YAMATAKE

MagneW 3000 PLUS Smart Electromagnetic Flowmeter Detector Model: MGG18/19, MGS28

User's Manual

Yamatake Corporation

CM2-MGG200-2001
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Safety

About This Manual

This manual contains information and warnings that must be observed to keep the model MGG18 Smart Electromagnetic Flowmeter Detector operating safely. Correct installation, correct operation and regular maintenance are essential to ensure safety while using this device.

In addition to this model MGG18 detector user manual, please refer to model MGG14C converter user's manual for start-up, calibration, trouble-shooting, operation, and maintenance of the complete Smart Electromagnetic Flowmeter.

For the correct and safe use of this device it is essential that both operating and service personnel follow generally accepted safety procedures in addition to the safety precautions specified in this manual.

The following symbols are used in this manual to alert you to possible hazards:

⚠ WARNING
Denotes a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION
Failure to observe these precautions may produce dangerous conditions that could result in operator injury or in physical damage to the device.

Safety Messages

Carefully read this section before in stalling or operating this device.

⚠ WARNING
To prevent the gas or liquid in the pipe from escaping, do not remove the electrode cover or the electrodes when the detector is installed on a pipe.

⚠ WARNING
ELECTRIC SHOCK HAZARD! Turn the power supply off before wiring.

⚠ WARNING
This detector is heavy. Dropping it could cause personal injury or damage to the device.

⚠ WARNING

Before removing the unit, make sure that there is no residual liquid or pressure inside the piping and the detector to avoid personal injury or damage to the unit.

⚠ CAUTION

The detector must be grounded (grounding reference is <100 Ω) to avoid output fluctuation, zero point instability or output drift.

⚠ CAUTION

The installation location must satisfy the following conditions to avoid output errors and fluctuations.

At the installation location:

- The electrical conductivity of the fluid to be measured must match the stated specification (specs vary according to the converter used) and be more or less constant.
- The fluid to be measured must be electrochemically homogenized. For example, if two fluids are mixed at an upstream point, the device should be installed at a point so that the two fluids can be evenly mixed by the time they reach the measuring point.
- The distribution of additive matter, if any, must be nearly uniform.

⚠ CAUTION

To avoid measurement problems, do not use the MagneW 3000 PLUS to measure the following fluids, even if their electrical conductivity, temperature and pressure fall within the specifications.

- Fluids that have sufficient electrical conductivity at high temperatures but do not satisfy the conductance requirements at room temperature (about 20°C (68°F)). For example, fatty acids or soap.
- Certain fluids that contain surfectants. For example, rinses, shampoos, CWM.
- Conductive adherents. For example, deposition of rosin or conductive material.
- Insulating adherents. For example, oil, kaolinite, kaolin, or calcium stearate.

⚠ CAUTION

This model MGG18 detector can only be connected to a Yamatake model MGG14C converter.

No other types of converters can be used with the device.

⚠ CAUTION

If the pipe is not filled, output errors will occur.

⚠ CAUTION

Do not rotate the unit more than 180° (one half rotation). Any further rotation can disconnect wiring.

After removing the screws, do not pull on the terminal box. You can break the lead wire.

When you move the terminal box, make sure the O-ring remains in the groove to insure an air-tight seal when the unit is reassembled.

⚠ CAUTION

Before installing the detector, make sure any foreign matter is flushed from the interior passage of the detector. Residual foreign matter could cause output fluctuations.

Do not touch the electrodes or allow oil or fat to come into contact with them to avoid output fluctuations.

Align the direction mark on the detector in the direction of the liquid flow. Misalignment can result in a negative output.

⚠ CAUTION

The correct fastening torque must be used to prevent leakage. To avoid damage to the detector, do not exceed the listed fastening torque.

⚠ CAUTION

Before installing the detector, make sure that the pipe is exactly straight and centered. Any irregularity could cause leakage or other hazards.

⚠ CAUTION

Never attempt to force the detector between two flanges if the space is too narrow. It can damage the detector.

⚠ CAUTION

Make certain the bore diameters of the pipe and the detector are exactly the same and install the detector so that the gasket does not protrude into the internal bore of the pipe, as this could result in leakage or other hazards.

⚠ CAUTION

Tighten each bolt a little at a time and apply uniform pressure to all the bolts. If leakage continues after tightening the bolts, make sure that the pipe is not off center, then continue to tighten each bolt a little at a time.

⚠ CAUTION

Using a gasket with too small a diameter can affect the flow velocity distribution, resulting in inaccurate measurement.

Using a gasket with too large a diameter can cause leakage. Also, any solid substance in the fluid to be measured could accumulate between the gasket and the flange, resulting in inaccurate measurement.

⚠ CAUTION

The necessary materials and the installation method vary according to the material of the ring and that of the pipe on which the detector is to be installed. Select the appropriate method of installation from the following table after confirming the specifications of the detector to be installed and the conditions of installation. Improper installation can result in leakage or damage to the pipe flanges.

⚠ CAUTION

The use of anything other than the PTFE gaskets provided can result in leakage.

The use of rubber gaskets is not recommended and can cause leakage.

⚠ CAUTION

The use of rubber gaskets and a lower fastening torque is not recommended and can cause insufficient surface pressure between the lining and the grounding ring, resulting in leakage.

⚠ CAUTION

Insufficient grounding can cause output fluctuations, instability of the zero point, or output drift. Secure single point grounding with a grounding resistance of 100 Ω or less is recommended.

Do not ground a welder to the detector to avoid damaging the detector.

Table of Contents

Chapter 1 :Introduction

Chapter 2 :Installation

List of Figure

List of Figure

List of Table

Chapter 1 : Introduction

1-1 : Principle of operation

The flowmeter consists of two parts: a detector which is mounted in the pipeline and through which the measured liquid flows, and a converter which may be mounted either integral with the detector or separately. The converter conditions and outputs the electrical signal from the detector or separately. The converter conditions and outputs the electrical signal from the detector.

The flowmeter works based on the principle of Faraday's law of electromagnetic induction, which states that if an electrical conductor, in this case the measured conductive liquid, passes through a magnetic field a small electromotive force (EMF) is induced perpendicular to the field and flow (refer to Figure 1-1).

Faraday's law:

E = k BDV when
E = Induced voltage (EMF)
B = Strength of the magnetic field
D = Conductor width (electrode spacing)
V = Velocity of the conductor
k = Correction factor

This induced EMF is proportional to the average flow rate and is detected by two electrodes (E_1 and E_2) mounted in the wall of the detector and then fed to the converter.

The only variable in this application of Faraday's law is the flow rate (V) of the conductive measured liquid, because field strength (B), is controlled constant and electrode spacing (D) is fixed.

Therefore, the output electromotive force is directly proportional to liquid flow rate, resulting in the linear output of a magnetic flowmeter.

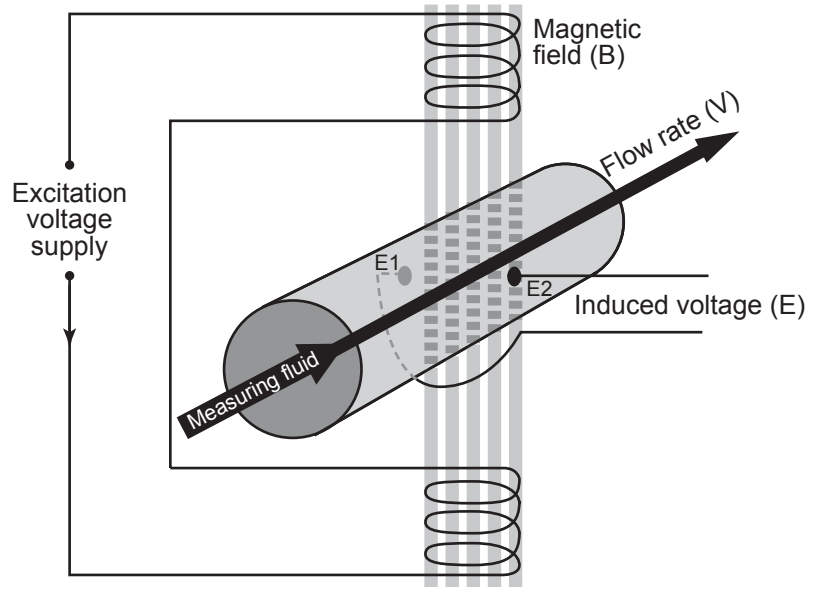


Figure 1-1 Faraday's law

1-2 : System operation

Introduction

Depending on how it is combined with the converter, this product is available in two configurations, integral and remote.

- Integral: Detector and converter are installed as an integrated unit on a pipe.
- Remote: Detector and converter are installed connected by cable.

1-2-1: Integral type

Figure 1-2 and Figure 1-3 show examples of measurement systems using the device.

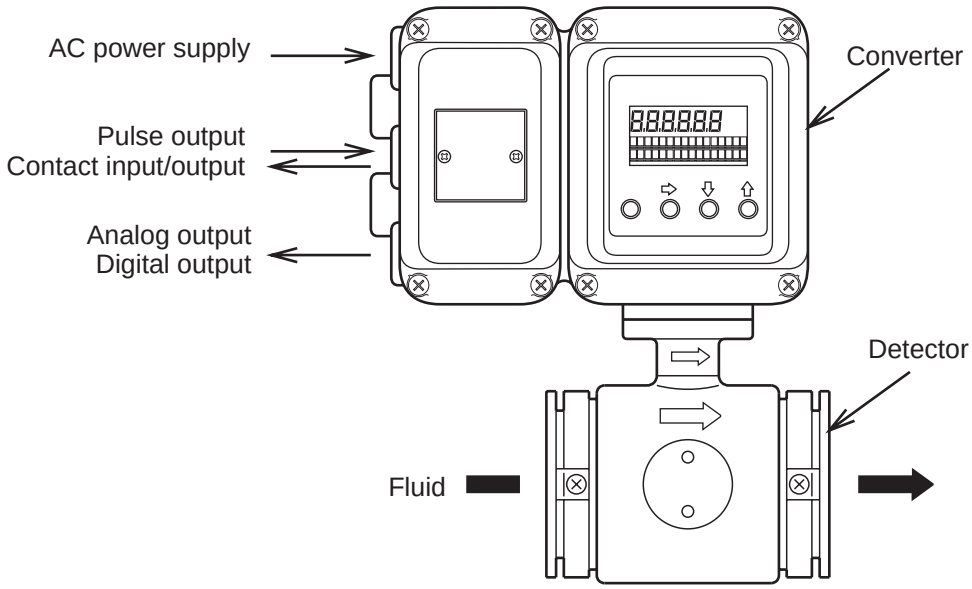


Figure 1-2 Integral configuration

1-2-2: Remote type

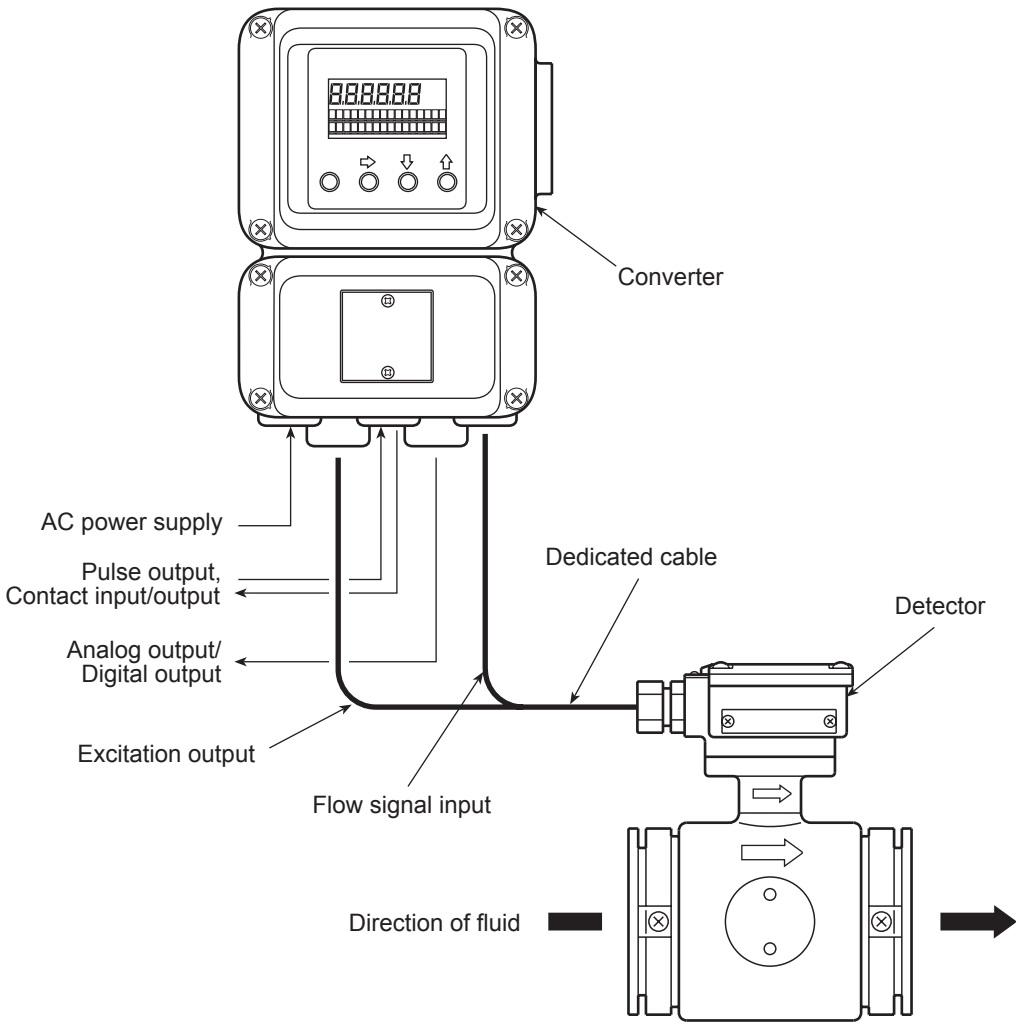


Figure 1-3 Remote Configuration

1-3 : Main components

Detector

There are three types of model MGG18 Smart Electromagnetic Flowmeter Detectors: Wafer detectors, Flange detector, and Union / Hose / Clamp detector. The type of detector you choose depends on your specific installation requirements. All types of detectors function such that when a conductive fluid passes through the detectors, an electromotive force signal proportional to the flow rate is generated.

⚠ WARNING

To prevent the gas or liquid in the pipe from escaping, do not remove the electrode cover or the electrodes when the detector is installed on a pipe.

1-3-1: Wafer type detector

A wafer detector consists of the components shown in the figure below.

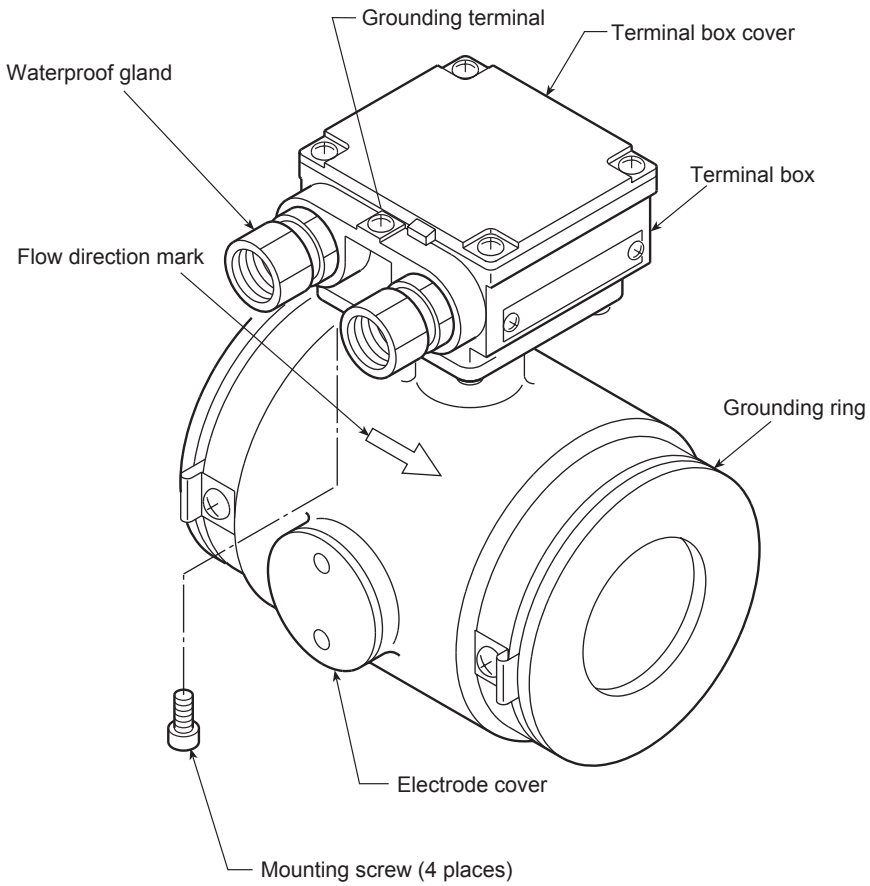


Figure 1-4 Wafer detector main parts

Name	Function
Flow direction mark	Indicates the direction of fluid flow. Mount the detector so that the measured fluid flows in the direction indicated by this mark.
Electrodes	Detect an electromagnetic force signal proportional to the flow rate of the fluid passing through the detector. The electrode material varies depending on the corrosion characteristics of the fluid to be measured.
Electrode cover	Houses the electrodes. Do not remove the cover with the detector installed on a pipe.
Grounding rings	Keep reference voltage as zero by grounding the unit. The grounding ring material varies depending on the corrosion characteristics of the fluid to be measured.
Terminal box (Remote model only)	Houses the connection terminals used for applying a standard voltage. Houses the excitation and signal terminals.
Terminal box cover (Remote model only)	Keeps the terminals dry and protected. Keep the terminal box cover on during operation.

1-3-2: Flange type detector

A Flange detector consists of the components shown in the figure below.

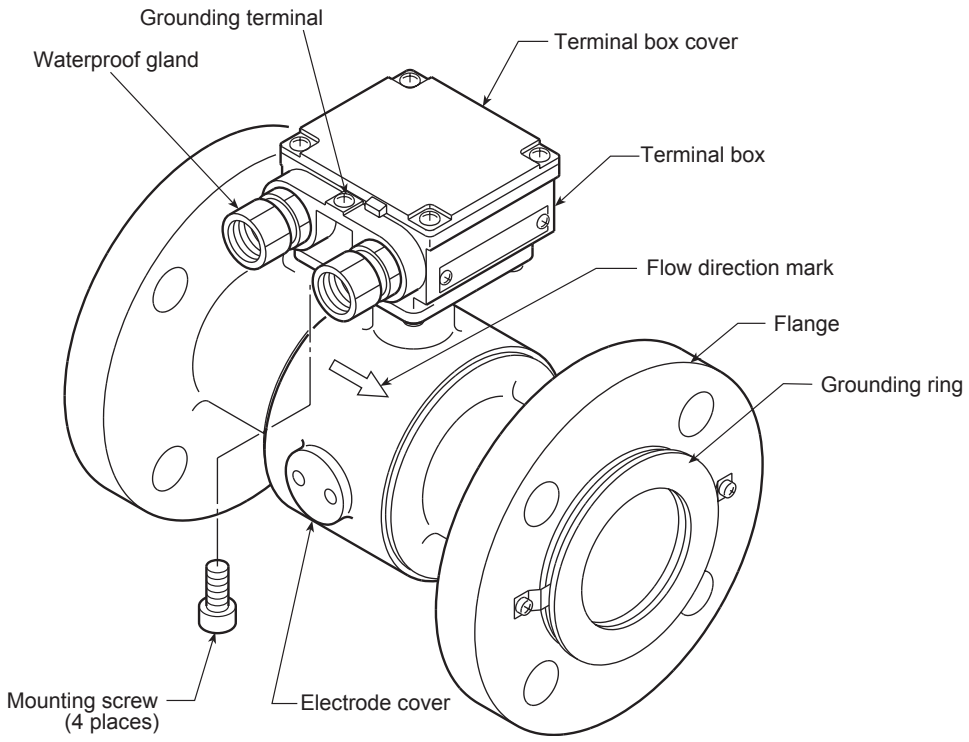


Figure 1-5 Flange detector main parts

Name	Function
Flow direction mark	Indicates the direction of fluid flow. Mount the detector so that the measured fluid flows in the direction indicated by this mark.
Electrodes	Detect an electromagnetic force signal proportional to the flow rate of the fluid passing through the detector. The electrode material varies depending on the corrosion characteristics of the fluid to be measured.
Electrode cover	Houses the electrodes. Do not remove the cover with the detector installed on a pipe.
Grounding rings	Keep reference voltage as zero by grounding the unit. The grounding ring material varies depending on the corrosion characteristics of the fluid to be measured.
Terminal box (Remote model only)	Houses the connection terminals used for applying a standard voltage. Houses the excitation and signal terminals.
Terminal box cover (Remote model only)	Keeps the terminals dry and protected. Keeps the terminal box cover on during operation.

1-3-3: Union / Hose / Clamp type detector

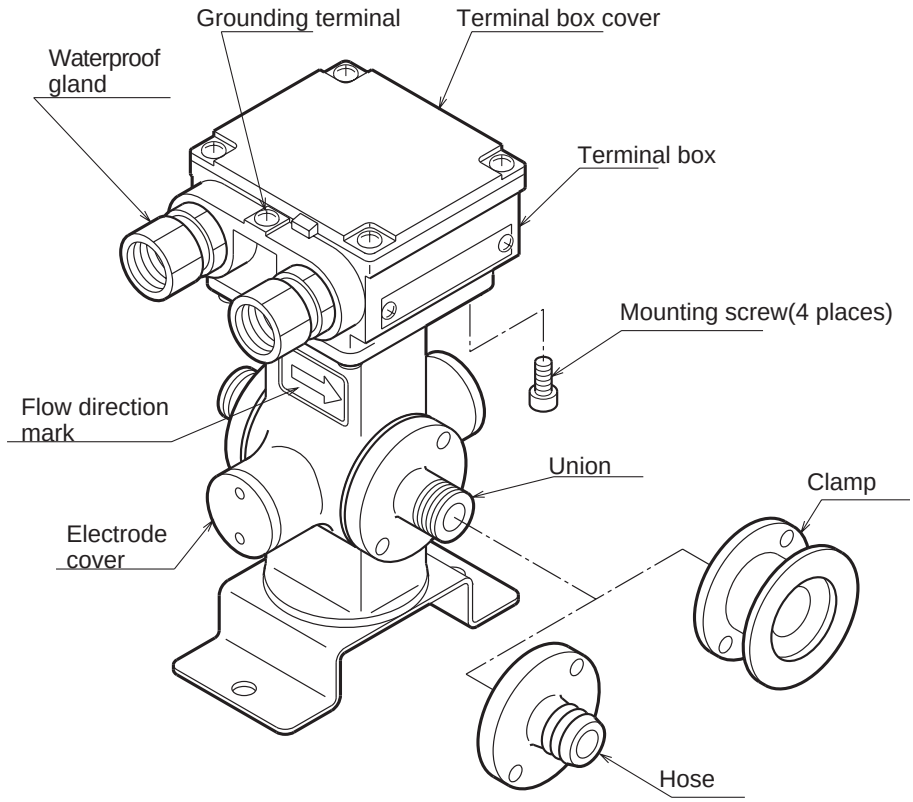


Figure 1-6 Union / Hose / Clamp detector main parts

Name	Function
Flow direction mark	Indicates the direction of fluid flow. Mount the detector so that the measured fluid flows in the direction indicated by this mark.
Electrodes	The electrodes generate an electromotive force signal proportional to the flow rate of the fluid passing through the detector. The electrode material varies depending on the corrosion characteristics of the fluid to be measured.
Electrode cover	Houses the electrodes. Do not remove the cover with the detector installed on a pipe.
Union (Connected by screws) **Hose** **Clamp**	The connection uses a union, hose, and clamp. The material is SUS316. Applicable for detector bore diameters of 2.5 to 15 mm.
Terminal box (Remote model only)	Houses the connection terminals used to apply a standard voltage. Houses excitation and signal terminals.
Terminal box cover (Remote model only)	Keeps the terminals box cover on during operation.

1-3-4: Sanitary type detector

Figure 1-7 shows the structure of the detector and the names of its major parts.

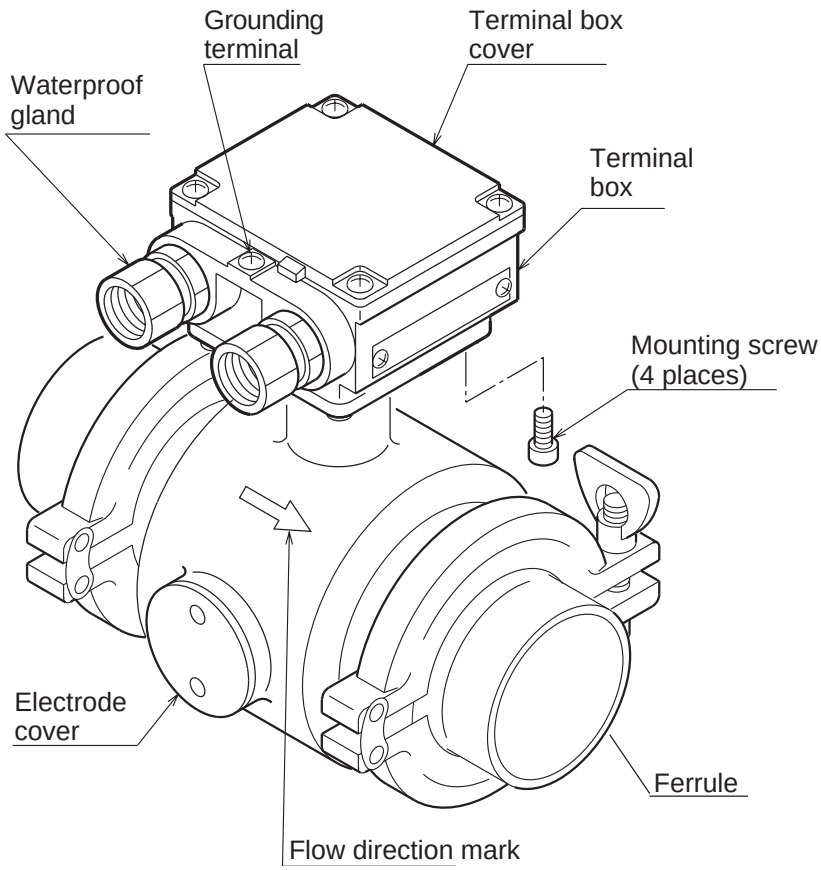


Figure 1-7 Details of the clamp type detector

Name	Function
Flow direction mark	Indicates the direction of fluid flow. Mount the detector so that the measured fluid flows in the direction indicated by this mark.
Electrodes	The electrodes generate an electromotive force signal proportional to the flow rate of the fluid passing through the detector. The electrode material varies depending on the corrosion characteristics of the fluid to be measured.
Electrode cover	Houses the electrodes. Do not remove the cover with the detector installed on a pipe.
Clamp	Clamp structure varies IDF clamp and tri-clamp.
Terminal box (Remote model only)	Houses the connection terminals used to apply a standard voltage. Houses excitation and signal terminals.
Terminal box cover (Remote model only)	Keeps the terminals box cover on during operation.

1-3-5: Detector terminal box

The detector terminal box houses the connection terminals used for applying a standard voltage. Houses the excitation and signal terminals.

⚠ WARNING

ELECTRIC SHOCK HAZARD! Turn off power to the converter side before wiring.

⚠ CAUTION

The detector must be grounded (grounding resistance is <100 Ω) to avoid output fluctuation, zero point instability or output drift.

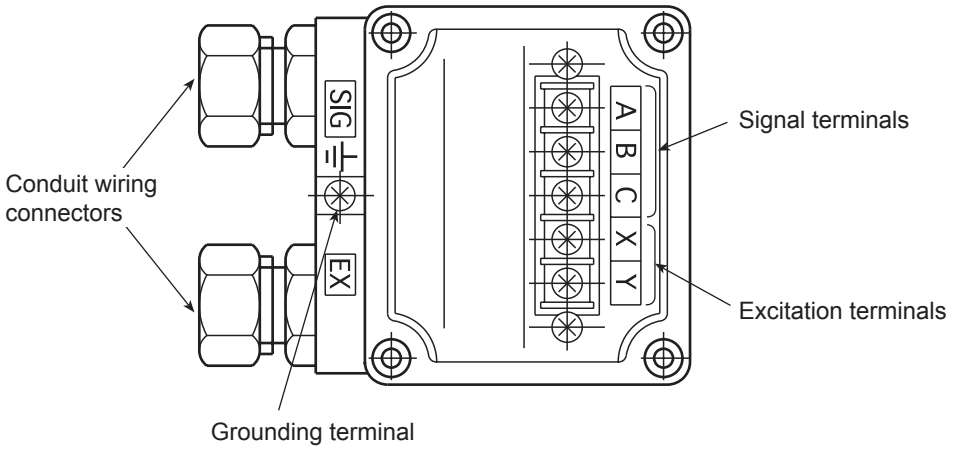


Figure 1-8 Detector terminal box main parts

Name	Function
Signal terminals	Marked A, B and C.
Excitation terminals	Marked X and Y.
Conduit wiring connectors	The excitation cable and the signal cable are wired through these connectors.
Grounding terminal	This terminal is used to ground the detector (grounding resistance is <100 Ω).

1-3-6: Approval of this device

Overview

If 1/2 NPT wiring connection is selected, this device functions as an FM/CSA, non-incendive -approved model. In this case, the installation standards described in this section must be followed.

Installation of this device

FM/CSA Nonincendive model

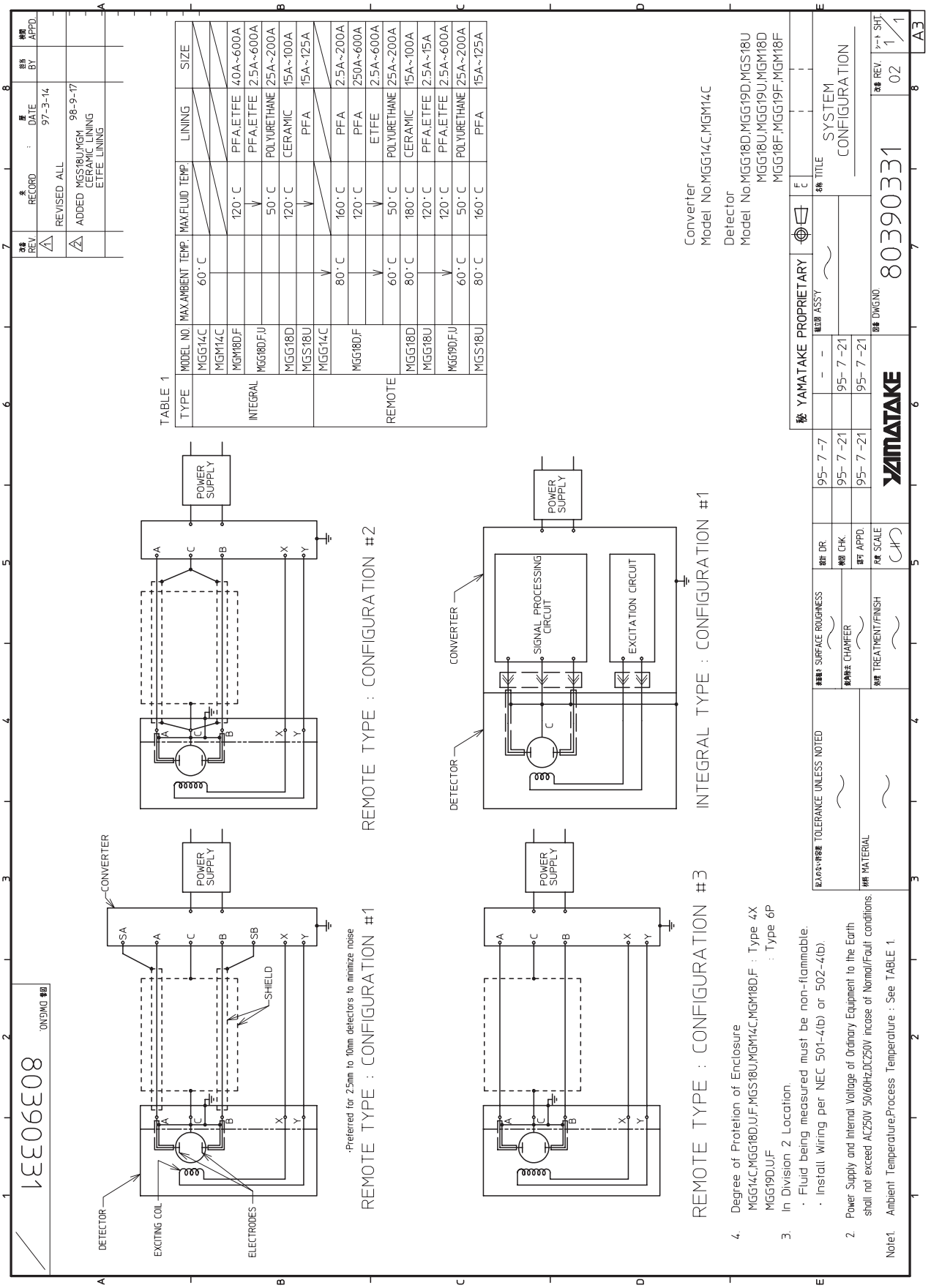
THIS EQUIPMENT IS SUITABLE FOR USE IN CLASS I, DIVISION 2, GROUPS (A, B, C, D), CLASS II/III, DIVISION 2, GROUPS (F, G), OR NON-HAZARDOUS LOCATIONS ONLY.

⚠ CAUTION

(1)Power supply and internal voltage of ordinary equipment to the earth shall not exceed 250 V AC 50/60 Hz, 250 V DC in case on normal / formal conditions.

(2)Ambient temperature is from -25 to 60°C

(3)Process temperature is from -40 to 160°C (Remote model).
Process temperature is from -40 to 120°C (Integral model)


80390331
REVISED ALL 97-3-14
ADDED MGS18U,MGM CERAMIC LINING ETFE LINING 98-9-17
TABLE 1
TYPE | MODEL NO | MAX.AMBIENT TEMP. | MAX.FLUID TEMP. | LINING | SIZE
INTEGRAL: MGG14C, MGM14C, MGM18D,F — 60°C — 120°C — PFA,ETFE — 40A~600A
INTEGRAL: MGG18D,FU — 60°C — 50°C — POLYURETHANE — 25A~200A
INTEGRAL: MGG18D — 60°C — 120°C — CERAMIC — 15A~100A
INTEGRAL: MGS18U — 60°C — 120°C — PFA — 15A~125A
REMOTE: MGG14C — 80°C — 160°C — PFA — 2.5A~200A
REMOTE: MGG18D,F — 80°C — 120°C — PFA — 250A~600A
REMOTE: MGG18D,F — 60°C — 50°C — ETFE — 2.5A~600A
REMOTE: MGG18D — 80°C — 180°C — POLYURETHANE — 25A~200A
REMOTE: MGG18U — 80°C — 120°C — CERAMIC — 15A~100A
REMOTE: MGG19D,FU — 60°C — 120°C — PFA,ETFE — 2.5A~15A
REMOTE: MGG19D,FU — 60°C — 50°C — PFA,ETFE — 2.5A~600A
REMOTE: MGS18U — 80°C — 160°C — POLYURETHANE — 25A~200A
REMOTE: MGS18U — 80°C — 120°C — PFA — 15A~125A
REMOTE TYPE : CONFIGURATION #1
REMOTE TYPE : CONFIGURATION #2
REMOTE TYPE : CONFIGURATION #3
INTEGRAL TYPE : CONFIGURATION #1
CONVERTER
POWER SUPPLY
SIGNAL PROCESSING CIRCUIT
EXCITATION CIRCUIT
DETECTOR
EXCITING COIL
ELECTRODES
SHIELD
·Preferred for 2.5mm to 10mm detectors to minimize noise
Converter
Model No.MGG14C,MGM14C
Detector
Model No.MGG18D,MGG19D,MGS18U
MGG18U,MGG19U,MGM18D
MGG18F,MGG19F,MGM18F
YAMATAKE PROPRIETARY
SYSTEM CONFIGURATION
80390331
02
A3
1. Degree of Protetion of Enclosure
MGG14C,MGG18D,U,F,MGS18U,MGM14C,MGM18D,F : Type 4X
MGG19D,U,F : Type 6P
3. In Division 2 Location.
· Fluid being measured must be non-flammable.
· Install Wiring per NEC 501-4(b) or 502-4(b).
2. Power Supply and Internal Voltage of Ordinary Equipment to the Earth shall not exceed AC250V 50/60Hz,DC250V incase of Normal/Fault conditions.
Note1. Ambient Temperature,Process Temperature : See TABLE 1.

Chapter 2 : Installation

This section describes unpacking, installation and wiring of the MagneW 3000 PLUS.

Depending on the grounding ring or piping material, the required parts or the method of device installation vary.

2-1 : Unpacking

This device is a precision instrument and should be handled with care to prevent damage or breakage.

⚠ WARNING
This detector is heavy. Dropping it could cause personal injury or damage to the device.

After unpacking the unit, verify that the following items are present:

- MagneW 3000 PLUS Detector
- Standard accessories
- Precautions for installation sheet

2-1-1: Verifying specifications

The specifications for this device are written on its attached identification plate. Compare these specifications with those listed in Appendix A, device standard specifications and model numbers, and verify that all specifications on the plate are correct, paying special attention to the following:

- Detector size
- Electrode material
- Lining material
- Flange rating
- Grounding ring material

If you have questions regarding the specifications of your device, contact your nearest Yamatake Corporation office or Yamatake Corporation representative. When making an inquiry, be sure to provide the model number and product number of this device.

2-2 : Storage

⚠ WARNING

Before removing the unit, make sure that there is no residual liquid or pressure inside the piping and the detector to avoid personal injury or damage to the unit.

When storing this device:

- Store the device indoors at room temperature and humidity, in a place safe from vibration or shock.
- Store the device in the same condition as it was shipped.

When storing this device after use:

(1) Rinse the inside of the detector with water to remove residual fluids and then allow it to dry.

(2) Firmly attach the terminal box cover and the electrode cover in order to keep out moisture.

(3) Replace the detector in its original packaging.

(4) Store the device indoors at room temperature and humidity, in a place safe from vibration or shock.

2-3 : Site selection

In order to make full use of the functions of the device, select an optimal installation site by following the selection criteria below.

⚠ CAUTION

Install the unit in a location with an ambient temperature of -30 to +80°C (-22 to + 176°F) and a relative humidity of 5% to 100%. Failing to meet these requirements could cause damage to the device or cause output errors.

Install the unit away from high-current power lines, motors and transformers to prevent damage from electromagnetic induction. Failing to meet this requirement could cause output errors.

Do not install the unit in a location subject to severe vibration or a highly corrosive atmosphere. Failing to meet this requirement could break the neck of the detector or cause other damage.

Install the unit as far from direct sunlight as possible to avoid output errors.

⚠ CAUTION

The installation location must satisfy the following conditions to avoid output errors and fluctuations.

At the installation location:

- The electrical conductivity of the fluid to be measured must match the stated specification (specs vary according to the converter used) and be more or less constant.
- The fluid to be measured must be electrochemically homogenized. For example, if two fluids are mixed at an upstream point, the device should be installed at a point so that the two fluids can be evenly mixed by the time they reach the measuring point.
- The distribution of additive matter, if any, must be nearly uniform.

⚠ CAUTION

To avoid measurement problems, do not use the MagneW 3000 PLUS to measure the following fluids, even if their electrical conductivity, temperature and pressure fall within the specifications.

Fluids that have sufficient electrical conductivity at high temperatures but do not satisfy the conductance requirements at room temperature (about 20°C (68°F)). For example, fatty acids or soap.

- Certain fluids that contain surfectants. For example, rinses, shampoos, CWM.
- Conductive adherents. For example, deposition of rosin or conductive material.
- Insulating adherents. For example, oil, kaolinite, kaolin, or calcium stearate.

⚠ CAUTION

This model MGG18 detector can only be connected to a Yamatake model MGG14C converter.
No other types of converter can be used with the device.

2-3-1: Detector position

- Position the detector so that its inner detector passage is continuously filled with the fluid being measured. The following figure provides examples.

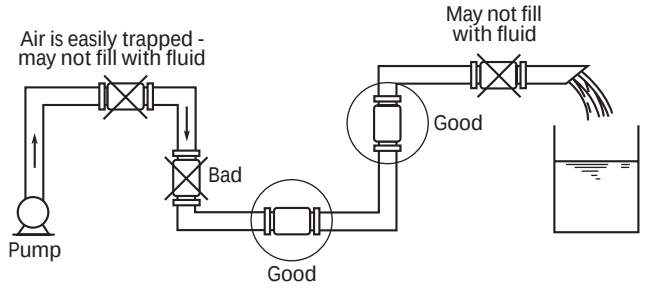


Figure 2-1 Detector placement

⚠ CAUTION

The detector must be positioned as shown by the circled areas in the figure shown above. If the pipe is not filled, output errors will occur.

- When measuring high viscosity fluid, connecting the pipe to a vertical detector is recommended (in order to secure an axial symmetrical flow).
- Install a straight pipe section on the upstream side of the detector. The following figure shows the length of the straight pipe section (D = nominal bore diameter of the detector).

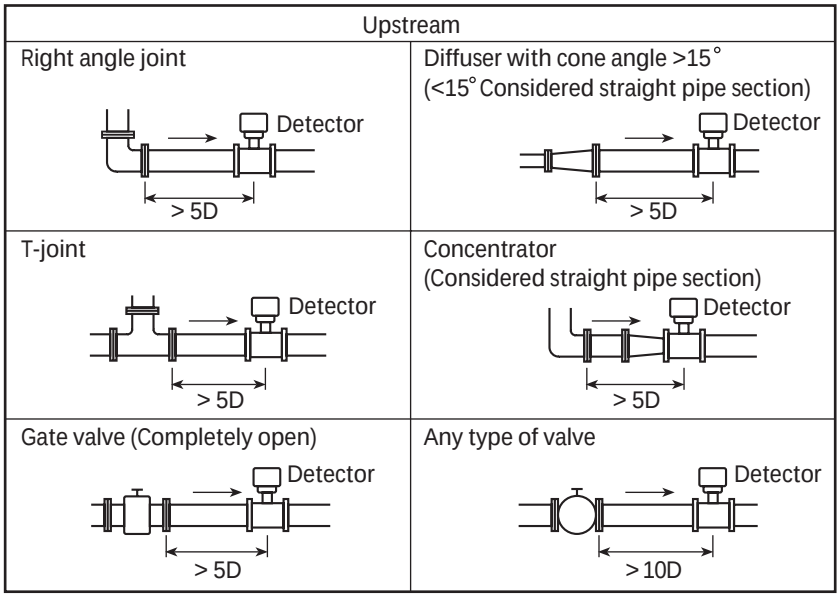


Figure 2-2 Straight pipe section on upstream side of detector

- Although a pipe section is not necessary on the downstream side, secure a section of at least 2D if eccentric flow appears.
- Select an installation site where there is no major pulsation or vibration (away from a pump).
- Make sure that there is adequate space around the detector after installation to perform maintenance.

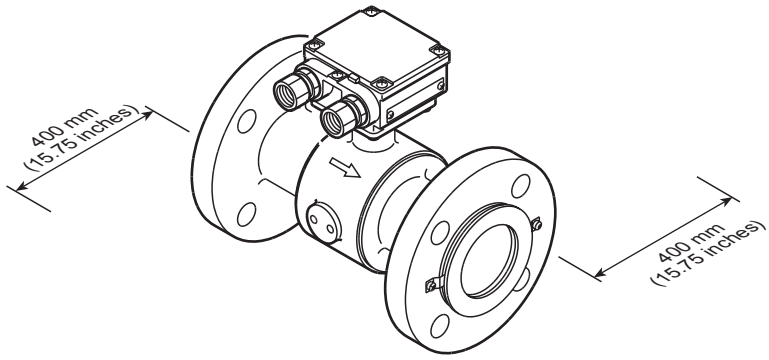


Figure 2-3 Space allowance required for maintenance

2-3-2: Changing the position of the terminal box

In some locations, the direction of the terminal box may be unsuitable if the detector is installed as it is shipped. In this case, the terminal box can be repositioned before installation.

After selecting an installation site, adjust the direction of the terminal box using the method described below.

To change the position of the terminal box:

(1) Using an M5 wrench, remove the four screws securing the terminal box to the detector.

(2) Holding the detector, rotate the terminal box horizontally to the required position.

⚠ CAUTION

Do not rotate the terminal box more than 180° (one half rotation). Any further rotation can disconnect wiring.
After removing the screws, do not pull on the terminal box. The lead wire can be broken.
When you move the terminal box, make sure the O-ring remains in the groove to insure an air-tight seal when the unit is reassembled.

(3) Using a hex wrench, retighten the four screws.

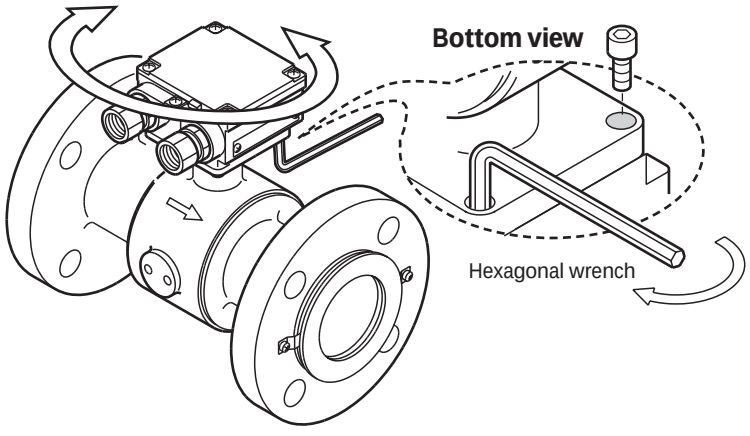


Figure 2-4 Repositioning the terminal box

2-4 : Installing a wafer detector

⚠ CAUTION

Before installing the detector, make sure any foreign matter is flushed from the interior passage of the detector. Residual foreign matter could cause output fluctuations.
Do not touch the electrodes or allow oil or fat to come into contact with them to avoid output fluctuations.
Align the direction mark on the detector in the direction of the liquid flow. Misalignment can result in a negative output.

The following figure shows the basic installation method for installing a wafer detector.

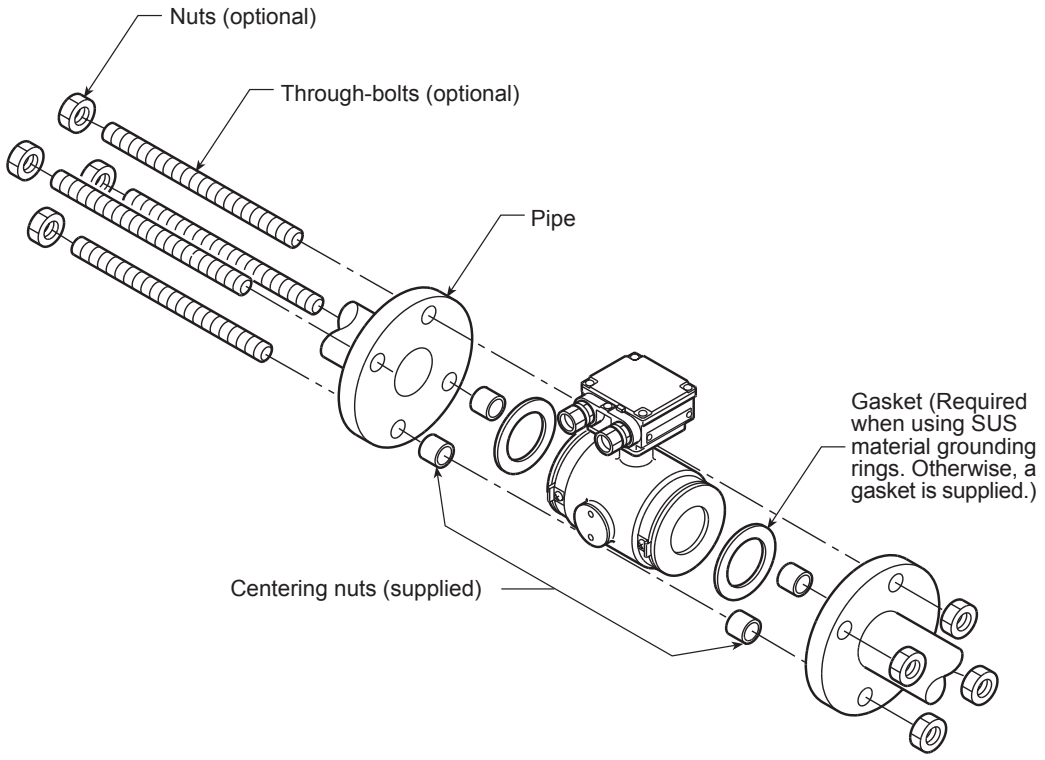


Figure 2-5 Installing a wafer detector

2-4-1: Determining the fastening torque

The following table shows the fastening torque for each pipe bore.

⚠ CAUTION

The correct fastening torque must be used to prevent leakage. To avoid damage to the detector, do not exceed the listed fastening torque.

Table 2-1 Fastening torque for wafer detectors

Nominal detector bore diameter mm (inch)		Fastening torque N•m (ft•lb)
2.5 - 15	(0.1 - 3/8)	13 - 18 (9.6 -13.3)
25	(1)	20 - 30 (14.8 - 22.1)
40 - 80	(1½ - 3.1)	30 - 50 (22.1 - 36.9)
100	(4)	50-70 (36.9 - 51.6)
125 - 150	(5 - 6)	80 -100 (59.0 - 73.8)
200	(4)	90 -100 (66.4 - 73.8)

2-4-2: Selecting the flange shape

The flanges used for installation should maximize the area of contact with the gasket.

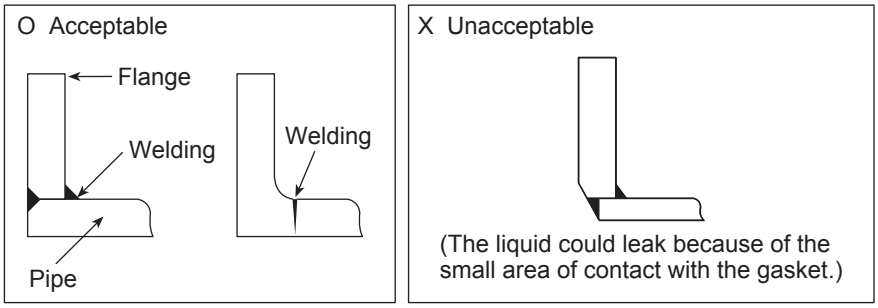


Figure 2-6 Flange Shapes

⚠ CAUTION

Before installing the detector, make sure that the pipe is exactly straight and centered. Any irregularity could cause leakage or other hazards.

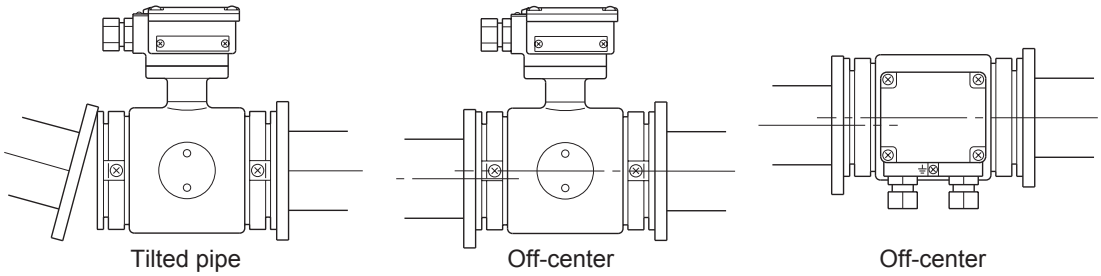


Figure 2-7 Unacceptable positioning

⚠ CAUTION

Never attempt to force the detector between two flanges if the space is too narrow. It can damage the detector.

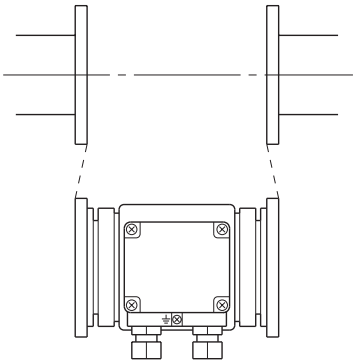


Figure 2-8 Unacceptable placement of detector between flanges

⚠ CAUTION

Make certain the bore diameters of the pipe and the detector are exactly the same and install the detector so that the gasket does not protrude into the inner bore of the pipe, as this could result in leakage or other hazards.

⚠ CAUTION

Tighten each bolt a little at a time and apply uniform pressure to all the bolts. If leakage continues after tightening the bolts, make sure that the pipe is not off center, then continue to tighten each bolt a little at a time.

2-4-3: Necessary parts

You will need the following parts to install a wafer detector:

- Centering nuts (four supplied)
- Connecting bolts and nuts (available separately)
- Gaskets: Required when using grounding rings made of SUS material. Not required when using grounding rings made of hastelloy, titanium, tantalum, or platinum.
- Protective Plate: Required when connecting the detector to polyvinyl chloride (PVC) piping.

Centering nuts

The centering nuts create the exact alignment of the pipe and detector. These nuts are positioned on through-bolts and the detector is set on top of the nuts to properly position it against the flanges.

The position of the centering nuts depends on the direction in which the detector is installed. For horizontal centering of the detector, position two centering nuts against each flange. For vertical centering of the detector, position the four centering nuts on the bottom flange. The following figures show horizontal and vertical centering nut positions.

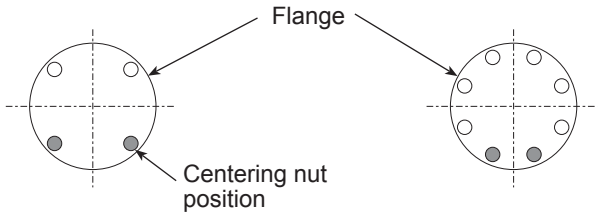


Figure 2-9 Centering nut positioning for horizontal centering

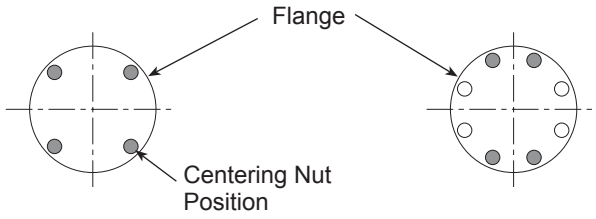


Figure 2-10 Centering nut positioning for vertical centering

Gaskets

Gaskets are supplied with the grounding ring, except when it is made of SUS material. If you are using SUS material, you must provide the gaskets. Yamatake recommends joint sheet or polytetraflouroethylene (PTFE) gasket material. For the inner (bore) diameters of the gaskets, see the following table. Rubber gaskets are not recommended.

⚠ CAUTION

Using a gasket with too small a diameter can affect the flow velocity distribution, resulting in inaccurate measurement.
Using a gasket with too large a diameter can cause leakage. Also, any solid substance in the fluid to be measured could accumulate between the gasket and the flange, resulting in inaccurate measurement.

Table 2-2 Recommended inner diameters of gaskets

Nominal detector bore diameter	**mm**	2.5	5	10	15	25	40	50	65	80	100	125	150	200
	(inch)	0.1	0.2	3/8	1/2	1	1½	2	2½	3	4	5	6	8
Gasket inner diameter	**mm** ±	6 1	6 1	11 1	16 1	25 1	40 1	51 1	64 1	76 1	101 1	124 1	148 1	196 1
	(inch) ±	0.24 0.04	0.24 0.04	0.43 0.04	0.63 0.04	0.98 0.04	1.57 0.04	2.01 0.04	2.52 0.04	2.99 0.04	3.98 0.04	4.88 0.04	5.83 0.04	7.72 0.04

If you install the detector at a lower torque level using rubber gaskets, you must use gaskets with the bore and outer diameters for the respective pipe bore shown in the following table. Depending on the grounding ring material, two gaskets of different thicknesses may be required. The following two tables provide the inner and outer diameters for the two different gasket thicknesses.

Table 2-3 Inner and outer diameters of rubber gaskets of thickness 0.5 to 1 mm (0.02 to 0.04 inches)

Nominal detector bore diameter	mm	2.5	5	10	15	25	40	50	65	80	100	125	150	200
	(inch)	0.1	0.2	3/8	1/2	1	1½	2	2½	3	4	5	6	8
Gasket inner diameter	mm ±	6 1	6 1	11 1	16 1	25 1	40 1	51 1	64 1	76 1	101 1	124 1	148 1	196 1
	(inch) ±	0.24 0.04	0.24 0.04	0.43 0.04	0.63 0.04	0.98 0.04	1.57 0.04	2.01 0.04	2.52 0.04	2.99 0.04	3.98 0.04	4.88 0.04	5.83 0.04	7.72 0.04
Gasket outer diameter	mm ±	34 1	34 1	34 1	34 1	50 1	75 1	91 1	111 1	121 1	146 1	177 1	207 1	257 1
	(inch) ±	1.34 0.04	1.34 0.04	1.34 0.04	1.34 0.04	1.97 0.04	2.95 0.04	3.58 0.04	4.37 0.04	4.76 0.04	5.75 0.04	6.97 0.04	8.15 0.04	10.12 0.04

Table 2-4 Inner and outer diameters of rubber gaskets of thickness 3 to 4 mm (0.12 to 0.16 inches)

Nominal detector bore diameter	mm	2.5	5	10	15	25	40	50	65	80	100	125	150	200
	(inch)	0.1	0.2	3/8	1/2	1	1½	2	2½	3	4	5	6	8
Gasket inner diameter	mm ±	6 1	6 1	11 1	16 1	25 1	39 1	51 1	64 1	76 1	101 1	124 1	148 1	196 1
	(inch) ±	0.24 0.04	0.24 0.04	0.43 0.04	0.63 0.04	0.98 0.04	1.54 0.04	2.01 0.04	2.52 0.04	2.99 0.04	3.98 0.04	4.88 0.04	5.83 0.04	7.72 0.04
Gasket outer diameter	mm ±	34 1	34 1	34 1	34 1	50 1	68 1	84 1	104 1	114 1	139 1	166 1	190 1	240 1
	(inch) ±	1.34 0.04	1.34 0.04	1.34 0.04	1.34 0.04	1.97 0.04	2.68 0.04	3.31 0.04	4.09 0.04	4.49 0.04	5.47 0.04	6.54 0.04	7.48 0.04	9.45 0.04

2-4-4: Selecting an installation method

To select an installation method you must determine the following:

- Horizontal or vertical placement of the detector
- Mounting pipe material
- Grounding ring material
- Need for a protective plate
- Use of rubber gaskets

⚠ CAUTION

The necessary materials and the installation method vary according to the material of the ring and that of the pipe on which the detector is to be installed. Select the appropriate method of installation from the following table after confirming the specifications of the detector to be installed and the conditions of installation. Improper installation can result in leakage or damage to the pipe flanges.

Table 2-5 Wafer detector installation methods

Pipe material	Grounding ring material	Installation Requirements	See Page
Metal	SUS material	With specified fastening torque	page 2-17
		With rubber gaskets and low fastening torque	page 2-19
	Non-SUS material	With specified fastening torque	page 2-18
		With rubber gaskets and low fastening torque	page 2-19
PVC	SUS material	With specified fastening torque	page 2-21
		With a protective plate	page 2-22
		With rubber gaskets and low fastening torque	page 2-23
	Non-SUS material	With specified fastening torque	page 2-24
		With a protective plate	page 2-25
		With rubber gaskets and low fastening torque	page 2-26

2-4-5: Installation on a horizontal pipe

To install a wafer detector on a horizontal pipe:

(1) Slip two centering nuts onto each of the four through-bolts.

(2) Insert two of the through-bolts into the flange holes as indicated in the figure below.

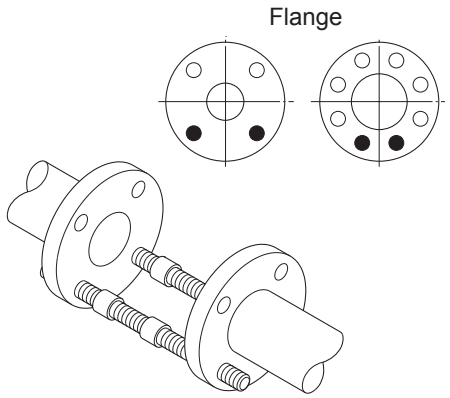


Figure 2-11 Inserting the through-bolts

(3) Position the detector so that the direction mark on the device matches the direction of fluid flow.

(4) Insert the detector and gaskets between the pipe flanges.

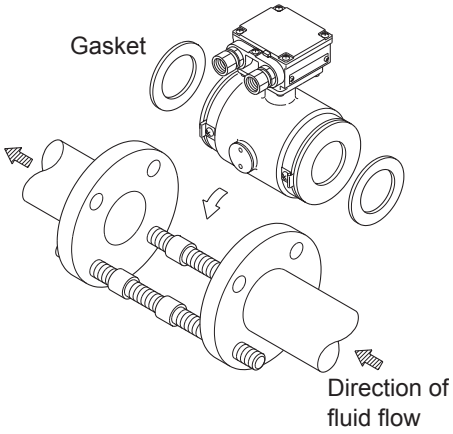


Figure 2-12 Inserting the detector

(5) Position the detector so that it sits on the centering nuts and make sure it remains properly centered.

(6) Make sure the gaskets do not protrude beyond the edges of the pipe flanges.

(7) Insert the remaining two through-bolts into the flange holes and tighten the bolts evenly using the appropriate fastening torque from Table 2-1 on page 2-7.

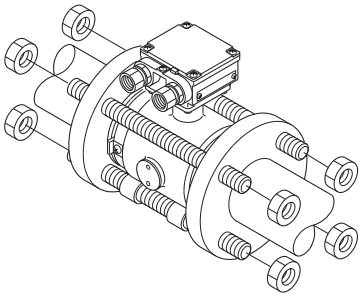


Figure 2-13 Tightening the bolts

2-4-6: Installation on a vertical pipe

To install a wafer detector on a vertical pipe:

(1) Slip one centering nut onto each of the four through-bolts.

(2) Insert two of the through-bolts into the back flange holes indicated in the figure below.

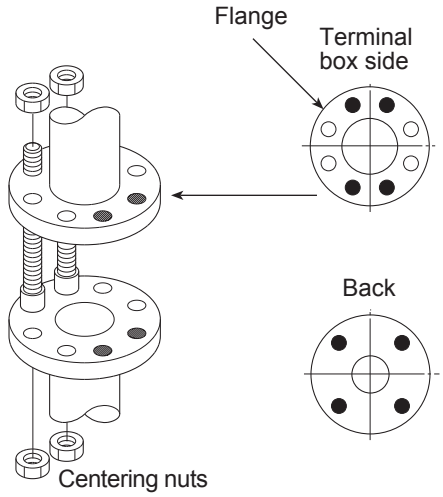


Figure 2-14 Inserting the through-bolts

(3) Position the detector so that the direction mark on the device matches the direction of fluid flow.

(4) Insert the detector and gaskets between the pipe flanges.

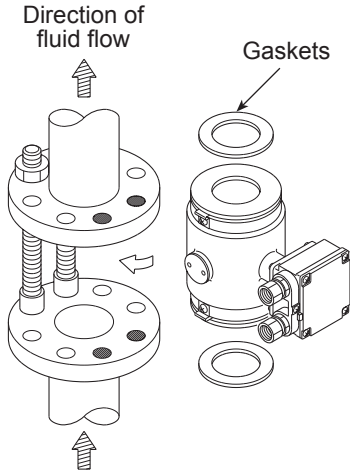


Figure 2-15 Inserting the detector

(5) Insert two through-bolts (fitted with one centering nut each) into the remaining two holes as shown in Figure 2-14 on page 2-14.

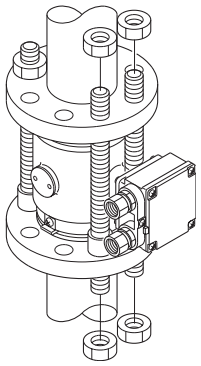


Figure 2-16 Inserting the through-bolts with centering nuts

(6) Make sure the gaskets do not protrude beyond the edges of the pipe flanges.

(7) Insert the remaining through-bolts into the flange holes and tighten the bolts evenly using the appropriate fastening torque from Table 2-1 on page 2-7.

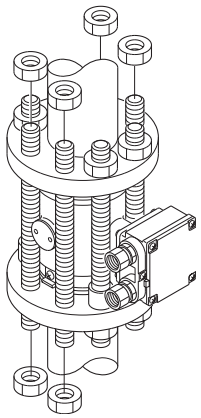


Figure 2-17 Inserting the remaining through-bolts and tightening the bolts

2-4-7: Installation on a metal pipe using SUS grounding ring material

The installation method described in this section is for installation on a metal pipe using SUS grounding ring material. For the installation method corresponding to any other combination of materials, refer to Table 2-5 on page 2-12.

For installation using SUS grounding ring material, Yamatake recommends non-rubber gaskets such as joint sheet or PTFE. Although rubber gaskets can be used, it is not possible to reduce the fastening torque. See page 2-19 for installation using rubber gaskets.

⚠ CAUTION

The use of rubber gaskets is not recommended and can cause leakage.

To install a wafer detector on a metal pipe using SUS grounding ring material and a specified torque:

- Install the detector as shown in the following illustration. The torque level for tightening the bolts is not related to the gasket material.

  See Table 2-1 on page 2-7 for the appropriate torque.

  See Table 2-2 on page 2-10 for the inner diameter of the gasket.

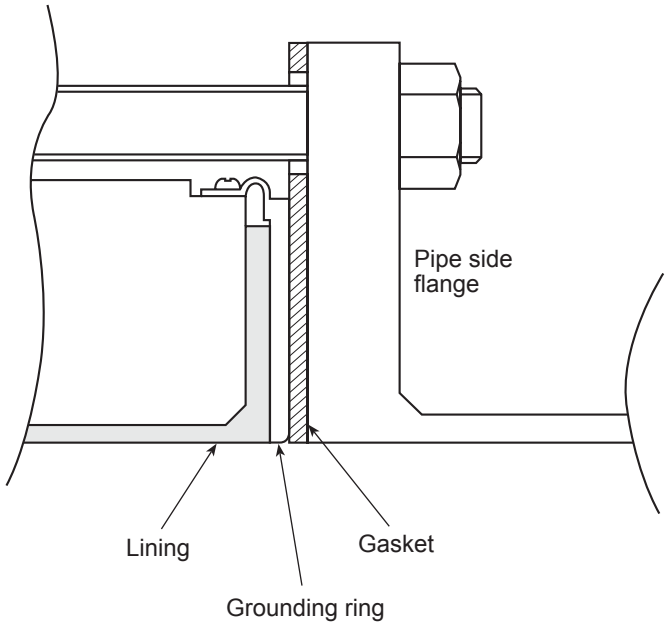


Figure 2-18 Installation on a metal pipe using SUS grounding ring material and a specified torque

2-4-8: Installation on a metal pipe using non-SUS grounding ring material

The installation methods described in this section are for installation on a metal pipe using non-SUS grounding ring material. For the installation method corresponding to any other combination of materials, refer to Table 2-5 on page 2-12.

PTFE gaskets are provided for this type of installation. Although rubber gaskets can be used, it is not possible to reduce the fastening torque. See page 2-19 for installation using rubber gaskets.

⚠ CAUTION

The use of anything other than the PTFE gaskets provided can result in leakage. The use of rubber gaskets is not recommended and can cause leakage.

To install a wafer detector on a metal pipe using non-SUS grounding ring material and a specified torque:

- Install the detector as shown in the following illustration. The torque level for tightening the bolts is not related to the gasket material.

  See Table 2-1 on page 2-7 for the appropriate torque.

  See Table 2-2 on page 2-10 for the inner diameter of the gasket.

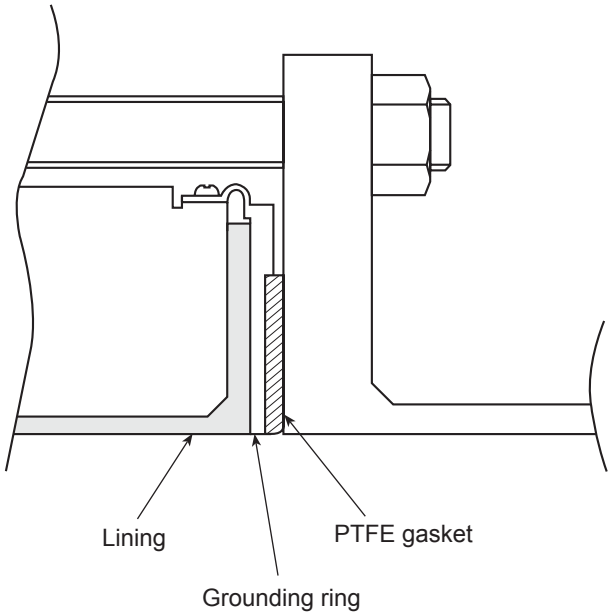


Figure 2-19 Installation on a metal pipe using non-SUS grounding ring material and a specified torque

To install a wafer detector on a metal pipe using non-SUS grounding ring material with rubber gaskets:

⚠ CAUTION

The use of anything other than the PTFE gaskets provided can result in leakage. The use of rubber gaskets is not recommended and can cause leakage.

(1) Remove the grounding ring from the detector and insert a rubber gasket 0.5 to 1.0 mm (0.02 to 0.04 inch) thick between the lining and the grounding ring.

(2) Reinsert the grounding ring on top of the rubber gasket.

(3) Remove the PTFE gasket and insert a rubber gasket 3.0 to 4.0 mm (0.12 to 0.16 inch) to replace it.

(4) With the rubber gaskets in the position shown in the following figure, attach the detector to the pipe. Both rubber gaskets should be made of the same material.

See Table 2-3 on page 2-11 and Table 2-4 on page 2-11 for the rubber gasket dimensions.

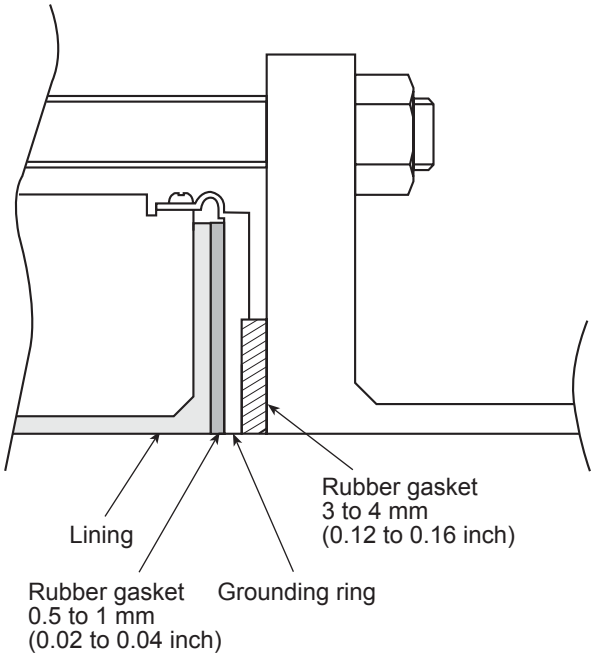


Figure 2-20 Installation on a metal pipe using non-SUS grounding ring material with rubber gaskets

(5) Fasten the bolts with a torque that provides a leakproof joint.

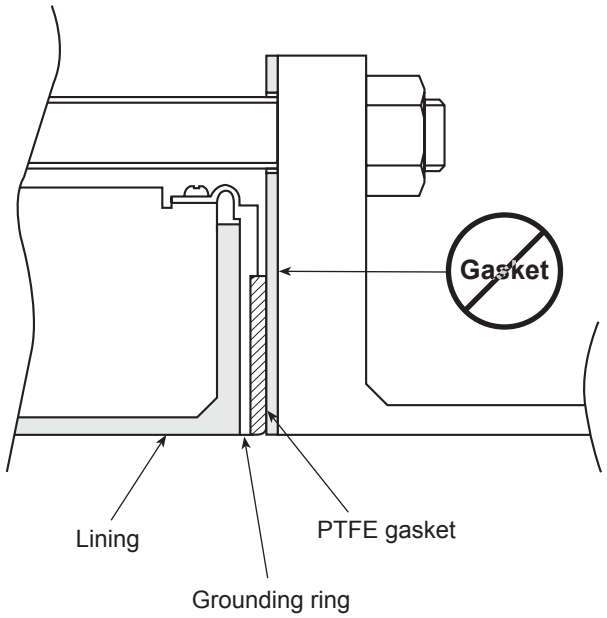


Figure 2-21 Incorrect installation

2-4-9: Installation on a PVC pipe using SUS grounding ring material

The installation methods described in this section are for installation on a PVC pipe using SUS grounding ring material. For the installation method corresponding to any other combination of materials, refer to Table 2-5 on page 2-12.

PTFE gaskets are provided for this type of installation. If you supply the gaskets, Yamatake recommends non-rubber gaskets such as joint sheet or PTFE. Although rubber gaskets can be used, they are not recommended. See page 2-23 for installation using rubber gaskets.

⚠ CAUTION

The use of rubber gaskets and a lower fastening torque is not recommended and can cause insufficient surface pressure between the lining and the grounding ring, resulting in leakage.

If tightening the bolts at the specified torque threatens to warp or damage the PVC pipes, you will need to use a protective plate. See page 2-22 for installation of the protective plate.

To install a wafer detector on a PVC pipe using SUS grounding ring material with a specified fastening torque:

- Install the detector as shown in the following illustration. The torque level for tightening the bolts is not related to the gasket material.

  See Table 2-1 on page 2-7 for the appropriate torque.

  See Table 2-2 on page 2-10 for the inner diameter of the gasket.

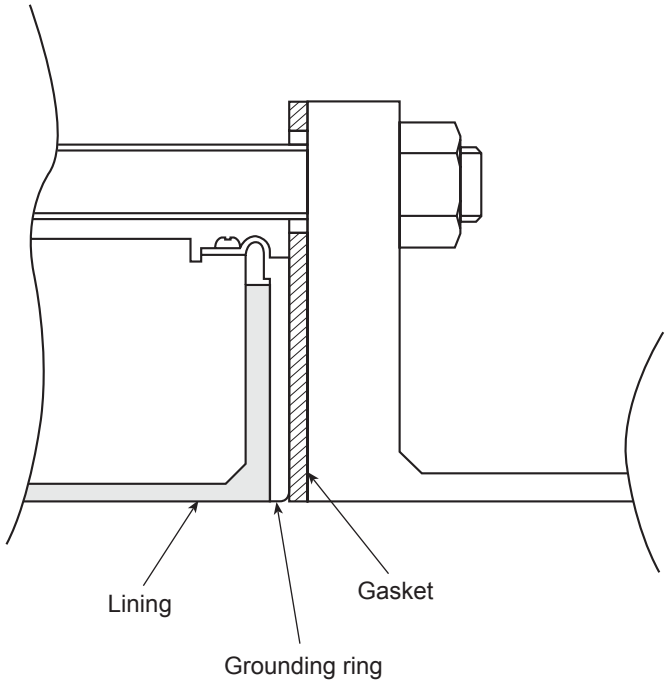


Figure 2-22 Installation on a PVC pipe using SUS grounding ring material

To install a wafer detector on a PVC pipe using SUS grounding ring material and a protective plate:

Use this method to install the detector using a protective plate to prevent the PVC pipe from being deformed or damaged when the bolts are tightened with the specified torque.

- Install the protective plate between the outer side of the PVC flange and the detector, as shown in the figure below. The protective plate protects the PVC pipe. The torque level for tightening the bolts is not related to the gasket material.

  See Table 2-1 on page 2-7 for the appropriate torque.

  See Table 2-2 on page 2-10 for the inner diameter of the gasket.

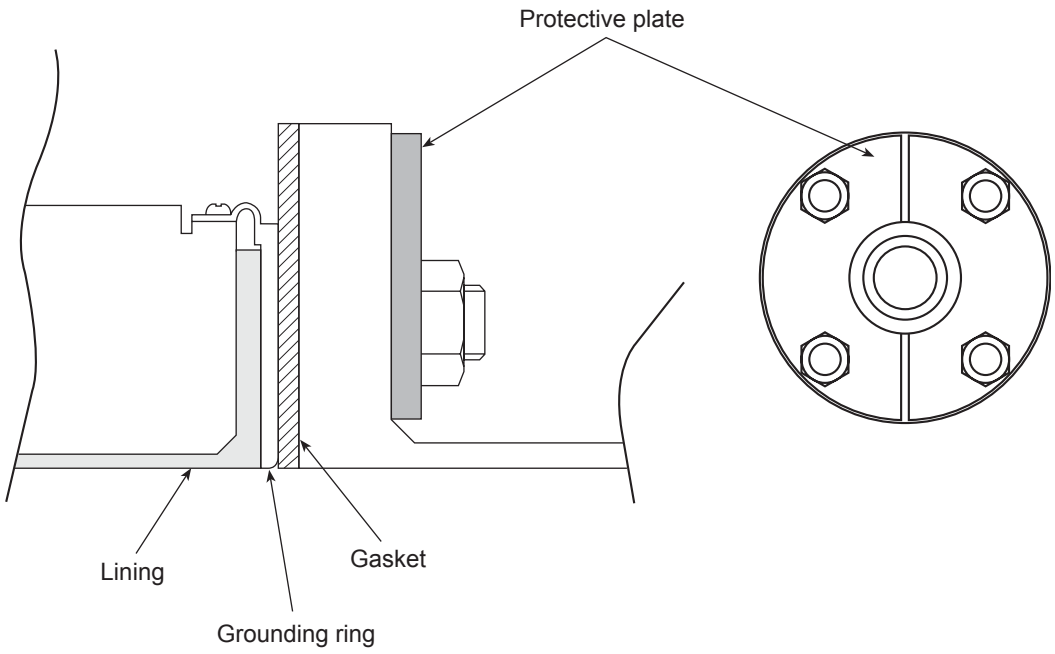


Figure 2-23 Installation on a PVC pipe using SUS grounding ring material and a protective plate

To install a wafer detector on a PVC pipe using SUS grounding ring material with rubber gaskets and a low fastening torque:

⚠ CAUTION

The use of rubber gaskets and a lower fastening torque is not recommended and can cause insufficient surface pressure between the lining and the grounding ring, resulting in leakage.

(1) Remove the grounding ring from the detector and insert a rubber gasket 0.5 to 1.0 mm (0.02 to 0.04 inch) thick between the lining and the grounding ring.

(2) Reinsert the grounding ring on top of the rubber gasket.

(3) With the rubber gasket in the position shown in the following figure, attach the detector to the pipe. In the example shown, both rubber gaskets are made of the same material.

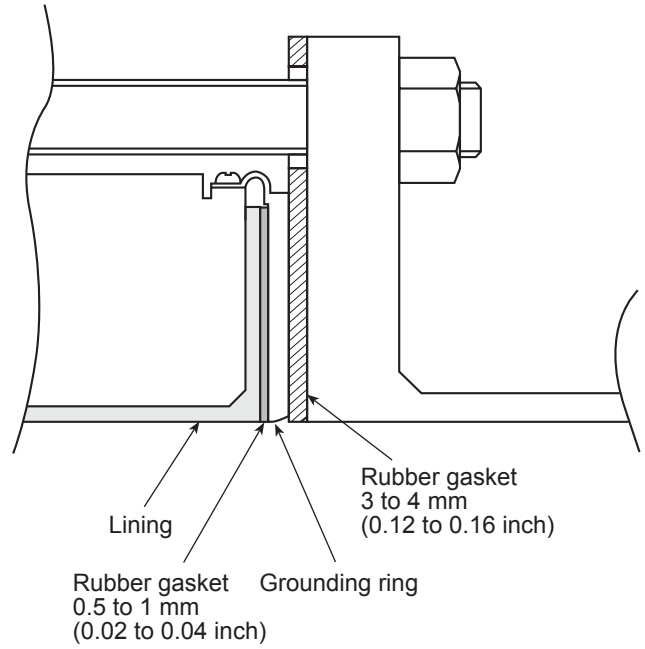


Figure 2-24 Installation on a PVC pipe using SUS grounding ring material with rubber gaskets (Not recommended)

(4) Fasten the bolts with a torque that provides a leakproof joint.

2-4-10: Installation on a PVC pipe using non-SUS grounding ring material

The installation methods described in this section are for installation on a PVC pipe using non-SUS grounding ring material. For the installation method corresponding to any other combination of materials, refer to Table 2-5 on page 2-12.

PTFE gaskets are provided for this type of installation. If you supply the gaskets, Yamatake recommends non-rubber gaskets such as joint sheet or PTFE. Although rubber gaskets can be used, they are not recommended. See page 2-26 for installation using rubber gaskets.

⚠ CAUTION

The use of rubber gaskets and a lower fastening torque is not recommended and can cause insufficient surface pressure between the lining and the grounding ring, resulting in leakage.

If tightening the bolts at the specified torque threatens to warp or damage the PVC pipes, you will need to use a protective plate. See page 2-25 for installation of the protective plate.

To install a wafer detector on a PVC pipe using non-SUS grounding ring material with a specified fastening torque:

- Install the detector as shown in the following illustration. The torque level for tightening the bolts is not related to the gasket material.

  See Table 2-1 on page 2-7 for the appropriate torque.

  See Table 2-2 on page 2-10 for the inner diameter of the gasket.

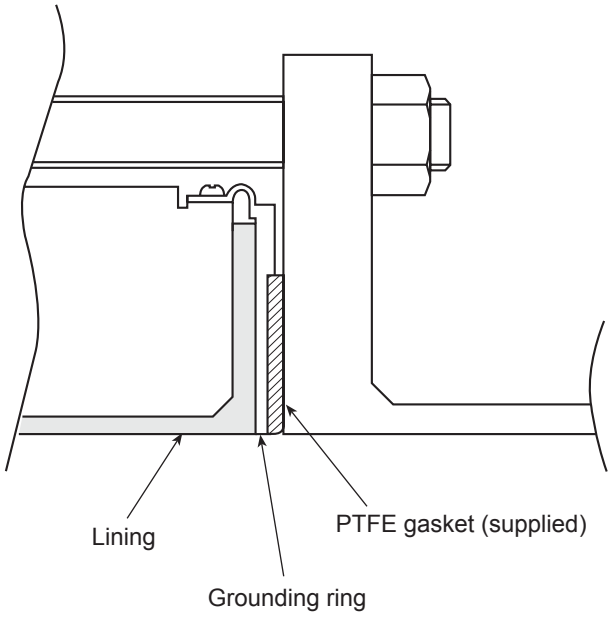


Figure 2-25 Installation on a PVC pipe using non-SUS grounding ring material

To install a wafer detector on a PVC pipe using non-SUS grounding ring material and a protective plate:

Use this method to install the detector using a protective plate to prevent the PVC pipe from being deformed or damaged when the bolts are tightened with the specified torque.

- Install the protective plate between the outer side of the PVC flange and the detector, as shown in the figure below. The protective plate protects the PVC pipe. The torque level for tightening the bolts is not related to the gasket material.

  See Table 2-1 on page 2-7 for the appropriate torque.

  See Table 2-2 on page 2-10 for the inner diameter of the gasket.

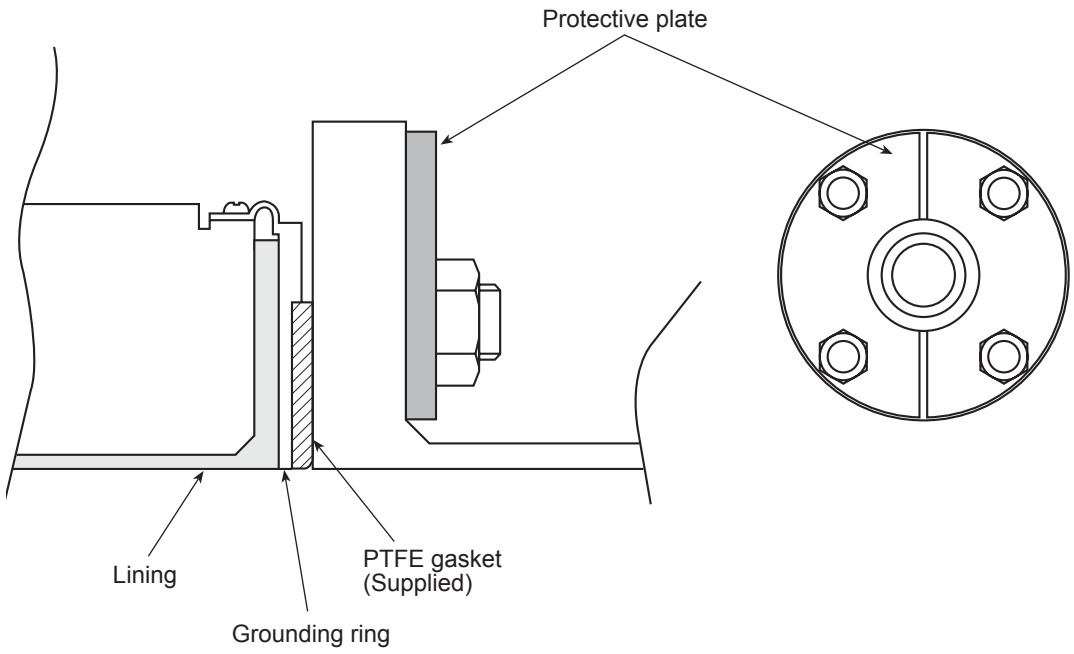


Figure 2-26 Installation on a PVC pipe using non-SUS grounding ring material and a protective plate

To install a wafer detector on a PVC pipe using non-SUS grounding ring material with rubber gaskets and a low fastening torque:

⚠ CAUTION

The use of rubber gaskets and a lower fastening torque is not recommended and can cause insufficient surface pressure between the lining and the grounding ring, resulting in leakage.

(1) Remove the grounding ring from the detector and insert a rubber gasket 0.5 to 1.0 mm (0.02 to 0.04 inch) thick between the lining and the grounding ring.

(2) Reinsert the grounding ring on top of the rubber gasket.

(3) Remove the PTFE gasket and insert a rubber gasket 3.0 to 4.0 mm (0.12 to 0.16 inch) to replace it.

(4) With the rubber gaskets in the position shown in the following figure, attach the detector to the pipe. Both rubber gaskets should be made of the same material. See Table 2-3 on page 2-11 and Table 2-4 on page 2-11 for the appropriate dimensions.

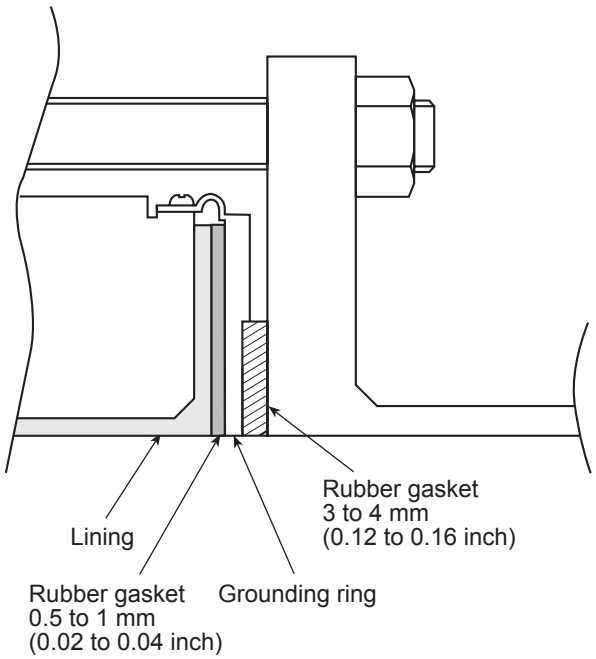


Figure 2-27 Installation on a PVC pipe using non-SUS grounding ring material with rubber gaskets

(5) Fasten the bolts with a torque that provides a leakproof joint.

2-5 : Installing a flanged detector

⚠ CAUTION

Before installing the detector, make sure any foreign matter is flushed from the interior passage of the detector. Residual foreign matter could cause output fluctuations.
Do not touch the electrodes or allow oil or fat to come into contact with them to avoid output fluctuations.
Align the direction mark on the detector in the direction of the liquid flow. Misalignment can result in a negative output.

The following figure shows the basic installation method for installing a flanged detector.

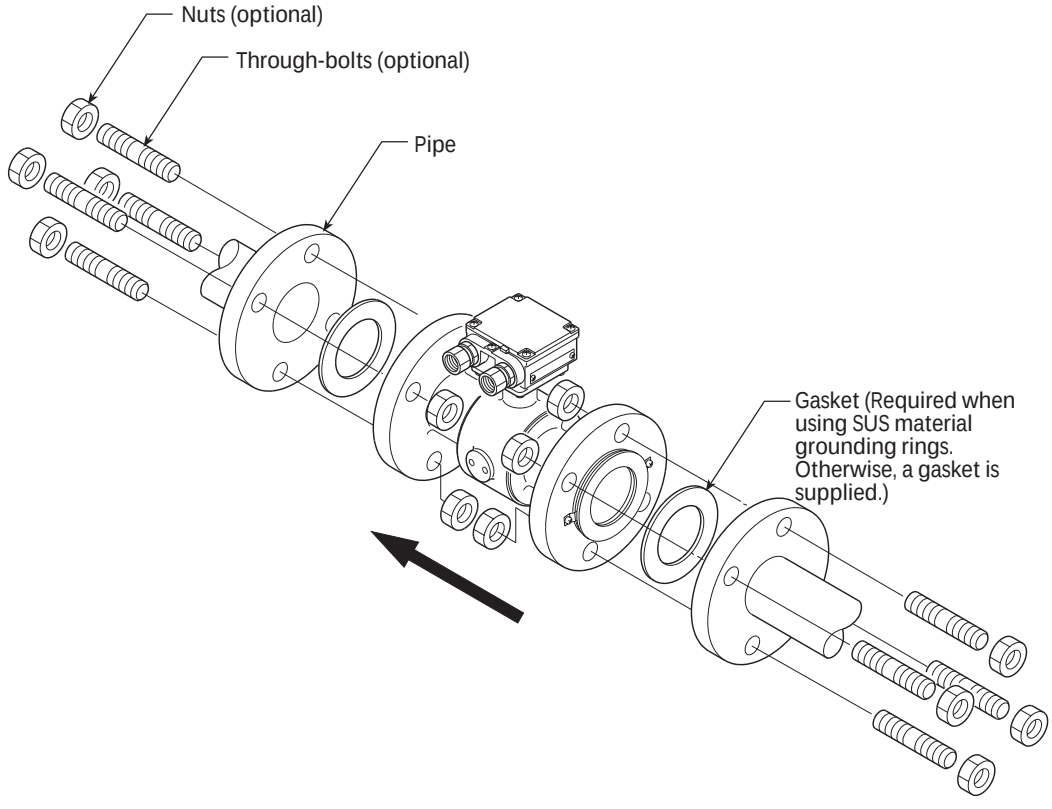


Figure 2-28 Installing a flanged detector

2-5-1: Determining the fastening torque

The following table shows the fastening torque for each pipe bore.

⚠ CAUTION

The correct fastening torque must be used to prevent leakage. To avoid damage to the detector, do not exceed the listed fastening torque.

Table 2-6 Fastening torque for flanged detectors

Nominal detector bore diameter mm (inch)	Flange ratings	Fastening torque		
		N•m (ft•lb)		kgf•cm
2.5 - 15 mm (0.1 - 3/8 inch)	JIS 10K	6 - 9	(4.4 - 6.6)	61 - 92
	JIS 20K	6 - 9	(4.4 - 6.6)	61 - 92
	JIS 30K	18 - 31	(13.3 - 22.9)	184 - 316
	JPI 150 JPI 300			
	ANSI 150	6 - 9	(4.4 - 6.6)	61 - 92
	ANSI 300	6 - 9	(4.4 - 6.6)	61 - 92
	DIN PN10/16	6 - 9	(4.4 - 6.6)	61 - 92
	DIN PN25/40	9 - 14	(6.6 - 10.3)	92 - 143
25 mm (1 inch)	JIS 10K	21 - 31	(15.5 - 22.9)	214 - 316
	JIS 20K	21 - 32	(15.5 - 23.6)	214 - 326
	JIS 30K	23 - 36	(17.0 - 26.6)	235 - 367
	JPI 150 JPI 300			
	ANSI 150	11 - 17	(8.1 - 12.5)	112 - 173
	ANSI 300	22 - 34	(16.2 - 25.1)	224 - 347
	DIN PN10/16	10 - 14	(7.4 - 10.3)	102 - 143
	DIN PN25/40	12 - 18	(8.9 - 13.3)	122 - 184
40 mm (1½ inches)	JIS 10K	22 - 32	(16.2 - 23.6)	224 - 326
	JIS 20K	22 - 34	(16.2 - 25.1)	224 - 347
	JIS 30K	41 - 65	(30.2 - 47.9)	418 - 663
	JPI 150 JPI 300			
	ANSI 150	13 - 18	(9.6 - 13.3)	133 - 184
	ANSI 300	36 - 57	(26.6 - 42.0)	367 - 581
	DIN PN10/16	22 - 32	(16.2 - 23.6)	224 - 326
	DIN PN25/40	25 - 38	(18.4 -28.0)	255 -387
50 / 65 mm (2 / 2½ inches)	JIS 10K	24 - 34	(17.7 - 25.1)	245 - 347
	JIS 20K	19 - 31	(14.0 - 22.9)	194 - 316
	JIS 30K	22 - 34	(16.2 - 25.1)	224 - 347
	JPI 150 JPI 300			
	ANSI 150	23 - 32	(17.0 - 23.6)	235 - 326
	ANSI 300	20 - 32	(14.8 - 23.6)	204 - 326

Table 2-6 Fastening torque for flanged detectors

Nominal detector bore diameter mm (inch)	Flange ratings	Fastening torque		
		N•m (ft•lb)		kgf•cm
	DIN PN10/16	24 - 34	(17.7 - 25.1)	245 - 347
	DIN PN25/40	28 - 42	(20.7 - 31.0)	286 - 428
80 mm (3 inches)	JIS 10K	20 - 31	(14.8 - 22.9)	204 - 316
	JIS 20K	37 - 61	(27.3 - 45.0)	377 - 622
	JIS 30K	42 - 66	(31.0 - 48.7)	428 - 673
	JIS G3451 F12	18 - 37	(13.3 - 27.3)	184 - 377
	JPI 150 JPI 300			
	ANSI 150	26 - 35	(19.2 - 25.8)	265 - 357
	ANSI 300	37 - 57	(27.3 - 42.0)	377 - 581
	DIN PN10/16	20 - 31	(14.8 - 22.9)	204 - 316
	DIN PN25/40	25 - 39	(18.4 - 28.8)	255 - 398
100 mm (4 inches)	JIS 10K	22 - 33	(16.2 - 24.3)	224 - 337
	JIS 20K	41 - 66	(30.2 - 48.7)	418 - 673
	JIS 30K	61 - 95	(45.0 - 70.1)	622 - 969
	JIS G3451 F12	21 - 41	(15.5 - 30.2)	214 - 418
	JPI 150 JPI 300			
	ANSI 150	21 - 31	(15.5 - 22.9)	214 - 316
	ANSI 300	43 - 66	(31.0 - 48.7)	438 - 673
	DIN PN10/16	22 - 33	(16.2 - 24.3)	224 - 337
	DIN PN25/40	48 - 74	(35.4 - 54.6)	489 - 755
125 / 150 mm (5 / 6 inches)	JIS 10K	47 - 67	(34.7 - 49.4)	479 - 683
	JIS 20K	58 - 91	(42.8 - 67.1)	591 - 928
	JIS 30K	80 - 123	(59.0 - 90.7)	816 - 1254
	JIS G3451 F12	23 - 45	(17.0 - 33.2)	235 - 459
	JPI 150 JPI 300			
	ANSI 150	42 - 60	(31.0 - 44.3)	428 - 612
	ANSI 300	50 - 74	(36.9 - 54.6)	510 - 755
	DIN PN10/16	47 - 67	(34.7 - 49.4)	479 - 683
	DIN PN25/40	97 - 97	(71.5 - 71.5)	989 - 989
200 mm (8 inches)	JIS 10K	44 - 65	(32.5 - 47.9)	449 - 663
	JIS 20K	66 - 102	(48.7 - 75.2)	673 - 1040
	JIS 30K	94 - 142	(69.3 - 104.7)	959 - 1448
	JIS G3451 F12	24 - 44	(17.7 - 32.5)	245 - 449
	JPI 150 JPI 300			
	ANSI 150	42 - 59	(31.0 - 43.5)	428 - 602
	ANSI 300	81 - 120	(59.7 - 88.5)	826 - 1224
	DIN PN10/16	47 - 68	(34.7 - 50.2)	479 - 693
	DIN PN25/40	123 - 189	(90.7 - 139.4)	1254 - 1927

Table 2-6 Fastening torque for flanged detectors

Nominal detector bore diameter mm (inch)	Flange ratings	Fastening torque		
		N•m (ft•lb)		kgf•cm
250 mm (10 inches)	JIS 10K	51 - 63	(37.6 - 46.5)	520 - 642
	JIS 20K	81 - 99	(59.7 - 73.0)	826 - 1010
	JIS G3451 F12	73 - 89	(53.8 - 65.6)	744 - 908
	JPI 150			
	JPI 300			
	ANSI 150	69 - 85	(50.9 - 62.7)	704 - 867
	ANSI 300	82 - 97	(60.5 - 71.5)	836 - 989
	DIN PN10/16	57 - 69	(42.0 - 50.9)	581 - 704
	DIN PN25	108 - 127	(79.7 - 93.7)	1101 - 1295
300 mm (12 inches)	JIS 10K	50 - 62	(36.9 - 45.7)	510 - 632
	JIS 20K	79 - 97	(58.3 - 71.5)	806 - 989
	JIS G3451 F12	49 - 59	(36.1 - 43.5)	500 - 602
	JPI 150			
	JPI 300			
	ANSI 150	56 - 68	(41.3 - 50.2)	571 - 693
	ANSI 300	116 - 136	(85.6 - 100.3)	1183 - 1387
	DIN PN10/16	45 - 55	(33.2 - 40.6)	459 - 561
	DIN PN25	105 - 122	(77.4 - 90.0)	1071 - 1244
350 mm (14 inches)	JIS 10K	54 - 66	(39.8 - 48.7)	551 - 673
	JIS 20K	143 - 167	(105.5 - 123.2)	1458 - 1703
	JIS G3451 F12	66 - 80	(48.7 - 59.0)	673 - 816
	JPI 150			
	JPI 300			
	ANSI 150	80 - 98	(59.0 - 72.3)	816 - 999
	ANSI 300	116 - 136	(85.6 - 100.3)	1183 - 1387
	DIN PN10/16	42 - 52	(31.0 - 38.4)	428 - 530
	DIN PN25	160 - 189	(118.0 - 139.4)	1632 - 1927
400 mm (16 inches)	JIS 10K	72 - 88	(53.1 - 64.9)	734 - 897
	JIS 20K	160 - 189	(118.0 - 139.4)	1632 - 1927
	JIS G3451 F12	69 - 85	(50.9 - 62.7)	704 - 867
	JPI 150			
	JPI 300			
	ANSI 150	80 - 98	(59.0 - 72.3)	816 - 999
	ANSI 300	166 - 195	(122.4 - 143.8)	1693 - 1988
	DIN PN10/16	72 - 88	(53.1 - 64.9)	734 - 897
	DIN PN25	199 - 234	(146.8 - 172.6)	2029 - 2386
500 mm (20 inches)	JIS 10K	114 - 133	(84.1 - 98.1)	1162 - 1356
	JIS 20K	173 - 204	(127.6 - 150.5)	1764 - 2080
	JIS G3451 F12	133 - 161	(98.1 - 118.7)	1356 - 1642
	JPI 150			
	JPI 300			
	ANSI 150	155 - 189	(114.3 - 139.4)	1581 - 1927

Table 2-6 Fastening torque for flanged detectors

Nominal detector bore diameter mm (inch)	Flange ratings	Fastening torque		
		N•m (ft•lb)		kgf•cm
	DIN PN10/16	106 - 129	(78.2 - 95.1)	1081 - 1315
	DIN PN25	214 - 251	(157.8 - 185.1)	2182 - 2559
600 mm (24 inches)	JIS 10K	184 - 216	(135.7 - 159.3)	1876 - 2203
	JIS 20K	267 - 315	(196.9 - 232.3)	2723 - 3212
	JIS G3451 F12	127 - 154	(93.7 - 113.6)	1295 - 1570
	JPI 150			
	JPI 300			
	ANSI 150	214 - 262	(157.8 - 193.2)	2182 - 2672
	DIN PN10/16	153 - 185	(112.8 - 136.4)	1560 - 1886
	DIN PN25	292 - 343	(215.4 - 253.0)	2978 - 3498
700 mm (28 inches)	JIS 10K			
	JIS G3451 F12			
	JPI 150			
	ANSI 150			
	DIN PN10			
800 mm (32 inches)	JIS 10K			
	JIS G3451 F12			
	JPI 150			
	JPI 300			
	ANSI 150			
	DIN PN10			
900 mm (40 inches)	JIS 10K			
	JIS G3451 F12			
	JPI 150			
	ANSI 150			
	DIN PN10			
1000 mm (36 inches)	JIS 10K			
	JIS G3451 F12			
	JPI 150			
	ANSI 150			
	DIN PN10			
1100 mm (44 inches)	JIS 10K			
	JIS G3451 F12			
	ANSI 150			
	DIN PN10			

Flange shape selection

The flanges used for installation should maximize the area of contact with the gasket.

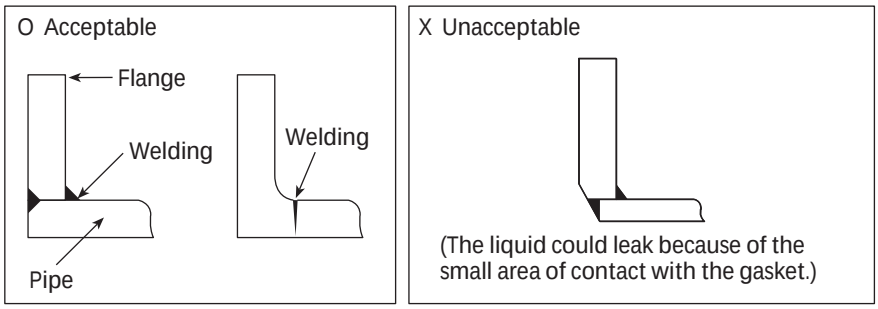


Figure 2-29 Flange Shapes

⚠ CAUTION

Never attempt to force the detector between two flanges if the space is too narrow. It can damage the detector.

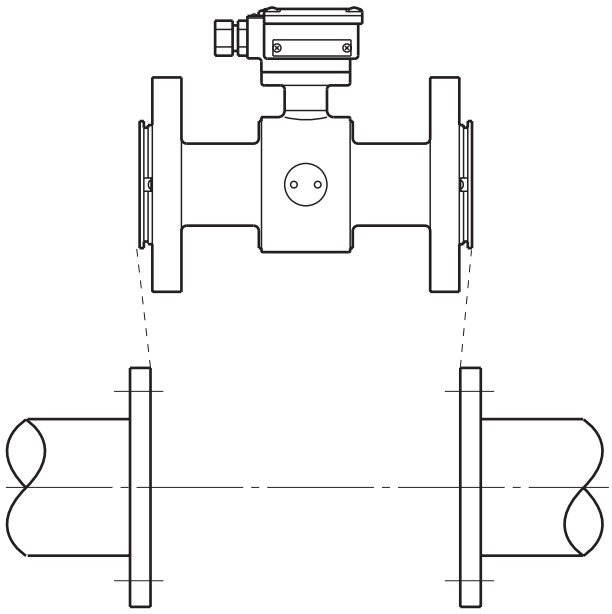


Figure 2-30 Unacceptable Placement of Detector Between Flanges

⚠ CAUTION

Make certain the bore diameters of the pipe and the detector are exactly the same and install the detector so that the gasket does not protrude into the inner bore of the pipe, as this could result in leakage or other hazards.

⚠ CAUTION

Tighten each bolt a little at a time and apply uniform pressure to all the bolts. If leakage continues after tightening the bolts, make sure that the pipe is not off center, then continue to tighten each bolt a little at a time.

2-5-2: Necessary parts

You will need the following parts to in stall the detector:

- Connecting bolts and nuts (available separately)
- Gaskets: Required when using grounding rings made of SUS material. Not required when using grounding rings made of other materials.
- Protective Plate: Required when connecting the detector to polyvinyl chloride (PVC) piping.

Gaskets

Gaskets are supplied with the grounding ring, except when it is made of SUS material. If you are using SUS material, you must provide the gaskets. Yamatake recommends joint sheet or polytetraflouroethylene (PTFE) gasket material. For the inner diameters of the gaskets, see the following table. Rubber gaskets are not recommended.

⚠ CAUTION

Using a gasket with too small a diameter can affect the flow velocity distribution, resulting in inaccurate measurement.
Using a gasket with too large a diameter can cause leakage. Also, any solid substance in the fluid to be measured could accumulate between the gasket and the flange, resulting in inaccurate measurement.

Table 2-7 Recommended inner diameters of gaskets

Bore diameter	mm (inch)	Inner diameter	mm (inch)
2.5	(0.1)	11±1	(0.43±0.04)
5	(0.2)	11±1	(0.43±0.04)
10	(3/8)	11±1	(0.43±0.04)
15	(1/2)	16±1	(0.63±0.04)
25	(1)	25±1	(0.98±0.04)
40	(1½)	40±1	(1.57±0.04)
50	(2)	51±1	(2.01±0.04)
65	(2½)	64±1	(2.52±0.04)
80	(3)	76±1	(2.99±0.04)
100	(4)	101±1	(3.98±0.04)
125	(5)	124±1	(4.88±0.04)
150	(6)	148±1	(5.33±0.04)
200	(8)	196±1	(7.72±0.04)
250	(10)	246±1	(9.69±0.04)
300	(12)	296±1	(11.65±0.04)
350	(14)	346±1	(13.62±0.04)
400	(16)	396±1	(15.59±0.04)
500	(20)	496±1	(19.53±0.04)
600	(24)	596±1	(23.46±0.04)
700	(28)		
800	(32)		
900	(36)		
1000	(40)		
1100	(44)		

2-5-3: Selecting an installation method

To select an installation method you must determine the following:

- Mounting pipe material (metal or PVC)
- Grounding ring material (SUS or non-SUS)
- Need for a protective plate
- Use of rubber gaskets

⚠ CAUTION

The necessary materials and the installation method vary according to the material of the ring and that of the pipe on which the detector is to be installed. Select the appropriate method of installation from the following table after confirming the specifications of the detector to be installed and the conditions of installation. Improper installation can result in leakage or damage to the pipe flanges.

Table 2-8 Flange detector installation methods

Pipe material	Grounding ring material	Installation requirements	See Page
Metal	SUS material	With specified fastening torque	page 2-35
	Non-SUS material	With specified fastening torque	page 2-36
PVC	SUS material	With specified fastening torque	page 2-38
		With a protective plate	page 2-39
		With rubber gaskets and low fastening torque	page 2-40
	Non-SUS material	With specified fastening torque	page 2-42
		With a protective plate	page 2-43
		With rubber gaskets and low fastening torque	page 2-44

2-5-4: Installation on a metal pipe using SUS grounding ring material

The installation method described in this section is for installation on a metal pipe using SUS grounding ring material. For the installation method corresponding to any other combination of materials, refer to Table 2-8 on page 2-34.

For installation using SUS grounding ring material, Yamatake recommends non-rubber gaskets such as joint sheet or PTFE. See Table 2-7 on page 2-33 for recommended inner (bore) diameters.

To install a flanged detector on a metal pipe using SUS grounding ring material and a specified torque:

- Install the detector as shown in the following illustration. The torque level for tightening the bolts is not related to the gasket material.

  See Table 2-6 on page 2-28 for the appropriate torque.

  See Table 2-7 on page 2-33 for the inner diameter of the gasket.

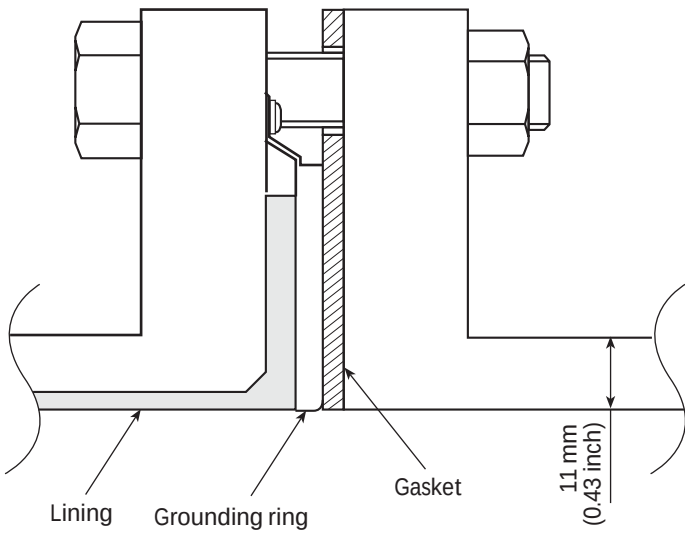


Figure 2-31 Installation on a metal pipe using SUS grounding ring material and a specified torque

2-5-5: Installation on a metal pipe using non-SUS grounding ring material

The installation method described in this section is for installation on a metal pipe using non-SUS grounding ring material. For the installation method corresponding to any other combination of materials, refer to Table 2-8 on page 2-34.

PTFE gaskets are provided for this type of installation. If you supply the gaskets, Yamatake recommends non-rubber gaskets such as joint sheet or PTFE.

To install a flanged detector on a metal pipe using non-SUS grounding ring material and a specified torque:

- Install the detector as shown in the following illustration. The torque level for tightening the bolts is not related to the gasket material.

  See Table 2-6 on page 2-28 for the appropriate torque.

  See Table 2-7 on page 2-33 for the inner diameter of the gasket.

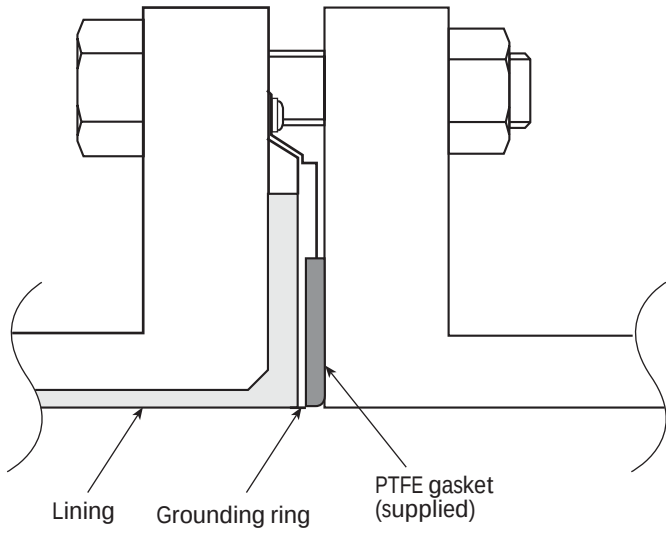


Figure 2-32 Installation on a metal pipe using non-SUS grounding ring material and a specified torque

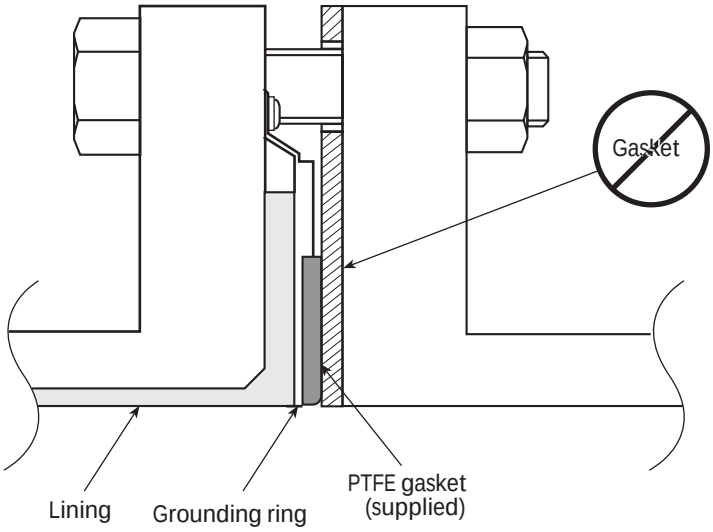


Figure 2-33 Incorrect installation

2-5-6: Installation on a PVC pipe using SUS grounding ring material

The installation methods described in this section are for installation on a PVC pipe using SUS grounding ring material. For the installation method corresponding to any other combination of materials, refer to Table 2-8 on page 2-34.

PTFE gaskets are provided for this type of installation. If you supply the gaskets, Yamatake recommends non-rubber gaskets such as joint sheet or PTFE. Although rubber gaskets can be used, they are not recommended. See page 2-40 for installation using rubber gaskets.

⚠ CAUTION

The use of rubber gaskets and a lower fastening torque is not recommended and can cause insufficient surface pressure between the lining and the grounding ring, resulting in leakage.

If tightening the bolts at the specified torque threatens to warp or damage the PVC pipes, you will need to use a protective plate. See page 2-39 for installation of the protective plate.

To install a flanged detector on a PVC pipe using SUS grounding ring material with a specified fastening torque:

- Install the detector as shown in the following illustration. The torque level for tightening the bolts is not related to the gasket material.

  See Table 2-6 on page 2-28 for the appropriate torque.

  See Table 2-7 on page 2-33 for the inner diameter of the gasket.

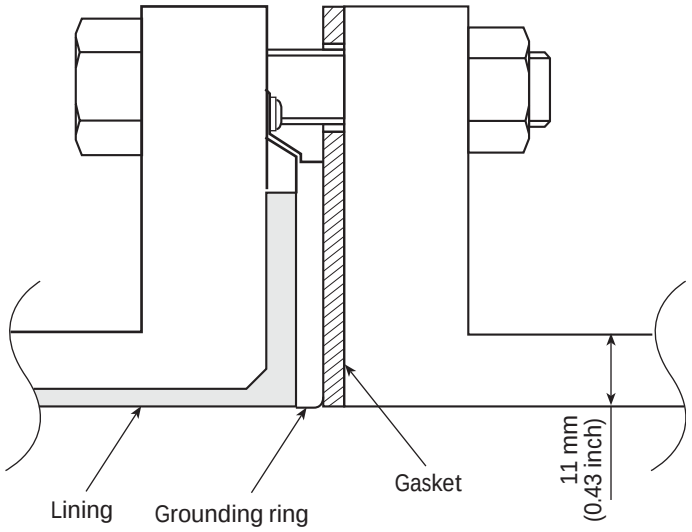


Figure 2-34 Installation on a PVC pipe using SUS grounding ring material and a specified torque

To install a flanged detector on a PVC pipe using SUS grounding ring material and a protective plate:

Use this method to install the detector using a protective plate to prevent the PVC pipe from being deformed or damaged when the bolts are tightened with the specified torque.

- Install the protective plate between the outer side of the PVC flange and the detector, as shown in the figure below. The protective plate protects the PVC pipe. The torque level for tightening the bolts is not related to the gasket material.

  See Table 2-6 on page 2-28 for the appropriate torque.

  See Table 2-7 on page 2-33 for the inner diameter of the gasket.

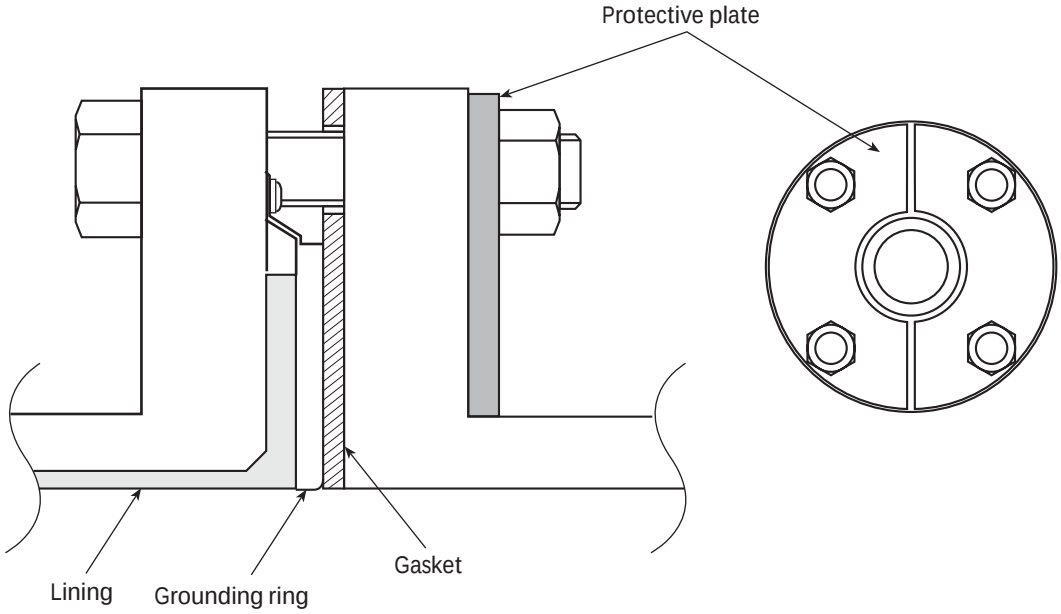


Figure 2-35 Installation on a PVC pipe using SUS grounding ring material and a protective plate

To install a flanged detector on a PVC pipe using SUS grounding ring material with rubber gaskets and a low fastening torque:

⚠ CAUTION

The use of rubber gaskets and a lower fastening torque is not recommended and can cause insufficient surface pressure between the lining and the grounding ring, resulting in leakage.

(1) Remove the grounding ring from the detector and insert a rubber gasket 0.5 to 1.0 mm (0.02 to 0.04 inch) thick between the lining and the grounding ring.

(2) Reinsert the grounding ring on top of the rubber gasket.

(3) Remove the PTFE gasket and insert a rubber gasket 3.0 to 4.0 mm (0.12 to 0.16 inch) to replace it.

(4) With the rubber gaskets in the position shown in the following figure, attach the detector to the pipe. Both rubber gaskets should be made of the same material.

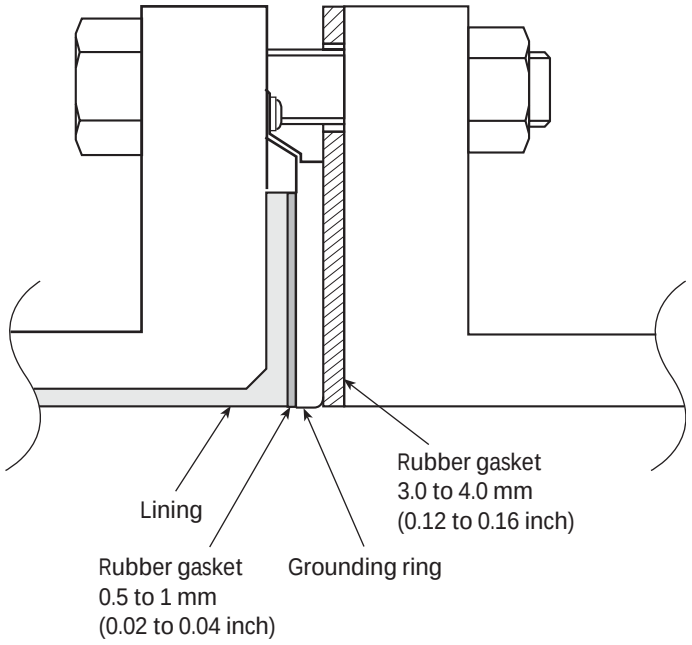


Figure 2-36 Installation on a PVC pipe using SUS grounding ring material with rubber gaskets (not recommended)

(5) Fasten the bolts with a torque that provides a leakproof joint.

2-5-7: Installation on a PVC pipe using non-SUS grounding ring material

The installation methods described in this section are for installation on a PVC pipe using non-SUS grounding ring material. For the installation method corresponding to any other combination of materials, refer to Table 2-5 on page 2-12.

PTFE gaskets are provided for this type of installation. If you supply the gaskets, Yamatake recommends non-rubber gaskets such as joint sheet or PTFE. When using rubber gaskets, gaskets of the same material with two different thicknesses (0.5 to 1.0 mm (0.02 to 0.04 inch) and 3.0 to 4.0 mm (0.12 to 0.16 inch)) are required. See Table 2-3 on page 2-11 and Table 2-4 on page 2-11 for the appropriate dimensions. See page 2-44 for installation using rubber gaskets.

⚠ CAUTION

The use of rubber gaskets and a lower fastening torque is not recommended and can cause insufficient surface pressure between the lining and the grounding ring, resulting in leakage.

If tightening the bolts at the specified torque threatens to warp or damage the PVC pipes, you will need to use a protective plate. See page 2-43 for installation of the protective plate.

To install a flanged detector on a PVC pipe using non-SUS grounding ring material with a specified fastening torque:

- Install the detector as shown in the following illustration. The torque level for tightening the bolts is not related to the gasket material.

  See Table 2-6 on page 2-28 for the appropriate torque.

  See Table 2-7 on page 2-33 for the inner diameter of the gasket.

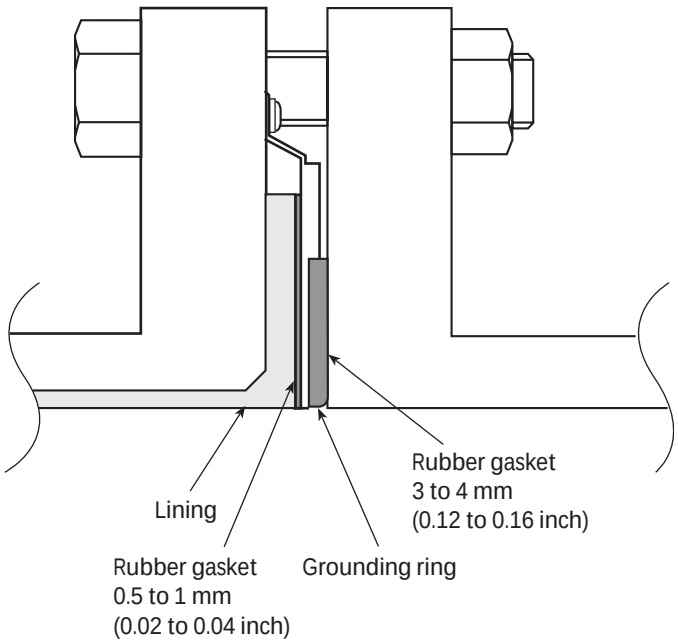


Figure 2-37 Installation on a PVC pipe using Non-SUS grounding ring material and a specified torque

To install a flanged detector on a PVC pipe using non-SUS grounding ring material and a protective plate:

Use this method to install the detector using a protective plate to prevent the PVC pipe from being deformed or damaged when the bolts are tightened with the specified torque.

- Install the protective plate between the external side of the PVC flange and the detector, as shown in the figure below. The protective plate protects the PVC pipe. The torque level for tightening the bolts is not related to the gasket material.

  See Table 2-6 on page 2-28 for the appropriate torque.

  See Table 2-7 on page 2-33 for the inner diameter of the gasket.

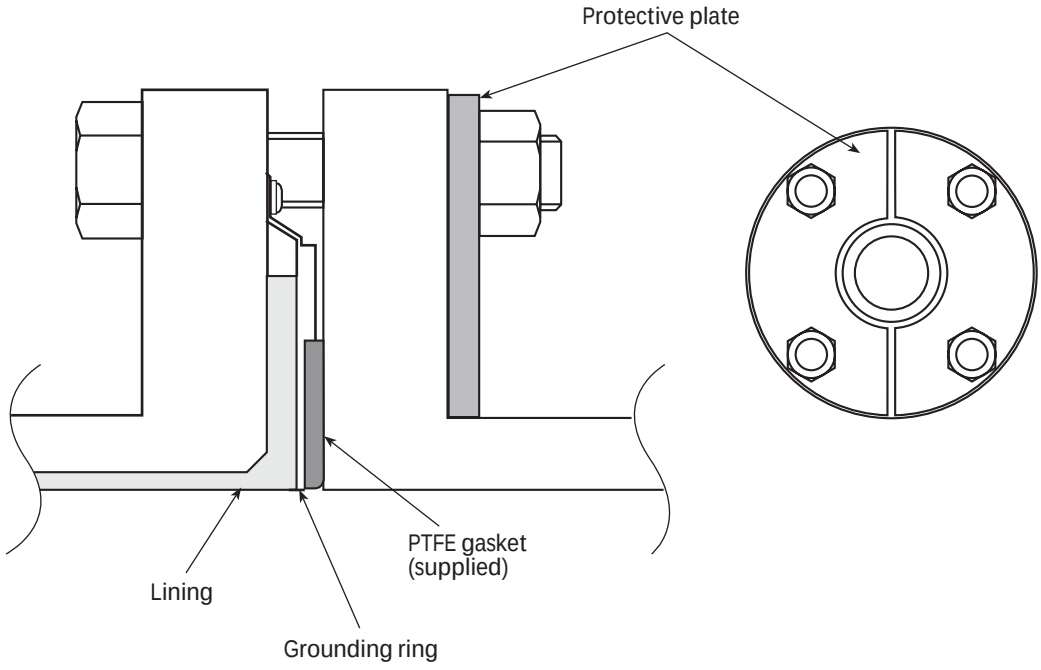


Figure 2-38 Installation on a PVC pipe using non-SUS grounding ring material and a protective plate

To install a flanged detector on a PVC pipe using non-SUS grounding ring material with rubber gaskets and a low fastening torque:

(1) Remove the grounding ring from the detector and insert a rubber gasket 0.5 to 1.0 mm (0.02 to 0.04 inch) thick.

(2) Reinsert the grounding ring on top of the rubber gasket.

(3) Remove the PTFE gasket and insert a rubber gasket 3.0 to 4.0 mm (0.12 to 0.16 inch) to replace it.

(4) With the rubber gaskets in the position shown in the following figure, attach the detector to the pipe. Both rubber gaskets should be made of the same material. See Table 2-3 on page 2-11 and Table 2-4 on page 2-11 for the appropriate dimensions.

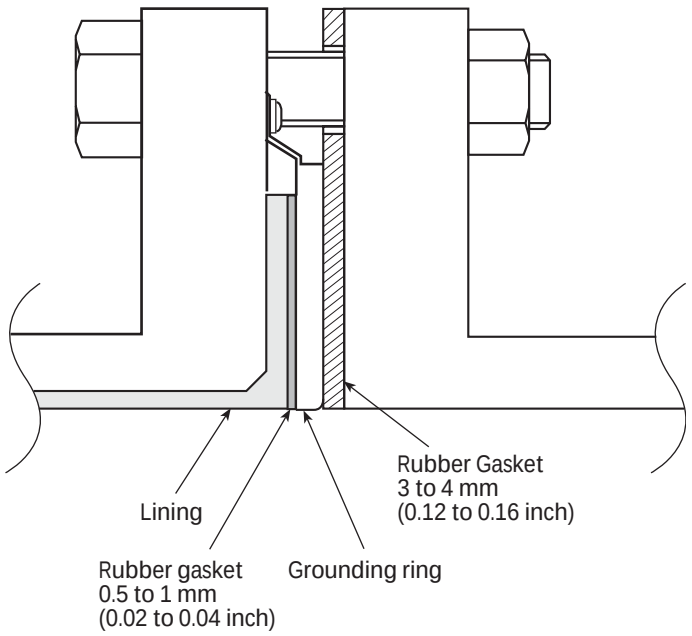


Figure 2-39 Installation on a PVC pipe using non-SUS grounding ring material with rubber gaskets

(5) Fasten the bolts with a torque that provides a leakproof joint.

2-6 : Installing a Union / Hose / Clamp Detector

2-6-1: Installation of Union and Hose assemblies basic installation method

Direction of installation

Match the flow direction of the fluid to be measured to that of the flow direction mark on the electromagnetic flowmeter. If they cannot be matched, the direction can be changed on the terminal box or the converter. Refer to the section “Direction of terminal box / converter”.

Position of the detector

Position the detector so that the center of the pipe aligns with that of the measuring pipe of the electromagnetic flowmeter. Be sure to fasten the electromagnetic flowmeter on a stand.

Pipe connection

For union assembly, mount the union joint nuts (supplied by the customer) on the process pipe. Connect the pipe by screwing it into the connection hole of the electromagnetic flowmeter using the union joint nuts. For hose assembly, screw in the hose, and fasten it with a fastening band, etc. (supplied by the customer).

Nut tightening (union assembly)

Use a torque wrench to tighten the union joint nuts. Do not tighten them fully to the specified fastening torque one at a time. Instead, tighten the upstream and downstream joint nuts alternately little by little over three or four turns. For the fastening torque, see Table 2-9.

⚠ CAUTION
Fasten the detector using the specified fastening torque to prevent leakage.

Table 2-9 Fastening torque

Nominal detector bore mm (inch)	Fastening torque N•m (ft•lb)
2.5 (0.1)	Max. 12 (8.9)
5 (0.2)	Max. 12 (8.9)
10 (3/8)	Max. 18 (13.3)
15 (1/2)	Max. 18 (13.3)

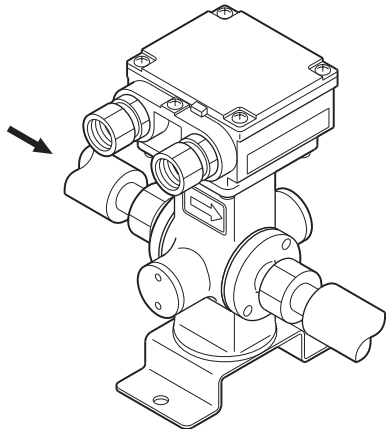


Figure 2-40 Example of installation (union assembly)

2-6-2: Installation of IDF-clamp/ Tri-clamp assembles basic installation method

Example of clamp assembly

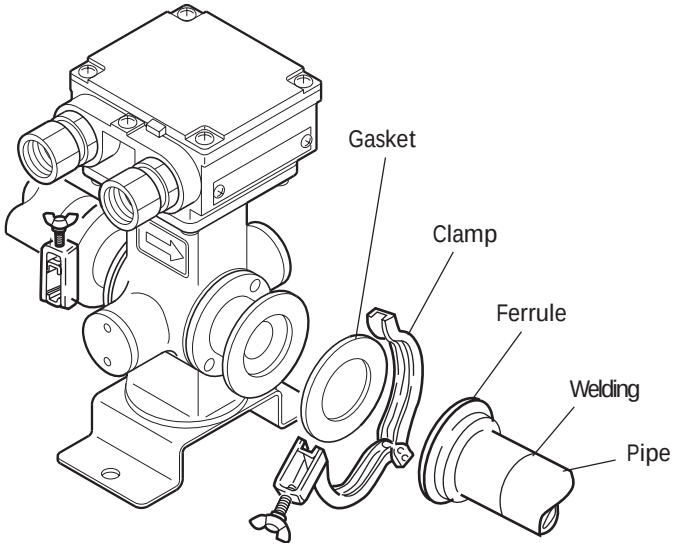


Figure 2-41 Example of installation

Welding a ferrule to the pipe

Weld the supplied ferrule onto the pipe. In the welding process, pay special attention to the taper processing, butting stages, welding current, etc. When welding ensure that there is no residual fluid in the meter and that the clamp section does not become distorted.

Mounting of the special gasket

Mount the supplied special clamp gasket so that it fits into the groove of the gasket.

⚠ WARNING

Mount it carefully into the groove so that there is no misalignment of the gasket. Misalignment can cause leakage or other hazards. Gaskets and clamps are attached to sanitary model MGS18U.

Direction of installation

Match the flow direction of the measured fluid to that of the flow direction mark of the detector, and insert the detector between the ferrules.

IDF-clamp / Tri-clamp tightening

Mount the clamp so that it will cover the detector and the tapered section of the ferrule, and screw it tightly.

2-7 : Wiring the detector

2-7-1: Connecting the detector and converter (Remote models)

The use of a dedicated cable (model MGA12W) is recommended for the connection between the detector and the converter. For detailed wiring information (including the dedicated cable) see the manual for the converter that you are using.

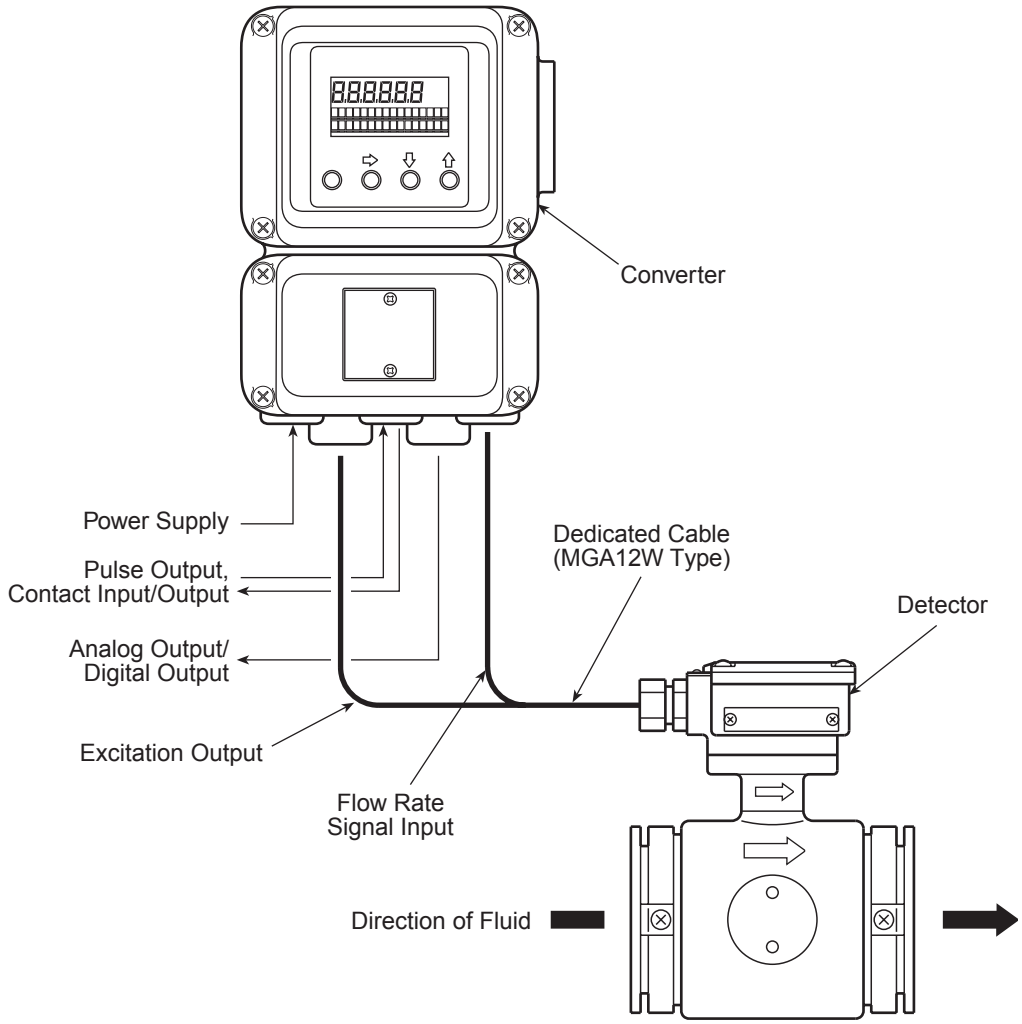


Figure 2-42 Connection using a dedicated cable

~Note *Although the dedicated cable is shielded, install it away from any possible sources of noise, such as a large capacity transformer, motors, or motor power supplies.*

2-7-2: Grounding the detector (Remote models)

The detector is grounded via the external grounding terminal.

⚠ CAUTION

Insufficient grounding can cause output fluctuations, instability of the zero point, or output drift. Secure single point grounding with a grounding resistance of 100 Ω or less is recommended.
To avoid damaging the detector, do not ground a welder to the detector.

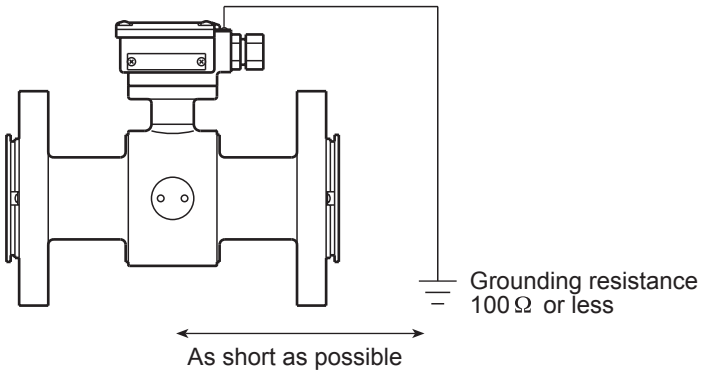


Figure 2-43 Grounding via the external grounding terminal

2-7-3: Installing the dedicated cable

The dedicated cable is used to connect the detector to the remote converter. It transmits either the flow rate proportional signal or the excitation current.

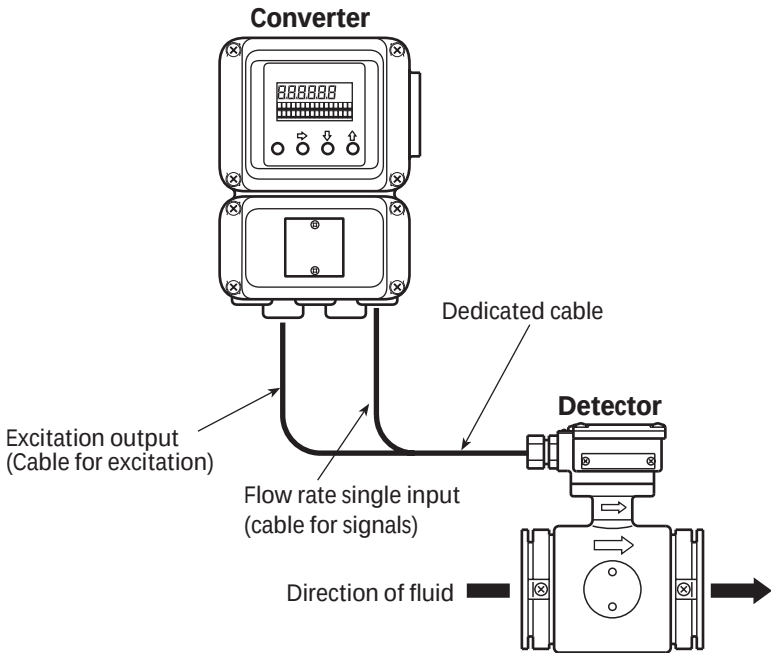


Figure 2-44 Connection using a dedicated cable

Dedicated cable structure

The structure of the dedicated cable is shown in the following figure. The cable must be properly dressed to insure proper connection.

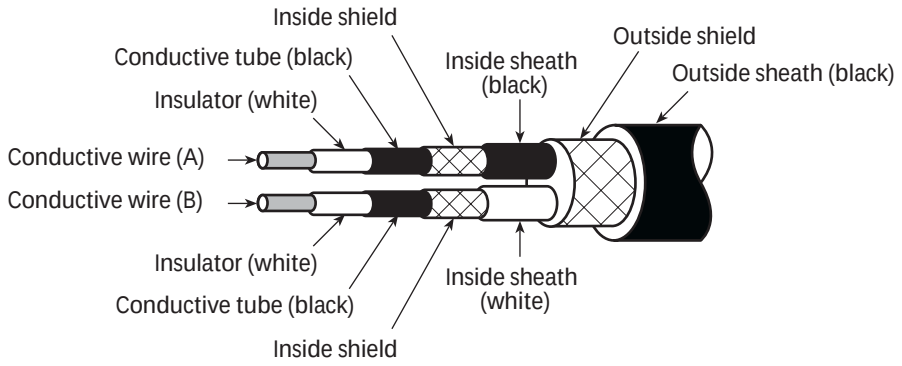


Figure 2-45 Dedicated cable structure

~Note *The conductive tubing (black) for conductive wires (A) and (B) is to be removed up to the end of the inside shield.*

Dressing the dedicated cable

To dress the dedicated cable:

(1) Scribe (cut) a line in the outside sheath (black) as shown in the following figure and remove the sheathing. The length varies depending on the model number of the cable. Make the length "L" slightly longer than necessary at first and then trim it to the specified length in Step 10.

⚠ CAUTION

Do not cut into the outside shield.

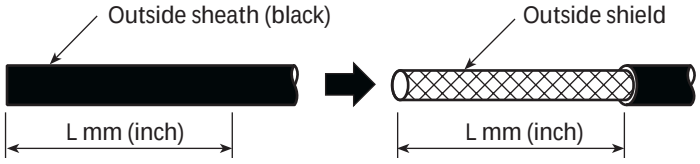


Figure 2-46 Trimming the outside sheath

~Note *If the terminal of the converter is designed not to use a shield drive, remove the outside shield and skip to Step 4.*

(2) Wind the lead wire once around the outside shield.

(3) Solder the lead wire (C-wire) to the middle of the 5 mm (0.2 inch) length. Make the length of the lead wire slightly longer than necessary and trim it to the specified length in Step 10.

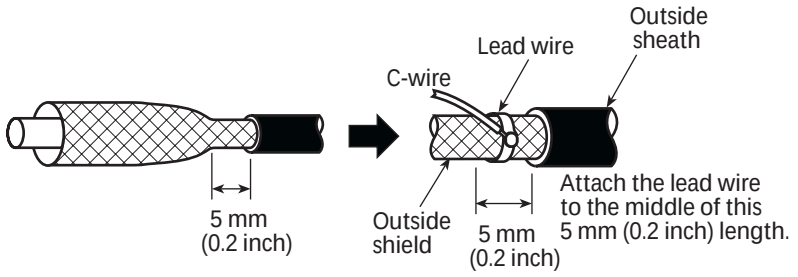


Figure 2-47 Attaching the C-wire

⚠ CAUTION

Be sure to use adequate solder so that contact failure will not occur between the C-wire and the outside shield. If the soldering connection is insecure, noise is generated due to contact resistance.

~Note *If the outside shield is not allowed to bend during soldering, in some cases, the conductive tube cannot be peeled off due to the heat of the solder.*

(4) Cut the outside shield off at a point 5 mm (0.2 inch) from the outside sheath, leaving the specified length from the end of the outside shield.

⚠ CAUTION

Do not cut into the inside sheath.

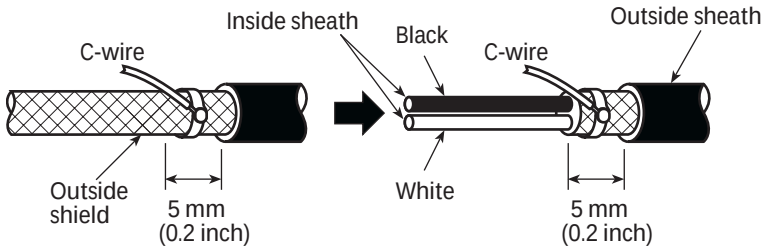


Figure 2-48 Trimming the outside shield

(5) Peel off the inside sheath so that a 10 mm (0.39inch) section remains.

⚠ CAUTION

Do not cut into the inside shield.

~Note *Check the operating manual for the product you are using to determine whether the lead wires (SA and SB) are necessary. If not, skip to Step 8.*

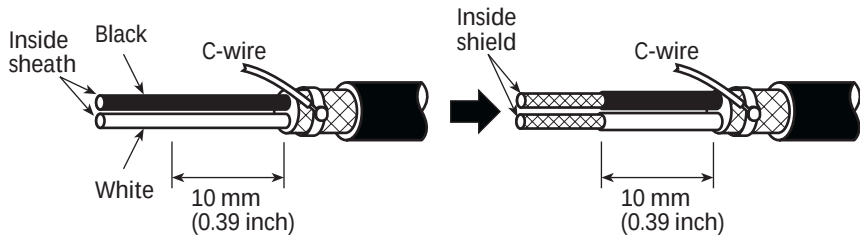


Figure 2-49 Trimming the inside sheath

(6) Wind each lead wire (SA and SB) around the inside shield once.

(7) Solder the lead wired (SA and SB) to the middle of this 5 mm (0.2 inch) length. Be sure to keep the two inside shields separate from each other to prevent them from being bonded together by mistake during soldering. The length of the lead wires should be measured from this point. Make the length of the lead wires slightly longer than necessary (see the operating manuals for the products) and trim to the specified length in Step 10.

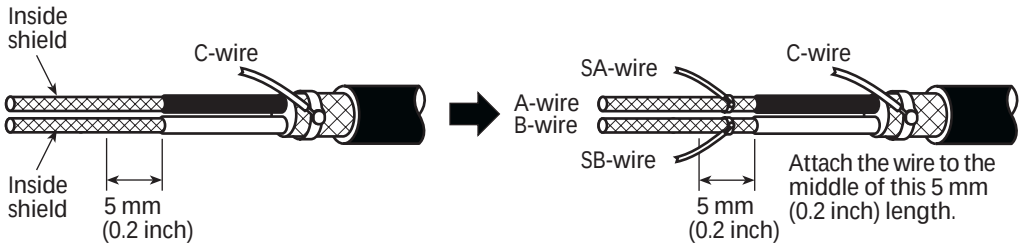


Figure 2-50 Attaching the lead wires (SA and SB)

⚠ CAUTION

Be sure to use adequate solder so that contact failure will not occur between the C - wire and the outside shield. If the soldering connection is insecure, noise is generated due to contact resistance.

(8) Cut the inside shield off at a point 5 mm (0.2 inch) from the inside sheath.

⚠ CAUTION

Do not cut into the conductive tube.

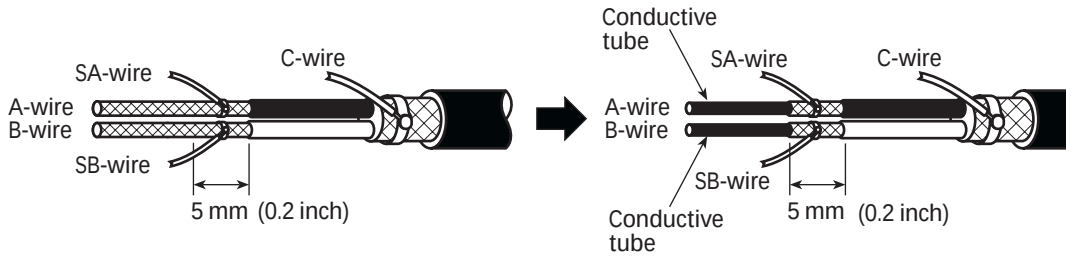


Figure 2-51 Trimming the inside shield

(9) Peel off the conductive tube (black) completely up to the inside shield.

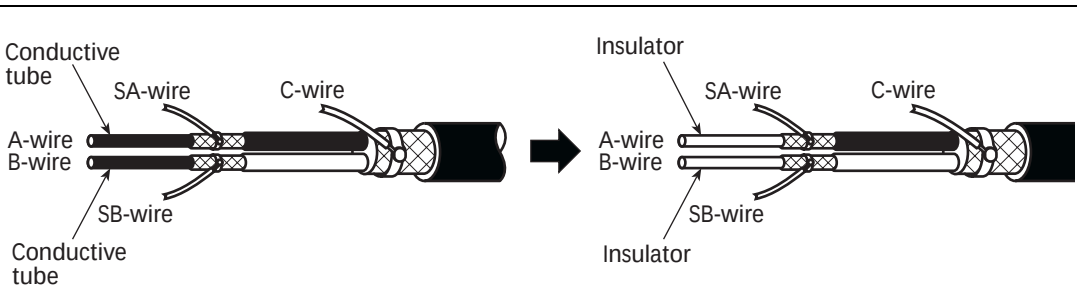


Figure 2-52 Removing the conductive tube

(10)Trim the insulator to within 5 mm (0.2 inch) from its end. Trim the other lead wires (soldered to the shield sections) to the specified lengths so that each conductive wire is exposed by 5 mm (0.2 inch).

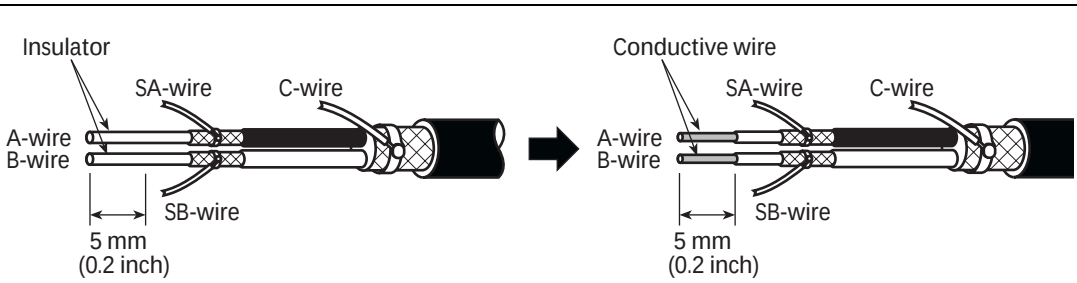


Figure 2-53 Trimming the insulator

(11)Wind insulating tape around each inside shield and then around each outside shield.

(12)Attach markers to the lead wires.

(13)Crimp the terminals onto each lead wire. Test each terminal by pulling on it to make sure the terminal will not come off.

~Note *In some cases, the C -wire must be crimped together with either the SA or SB lead wire. For further information, refer to the appropriate operation manuals.*

Testing continuity

Test the continuity between the following terminals of the trimmed cables.

Table 2-10 Cable continuity

Terminals	Resistance
A - A	0 Ω
B - B	
C - C	

Testing the insulation

Test the insulation between the following terminals using an insulation resistance tester.

Table 2-11 Cable continuity

Terminals	Resistance
A - B	> 100 MΩ, 500 V DC
B - C	
A - SA	
A - SB	
B - C	
B - SA	
B - SB	
C - SA	
C - SB	

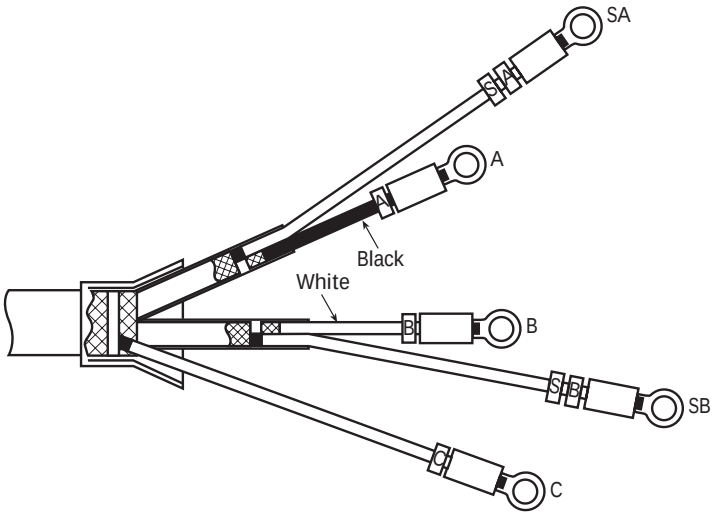


Figure 2-54 Terminal connections

2-8 : Troubleshooting and maintenance

MagneW 3000 PLUS detector is maintenance free.

For device loop diagrams for troubleshooting, operation, and maintenance, refer to the MagneW 3000 PLUS Smart Electromagnetic Flowmeter Model MGG14C User's Manual (CM2-MGG210-2001).

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