that process pressure does not exceed lowest pressure rating of either the element or transmitter.

| Catalog No. | Pipe Size | A±3/16 | B | C | INCHES | | For reference only, not for construction. |
|-------------|-----------|--------|---|-------|--------|--------|--|
| | | | | | | mm | |
| 1330LZ0 | 1/2 | 24 | 8 | 2-1/2 | 3/16 | 4.76 | All dimensions in inches. |
| 1330LZ1 | 1 | 24 | 8 | 2-1/2 | 1-1/16 | 26.99 | |
| 1330LZ2 | 1 | 24 | 8 | 2-1/2 | 2-1/2 | 63.50 | |
| 1330LZ3 | 1-1/2 | 38 | 8 | 3 | 3 | 76.20 | |
| | | | | | 8 | 203.20 | |
| | | | | | 24 | 609.20 | |
| | | | | | 38 | 965.20 | |

Figure 2-5. Mounting Dimensions for Elements With Upstream and Downstream Piping

OPERATION



| Catalog No. | Pipe Size | A±3/16 | B | C |
|---------------|-----------|--------|---|-------|
| 1330LZ0 ----- | 1/2 | 24 | 8 | 2-1/2 |
| 1330LZ1 ----- | 1 | 24 | 8 | 2-1/2 |
| 1330LZ2 ----- | 1 | 24 | 8 | 2-1/2 |
| 1330LZ3 ----- | 1-1/2 | 38 | 8 | 3 |

| INCHES | mm |
|--------|--------|
| 3/16 | 4.76 |
| 1-1/16 | 26.99 |
| 2-1/2 | 63.50 |
| 3 | 76.20 |
| 8 | 203.20 |
| 24 | 609.20 |
| 38 | 965.20 |

For reference only,
not for construction.

All dimensions in inches.

Figure 2-5. Mounting Dimensions for Elements With Upstream and Downstream Piping

3 OPERATION

3.1 STARTUP

Before any true transmitter zero reading can be taken it is necessary to establish that the process pipe and flow element are solid filled with process fluid and that there is no flow. A shut-off valve or control valve downstream from the element will facilitate this condition. Opening the valve for a short time will remove any gasses that are present in the system. It will also be necessary to purge air from the transmitter body by opening the vent valves on the high- and low-side flanges. Any air present in the transmitter body will cause a false zero reading.

3.1.1 Zero Check

With the flow element under full line pressure, at normal operating temperature and at zero flow, the transmitter output can be adjusted to an exact zero reading on the readout device. If possible, open the downstream valve for a few seconds and then close it. The readout device should return to a zero reading. If it does not, readjust the zero screw on the transmitter. Repeat this procedure two or three times to establish a true zero.

3.1.2 Span Check

In most cases it will not be possible to check for the correct span because this would require a field calibration. The transmitter associated with the flow element has been calibrated at the factory to agree with the calibration and/or calculation of the element.

* NOTE A calibration report is supplied with each flow element that is calibrated in the ABB Flow Laboratory. Check the calibration report to see that the maximum differential of the element agrees with the differential span of the transmitter. If it does not, it will be necessary to recalibrate the transmitter.

3.2 ACCURACY

The body of the integral orifice assembly provides a precisely controlled diameter (D) adjacent to the orifice plate, Figures 3-1 and 3-2. For elements with piping, the pipe sections are Schedule 40 pipe with standard pipe manufacturing tolerances. The pipe tolerances do not affect accuracy because of the controlled body diameter.

All flow elements that are calibrated in the ABB Flow Laboratory are calibrated to $\pm 0.5\%$ of flow. The accuracy of uncalibrated flow elements may be 2 to 5% of flow span, depending on the type of element, pipe size and orifice size; refer to Table 1-2. Additional errors will occur if the process fluid density differs from the design value. The percent errors given do not include the inherent errors of the transmitter which are normally very small until flow rates fall below 30% of maximum flow (9% of maximum differential pressure).

OPERATION

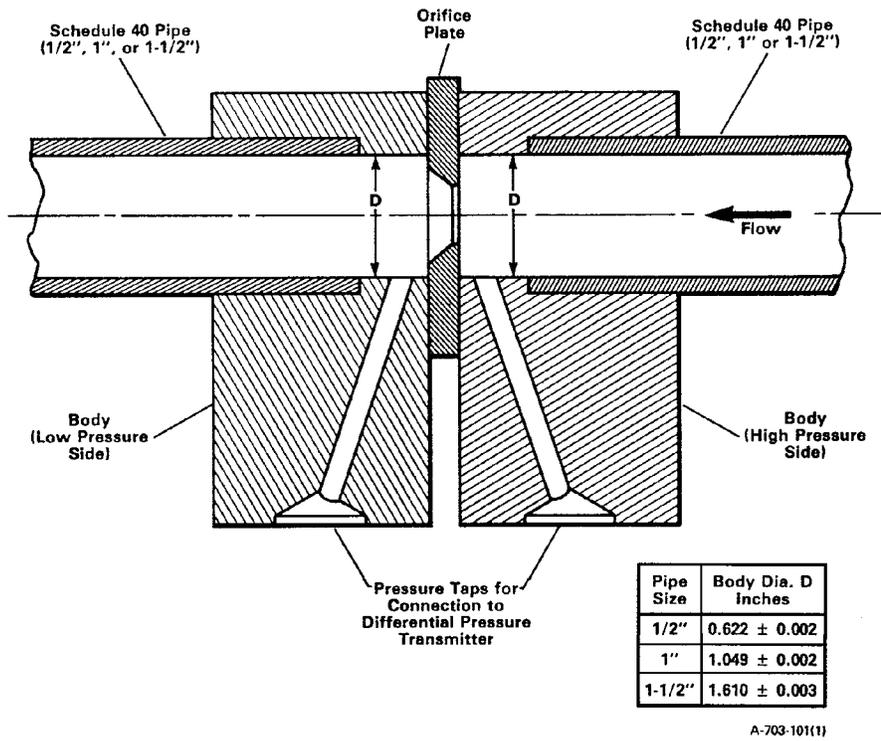


Figure 3-1. Cross-Section View of Flow Element With Upstream and Downstream Piping

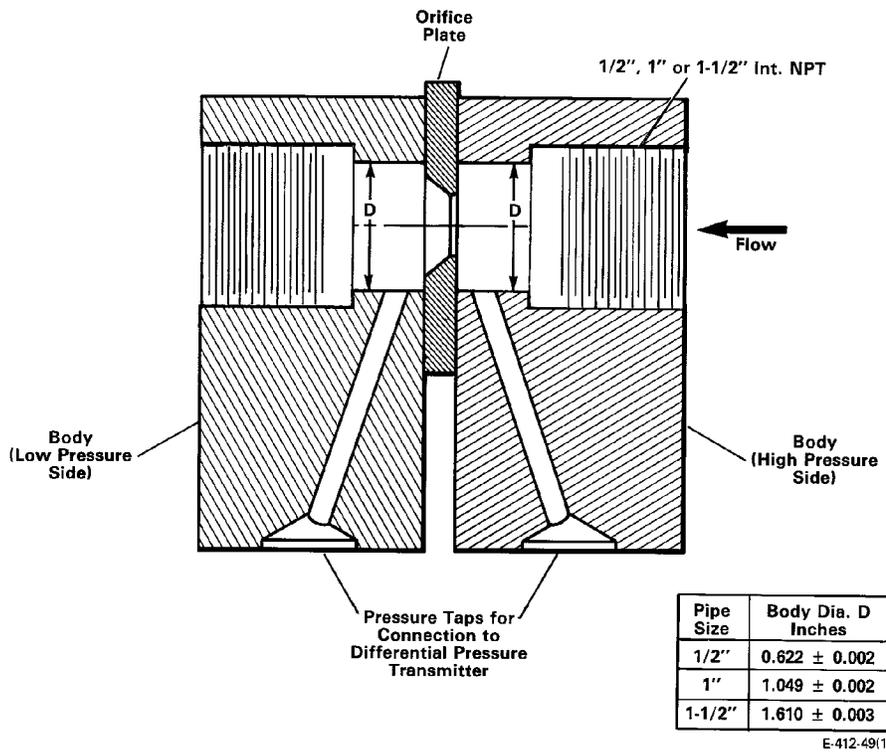


Figure 3-1. Cross-Section View of Flow Element With Threaded Connections

3.3 FLOW EQUATIONS

The standard flow equations for integral orifice elements are as follows:

Liquid Flow at flowing temperature

$$q = (5.668 \times F_a \times K \times d^2) \times (h / g_f)^{1/2}$$

Liquid Flow at 60°F

$$q = [(5.668 \times F_a \times K \times d^2 \times Y) / g_t] \times (h / g_f)^{1/2}$$

Gas Flow

$$Q = (7727 \times F_a \times F_{pv} \times K \times d^2 \times Y) \times [(h \times P_f) / (G \times T_f)]^{1/2}$$

Steam Flow

$$W = (359 \times F_a \times K \times d^2 \times Y) \times (h / V)^{1/2}$$

To calculate exact differential pressure produced at known flow rate, use one of the following equations:

$$\text{Liquid: } h = g_f \left[\frac{q \text{ (in U.S. qpm)}}{5.668 \times F_a \times K \times d^2} \right]^2$$

$$\text{Gas: } h = \frac{G T_f}{P_f} \left[\frac{Q \text{ (in scfh)}}{7727 \times F_a \times F_{pv} \times K \times d^2 \times Y} \right]^2$$

$$\text{Steam: } h = V \left[\frac{W \text{ (lb / hr)}}{359 \times F_a \times K \times d^2 \times Y} \right]^2$$

- where
- q = Maximum flow rate, gallons/min
 - Q = Maximum flow rate, SCFH
 - W = Maximum flow rate, lbs/hr
 - F_a = Orifice expansion factor, Figure 3-3
 - K = Flow coefficient, Table 3-1
 - d = Orifice diameter, inches
 - h = Maximum differential pressure, inches of water
 - g_f = Liquid specific gravity at flowing temperature
 - g_t = Liquid specific gravity at 60°F
 - F_{pv} = Gas supercompressibility factor (normally 1) = (Z_{basic} / Z_{Flowing})^{1/2}
 - Y = Gas expansion factor, Figure 3-4
 - P_f = Pressure of flowing fluid, psia
 - T_f = Temperature of flowing fluid, degrees Rankine (°F + 460)
 - G = Gas specific gravity
 - V = Specific volume of steam, cu ft/lb

3.4 METRIC CONVERSIONS

| | | | | | |
|----------------------|---|-----------------|-----------|---|------------------------|
| 1 kPa | = | 0.1450 psi | 1 bar | = | 14.50 psi |
| 1 kg/cm ² | = | 14.22 psi | 1 mm Hg | = | 0.5357 inches of water |
| 1 meter | = | 3.281 ft | 1 cm | = | 0.3937 inches |
| 1 liter | = | 0.2642 gals | 1 Imp Gal | = | 1.201 gals |
| 1 cu meter/sec | = | 35.32 cu ft/sec | 1 kg/hr | = | 2.205 lbs/hr |
| °C | = | 5/9(°F-32) | | | |

OPERATION

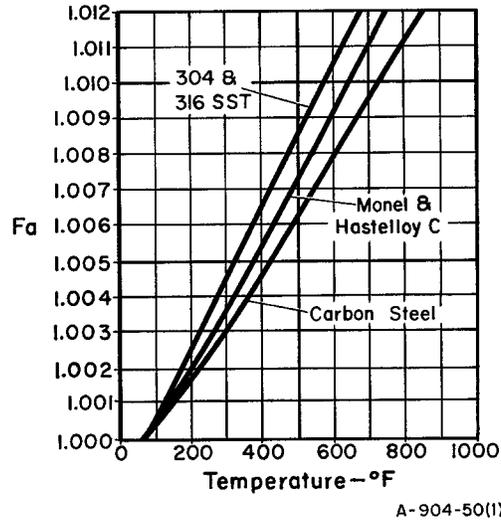
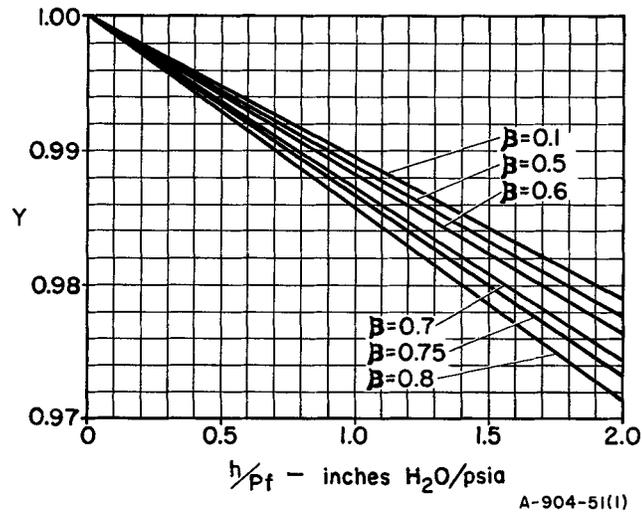


Figure 3-3. Orifice Expansion Factor

Table 3-1. Orifice Flow Coefficient

| Pipe Size (Inches) | Orifice Bore (Inches) | Nominal Flow Coefficient K |
|--------------------|-----------------------|----------------------------|
| 1/2 | 0.020 | 0.670 |
| | 0.035 | 0.642 |
| | 0.065 | 0.628 |
| | 0.113 | 0.612 |
| | 0.150 | 0.608 |
| | 0.196 | 0.608 |
| | 0.270 | 0.619 |
| 1 | 0.340 | 0.642 |
| | 0.150 | 0.604 |
| | 0.270 | 0.604 |
| | 0.020 | 0.645 |
| | 0.035 | 0.635 |
| | 0.065 | 0.620 |
| | 0.113 | 0.605 |
| | 0.196 | 0.603 |
| | 0.340 | 0.605 |
| 0.500 | 0.630 | |
| 1-1/2 | 0.612 | 0.666 |
| | 0.735 | 0.715 |
| | 0.500 | 0.611 |
| | 0.612 | 0.614 |
| | 0.750 | 0.623 |
| 1-1/2 | 0.917 | 0.650 |
| | 1.127 | 0.714 |



| Pipe Size (Inches) | Orifice Bore (Inches) | β |
|--------------------|-----------------------|---------|
| 1/2 | 0.020 | 0.1 |
| | 0.035 | 0.1 |
| | 0.065 | 0.1 |
| | 0.113 | 0.2 |
| | 0.150 | 0.2 |
| | 0.196 | 0.3 |
| | 0.270 | 0.4 |
| | 0.340 | 0.5 |
| 1 | 0.150 | 0.1 |
| | 0.270 | 0.2 |
| | 0.020 | 0.1 |
| | 0.035 | 0.1 |
| | 0.065 | 0.1 |
| | 0.113 | 0.1 |
| | 0.196 | 0.2 |
| | 0.340 | 0.3 |
| | 0.500 | 0.5 |
| | 0.612 | 0.6 |
| 0.735 | 0.7 | |
| 1-1/2 | 0.500 | 0.3 |
| | 0.612 | 0.4 |
| | 0.750 | 0.5 |
| | 0.917 | 0.6 |
| | 1.127 | 0.7 |

Figure 3-4. Gas Expansion Factor

4 MAINTENANCE

4.1 REMOVING ELEMENT FROM SERVICE

 **WARNING** Process pressure and material retained in the flow element can cause injury and damage to equipment. Standard plant safety procedures must be followed when removing the element from service.

Shut off the process pressure before loosening any bolts. Disconnect the transmitter from the element by removing the four mounting screws connecting the element to the transmitter flanges, then disconnect the element from the process pipe line.

4.2 CHANGING ORIFICE

The orifice can be changed by disassembling the element as shown in Figures 4-1 and 4-2. When installing the new orifice, be sure to orient it as shown in Figures 4-1 and 4-2. Use new gaskets to insure proper sealing.

 **WARNING** On 1-1/2-inch elements, be sure to use the hardened steel washers under the nuts and bolt heads to assure adequate bearing strength.

The correct body bolts, nuts, and mounting bolts must be used to maintain the specified pressure rating of the element. The identification code on the bolt heads and nuts must be as shown in Figures 4-1 and 4-2. Tighten body bolts to the following torque values:

1/2-inch and 1-inch Elements:
250 to 350 inch-lb (28.2 to 39.5 Nm)

1-1/2-inch element:
400 to 425 inch-lb (45.2 to 48 Nm)

* **NOTE** When reconnecting the element to the transmitter, use new gaskets and torque connecting screws as specified under 2.3 Mounting and Differential Pressure Connections.

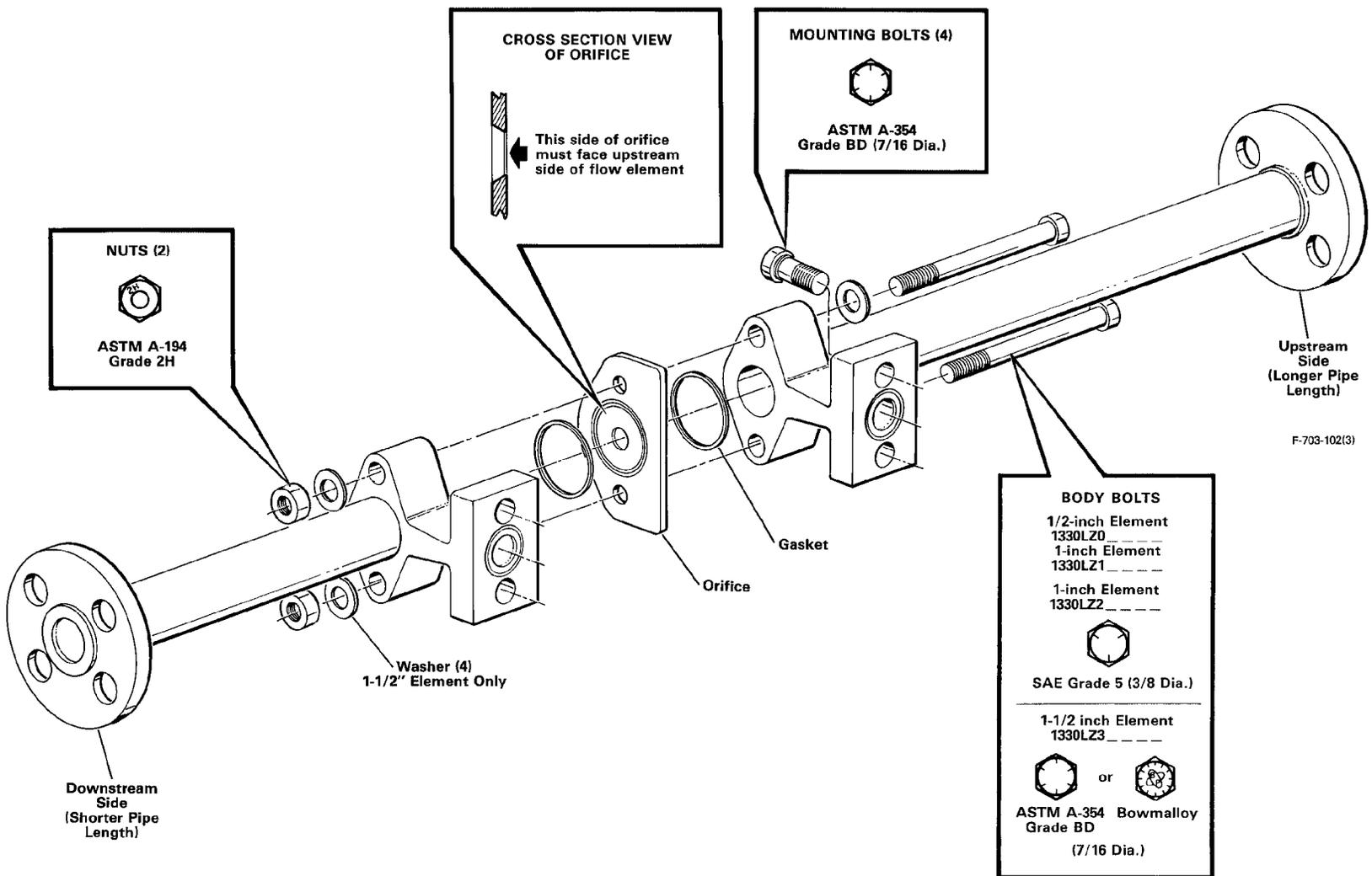
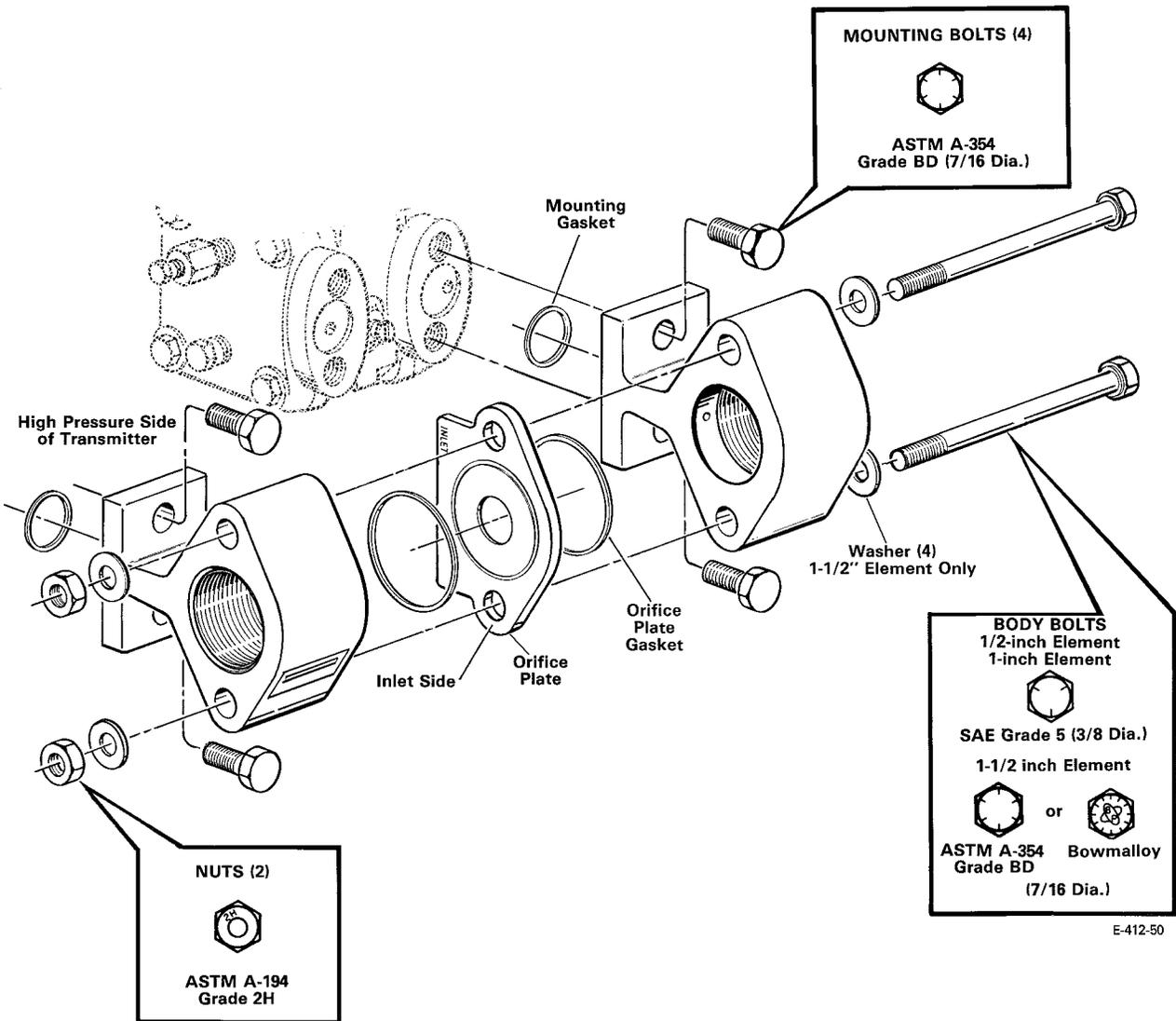


Figure 4-1. Exploded View of Flow Element with Upstream and Downstream Piping



E-412-50

Figure 4-2. Exploded View of Flow Element With Threaded Connections

5 PARTS LIST

5.1 ORDERING INFORMATION

When ordering parts, always specify the complete serial number of the integral orifice flow element.

5.2 RECOMMENDED SPARE PARTS

A plus (+) sign before the item number indicates that the item is a recommended spare part.

5.3 PARTS AVAILABILITY

This parts list may contain parts that are not saleable. These parts are identified with an asterisk (*) in the part number column. They are listed and shown as required to provide a comprehensive breakdown of the assembly.

5.4 PARTS IDENTIFICATION

A dash (-) in the item number column indicates that the part is not illustrated in the referenced figure. A dash (-) in the part number column indicates there is no part identification available.

Some part descriptions have dots preceding them. These dots indicate that the parts are components of the assembly or subassembly (SA) which immediately proceeds them in the listing.

5.5 UNDERSCORE IDENTIFICATION

Underscores in place of characters in a catalog number (e.g. 1330LZ _ _ _ _ A) indicate any character may apply. Refer to **1.2 Explanation of Serial and Catalog Numbers**.

Underscores in place of characters in a part number (e.g. 6P_ _ _ _ _) indicate that more than one character may apply. The part number may be referenced to another page or section for selection of required characters.

PARTS LIST

5.6 PARTS LISTING

Refer to Figure 5-1.

| <u>Item</u> | <u>Part No.</u> | <u>Description</u> | <u>No. Req'd</u> |
|-------------|-----------------|---|------------------|
| 1 | * | Protective Cover | 1 |
| 2 | 6P----- | Orifice Plate Replacement Kit; refer to Table 5-1 for part numbers Kit includes Items 9, 10 and plate. | 1 |
| 3 | 9P1566 | Element Mounting Bolt | 4 |
| 4 | 9P1907-3 | Body Mounting Bolt, SAE Grade 5 - 1330LZ2 | 2 |
| 4 | 9P1929-2 | Body Mounting Bolt, Grade BD - 1330LZ3 | 2 |
| 5 | 22P958 | Body Mounting Washer - 1330LZ3 | 4 |
| 6 | * | Body and Flange, Downstream | 1 |
| 7 | * | Body and Flange, Upstream | 1 |
| 8 | 32P803-1 | Body Mounting Nut, Grade 2HB - 1330LZ2 | 2 |
| 8 | 32P818 | Body Mounting Nut, Grade 2HB - 1330LZ3 | 2 |
| 9 | 43P900-1 | Element Mounting Gasket | 2 |
| +10 | 43P900-8 | Body Mounting Gasket - 1330LZ2 | 2 |
| +10 | 43P900-13 | Body Mounting Gasket - 1330LZ3 | 2 |
| 11 | * | Label | 2 |
| 12 | * | Data Plate | 1 |

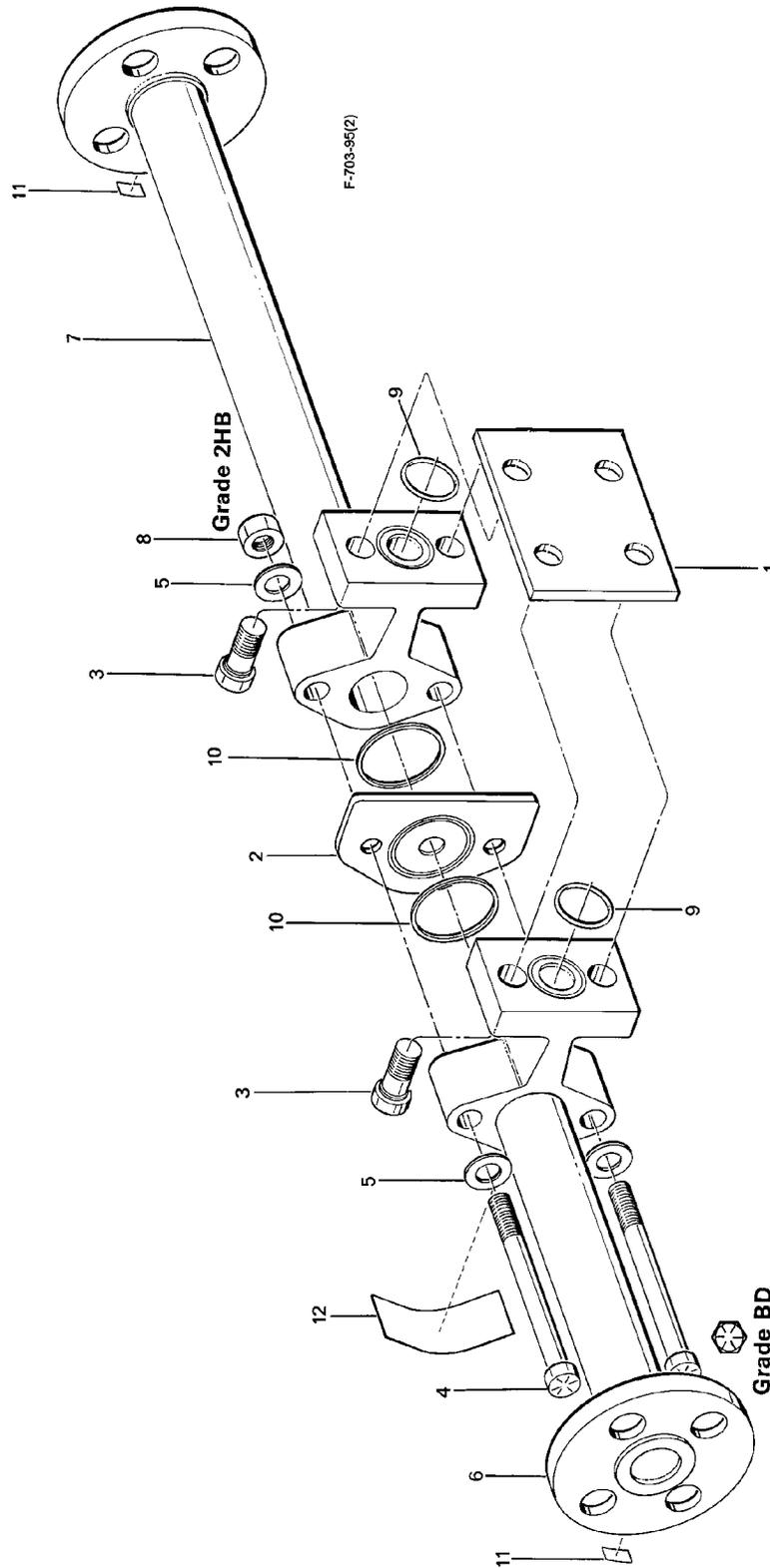


Figure 5-1. Integral Orifice Flow Element

PARTS LIST*Table 5-1. Part Numbers for Orifice Plate Replacement Kits***Type 316 SST Plate Material**

| Pipe Size | Integral Orifice Catalog No. | Kit Part No. | Orifice Bore (inches) | Orifice Bore (mm) |
|-------------|------------------------------|--------------|-----------------------|-------------------|
| 1/2 Inch | 1330LZ01_0_ | 6S1382JAK | 0.020 | 0.51 |
| | 1330LZ02_0_ | 6S1382JBK | 0.035 | 0.89 |
| | 1330LZ03_0_ | 6S1382JCK | 0.065 | 1.65 |
| | 1330LZ04_0_ | 6S1382JDK | 0.113 | 2.87 |
| | 1330LZ05_0_ | 6S2835JNK | 0.150 | 3.81 |
| | 1330LZ06_0_ | 6S1382JFK | 0.196 | 4.98 |
| | 1330LZ07_0_ | 6S2835JPK | 0.270 | 6.86 |
| | 1330LZ08_0_ | 6S1382JHK | 0.340 | 8.64 |
| | 1330LZ09_0_ | SPECIAL | BORE | |
| 1 Inch | 1330LZ11_0_ | 6S2835JNK | 0.150 | 3.81 |
| | 1330LZ12_0_ | 6S2835JPK | 0.270 | 6.86 |
| | 1330LZ13_0_ | 6S2835JRK | 0.612 | 15.54 |
| | 1330LZ21_0_ | 6S1382JAK | 0.020 | 0.51 |
| | 1330LZ22_0_ | 6S1382JBK | 0.035 | 0.89 |
| | 1330LZ23_0_ | 6S1382JCK | 0.065 | 1.65 |
| | 1330LZ24_0_ | 6S1382JDK | 0.113 | 2.87 |
| | 1330LZ25_0_ | 6S1382JFK | 0.196 | 4.98 |
| | 1330LZ26_0_ | 6S1382JHK | 0.340 | 8.64 |
| | 1330LZ27_0_ | 6S1382JKK | 0.500 | 12.70 |
| | 1330LZ28_0_ | 6S1382JMK | 0.735 | 18.67 |
| 1330LZ29_0_ | SPECIAL | BORE | | |
| 1-1/2 Inch | 1330LZ31_0_ | 6S1192JKK | 0.500 | 12.70 |
| | 1330LZ32_0_ | 6S1192JLK | 0.612 | 15.54 |
| | 1330LZ33_0_ | 6S1192JNK | 0.750 | 19.05 |
| | 1330LZ34_0_ | 6S1192JPK | 0.918 | 23.32 |
| | 1330LZ35_0_ | 6S1192JQK | 1.127 | 28.63 |
| | 1330LZ39_0_ | SPECIAL | BORE | |

Table 5-1. Part Numbers for Orifice Plate Replacement Kits (Cont'd)

Hastelloy C Plate Material

| Pipe Size | Integral Orifice Catalog No. | Kit Part No. | Orifice Bore (inches) | Orifice Bore (mm) |
|-------------|------------------------------|--------------|-----------------------|-------------------|
| 1/2 Inch | 1330LZ01_4_ | 6S1382ZAK | 0.020 | 0.51 |
| | 1330LZ02_4_ | 6S1382ZBK | 0.035 | 0.89 |
| | 1330LZ03_4_ | 6S1382ZCK | 0.065 | 1.65 |
| | 1330LZ04_4_ | 6S1382ZDK | 0.113 | 2.87 |
| | 1330LZ05_4_ | 6S2835ZNK | 0.150 | 3.81 |
| | 1330LZ06_4_ | 6S1382ZFK | 0.196 | 4.98 |
| | 1330LZ07_4_ | 6S2835ZPK | 0.270 | 6.86 |
| | 1330LZ08_4_ | 6S1382ZHK | 0.340 | 8.64 |
| | 1330LZ09_4_ | SPECIAL | BORE | |
| 1 Inch | 1330LZ11_4_ | 6S2835ZNK | 0.150 | 3.81 |
| | 1330LZ12_4_ | 6S2835ZPK | 0.270 | 6.86 |
| | 1330LZ13_4_ | 6S2835ZRK | 0.612 | 15.54 |
| | 1330LZ21_4_ | 6S1382ZAK | 0.020 | 0.51 |
| | 1330LZ22_4_ | 6S1382ZBK | 0.035 | 0.89 |
| | 1330LZ23_4_ | 6S1382ZCK | 0.065 | 1.65 |
| | 1330LZ24_4_ | 6S1382ZDK | 0.113 | 2.87 |
| | 1330LZ25_4_ | 6S1382ZFK | 0.196 | 4.98 |
| | 1330LZ26_4_ | 6S1382ZHK | 0.340 | 8.64 |
| | 1330LZ27_4_ | 6S1382ZKK | 0.500 | 12.70 |
| | 1330LZ28_4_ | 6S1382ZMK | 0.735 | 18.67 |
| 1330LZ29_4_ | SPECIAL | BORE | | |
| 1-1/2 Inch | 1330LZ31_4_ | 6S1192ZKK | 0.500 | 12.70 |
| | 1330LZ32_4_ | 6S1192ZLK | 0.612 | 15.54 |
| | 1330LZ33_4_ | 6S1192ZNK | 0.750 | 19.05 |
| | 1330LZ34_4_ | 6S1192ZPK | 0.918 | 23.32 |
| | 1330LZ35_4_ | 6S1192ZQK | 1.127 | 28.63 |
| | 1330LZ39_4_ | SPECIAL | BORE | |



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