

ELECTROMAGNETIC FLOWMETER DETECTOR

MODEL GF630, GF632

INSTRUCTION MANUAL

for FM Approval and CSA Certification

TOSHIBA CORPORATION

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NOTES

Before using the equipment, please read this manual carefully and understand the contents, and then use the equipment correctly.

- **NEVER attempt to operate the equipment in any ways that are not described in this instruction manual.**
- **After reading this manual, store it with care in a place where it can be referred to whenever needed.**
- **Please be sure that this manual is delivered to the personnel who will use this product.**

NOTICE

We thank you very much for your purchase of our GF630 series electromagnetic flowmeter detector.

Integral type GF630/LF600F and GF630/LF610F

Separate type detector GF632

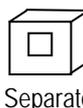
This instruction manual describes the notes on using an electromagnetic flowmeter detector, installation, configuration and maintenance. It is intended for the personnel in charge of installation, operation and maintenance.

To use this product properly and safely, read this manual (6F8A0883) carefully before using this product. After reading this manual, store it in a place where it can be referred to whenever needed. This manual uses the following markers to identify the integral type or separate type when it describes items specific to the integrated type or separate type. Items without this marker are common items to the integral type and separate type.

Integral type GF630/LF600F and GF630/LF610F:



Separate type detector GF632:



Toshiba GF63* electromagnetic flowmeter detectors can be used in combination with various types of electromagnetic flowmeter converters (LF600F, LF610F, LF602F and LF612F).

For the notes on usage, connecting, wiring, installation, configuration and maintenance of the combined converter, check the model number of the combined converter and read the instruction manual of the relevant converter.

About Safety Precautions

Read the **Safety Precautions** described at the front carefully and understand the contents before using this product.

The “**Safely symbols**” used in the “**Safety Precautions**” are shown in a location such as in the margin to the left of the corresponding commentary in the main text.

NOTES

- 1. The reproduction of the contents of this Manual in any form, whether wholly or in part, is not permitted without explicit prior consent and approval.**
- 2. The information contained in this Manual is subject to change or review without prior notice.**
- 3. Be sure to follow all safety, operating and handling precautions described in this Manual and the regulations in force in the country in which this product is to be used.**
- 4. For the detail of the converter, Please refer to the converter LF600F, LF610F instruction manual.**

SAFETY PRECAUTIONS

Safety signs and labels affixed to the product and/or described in this manual give important information for using the product safely. They help prevent damage to property and obviate hazards for persons using the product. Make yourself familiar with signal words and symbols used for safety signs and labels. Then read the safety precautions that follow to prevent an accident involving personal injury, death or damage to property.

Explanation of signal words

The signal word or words are used to designate a degree or level of hazard seriousness.

The signal words used for the product described in this manual are WARNING and CAUTION.

 WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
 CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor to moderate injuries or in property damage.

Safety symbols

The following symbols are used in safety signs and labels affixed to a product and/or in the manual for giving safety instructions.

	Indicates an action that is prohibited. Simply DON'T do this action. The prohibited action is indicated by a picture or text inside or next to the circle
	Indicates an action that is mandatory. DO this action. The mandatory action is indicated by a picture or text inside or next to the circle (white letters on a colored background).
	Indicates a potential hazard. The potentially hazardous situation is indicated by a picture or text inside or next to the triangle.

SAFETY PRECAUTIONS

Safety Precautions for Installation and Wiring

 WARNING	
 DON'T	<p>■ Do not disconnect while circuit is live unless location is known to be nonhazardous.</p> <p>Live part of electric circuit or a high temperature department can cause explosion.</p>
 DON'T	<p>■ Do not modify or disassemble the enclosure.</p> <p>Strength degradation and defects of enclosure can cause explosion.</p>
 DON'T	<p>■ Do not use parts of other products.</p> <p>Protective performance degradation for hazardous location can cause explosion.</p>
 DON'T	<p>■ Do not touch live circuits until assembly of all components is not over.</p> <p>Protective performance degradation for hazardous location can cause explosion.</p>
 DO	<p>■ Install per the National Electrical Code for the US (NEC, ANSI/NFPA 70) and the Canadian Electrical code for Canada (CEC, CAN/CSA-C22.1) and the drawing Appendix 1.</p> <p>Unsuitable conduit connections for hazardous location can cause explosion.</p>

SAFETY PRECAUTIONS(continued)

Safety Precautions for Installation and Wiring

 CAUTION	
<p>■ Install a switch and fuse to isolate the GF630/LF600F, GF630/LF610F and GF632 from mains power.</p> <p> DO Power supply from mains power can cause electric shock or circuit break-down.</p>	<p>■ Use an appropriate device to carry and install the GF630/LF600F, GF630/LF610F and GF632.</p> <p> DO If this product falls to the ground, injury, or malfunction of or damage to the product, can be caused.</p>
<p>■ Turn off mains power before conducting wiring work.</p> <p> DO Wiring while power is applied can cause electric shock.</p>	<p>■ Do not modify or disassemble the GF630/LF600F, GF630/LF610F and GF632 unnecessarily.</p> <p> DON'T Modifying or disassembling this product can cause electric shock, malfunction of or damage to this product.</p>
<p>■ Turn off mains power before working on pipes.</p> <p> DO Working on pipes while power is applied can cause electric shock.</p>	<p>■ Ground the GF630/LF600F, GF630/LF610F and GF632 independently from power equipment. (100 ohm or less ground resistance)</p> <p> DO Operating this product without grounding can cause electric shock or malfunction.</p>
<p>■ Do not conduct wiring work with bare hands.</p> <p> DON'T Remaining electric charge even if power is turned off can still cause electric shock.</p>	<p>Use crimped terminal lugs for the terminal board and GND terminal.</p> <p> DO Loose connections can cause electric shock, fire from excessive current or system malfunction.</p>
<p>■ Do not work on piping and wiring with wet hands.</p> <p> DON'T Wet hands may result in electric shock.</p>	
<p> The label shown left is placed near the terminal board for power supply on the converter. (A black border and symbol on yellow triangle) Be alert to electric shock.</p>	

SAFETY PRECAUTIONS (continued)

Safety Precautions for Maintenance and Inspection

 CAUTION	
<p>■ Do not conduct wiring work with wet hands.</p> <div style="display: flex; align-items: center;">  <div style="margin-left: 10px;"> <p>Wet hands may result in electric shock.</p> <p>DON'T</p> </div> </div>	<p>■ Do not conduct wiring work when power is applied.</p> <div style="display: flex; align-items: center;">  <div style="margin-left: 10px;"> <p>Wiring while power is applied can cause electric shock.</p> <p>DON'T</p> </div> </div>
<p>■ Do not touch the GF630/LF600F, GF630/LF610F and GF632 main body when high temperature fluid is being measured.</p> <div style="display: flex; align-items: center;">  <div style="margin-left: 10px;"> <p>The fluid raises the main body temperature and can cause burns when touched.</p> <p>DON'T</p> </div> </div>	<div style="display: flex; align-items: center;">  <div style="margin-left: 10px;"> <p>The label shown left is placed near the terminal board for power input of the converter. (A black border and symbol on yellow triangle) Be alert to electric shock.</p> </div> </div>

Usage limitation

This product is **not manufactured for applying to a system requiring safety directly involved human life as follows**. Please contact your nearest Toshiba representative if there is a possibility of using this product for such use.

- **Main control systems of nuclear power plants, safety protection systems in nuclear facilities or other important systems requiring safety**
- **Medical control systems relating to life support**

Warranty and Limitation of Liability

Toshiba does not accept liability for any damage or loss, material or personal, caused as a direct or indirect result of the operation of this product in connection with, or due to, the occurrence of any event of force majeure (including fire or earthquake) or the misuse of this product, whether intentional or accidental.

Handling Precautions

To obtain the optimum performance from the GF630/LF600F, GF630/LF610F and GF632 for years of continuous operation, observe the following precautions.

(1) **Do not store or install** the flowmeter in:

- **Where there is direct sunlight.**
- Where there is snow and ice
Infrared switches may not function correctly.
- Where **excessive vibration or mechanical shock** occurs.
- Where **high temperature or high humidity** conditions obtain.
- Where **corrosive atmospheres** exist.
- **That can be submerged under water.**
- **Where there is a sloped floor.** To put the flowmeter temporarily on the floor, **place it carefully with something, such as a block, to support it so that the flowmeter will not topple over.**
- **Places where there is following factors.**
 - Factors to impede infrared switch to operate properly
 - Intense light such as direct sunlight and reflected sunlight by window glass or metal plate
 - Place where brightness changes suddenly such as ON/OFF of lighting
 - Dense smoke or steam near the control panel
 - Those attached on the control panel such as rain (dew drop), snow, ice, mud and oil, and haze due to their attachment
 - Light reflecting object near the control panel, or reflecting object such as metal plate placed opposing to the control panel

When any of above factors is considered, take a measure for the proper operation of infrared switch such as to place a cover or to secure a space for at least a person to stand in front of the control panel.

When unable to avoid above factors, operate the EMF converter removing the factor by covering the control panel by hand so that light does not shine on it, by cleaning those attached on the control panel, or by standing in-between the reflecting object and the control panel to block the light.

(2) In the case that the piping is **non-conductive** material, make sure to install the **grounding rings**(option) to each flange of detector using the M3 or M4 screw before piping.

(3) Wire cables **correctly and securely.**

Be sure to ground at the converter side (**grounding resistance 100 ohm or less**).

Avoid a common ground **used with other equipment** where earth current may flow. An **independent ground** is preferable

(4) Select cable paths away from electrical equipment (motors, transformers, or radio transmitters), which causes electromagnetic or electrostatic interference.

(5) The apparatus does not be provided with the cable connections.

Please prepare yourself for the cable connections which could be used in Division2 hazardous locations.

The cable lead-in section must be tightened securely to keep air tightness.

Handling Precautions (continued)

- (6) If the inside of the converter and detector's terminal box are wetted or humidified, it may cause insulation deterioration, which can result in **fault or noise occurrence**. So do not conduct **wiring in the open air on rainy days**.
Also, be careful not to wet down the converter and detector's terminal box even in the case of indoor wiring, and complete wiring work in a short period of time.
- (7) Make sure the fluid to be measured will not freeze in the detector pipe. This can cause damage to the detector pipe.
- (8) Select appropriate wetted materials suited for the process fluid to be measured. Otherwise, fluid leakage due to corrosion can be caused.
- (9) **Observe the following precautions when you open the converter housing cover:**
- **Do not open the cover in the open air unprotected against rain or wind.** This can cause **electric shock** or cause **damage to the flowmeter electronics**.
- Do not open the cover **under high ambient temperature or high humidity conditions or in corrosive atmospheres**. This can cause **deterioration of system accuracy** or cause **damage to the flowmeter electronics**.
- (10) Since a varistor is built in converter, **do not conduct a withstand voltage test for the converter**.
In addition, the voltage for checking the insulation of the converter must be **250VDC or lower**.
- (11) This product may cause **interference to radio and television sets** if they are used near the installation site. **Use metal conduits etc. for cables to prevent this interference**.
- (12) Radio transmitters such as transceivers or cellular phones may cause interference to the flowmeter if they are used near the installation site. Observe the following precautions when using them:
- **Close a transmitter cover** before using a transceiver.
 - Do not use a transceiver whose output power is more than **5 W**.
 - Move the antenna of a transceiver or a cellular phone **at least 50 cm** away from the flowmeter and signal cables when using it.
 - **Do not use a radio transmitter or a cellular phone near the flowmeter** while it is operating online. The transmitter or cellular phone's output impulse noise may interfere with the flowmeter.
 - **Do not install a radio transmitter antenna** near the flowmeter and signal cables.
- (13) For reasons of flowmeter failure, inappropriate parameters, unsuitable cable connections or poor installation conditions, the flowmeter may not operate properly. To prevent any of these problems causing a system failure, **it is recommended that you have preventive measures designed and installed on the flowmeter signal receiving side**.
- (14) **For installation and connectirn of the converter, check the model number of converter and read the instruction manual of the relevant converter.**

* We assume no responsibility for nonconformity caused by violation of precautions described in this manual or used in violation of the installation method and the operation method stipulated in a relevant ordinance or other regulations.

About disposal

When you dispose of this electromagnetic flowmeter detector, follow the ordinance or regulations of your state.

Table of Contents

SAFETY PRECAUTIONS	2
Handling Precautions	6
1. Product Inspection and Storage	9
1.1 Product Inspection	9
1.2 Storage	9
2. Overview	10
3. Names of Parts	11
4. Installation	14
4.1 Notes on Selecting the Installation Location	16
4.2 Mounting Procedure	16
4.3 Piping Connections	22
4.4 Grounding	25
5. Wiring	27
5.1 Cables	29
5.2 External Device Connections and Grounding	30
5.3 Notes on Wiring	30
5.4 Wiring	31
6. Operation	34
7. Maintenance and Troubleshooting	35
7.1 Maintenance	36
7.2 Troubleshooting	37
8. Principle of Operation	40
9. Specifications	41
9.1 Flowmeter Specifications	41
9.2 Type Specification Code	46
10. Outline Dimensions	47
Appendix 1	
1-1 A system diagram for GF630/LF600F and GF630/LF610F	52
1-2 A system diagram for GF632	53

1. Product Inspection and Storage

1.1 Product Inspection

GF630 series electromagnetic flowmeter is shipped in a cardboard container filled with shock-absorbing materials. Open the package carefully and check as follows:

- Make sure the following items are included in the package.

For the **integral type** (when a converter and detector are united)



Electromagnetic flowmeter main unit -----	1 unit
Instruction manuals-----	One each for the converter and detector
Ground cable -----	2 pieces

For the **separate type** (when a converter and detector are separated)



Electromagnetic flowmeter converter-----	1 unit
Electromagnetic flowmeter detector -----	1 unit
Instruction manuals-----	each for the converter and detector
Ground cable -----	2 pieces

- Inspect the flowmeter for indications of **damage** that may have occurred during shipment.
- Make sure the type and specifications of the flowmeter are in accordance with the **ordered specifications**.

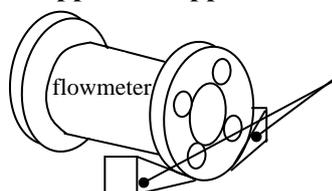
If you cannot find the items listed above or any problem exists, contact your nearest Toshiba representative.

1.2 Storage

To store the electromagnetic flowmeter after opening the package, select a storing place as follows and keep it under the conditions described below:

CAUTION

- (1) Avoid places where there is **direct sunlight, rain or wind**.
- (2) Store the product in a well-ventilated place. Avoid places of **extremely high humidity or extremely high or low temperature**. The following environment is recommended:
 - **Humidity range: 10 to 90% RH (no condensation)**
 - **Storage temperature: -25 to +65° C**
- (3) Avoid places where **vibrations or mechanical shock occur**.
- (4) If the cover of the converter is left open while being stored, gradual deterioration of circuit isolation can be caused. Therefore **don't open the cover** until it is connected with wires.
- (5) To put the flowmeter temporarily on the floor, **place it carefully with something, such as block or stopper, to support it so that the flowmeter will not topple over**.



Stopper, etc. to prevent from toppling over it.

2. Overview

The GF630/LF600F, GF630/LF610F and GF632 electromagnetic flowmeter can be use in the following hazardous (classified) locations.

Class I , Division 2, Groups A, B, C and D,
Class II , Division 2, Groups E, F and G
ClassIII

The GF630 and GF632 electromagnetic flowmeter measures the volumetric flow rates of electrically conductive materials on the basis of Faraday's Law of electromagnetic induction.

The device consists of two units: the GF630 and GF632 detector, through which the fluid to be measured flows, and the converter, which receives the electromotive force signals from the detector, then converts the signals into the 4–20 mA dc signal.

Features

Every type of electromagnetic flowmeter has the following features:

- Fluid flow is not obstructed and pressure loss is negligible.
- The process fluid's temperature, pressure, density or flow conditions has no effect on the accuracy of the flowmeter.
- The flowmeter output is directly proportional to the process flow rate, thus it is easy to read its output.

3. Names of Parts

3.1 Appearance

3.1.1 Appearance of GF630/LF600F and GF630/LF610F



For the detail of the converter, check the converter LF600F and LF610F instruction manual.

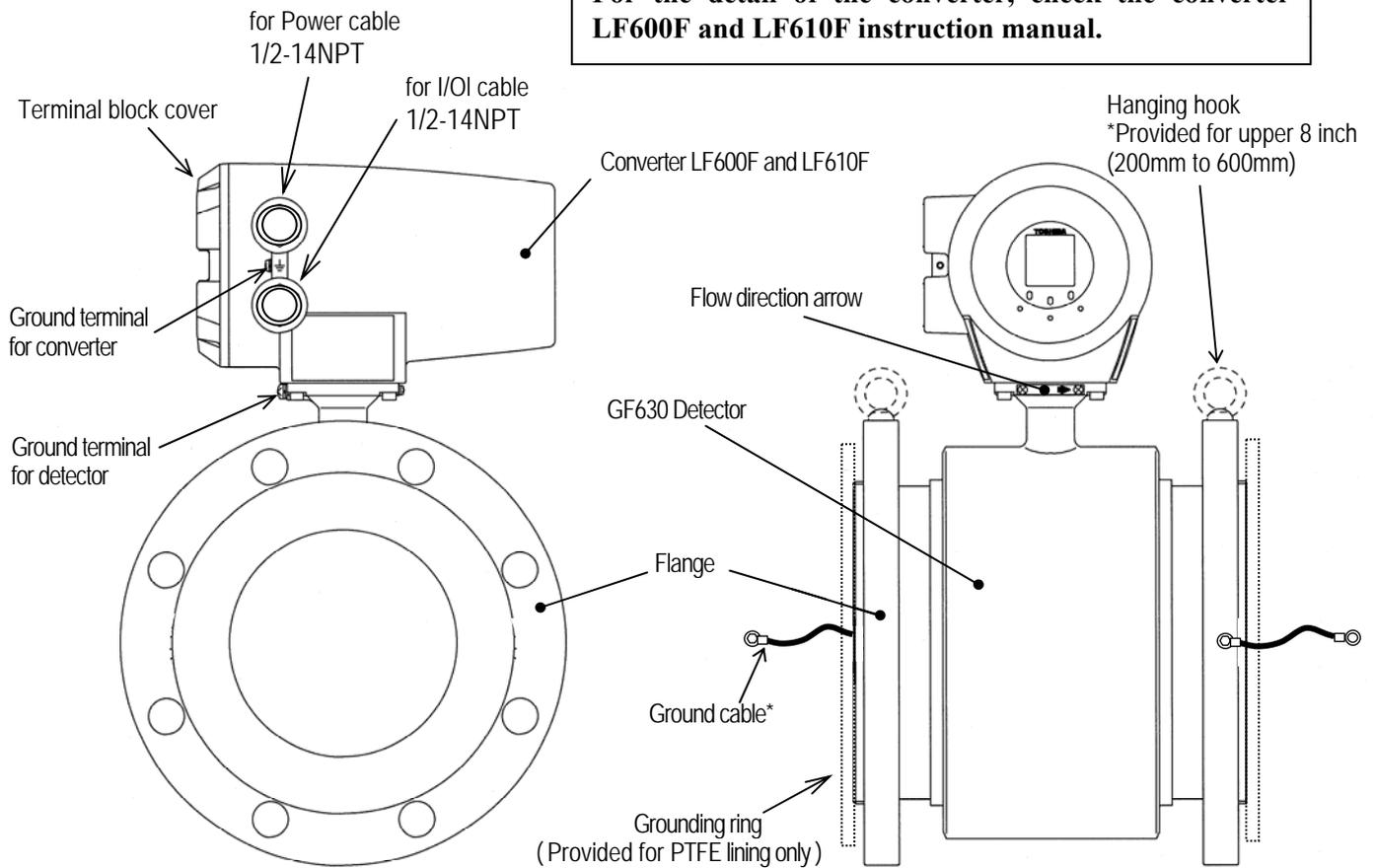


Figure 3.1.1 Appearance of GF630/LF600F and GF630/LF610F

Note: The ground cables are included in the package, so install them to flanges as shown in the Fig.4.5 as needed. (The screws are equipped to detector flanges.)

3.1.2 Appearance of Detector GF632



Separate

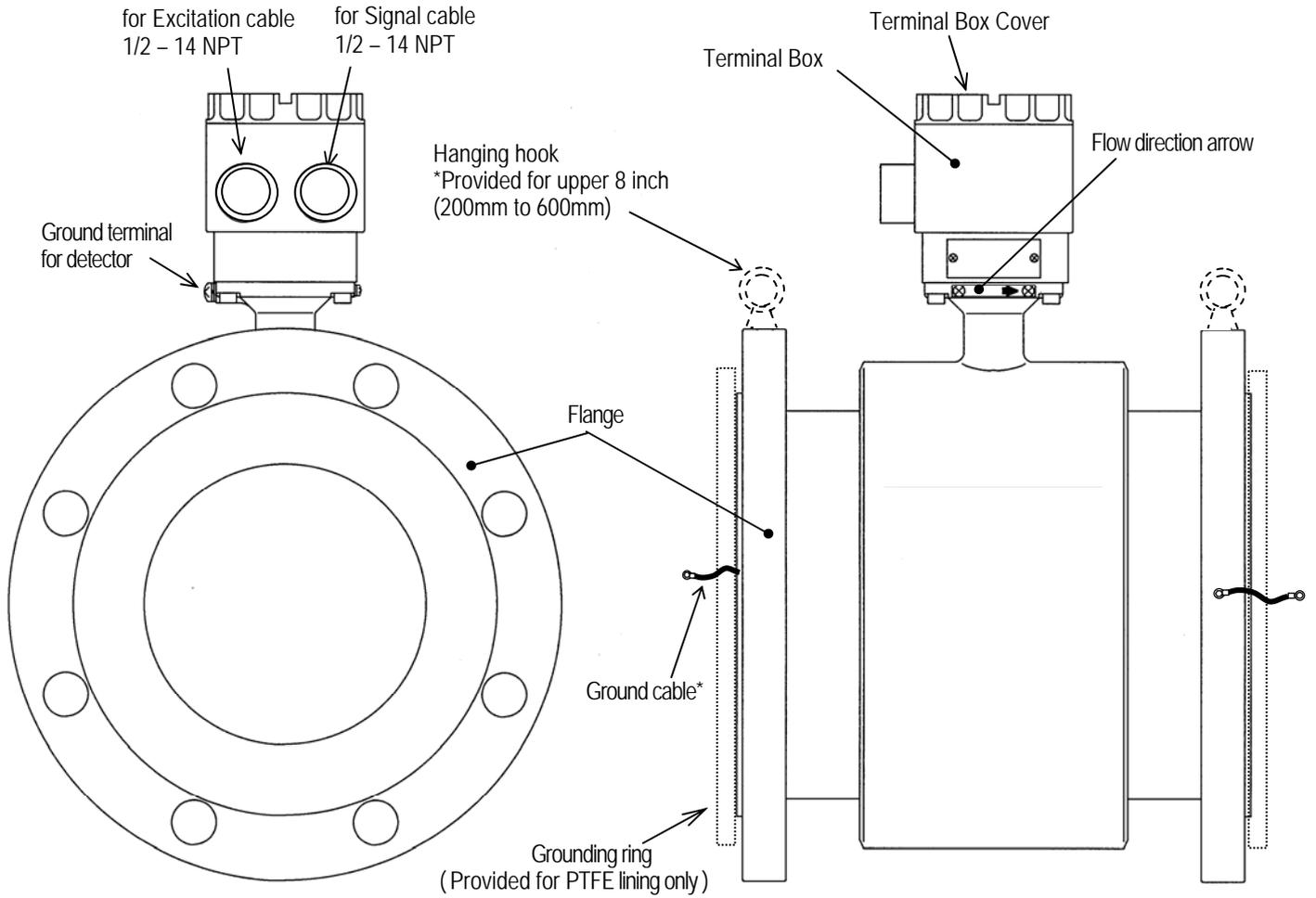


Figure 3.1.2 Appearance of Detector GF632

Note: The ground cables are included in the package, so install them to flanges as shown in the Fig.4.5 as needed. (The screws are equipped to detector flanges.)

3.2 Construction of the terminal blocks

3.2.1 Terminal Block Construction of GF630/LF600F and GF630/LF610F Type



Integral

For the detail of the converter, check the converter LF600F and LF610F instruction manual.

3.2.2 Terminal Block Construction of GF632 Type



Separate

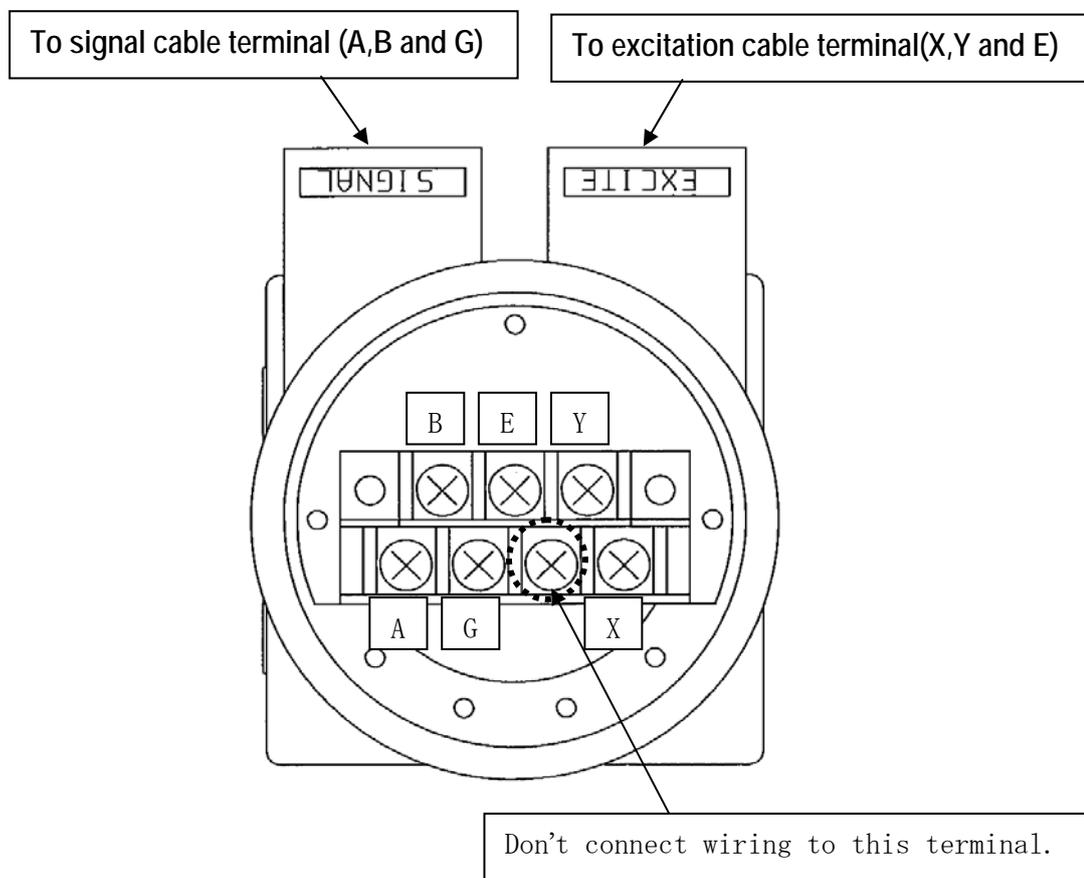


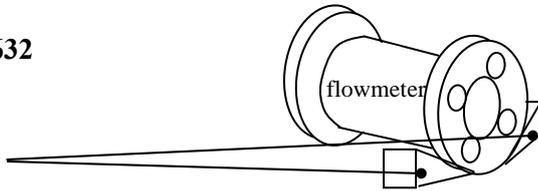
Figure 3.2.2 Terminal Block of GF632

4. Installation

Safety Precautions for Installation

 WARNING	
<p>■ Do not active live circuits under environment of explosive atmospheres.</p> <p> DON'T</p>	<p>Live part of electric circuit or a high temperature department can cause explosion.</p>
<p>■ Do not use parts of other products.</p> <p> DON'T</p>	<p>Protective performance degradation for hazardous location can cause explosion.</p>
<p>■ Do not active live circuits While assembly of all components is not over.</p> <p> DON'T</p>	<p>Protective performance degradation for hazardous location can cause explosion.</p>
<p>■ Install per the National Electrical Code for the US (NEC, ANSI/NFPA 70) and the Canadian Electrical code for Canada (CEC, CAN/CSA-C22.1) and the drawing Appendix 1.</p> <p> DO</p>	<p>Unsuitable conduit connections for hazardous location can cause explosion.</p>

 CAUTION	
<p>■ Ground the GF630/LF600F, GF630/LF610F and GF632 independently from power equipment. (100 ohm or less ground resistance)</p> <p> Operating this product without grounding can cause electric shock or malfunction.</p> <p>DO</p>	<p>■ Use an appropriate device to carry and install the GF630/LF600F, GF630/LF610F and GF632 .</p> <p> If his product falls to the ground, injury, or malfunction of or damage to the product, can be caused.</p> <p>DO</p>
<p>■ Install a switch and fuse to isolate the GF630/LF600F, GF630/LF610F and GF632 from mains power.</p> <p> Power supply from mains power can cause electric shock or circuit break-down.</p> <p>DO</p>	<p>■ Do not modify or disassemble the GF630/LF600F, GF630/LF610F and GF632 unnecessarily.</p> <p> Modifying or disassembling this product can cause electric shock, malfunction or damage to this product.</p> <p>DON'T</p>
<p>■ Do not work on piping and wiring with wet hands.</p> <p> Wet hands may result in electric shock.</p> <p>DON'T</p>	<p> The label shown left is placed near the terminal board for power supply to the converter.</p> <p>Be alert to electric shock</p>
<p>■ To put the flowmeter temporarily on the floor, place it carefully with something, such as stopper, to support it so that GF630/LF600F, GF630/LF610F and GF632 will not topple over.</p> <p> Stopper, etc. to prevent from toppling over it.</p> <p>DO</p>	



4.1 Notes on Selecting the Installation Location

1. Avoid places within the immediate proximity of equipment producing electrical interference (such as **motors, transformers, radio transmitters, electrolytic cells, or other equipment causing electromagnetic or electrostatic interference**).
2. **Avoid places where excessive pipe vibration occurs.**
3. Avoid places where fluid is pumped in a pulsating manner
4. Avoid places where there is **direct sunlight**. If this is unavoidable, use an appropriate **shade**
5. Avoid places where **corrosive atmospheres** or **high humidity conditions** obtain.
6. Avoid places where **there may be limited access such as pipes installed next to high ceilings or constricted areas** where clearance for installation or maintenance work is not provided.
7. Design piping so that the detector pipe is always filled with fluid, whether the fluid is flowing or not.
8. The detector has no adjustable piping mechanism. Install an adjustable short pipe where needed.
9. Chemical injections should be conducted on the downstream side of the flowmeter.
10. The maximum length of the cable that connects **the detector and converter is 300m**. Select the converter installation location so that the distance between the detector and converter dose not exceed 300m.



Separate

4.2 Mounting Procedure

4.2.1 Pipe checks

- (1) Before installing pipes, check for any leaning, misplacement or eccentricity as illustrated in Figure 4.1. An attempt to unreasonably connect pipes that are inclined may lead to a detector breakdown or fluid leakage. Connecting pipes in an eccentric state may also cause wears and tear of linings and grounding rings, as well as measurement errors.

Before installing pipes, make sure to flush the interior of the pipes to remove deposited material.

(a) Pipe leaning

(b) Pipe axis misplacement (or eccentricity)

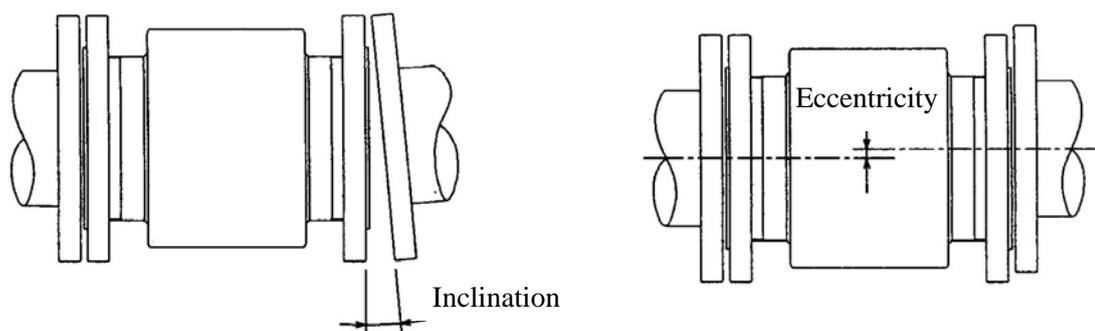


Figure 4.1 Pipe leaning and axis misplacement

(2) Preventing an Empty Pipe Condition

Fix the relevant pipes installed on both sides of the detector by attaching fittings, etc. to support the pipe. By supporting the pipes, not only the pipe vibration is reduced but also the damage to the pipes by the electromagnetic flowmeter's weight and the fluid mass (see Figures 4.2 and 4.3).

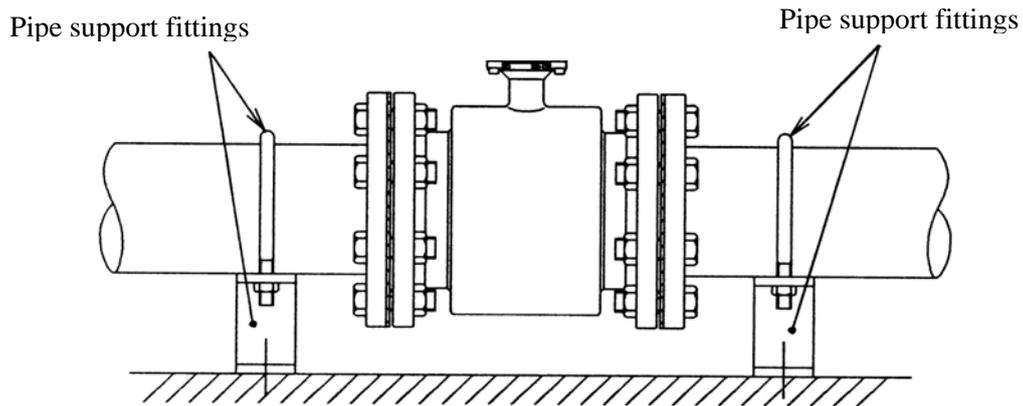


Figure 4.2 Example of Pipe Fixing Procedure

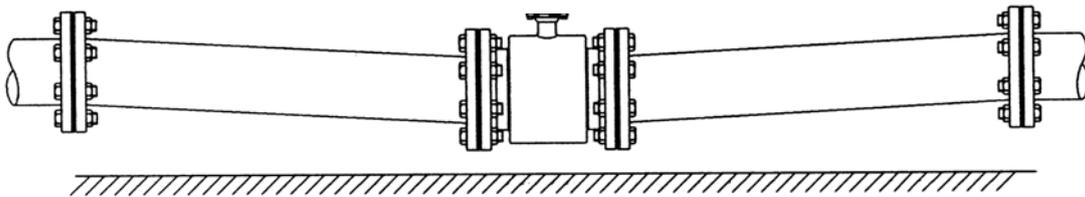


Figure 4.3 Model Diagram of Unsupported Pipes

4.2.2 Installation Procedure

In the case that the piping is **non-conductive** material, make sure to install the **grounding rings**(option) to each flange of detector using the M4 screw before piping . The M4 screws are prepared to each flange.

In addition, in the case of detector with FEP lining, make sure to install the gaskets between grounding ring and lining. The gaskets must be installed so as not to protrude into the measurement tube.

And install the ground cables to each flange of detector using the M5 screw as needed. The M5 screws, spring washers and washers are prepared to flange. And the ground cables are included in the package.

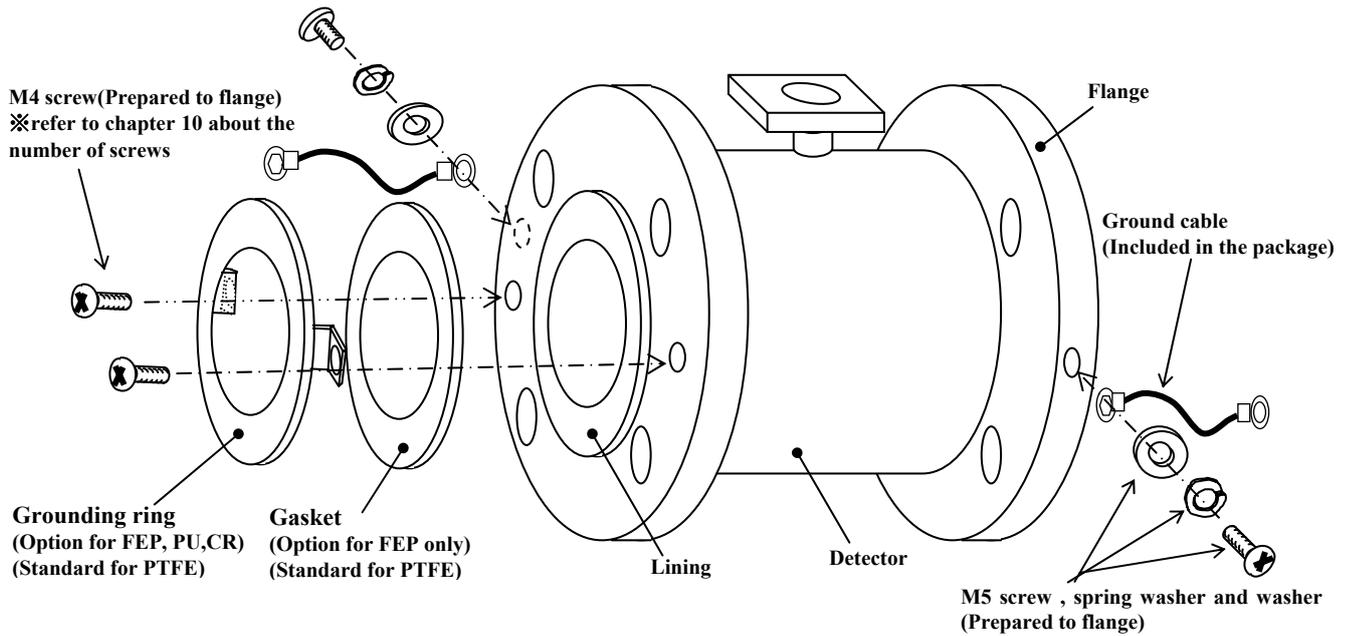


Figure 4.4 Install of grounding rings and ground cables

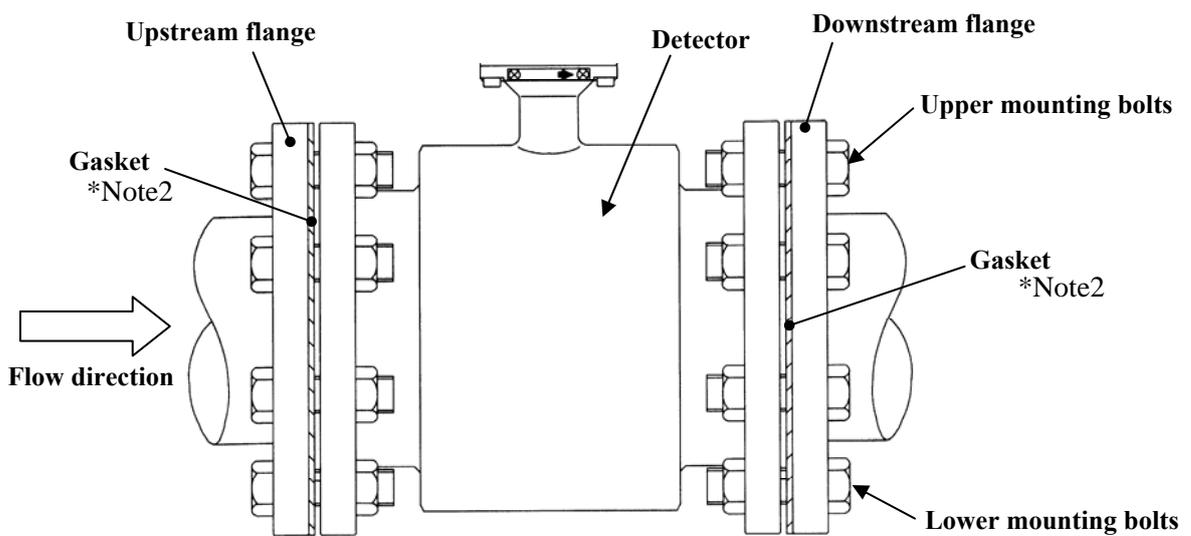


Figure 4.5 GF63* flowmeter detector piping connections

To mount the GF63*, place it between the upstream and downstream pipe flanges and tighten it with flange bolts and nuts. See Figure 4.5 and follow the procedure below:

1. Insert two lower mounting bolts through the clearance holes in the upstream (or downstream) pipe flange.
2. Install a gasket next to the upstream (or downstream) flange face and the other gasket next to the downstream (or upstream) pipe flange. The two mounting bolts can now be guided through the clearance holes in the downstream gasket and flange.
3. Place the GF63* flowmeter detector between the two flange gasket, with the flowmeter detector body above the two bolts. The flowmeter must be oriented in accordance with the flow direction arrow.
4. Install the two upper mounting bolts through the clearance holes in the upstream and downstream gasket and flanges. Then install the remaining mounting bolts depending on the flange pattern used.
5. Thread nuts on both ends of the 4 (or more) mounting bolts, finger tight. **(See Table 4.1 Bolt length and tightening torque)**
6. While centering the flowmeter with the longitudinal axis of the pipeline, tighten the nuts with a wrench diagonally across in even increments. **(See Table 4.1 Bolt length and tightening torque)**

Note1: The flowmeter detector pipe axis must be aligned with the pipeline axis on both upstream and downstream sides. This is essential to have stable characteristics of flow measurement (especially flowmeters with meter sizes of 2"(50 mm) or less). for

Note2: In the case of detector with CR or PU lining, please avoid use of a gasket that is same materials with lining material. If the same materials were used, gasket and lining would bond mutually.

CAUTION

- (1) When high-temperature fluid is being measured, radiant heat from the detector pipe surface and adjoining pipes may cause the ambient temperature of the converter to go above 60°C (140°F). If the ambient temperature goes above 60°C (140°F), try to lower the temperature by measures such as wrapping heat-insulating materials over the detector pipe and adjoining pipes.
- (2) To put the flowmeter temporarily on the floor, place it carefully with something, such as stopper, to support it so that GF630 and GF632 will not topple over.

Table 4.1 Bolt length and Nut tightening torque

Meter size		ANSI class 150			
		Machine Bolts			Tightening torque [N·m] *1
		P.C.S	Diameter	Length [inch]	
15mm	1/2"	4	1/2"	2"	7 to 9
25mm	1"	4	1/2"	2.16"	14 to 17
32mm	1 1/4"	4	1/2"	2.16"	19 to 24
40mm	1 1/2"	4	1/2"	2.36"	16 to 21
50mm	2"	4	5/8"	2.56"	37 to 46
65mm	2 1/2"	4	5/8"	2.95"	52 to 66
80mm	3"	4	5/8"	2.95"	55 to 69
100mm	4"	8	5/8"	2.95"	40 to 51
125mm	5"	8	3/4"	3.15"	68 to 85
150mm	6"	8	3/4"	3.15"	89 to 112
200mm	8"	8	3/4"	3.54"	119 to 149
250mm	10"	12	7/8"	3.86"	159 to 198
300mm	12"	12	7/8"	3.94"	183 to 229
350mm	14"	12	1"	4.33"	203 to 254
400mm	16"	16	1"	4.53"	232 to 289
450mm	18"	16	1 1/8"	4.92"	322 to 402
500mm	20"	20	1 1/8"	5.12"	336 to 420
600mm	24"	20	1 1/4"	5.70"	497 to 622

*1: 1[N·m] is 0.7376 [ft·lbf].

4.2.3 Precautions in transportation

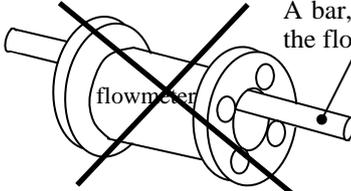
To prevent the device from being damaged during transportation, the original packing should be left untouched until the device arrives near the intended installation site.

The detector is equipped with hanging hooks. Lift it as shown in Figure 4.5. For information on the actual mass of each diameter, refer to Table 4.2.

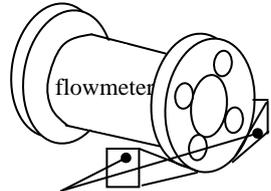
CAUTION

(1) Never lift the detector by inserting a bar into its measurement pipe, because this will damage the linings, thus making it impossible to take stable measurements.

(2) To put the flowmeter temporarily on the floor, place it carefully with something, such as stopper, to support it so that GF630/LF600F, GF630/LF610F and GF632 will not topple over.



A bar, etc. to lift the flowmeter.



Stopper, etc. to prevent from toppling over it.

* The lifting work should be executed by those qualified for crane work or slinging work

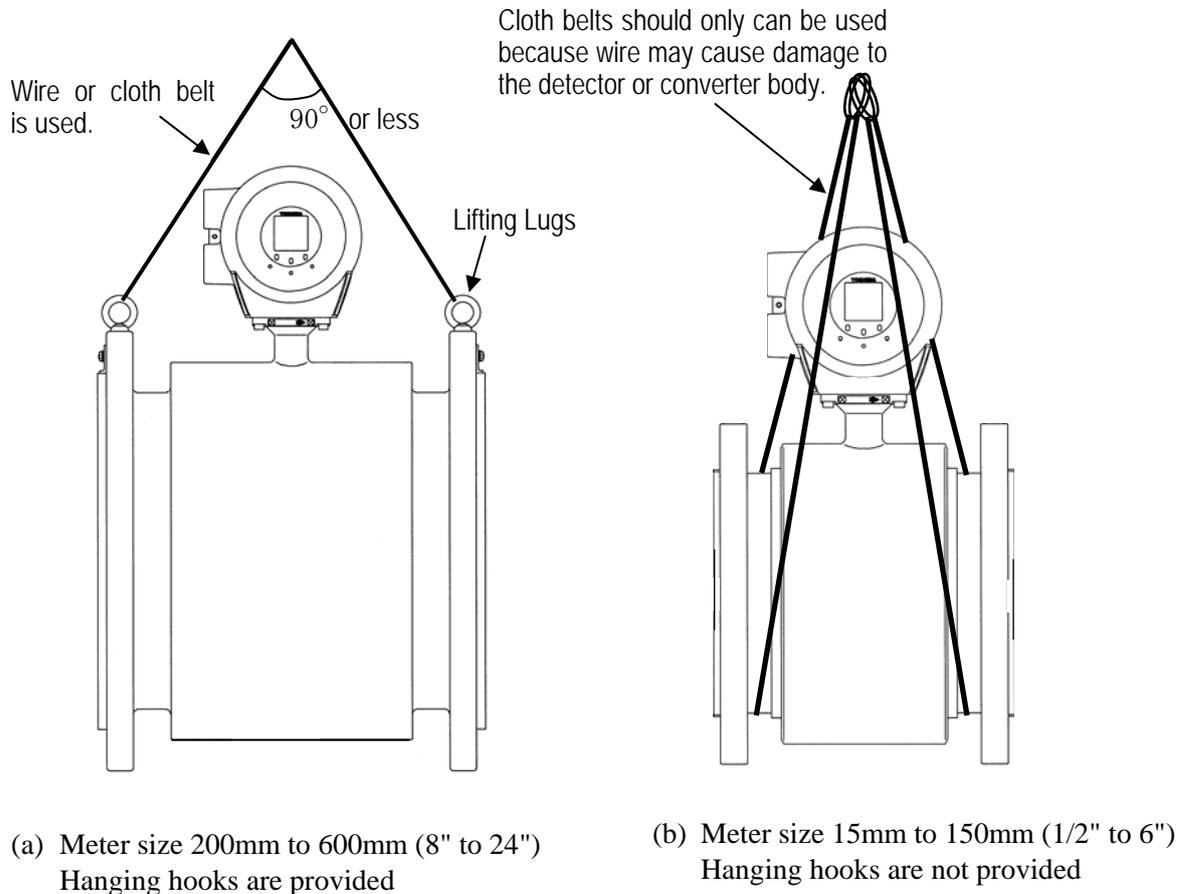


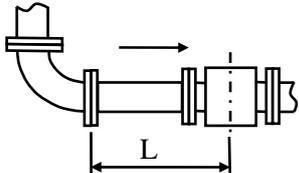
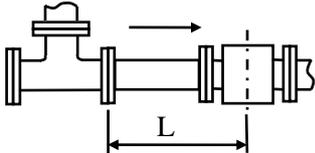
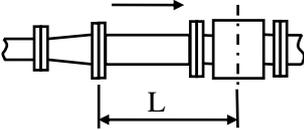
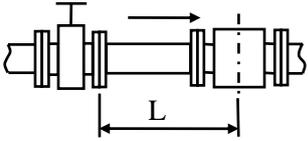
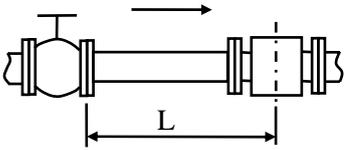
Figure 4.6 Transportation of GF63* flowmeter detector

4.3 Piping Connections

(1) Required Upstream Straight Pipe Length

If various joints are used upstream of the detector outlet, the straight pipe length as shown in Table 4.3 is required.

Table 4.3 Required straight pipe length on the upstream side

L=5D	L=10D
<p>(1) 90° bent</p>  <p>(2) Tee</p>  <p>(3) Diffuser</p>  <p>(4) Fully opened sluice valve</p> 	<p>(5) Other valves (not fully opened)</p> 

L: Required straight pipe length—straight pipe length plus half length of the detector.
D: Nominal bore size (diameter)

NOTES

The length of a reducer, if connected, can be counted as a part of the straight pipe length.
 No straight pipe length is needed on the downstream side. If a butterfly valve is installed downstream of the detector, do not let the valve plate protrude into the pipe of the detector

(2) Pipe Orientation

The detector may be installed in horizontal, vertical or sloping pipe runs as shown in Figure 4.6. However, except for horizontal installation, fluid should flow from lower to upper directions. If no air bubble, Vertical down flow application are acceptable under pressured piping conditions. See Figure 4.6.

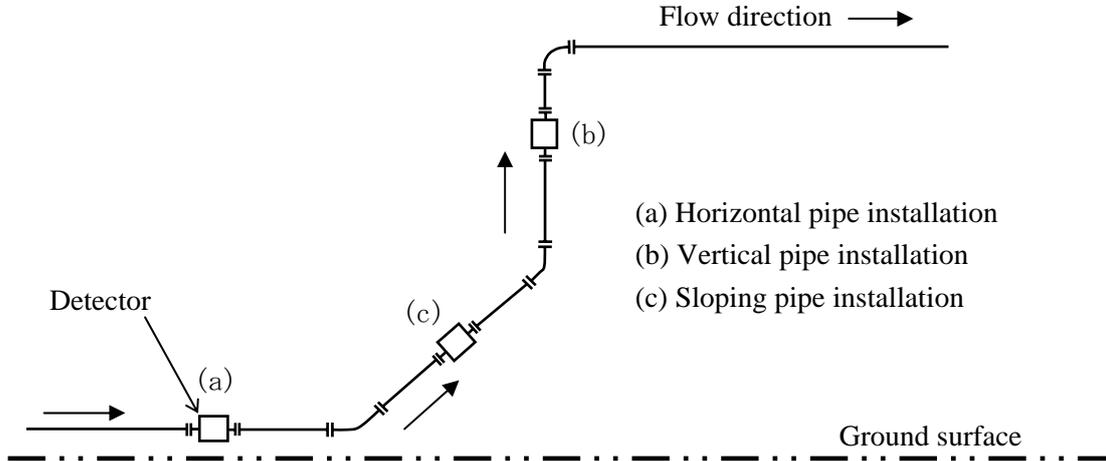


Figure 4.7 Detector Piping Orientation

The electrodes should be positioned horizontally relative to the ground surface in any piping installation. See Figure 4.7.

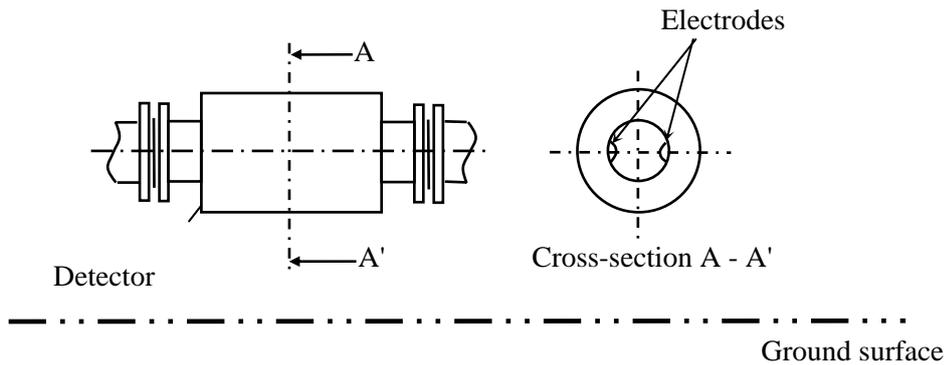


Figure 4.8 Installation position of the detector

(3) Flow Direction

Install the detector in accordance with the flow direction arrow on the detector. See Figure 4.8.

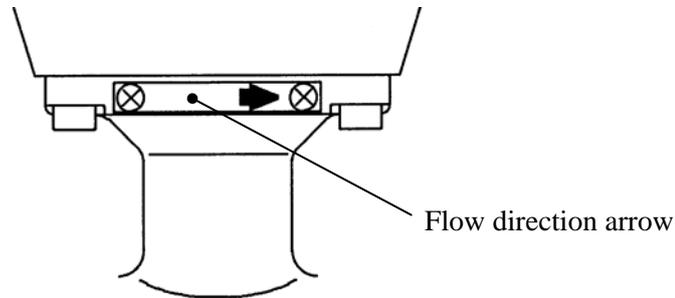


Figure 4.9 Flow direction arrow on the detector

(4) Preventing an Empty Pipe Condition

Design an upright pipe run (Figure 4.9) or sufficient head pressure (Fig. 4.10) at the downstream detector outlet if there is a possibility of the detector pipe becoming emptied.

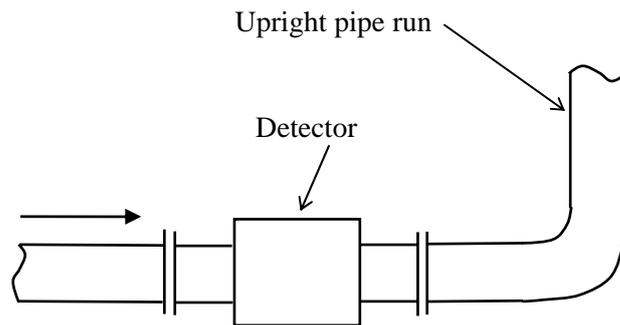


Figure 4.10 Detector with an upright pipe run at downstream outlet

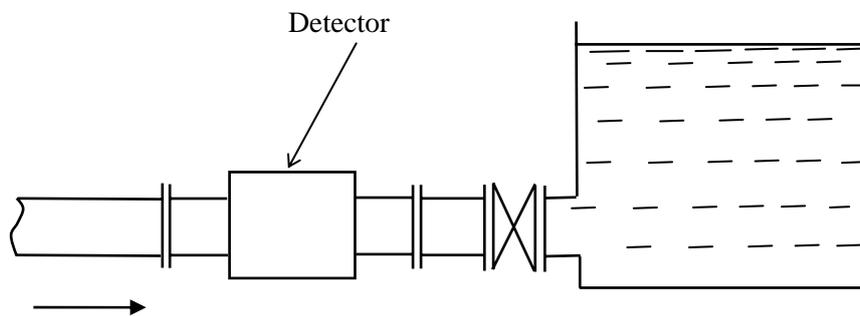


Figure 4.11 Detector with sufficient head pressure at downstream outlet

4.4 Grounding

CAUTION	
<p>■ Do not wire cables and replace parts when power is supplied.</p> <div style="display: flex; align-items: center; margin-top: 10px;"> <p style="font-size: small;">Wiring work and replacing parts in the power-on state may cause electric shock.</p> </div> <p style="font-weight: bold; font-size: small; margin-top: 5px;">DON'T</p>	<p>■ Do not work on piping and wiring with wet hands.</p> <div style="display: flex; align-items: center; margin-top: 10px;"> <p style="font-size: small;">Wet hands may result in electric shock.</p> </div> <p style="font-weight: bold; font-size: small; margin-top: 5px;">DON'T</p>



(1) Grounding of the GF630/LF600F and GF630/LF610F type

Ground as shown in Figure 4.12. Make the grounding wire as short as possible. Use **grounding wire material of IV wire 5.5mm² or more**. Do not share a grounding wire with other instruments where grounding current may flow. (An independent grounding is preferable.)

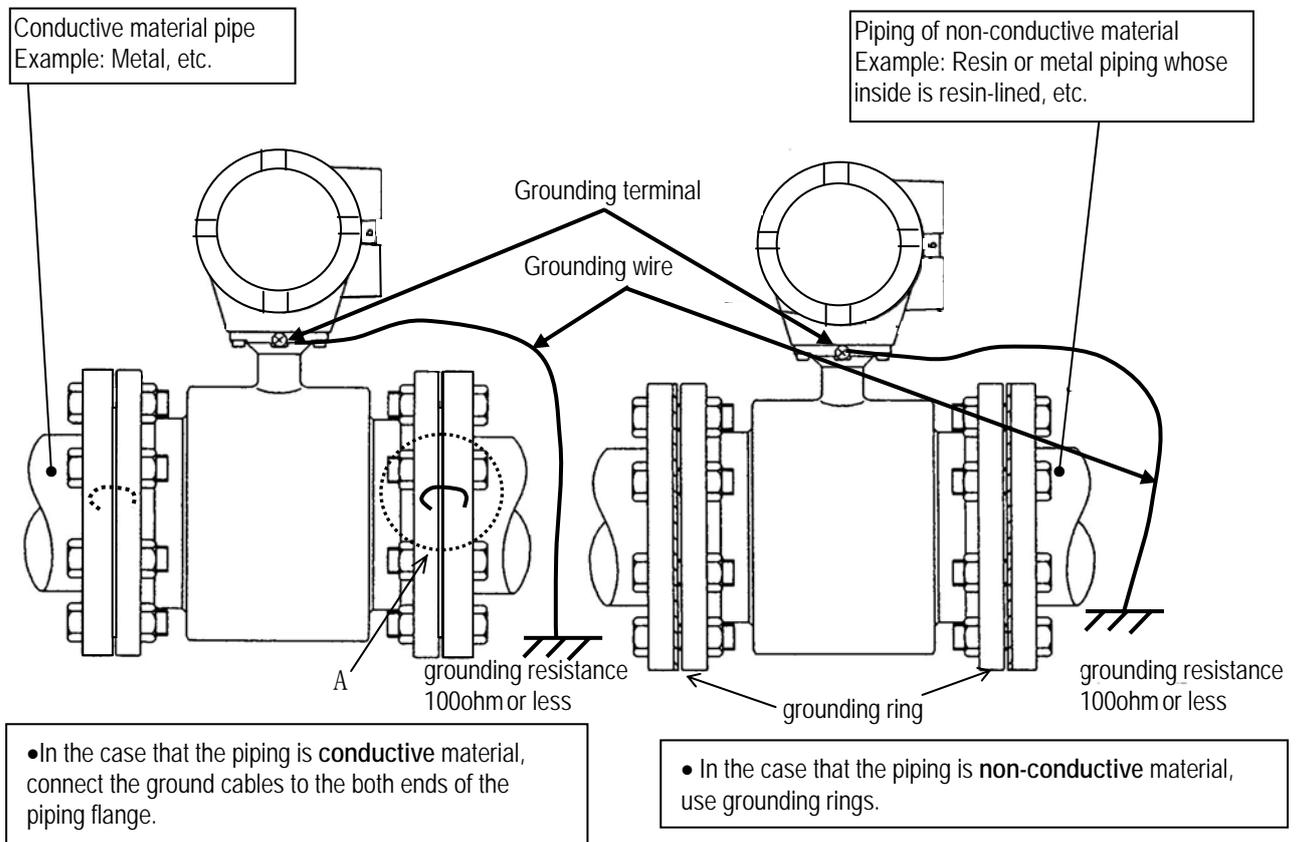


Figure 4.12 Grounding the GF630/LF600F and GF630/LF610F Type

Please connect the ground cables of detector to piping using the M5 screw shown as Figure 4.13 as needed. (In the case that there are no threaded hole with piping, please tap the threaded hole.)
 ※It is necessary to connect the ground cable surely electrically.

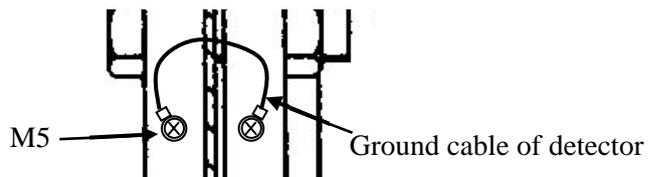


Figure 4.13 Grounding wire connection (Detail of part A)



(2) Grounding of the GF632 type

Ground the external grounding terminal of the detector and the FG terminal of the converter (or external grounding terminal of the converter) securely (**grounding resistance 100ohm or lower**). Use grounding wire material of **IV wire 5.5mm² or more**. **Do not share a grounding wire with other instruments where grounding current may flow. (An independent grounding is preferable.)**

If it is difficult to perform grounding work at the detector side because of a pit installation or other reasons, use a

3-core cable for the excitation cable and connect the E terminal of the detector to the E terminal of the converter. (The E terminal of the converter is internally connected with the FG terminal and the converter case.)

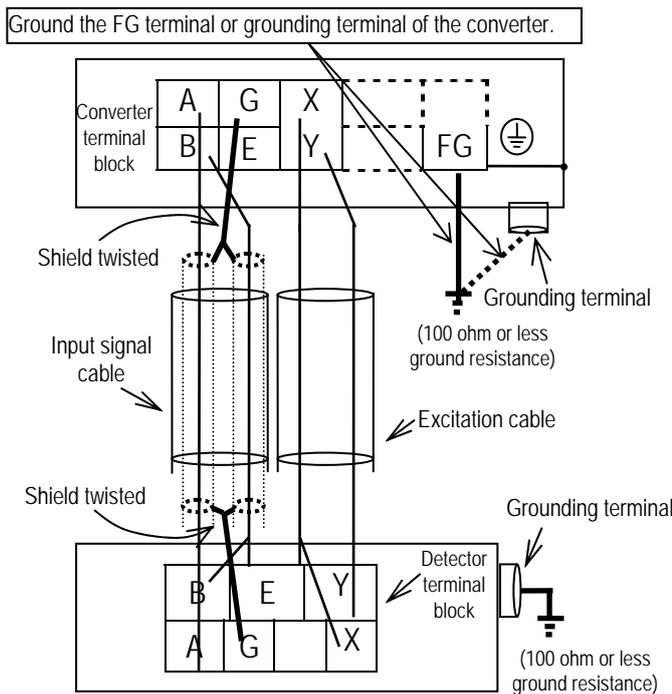


Figure 4.14 (a)

Wiring between Detector and Converter (For grounding the detector, see Figure 4.13 below.)

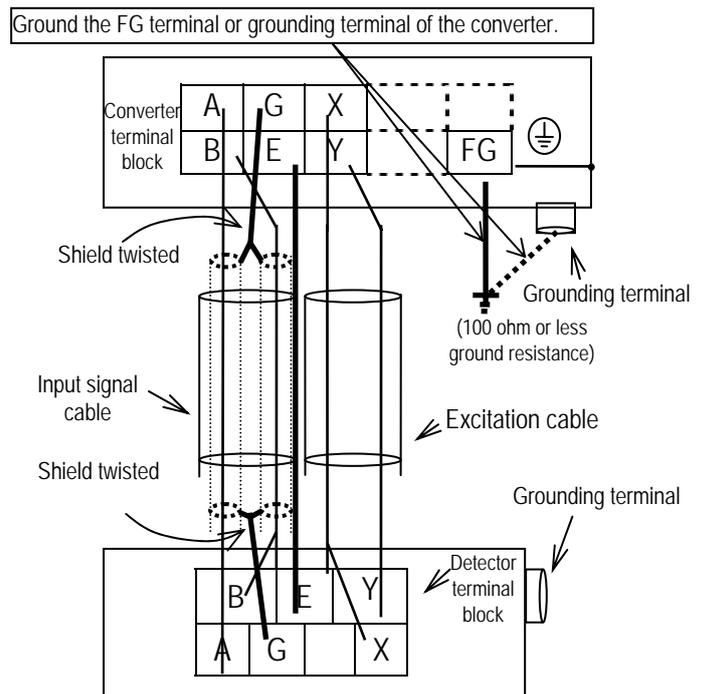
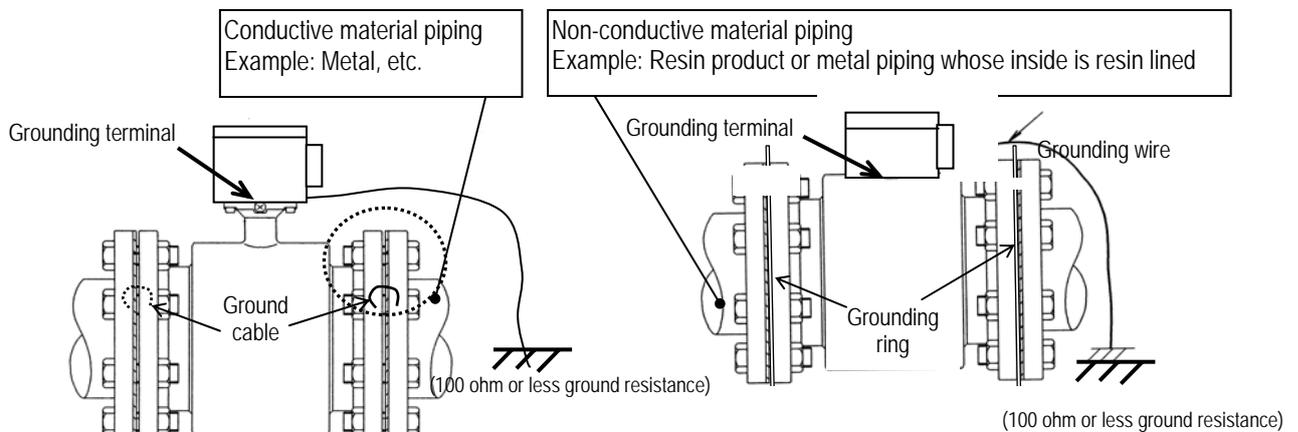


Figure 4.14 (b)

Wiring between Detector and Converter (when grounding of the detector is difficult)



- In the case that the piping is **conductive material**, connect the ground cable to the both ends of the piping flange as needed.
- In the case that the piping is **non-conductive material**, use grounding rings.

Figure 4.15 Grounding the GF632 Type Detector

5. Wiring

Safety Precautions for Wiring

 WARNING	
<p>■ DO NOT DISCONNECT WHILE CIRCUIT IS LIVE UNLESS LOCATION IS KNOWN TO BE NONHAZARDOUS.</p> <p> DON'T</p>	<p>Live part of electric circuit or a high temperature department can cause explosion.</p>
<p>■ Do not active live circuits While assembly of all components is not over.</p> <p> DON'T</p>	<p>Protective performance degradation for hazardous location can cause explosion.</p>
<p>■ Install per the National Electrical Code for the US (NEC, ANSI/NFPA 70) and the Canadian Electrical code for Canada (CEC, CAN/CSA-C22.1) and the drawing Appendix 1.</p> <p> DO</p>	<p>Unsuitable conduit connections for hazardous location can cause explosion.</p>

 CAUTION	
<p>■ Install a switch and fuse to isolate the GF630/LF600F, GF630/LF610F and GF632 from mains power.</p> <p> Power supply from mains power can cause electric shock or circuit break-down.</p> <p>DO</p>	<p>■ Turn off mains power before conducting wiring work.</p> <p> Wiring while power is applied can cause electric shock.</p> <p>DO</p>
<p>■ Do not work on piping and wiring with wet hands.</p> <p> Wet hands may result in electric shock</p> <p>DON'T</p>	<p>■ Ground the LF600F and LF610F independently from power equipment. (100 ohm or less ground resistance)</p> <p> Operating this product without grounding can cause electric shock or malfunction.</p> <p>DO</p>
<p>■ Do not conduct wiring work with bare hands.</p> <p> Remaining electric charge even if power is turned off can still cause electric shock.</p> <p>DON'T</p>	<p>■ For the power supply wiring and grounding wiring, use crimping terminals with insulated sleeve. There is a risk of electric shock due to drop-off or loosening, and a risk of fire and equipment trouble due to heat generation.</p> <p> DO</p>
<p>Do not modify or disassemble the GF630/LF600F, GF630/LF610F and GF632 unnecessarily.</p> <p> Modifying or disassembling this product can cause electric shock, malfunction of or damage to this product.</p> <p>DON'T</p>	<p> The label shown left is placed near the power supply terminal on the converter. Be alert to electric shock.</p>

Flowmeter accuracy may be affected by the way wiring is executed. Proceed with correct wiring taking the precautions in following pages.

Notes on wiring

 CAUTION

- (1) The apparatus does not be provided with the cable connections. Please prepare yourself for the cable connections which could be used in Division2 hazardous locations.
The cable lead –in section must be tightened securely to keep air tightness.
- (2) Select the cable runs **away from electrical equipment (motors, transformers, or radio transmitters) which causes electromagnetic or electrostatic interference.**
- (3) Deterioration of flowmeter circuit insulation occurs if the converter interior or cable ends get wet or humidified. This in turn causes **malfunction of flowmeter or noise problems. Avoid a rainy day if the flowmeter is to be installed outdoors.** Even indoors, prevent water from splashing over the flowmeter. Try to finish the wiring as quickly as possible
- (4) The converter has an arrestor installed inside. Therefore, **do not conduct a withstand voltage test for the converter.** To check the insulation of the converter, use a voltage of **250Vdc or less.**
- (5) After wiring, be sure to install the terminal block protection cover.
-  (6) Because the excitation cable and flow rate signal cable transmit very delicate signals, pass each of them separately through a thick steel conduit tube, keep them away from the large current wiring as far as possible, and do not install them in parallel.

Separate

5.1 Cables

Use the kind of cables shown in Table 5.1 to wire the converter.

Table 5.1 Installation Cables

Name	Cable name	Nominal cross-sectional area	Finished outer diameter	Description
Power cable	3-core vinyl sheathed cable or 2-core vinyl sheathed cable	2 mm ²	11~13mm	CVV JIS C 3401 or equivalent
Output signal cable	The number of conductors the cable contains differs depending on the specification of the output signal cable. Use a shielded cable of finished outer diameter 11 to 13mm and nominal cross-sectional area 1.25mm ² .			CVV-S JIS -258-C or equivalent
 Flow rate signal cable	2-core shielded chloroprene cabtyre cable (Rubber covered cable)	0.75 mm ²	11~13mm	2PNCT-S JIS C 3327 or equivalent
 Excitation cable	3-core chloroprene cabtyre cable (Rubber covered cable)	2 mm ² 1.25 m ²	11~13mm	2PNCT JIS C 3327 or equivalent

Separate

Separate

5.2 External Device Connections and Grounding

For the notes on connecting, wiring and installation of the combined converter, check the model number of the combined converter and read the instruction manual of the relevant converter.

5.3 Notes on Wiring

5.3.1 Notes on Instrumentation-Converter Wiring

To avoid 2-point grounding, **ground the shield of output cable basically at the receiving side.**

Use a grounding wire of IV wire 5.5mm² or more. The size of the external grounding terminal screws is M4.

Do not share a grounding wire with other instruments where grounding current may flow. (An independent grounding is preferable.)

Power cable

When a 3-core cable is used: **Ground with the FG terminal.**

When a 2-core cable is used: Use an external grounding terminal and make the cable as short as possible.



5.3.2 Notes on Wiring of the Separate type (GF632)

Separate

The detector is shipped with a flow rate signal cable and excitation cable. Be sure to use those cables coming with the detector.

Note: When the cable length exceeds 300m, cables may not be supplied. Check whether the cable is supplied with the specs.

The allowable cable length between the detector and converter varies depending on the conductivity of the operating fluid. **Refer to the instruction manual of the combined detector.**

When connecting with the detector, wire the cables in the order of the excitation cable and flow rate signal cable.

Because the input cables transmit very delicate signals, pass the excitation cable and input signal cable **separately through a thick steel conduit tube, keep them away from the large current wiring as far as possible, and do not install them in parallel.**

When replacing the flow rate signal cable and excitation cable, also refer to the instruction manual of the relevant detector. Order the detector terminal box cover packing from Toshiba or a Toshiba distributor.

5.4 Wiring

5.4.1 Terminal Treatment of Cables

Follow the procedures below to treat the terminals (at the converter side) of various cables and install the cables to the terminal block. Use appropriate cables based on the description in Section 5.1 "Cables." Crimp a **round type insulated crimp-type terminal** to the end of the cables.

(1) Power cable, current output cable, digital I/O cables

The necessary cables should be ordered from the person responsible for the installation. Strip the sheath of each conductor as shown in Figure 5.1 and attach a crimping terminal with insulated sleeve to it. The size of the crimping terminal is as follows:

Integral type **LF600F and LF610F: M4**

Separate type **LF602F and LF612F: M3.5**

- Connect the power cable to terminal blocks L1 and L2.
- Connect the current output cable to terminal blocks + and -.
- Connect the digital I/O cable to terminal blocks D1, D01, D02 and COM, as required.

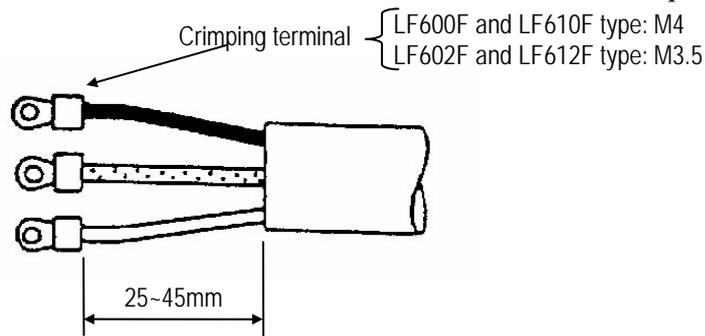


Figure 5.1 Terminal Treatment of Power Cable, Current Output Cable and Digital I/O cable



(2) Excitation cable

Strip the sheath from the end of each conductor as shown in Figure 5.2, attach an M3.5 crimping terminal with insulated sleeve, and connect it to the terminal blocks X and Y. Connect the red conductor to terminal block E.

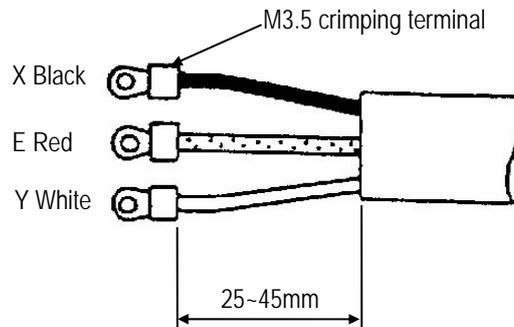


Figure 5.2 Terminal Treatment of Excitation Cable



(3) Connecting the input signal cable

Separate

Strip the sheath from the end of each conductor of a 2-core individually shielded cable as shown in Figure 5.4. Twist those shields and cover them with a thermal contraction tube or vinyl tube not to make contact with the case or core wires. Then attach an M3.5 crimping terminal with insulated sleeve as shown in Figure 5.3. Connect a crimping terminal to the A and B terminals on the terminal block and connect to each G terminal of the detector and converter.

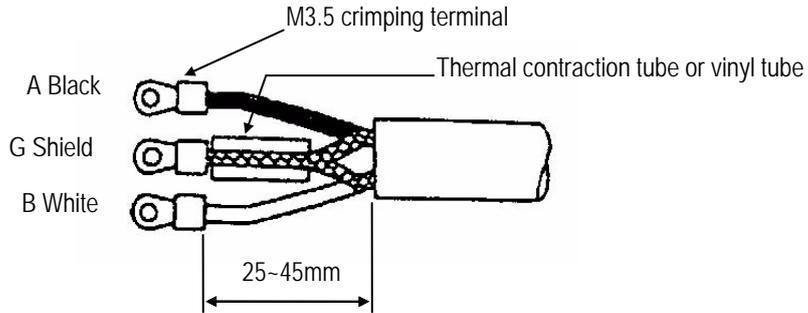
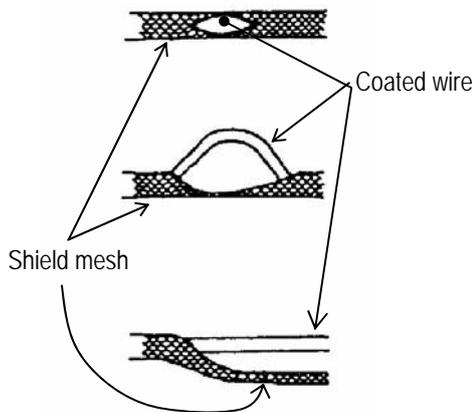


Figure 5.3 Terminal Treatment of Flow Rate Signal Cable

● **Notes on signal cable shield processing work**

When stripping an external sheath, intermediate and insulated sheath, be careful not to scratch or cut the internal conductors and shield mesh. Do not disjoint the shield mesh but treat it as shown in Figure 5.9.



- a. Open the shield mesh with a pair of tweezers or the like.
- b. Pull out the internal coated wires from the hole of the shielded mesh.
- c. Pull out all internal coated wires and extend the shield mesh wire.

Figure 5.4 Treating the Signal Cable Shield Mesh



Separate

5.4.2 Cable Connection

Connect and install the terminal-treated cables to the terminal block.

*Connect the cables to the terminal block securely. A loose connection may cause incorrect measurement. After connecting a cable, try to pull it to check whether it has been connected securely.

(1) Referring to **combined converter's manuals of "Connections and Grounding"**, connect each cable to the terminal block. **Tighten the screws of the terminal block tightly to ensure the secure connection.** A loose connection may cause incorrect measurement. **After connecting a cable, try to pull it to see whether it has been connected securely.**

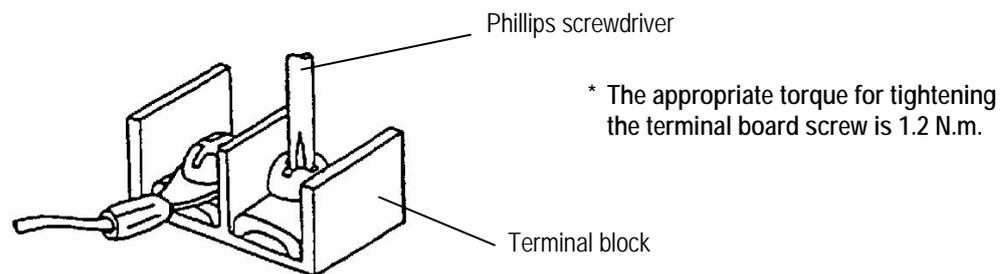


Figure 5.6 Connecting a Cable to Terminal Block

(2) Attach the terminal box cover . To keep the seal, tighten securely the cover.

6. Operation

 CAUTION	
<ul style="list-style-type: none"> ■ Do not touch the terminal board when power is supplied. <div style="display: flex; align-items: center;">  <p>Touching the terminal board when power is supplied can cause electric shock.</p> </div> <p>DON'T</p>	<ul style="list-style-type: none"> ■ Do not touch the main body when high temperature fluid is being measured. <div style="display: flex; align-items: center;">  <p>The fluid raises the main body temperature and can cause burns.</p> </div> <p>DON'T</p>

Preparatory check

Follow the procedure described below to prepare before starting the flow measurement (described with regard to the entire flowmeter).

System Check

Check the items listed below

- Check **the wiring between the converter and related instruments.**
- Make sure **all the bolts of connection flanges on which the flowmeter** is mounted securely tightened.
- Make sure **the direction of flow arrow** is in accordance with actual flow.
- Make sure the flowmeter is **grounded** with 100 ohm or less ground resistance.
- Make sure the **housing covers** are securely tightened.

Placing System On-Stream

- **Let the fluid go through** the detector pipe. (Note 1)
- When the detector is filled with the fluid, **stop** the fluid and keep it still in the detector pipe.

Supplying Electric Power

- Make sure the **power supply** is as specified.

Checking Converter Parameters

- Check the configuration parameter settings. **Refer to combined converter's manual.**

Zero Adjustment

- Wait for 30 minutes to warm up the flowmeter. Then making sure the fluid holds still in the detector pipe, starts the **zero adjustment**. Refer to **combined converter's manual**.

On-line measurement

- After checking the items and conducting the zero adjustment as listed above, let the fluid go through the detector pipe. Output (4–20 mA dc) directly proportional to the flow rate can be obtained.

Note 1: If the detector pipe is not filled with the fluid to be measured, the flow rate will be indefinite and unable to be measured. Before using the flowmeter, be sure to fill the detector pipe the fluid to be measured.

7. Maintenance and Troubleshooting

Safety precaution for Maintenance and Troubleshooting

 WARNING	
<p>■ Do not disconnect while circuit is live unless location is known to be nonhazardous.</p> <p> DON'T</p>	<p>Live part of electric circuit or a high temperature department can cause explosion.</p>
<p>■ Do not modify or disassemble the enclosure.</p> <p> DON'T</p>	<p>Strength degradation and defects of enclosure can cause explosion.</p>
<p>■ Do not use parts of other products.</p> <p> DON'T</p>	<p>Protective performance degradation for hazardous location can cause explosion.</p>
<p>■ Do not live circuits While assembly of all components is not over.</p> <p> DON'T</p>	<p>Protective performance degradation for hazardous location can cause explosion.</p>
<p>■ Install per the National Electrical Code for the US (NEC, ANSI/NFPA 70) and the Canadian Electrical code for Canada (CEC, CAN/CSA-C22.1) and the drawing Appendix 1.</p>	
<p> DO</p>	<p>Unsuitable conduit connections for hazardous location can cause explosion.</p>

 CAUTION	
<p>■ Do not conduct wiring work when power is applied.</p> <p> DON'T</p>	<p>Wiring while power is applied can cause electric shock.</p>
<p>■ Do not touch the GF630/LF600F, GF630/LF610F and GF632 main body when high temperature fluid is being measured.</p> <p> DON'T</p>	<p>The fluid raises the main body temperature and can cause burns.</p>

7.1 Maintenance

■ Cleaning

Adhesion might be created in the detector over a long period of time when used on certain materials.

Try to confirm whether to cause the adhesion in the detector pipe when the phenomenon is seen, and an abnormality (ex. decreasing indication, etc.) is confirmed.

Please clean with a soft brush etc. and remove any unnecessary build up inside the meter. When using it in the line to which such a phenomenon occurs easily, it is recommended that the detector pipe be cleaned regularly. Use new gaskets when reinstalling the flowmeter detector in the pipeline.

■ Mag-Prover Built-In Calibrator

The converter LF60*F and LF61*F has a built-in reference signal calibration and verification circuit that allows you to re-verify the original magmeter flow lab calibration without the need for external devices. **This reference signal can be used to check the zero and span of the converter for the purpose of instrumentation maintenance or periodical inspection. Refer to combined converter's manual.**

■ Operative life

The design operative life of this flowmeter is 10 years from the date of shipment at a standard use condition .

The life of the flowmeter differs depending on the environmental conditions and the way it was used. To extend the life of the flowmeter, **inspect the flowmeter periodically and clean or replace components** if necessary.

■ Product disposal

The electromagnetic flowmeter must be disposed of, according to the rules and regulations of your local government.

Especially if you dispose of electrolytic capacitors to replace parts, have it done by an agency which is licensed to handle industry waste materials.

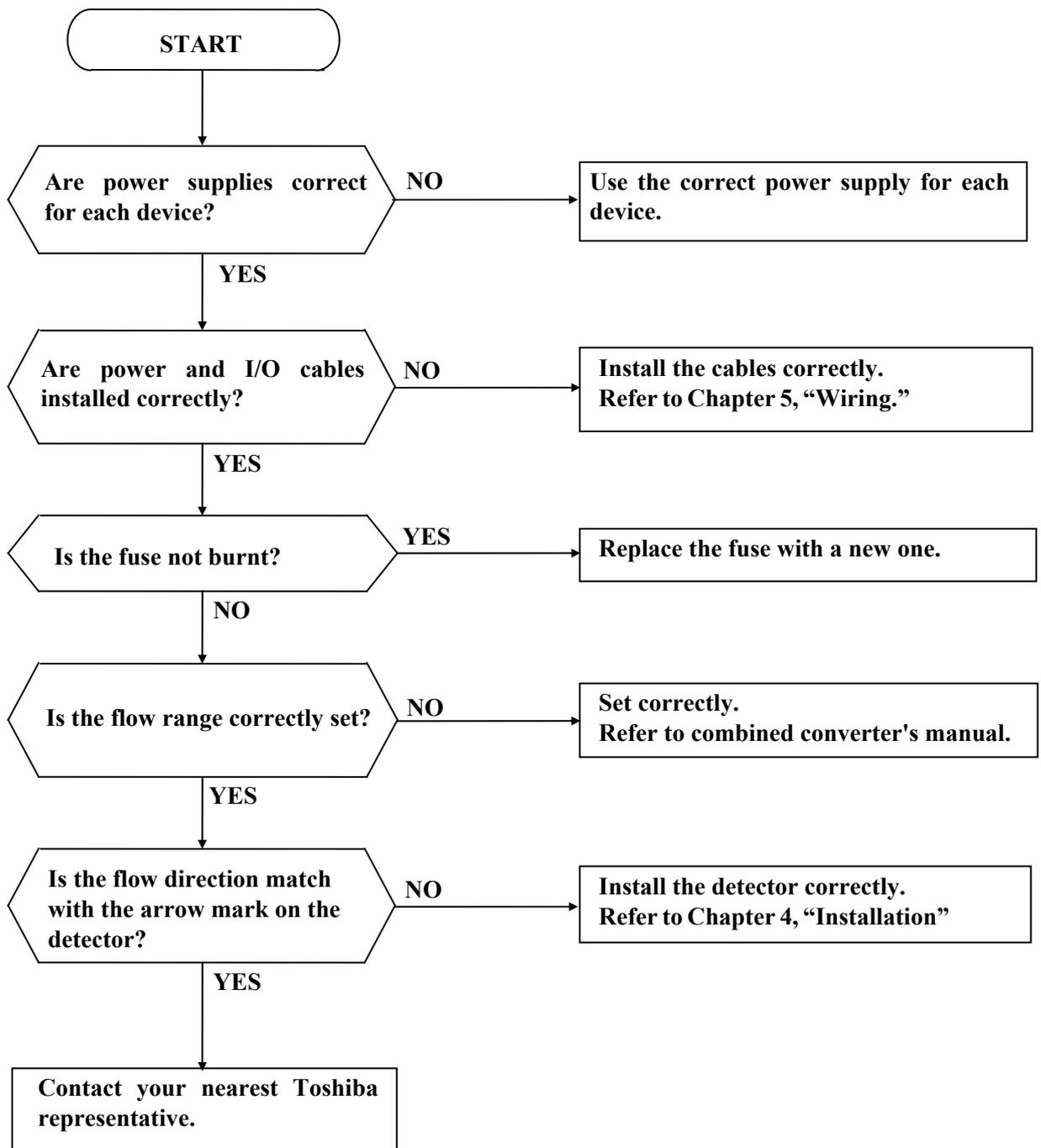
7.2 Troubleshooting

If a problem occurs while using the GF630/LF600F, GF630/LF610F and GF632, follow the flowcharts described below.

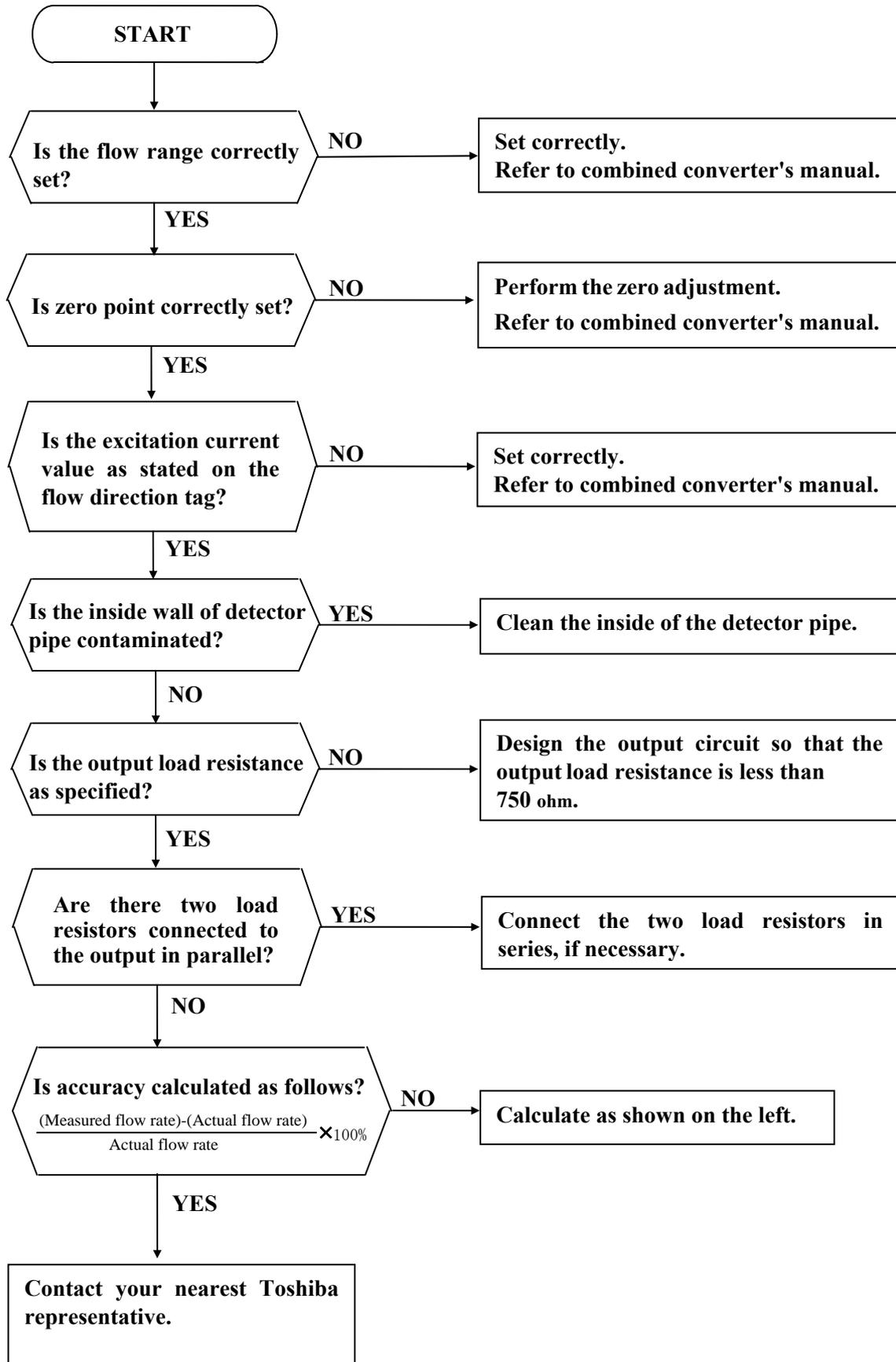
You may find a way to solve the problem. The flowcharts are based on three symptoms (1) to (3).

If you cannot solve the problem, contact your nearest Toshiba representative.

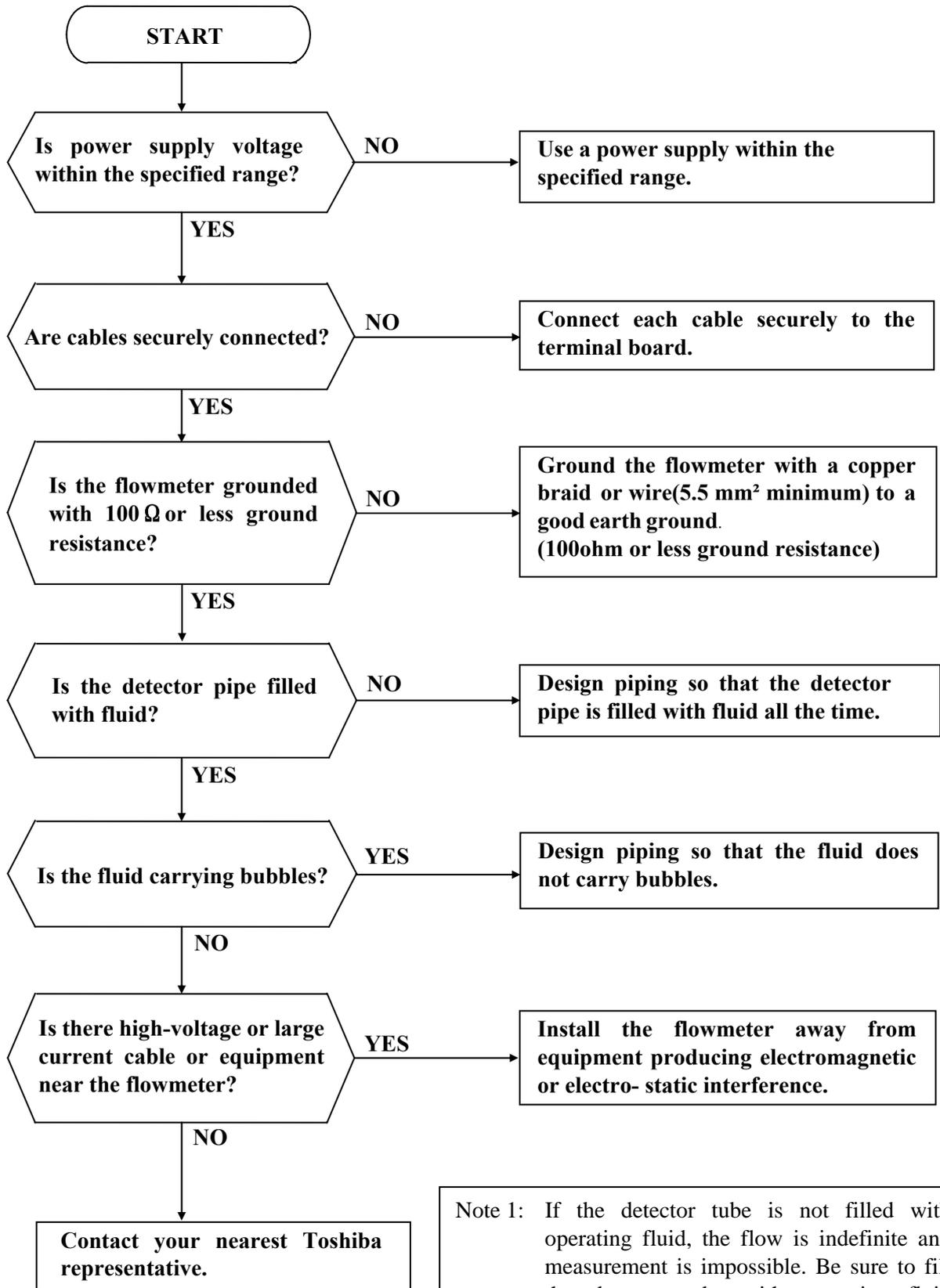
7.2.1 Flow rate is not indicated



7.2.2 Flow rate indicated is not correct



7.2.3 Flow rate indication is not stable



Note 1: If the detector tube is not filled with operating fluid, the flow is indefinite and measurement is impossible. Be sure to fill the detector tube with operating fluid before starting measurement.

8. Principle of Operation

The operating principle of the electromagnetic flowmeter is based on Faraday's Law of electromagnetic induction and it is designed to measure the volumetric flow rate of fluid. An insulated pipe of diameter D is placed vertically to the direction of a magnetic field with flux density B (see Figure 8.1). When an electrically conductive fluid flows in the pipe, an electrode voltage E is induced between a pair of electrodes placed at right angles to the direction of magnetic field. The electrode voltage E is directly proportional to the average fluid velocity V .

The following expression is applicable to the voltage.

$$E = K \times B \times D \times V \text{ [V] (Eq. 8.1)}$$

Volumetric flow rate Q [m^3/s] is:

$$Q = \frac{\pi \times D^2}{4} \times V \text{(Eq. 8.2)}$$

Using the Equation 8.1 and 8.2

$$E = K \times B \times D \times \frac{4}{\pi \times D^2} \times Q$$

$$E = \frac{4 \times K \times B}{\pi \times D} \times Q \text{(Eq. 8.3)}$$

Therefore, volumetric flow rate is directly proportional to the induced voltage.

E = induced electrode voltage [V]

K = constant

B = magnetic flux density [T]

D = meter pipe diameter [m]

V = fluid velocity [m/s]

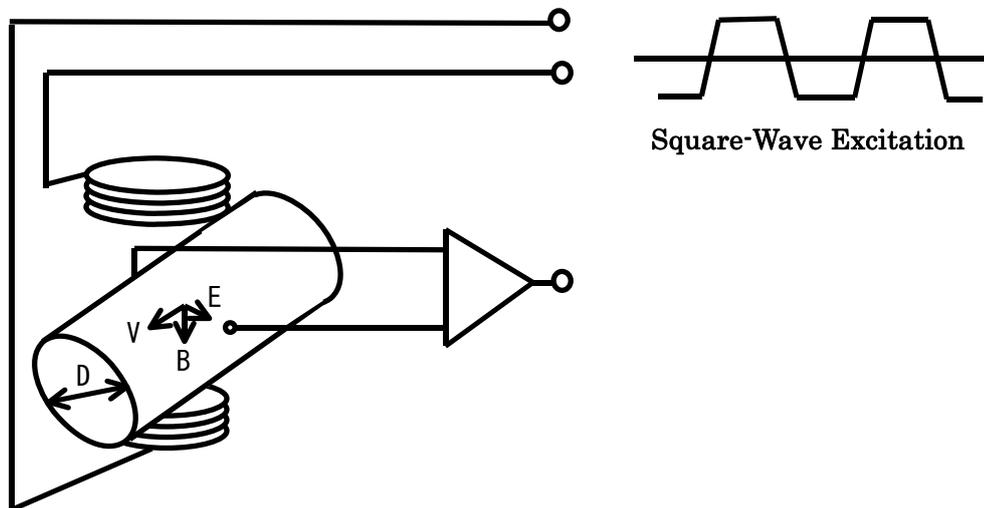


Figure 8.1 Principle of Operation

The GF630/LF600F, GF630/LF610F and GF632 use the square-wave excitation method, which provides long-term stable operation. With square-wave excitation, the GF630/LF600F, GF630/LF610F and GF632 offers reliable measurement without being affected by electrostatic or electromagnetic interference, or electrochemical polarization between the electrodes and the fluid to be measured.

9. Specifications

The flowmeter specifications and the type specification code used when ordering the flowmeter are described in this chapter.

9.1 Specifications

Meter size: 1/2", 1", 1 1/4", 1 1/2", 2", 2 1/2", 3", 4", 5", 6", 8", 10", 12", 14", 16", 18", 20" and 24"
(15, 25, 32, 40, 50, 65, 80, 100, 125, 150, 200, 250, 300, 350, 400, 450, 500 and 600 mm)

Measuring range: 0–1.0 ft/s to 0–32.8 ft/s (0–0.3 m/s to 0–10 m/s).

0–0.3 ft/s to 0–1.0 ft/s (0–0.1 m/s to 0–0.3 m/s) range is available optionally for meter size 1/2" to 18" (15 to 450 mm).

Accuracy: (Accuracy when combined with the converter)

< 1/2" to 18" (15mm to 450 mm) >

±0.2 % of Rate *¹

*¹ This pulse output error result is established under standard operating conditions at Toshiba's flow calibration facility, Fuchu Japan. (NIST Traceable).

*¹ Individual meter measurement error may vary up to ±0.5% of Rate at 1.64 ft/s (0.5m/s) or more and ±0.3% of rate ±0.039 inch/s (1mm/s) at 1.64 ft/s or less.

*¹ Current output: plus ± 8μA (0.05% of span).

*¹ Refer to individual calibration data for each individual meter's measurement error.

< 20" to 24" (500mm to 600mm) >

± 0.3 % of Rate *²

*² This pulse output error result is established under standard operating conditions at Toshiba's flow calibration facility, Fuchu Japan.

*² Individual meter measurement error may vary up to ±0.5 % of Rate at 3.28 ft/s (1.0 m/s) or more and ± 0.3% of Rate ±0.079 inch/s (2 mm/s) at 3.28 ft/s (1.0 m/s) or less.

*² Current output: plus ± 8μA (0.05% of span.)

*² Refer to individual calibration data for each individual meter's measurement error.

Fluid conductivity: 5 μS/cm minimum

Fluid temperature: –20°C to +100°C (–4°F to 212°F) ···FEP
–20°C to +120°C (–4°F to 248°F) ···PTFE
–20°C to +60°C (–4°F to 140°F) ···Polyurethane (PU)
–10°C to +60°C (14°F to 140°F) ···Chloroprene rubber(CR)

Ambient temperature: –20°C to + 60°C (–4°F to 140°F)

Storage temperature: –25°C to +65°C (–13°F to 149°F)

Storage humidity: 10 to 90%RH (no condensation)

Fluid pressure: 0 to 1MPa (0 to 150 psi, or 0 to 10 bar)
(To be within the applicable flange limitation)

Connection flange standard: See Table 9.2 Type Specification Code.

Principal materials

Case	Carbon steel
Lining	FEP (standard for meter sizes 15 to 250mm)
	PTFE (standard for meter sizes 300 to 600mm)
	Polyurethane (PU) (standard for meter sizes 15 to 400mm)
	Chloroprene rubber (CR) (standard for meter sizes 450 to 600mm)
Electrodes	316L stainless steel (Polyurethane, Chloroprene rubber)
	Hastelloy C equivalent (FEP, PTFE)
Grounding rings	None (standard for Polyurethane, FEP and CR) (Option: See chapter 10.3)
	316 stainless steel (standard for PTFE)

See Table 9.2 Type Specification Code for optional materials and other related information.

Coating: Corrosion resistant resin coating (std.), pearl-gray colored

Structure: IP67 and NEMA 4X



Cable connection port: 1/2-14NPT male screw for both signal cable and exciting cable

Separate



Cable length: Allowable cable length between the converter and the detector varies with the electrical conductivity of fluid. See Figure 9.1

Separate

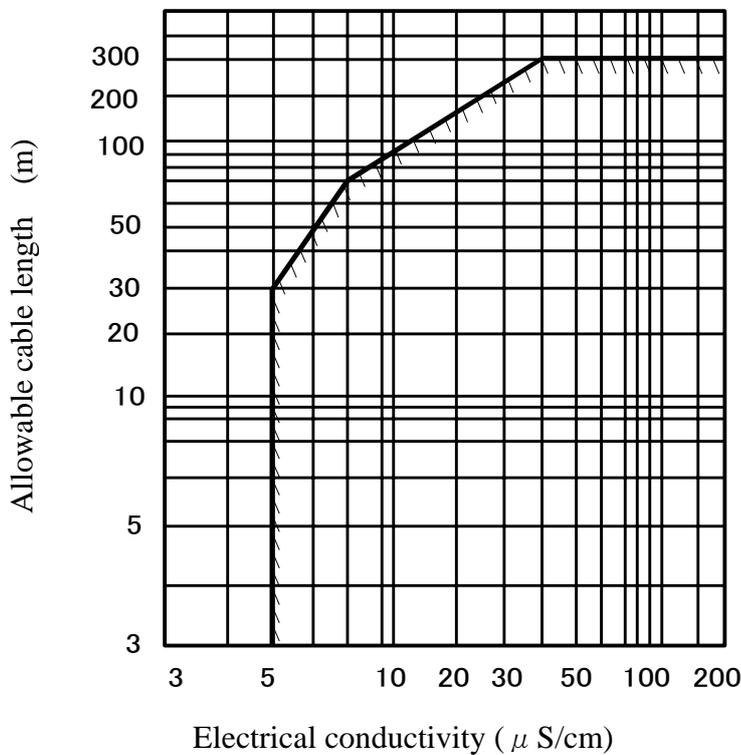


Figure 9.1 Electrical Conductivity vs. Cable Length

Calibration range :

It calibration by standard Range shown in the table below when Range is not specified.
 It calibration when there is specification by flowing quantity Range in which the customer is specified. Is this specification Range flowing quantity of Figure 9.1. Please confirm becoming in the upper bound value from the flow velocity chart.

Meter size		Standard Flow range	
		Flow rate (m ³ /h)	Flow velocity (m/s)
15 mm	1/2"	2	3.144
25mm	1"	6	3.395
32mm	1 1/4"	10	3.454
40mm	1 1/2"	15	3.316
50mm	2"	25	3.537
65mm	2 1/2"	40	3.348
80mm	3"	60	3.316
100mm	4"	100	3.537
125mm	5"	150	3.395
150mm	6"	200	3.144
200mm	8"	300	2.653
250mm	10"	600	3.395
300mm	12"	900	3.537
350mm	14"	1200	3.465
400mm	16"	1600	3.537
450mm	18"	2500	4.366
500mm	20"	3000	4.244
600mm	24"	4000	3.930

To select the meter size: See Figure 9.2 and find meter sizes within the velocity of 0.1 to 10 m/s for a specified full-scale (measuring range high limit) flow. Select one that has its full-scale velocity between 1 and 3 m/s.

Make sure the full-scale flow rate used for the final planning stage stays within 10 m/s in terms of flow velocity.

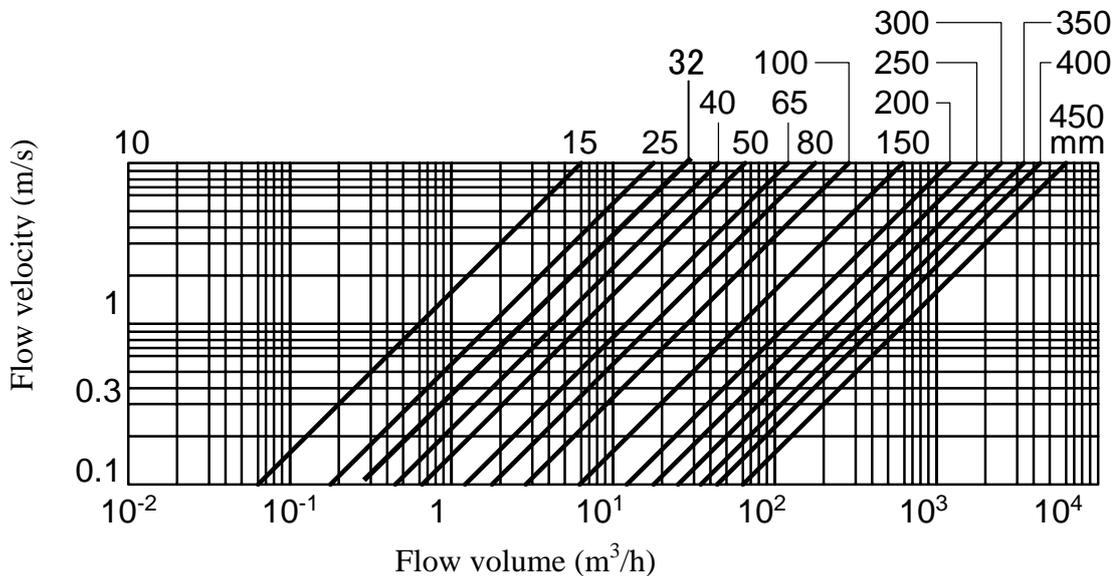


Figure 9.2 Flow volume

SI Unit

Flow volume Meter size		Flow velocity range			
		0.1m/s	0.3m/s	1m/s	10m/s
15mm	1/2"	0.06361(m³/h)	0.1908(m³/h)	0.6361(m³/h)	6.361(m³/h)
25mm	1"	0.1767	0.5301	1.767	17.67
32mm	1 1/4"	0.2895	0.8686	2.895	28.95
40mm	1 1/2"	0.4523	1.357	4.523	45.23
50mm	2"	0.7067	2.120	7.067	70.67
65mm	2 1/2"	1.195	3.583	11.95	119.5
80mm	3"	1.809	5.428	18.09	180.9
100mm	4"	2.827	8.482	28.27	282.7
125mm	5"	4.417	13.25	44.17	441.7
150mm	6"	6.361	19.08	63.61	636.1
200mm	8"	11.31	33.93	113.1	1131
250mm	10"	17.67	53.01	176.7	1767
300mm	12"	25.45	76.34	254.5	2545
350mm	14"	34.64	103.9	346.4	3464
400mm	16"	45.23	135.7	452.3	4523
450mm	18"	57.25	171.7	572.5	5725
500mm	20"	—	212.1	706.9	7069
600mm	24"	—	305.4	1018	10180

US Unit

Flow volume Meter size	Flow velocity range				
	0.328ft/s	0.98ft/s	3ft/s	10ft/s	32.8ft/s
1/2 inch	0.2801 gal/min	0.8403 gal/min	2.561 gal/min	8.538 gal/min	28.01 gal/min
1 inch	0.7781 gal/min	2.334 gal/min	7.115 gal/min	23.72 gal/min	77.81 gal/min
1 1/4 inch	1.275 gal/min	3.824 gal/min	11.66 gal/min	38.86 gal/min	127.5 gal/min
1 1/2 inch	1.992 gal/min	5.975 gal/min	18.21 gal/min	60.71 gal/min	199.2 gal/min
2 inch	3.112 gal/min	9.337 gal/min	28.46 gal/min	94.86 gal/min	311.2 gal/min
2 1/2 inch	5.260 gal/min	15.78 gal/min	48.09 gal/min	160.3 gal/min	526.0 gal/min
3 inch	7.967 gal/min	23.90 gal/min	72.85 gal/min	242.8 gal/min	796.7 gal/min
4 inch	12.45 gal/min	37.35 gal/min	113.8 gal/min	379.4 gal/min	1,245 gal/min
5 inch	19.45 gal/min	58.35 gal/min	177.9 gal/min	592.9 gal/min	1,945 gal/min
6 inch	28.01 gal/min	84.03 gal/min	256.1 gal/min	853.8 gal/min	2,801 gal/min
8 inch	49.80 gal/min	149.4 gal/min	455.3 gal/min	1,518 gal/min	4,980 gal/min
10 inch	77.81 gal/min	233.4 gal/min	711.5 gal/min	2,372 gal/min	7,781 gal/min
12 inch	112.0 gal/min	336.1 gal/min	1,025 gal/min	3,415 gal/min	11,200 gal/min
14 inch	152.5 gal/min	457.5 gal/min	1,394 gal/min	4,648 gal/min	15,250 gal/min
16 inch	199.2 gal/min	597.5 gal/min	1,821 gal/min	6,071 gal/min	19,920 gal/min
18 inch	252.1 gal/min	756.3 gal/min	2,305 gal/min	7,684 gal/min	25,210 gal/min
20 inch	-	933.7 gal/min	2,846 gal/min	9,486 gal/min	31,120 gal/min
24 inch	-	1,344 gal/min	4,098 gal/min	13,660 gal/min	44,820 gal/min

9.2 Type Specification Code

Table 9.2 Type Specification Code

Model number					Specification code							Contents	Lining			
1	2	3	4	5	6	7	8	9	10	11	12		PU	CR	FEP	PTFE
G	F	6	3									Flanged connection electromagnetic flowmeter detector				
				0								Integral type	●	●	●	●
				2								Separate type	●	●	●	●
					0	1						Meter size				
					0	2						15mm	●	—	●	—
					0	3						25mm	●	—	●	—
					0	4						32mm	●	—	●	—
					0	5						40mm	●	—	●	—
					0	6						50mm	●	—	●	—
					0	8						65mm	●	—	●	—
					1	0						80mm	●	—	●	—
					1	2						100mm	●	—	●	—
					1	5						125mm	●	—	●	—
					2	0						150mm	●	—	●	—
					2	5						200mm	●	—	●	—
					3	0						250mm	●	—	●	—
					3	5						300mm	●	—	—	●
					4	0						350mm	●	—	—	●
					4	5						400mm	●	—	—	●
					5	0						450mm	—	●	—	●
					6	0						500mm	—	●	—	●
												600mm	—	●	—	●
							A					Connection flange standard ANSI 150	●	●	●	●
												Lining				
												Polyurethane (PU)	●	—	—	—
												Chloroprene	—	●	—	—
												FEP	—	—	●	—
												PTFE (*NOTE 1)	—	—	—	●
												Electrode Material				
												316L stainless steel	●	●	—	—
												Hastelloy C equivalent	—	—	●	●
												Flow and calibration velocity range				
											A	0.3 to 10m/s (standard range calibration)	●	●	●	●
											B	0.3 to 10m/s(specified range calibration)	○	○	○	○
											C	0.1 to 10m/s(specified range calibration)	○	○	○	○
											1	Standard	●	●	●	●

● : Standard ○ : Option — : Unselectable

NOTE

1) The grounding rings are provided to PTFE Lining, which material is 316 stainless steel.

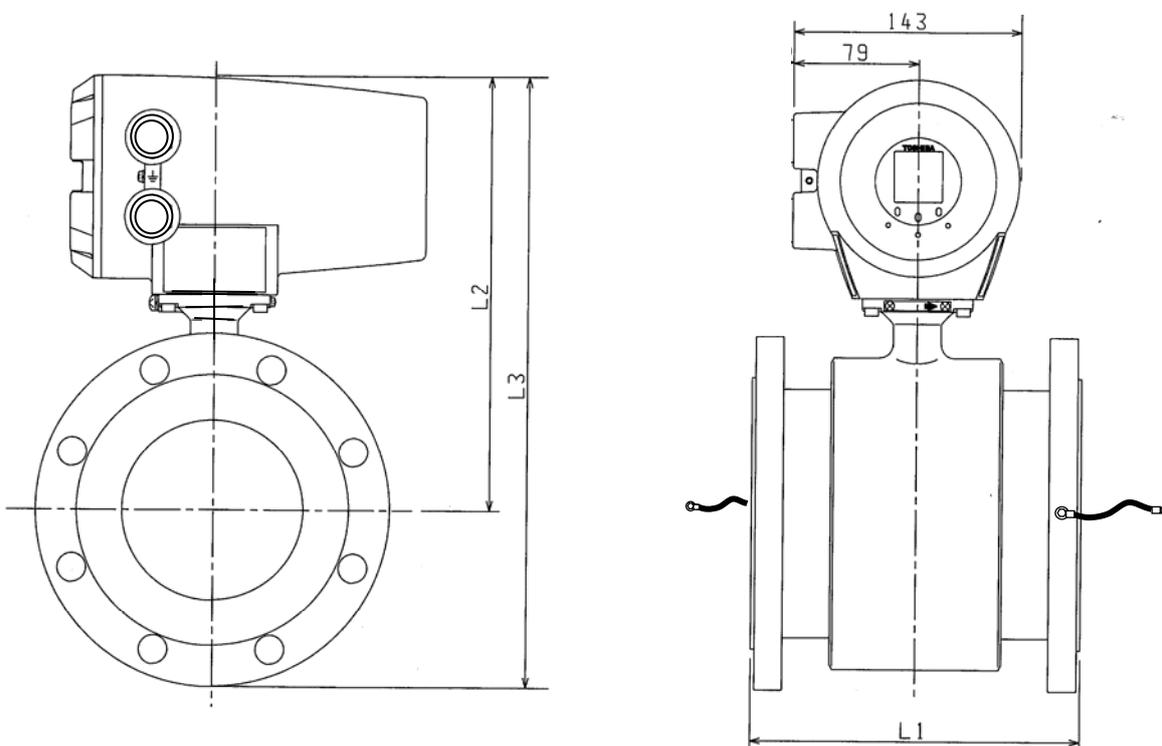
10. Outline Dimensions

10.1 Outline dimensions of GF630/LF600F and GF630/LF610F



Integra

(1) Meter size of 1/2 inch to 6 inch (15mm to 150mm)

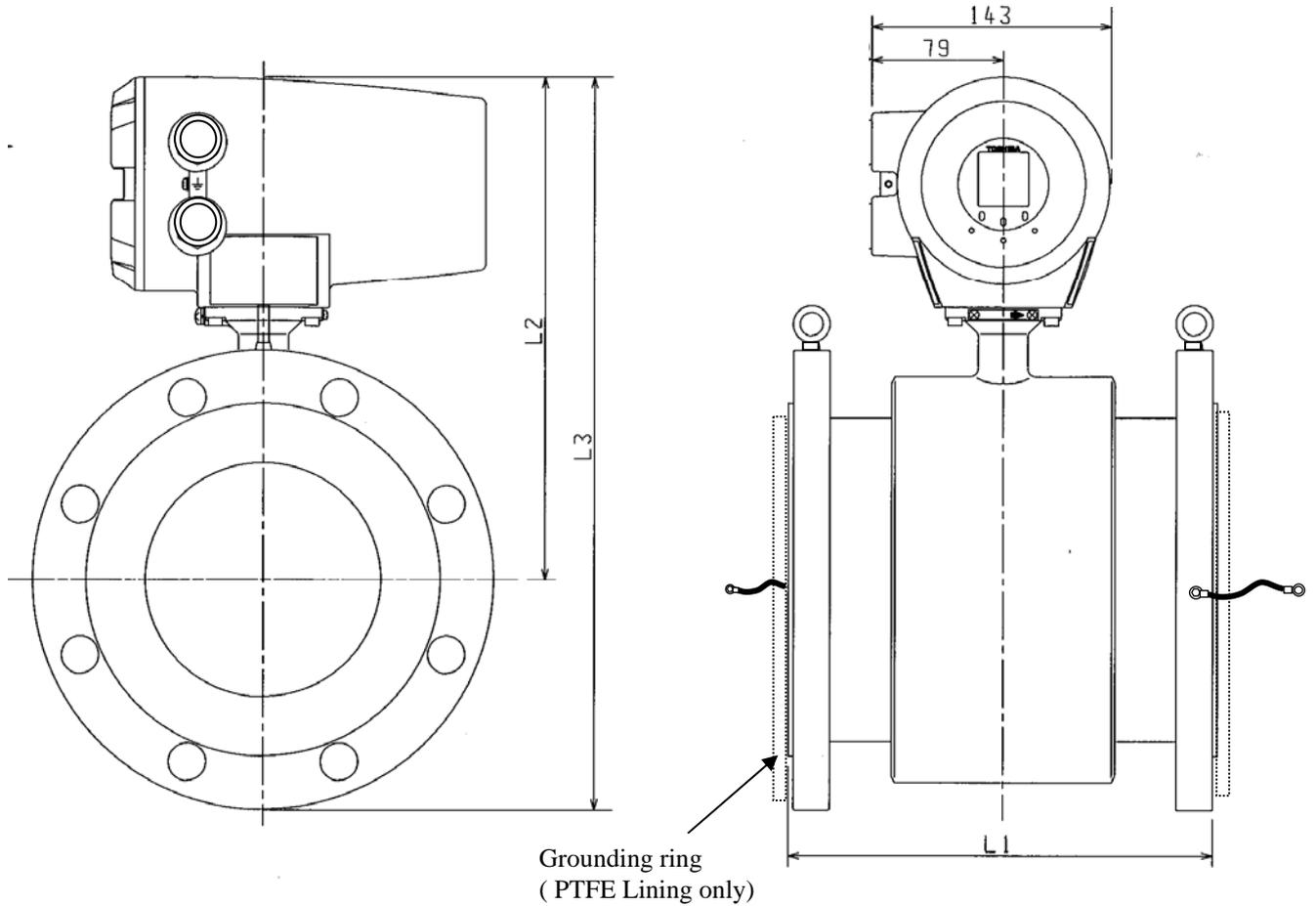


Meter Size		L1±6 (mm)	L2±5 (mm)	L3 ±5(mm)	Mass Approx. (kg)
				ANSI 150	ANSI 150
15mm	1/2"	200	220	264	7
25mm	1"	200	230	284	8
32mm	1 1/4"	200	235	294	9
40mm	1 1/2"	200	240	304	10
50mm	2"	200	250	326	13
65mm	2 1/2"	200	263	351	15
80mm	3"	200	268	363	19
100mm	4"	250	279	393	25
125mm	5"	250	299	426	32
150mm	6"	300	314	453	38

NOTES

(1) For the detail dimension of converter, check the converter LF600F and LF610F instruction manual.

(2) Meter size of 8 inch to 24 inch (200mm to 600mm)



Meter Size		L1 ± 6 ^{*1} (mm)	L2 ± 5 (mm)	L3 ± 5(mm) ANSI 150	Mass Approx. (kg)	
					PU, CR and FEP ANSI 150	PTFE ^{*2} ANSI 150
200mm	8"	350	339	510	58	
250mm	10"	450	359	562	85	
300mm	12"	500	384	625	124	132
350mm	14"	550	406	673	148	158
400mm	16"	600	434	732	182	195
450mm	18"	600	456	774	200	212
500mm	20"	600	481	830	230	244
600mm	24"	600	536	942	317	336

NOTES

*1) L1 of PTEF Lining contains the thickness of grounding rings.

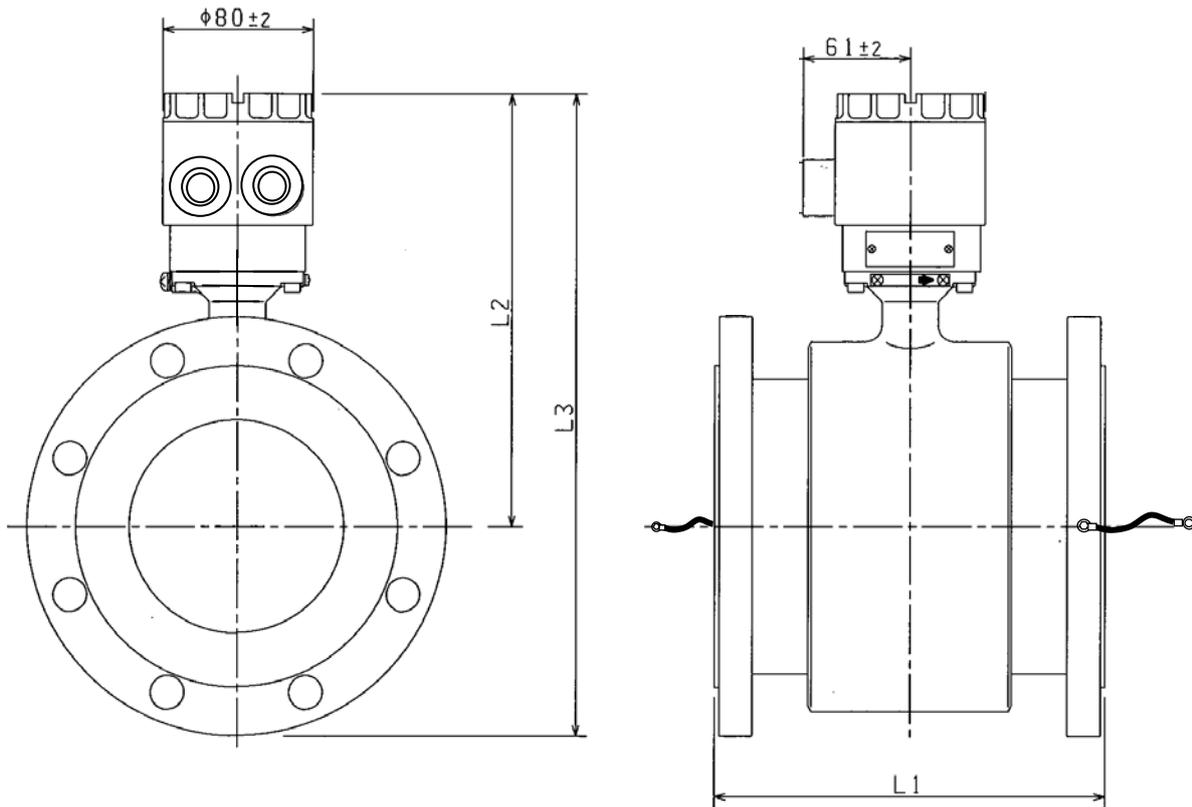
*2) Mass of PTFE Lining contains the mass of grounding rings.

(1) For the detail dimension of converter, check the converter LF600F and LF610F instruction manual.

10.2 Outline dimensions of GF632

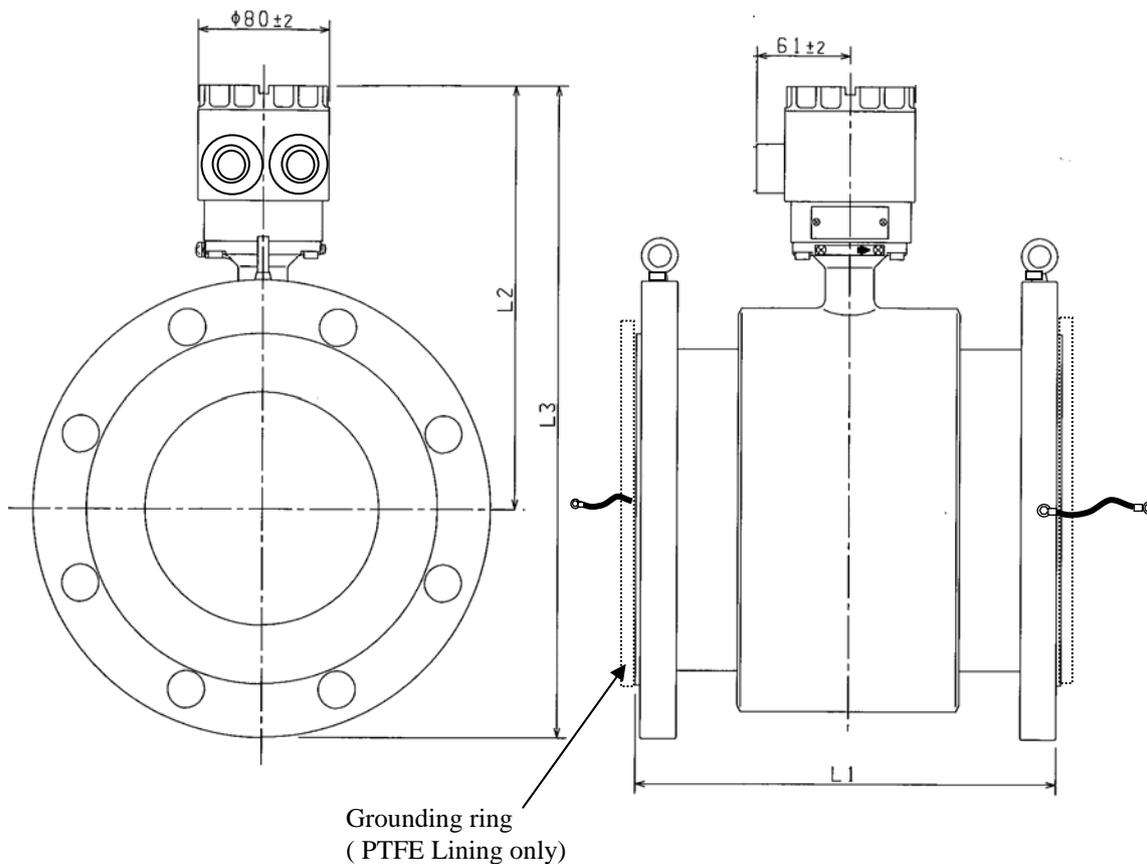


(1) Meter size of 1/2 inch to 6 inch (15mm to 150mm)



Meter Size		L1±6 (mm)	L2±5 (mm)	L3 ±5(mm)		Mass
				ANSI 150	ANSI 150	Approx. (kg)
15mm	1/2"	200	172	216	ANSI 150	5
25mm	1"	200	182	236	ANSI 150	6
32mm	1 1/4"	200	187	246	ANSI 150	7
40mm	1 1/2"	200	192	256	ANSI 150	8
50mm	2"	200	202	278	ANSI 150	11
65mm	2 1/2"	200	215	303	ANSI 150	13
80mm	3"	200	220	315	ANSI 150	17
100mm	4"	250	231	345	ANSI 150	23
125mm	5"	250	251	378	ANSI 150	30
150mm	6"	300	266	405	ANSI 150	36

(2) Meter size of 8 inch to 24 inch (200mm to 600mm)



Meter Size		*1 L1±6 (mm)	L2±5 (mm)	L3 ±5(mm)	Mass Approx. (kg) *2	
					ANSI 150	
					PU, CR and FEP	PTFE
200m m	8"	350	291	462	56	
250m m	10"	450	311	514	83	
300m m	12"	500	336	577	122	130
350m m	14"	550	358	625	146	156
400m m	16"	600	386	684	180	193
450m m	18"	600	408	726	198	210
500m m	20"	600	433	782	228	242
600m m	24"	600	488	894	315	334

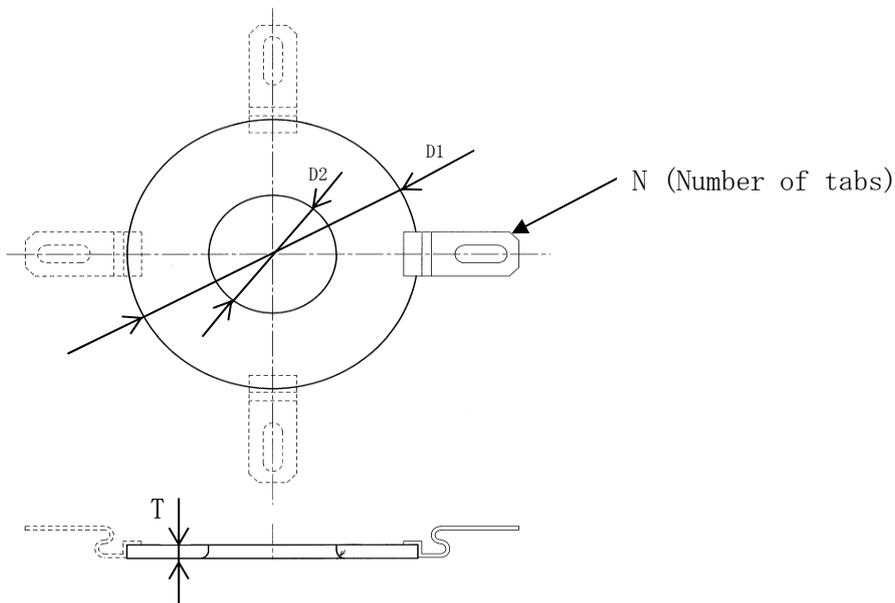
*1) L1 of PTEF Lining contains the thickness of grounding rings.

*2) Mass of PTFE Lining contains the mass of grounding rings.

10.3 Outline dimensions of Grounding ring

Option for Polyurethan, CR and FEP ^{*1}

Material : SUS316

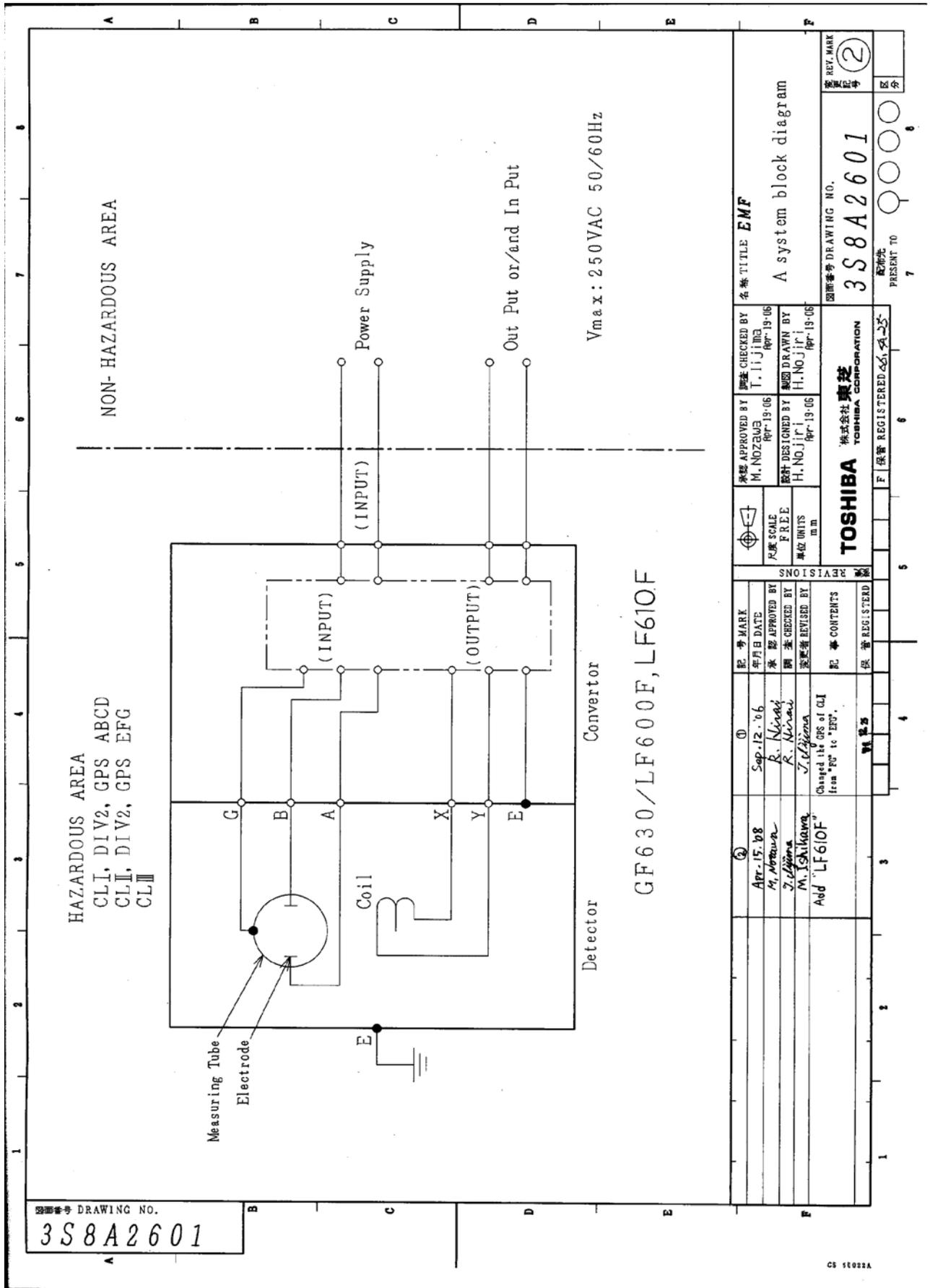


Meter size		ANSI 150 (Unit: inch)				JIS 10K (Unit: mm)			
inch	mm	ΦD1	ΦD2	T	N	ΦD1	ΦD2	T	N
1/2	15	1.65	0.63	0.16	2	42	16	3	2
1	25	2.36	1.06	0.16	2	60	27	3	2
1-1/4	32	2.76	1.34	0.16	2	70	34	3	2
1-1/2	40	3.03	1.65	0.12	2	77	42	3	2
2	50	3.74	2.05	0.12	2	95	52	3	2
2-1/2	65	4.69	2.44	0.12	2	115	67	3	2
3	80	5.08	3.03	0.12	2	125	82	3	2
4	100	5.91	4.09	0.12	2	150	104	3	2
5	125	7.28	5.08	0.12	2	185	129	3	2
6	150	8.46	6.06	0.12	2	215	154	3	2
8	200	10.43	8.03	0.12	4	265	204	3	4
10	250	13.11	10.04	0.12	4	325	255	3	4
12	300	15.59	12.01	0.12	4	372	305	3	4
14	350	17.32	13.11	0.12	4	416	333	3	4
16	400	19.80	15.12	0.12	4	479	384	3	4
18	450	21.34	17.05	0.12	4	534	433	3	4
20	500	23.58	19.02	0.12	4	589	483	3	4
24	600	27.95	22.99	0.12	4	691	584	3	4

*1) When the grounding ring will apply to the FEP lining, please attach the gaskets between the grounding ring and lining. (Refer to Fig 4.4.)

Appendix 1

1-1 A system block diagram for GF630/LF600F and GF630/LF610F

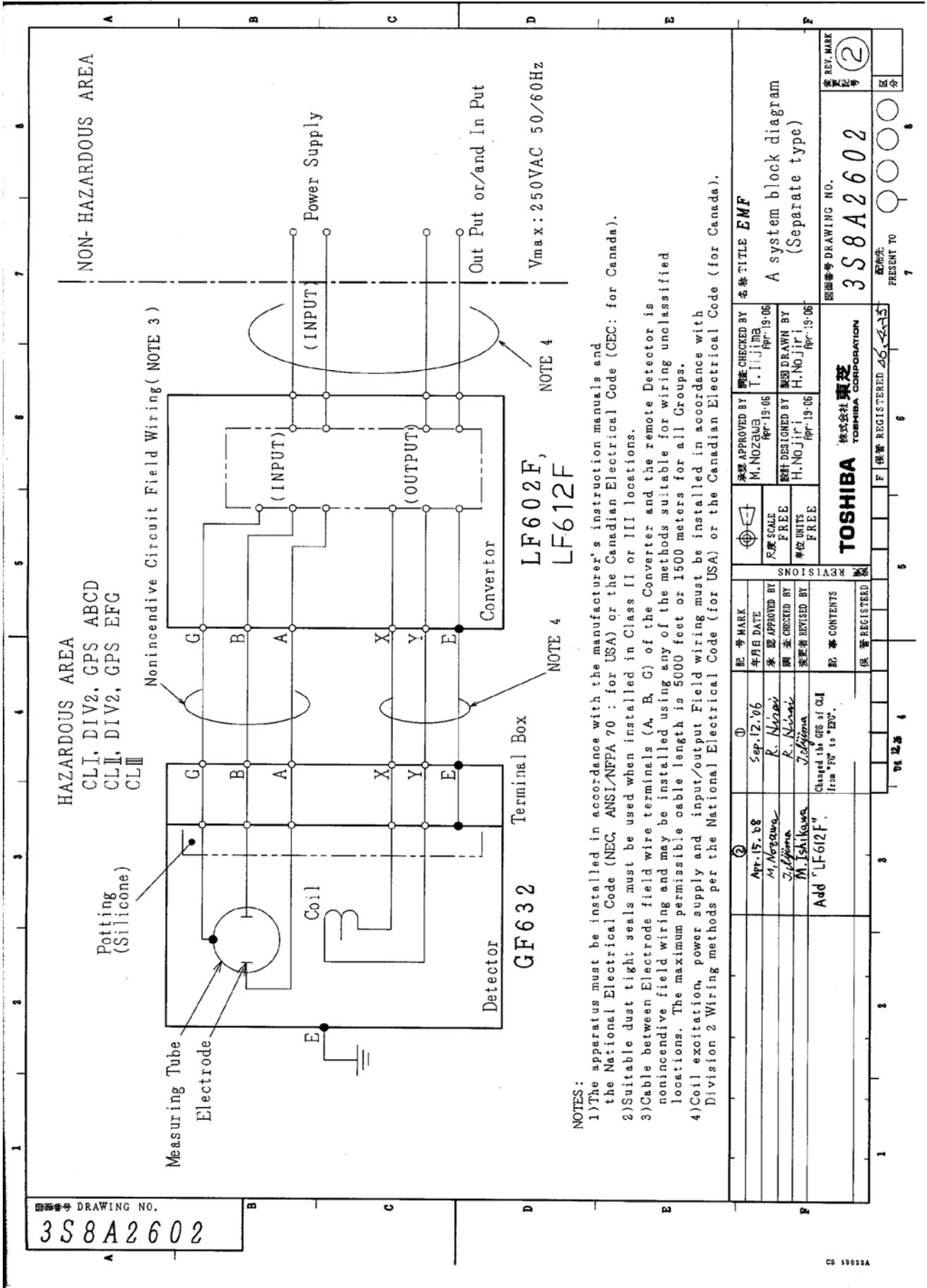


図面番号 DRAWING NO.
3S8A2601

承認 APPROVED BY M. NOZAKI Apr-19-06 設計 DESIGNED BY H. NOZAKI Apr-19-06 検査 CHECKED BY T. IJIMA Apr-19-06 名義 TITLE EMF A system block diagram		図面番号 DRAWING NO. 3S8A2601 配列 PRESENT TO 7	
記号 MARK 年月日 DATE 承認 APPROVED BY 調査 CHECKED BY 変更者 REVISED BY 配 書 CONTENTS 保 管 REG. STERD ② Apr-15-08 M. Matsuda S. Akima M. Ishikawa Add 'LF610F' ① Sep-12-'06 R. Nishij R. Nishij J. Uchiyama Changed the ops of G1 from 'FG' to 'EG'.		尺 寸 SCALE F R E E 単 位 UNITS m m 保 管 注 記 REGISTERED 記 号 TOSHIBA 株式会社 東芝 TOSHIBA CORPORATION 配列 PRESENT TO 7	

CS 5022A

1-2 A system block diagram for GF632



NOTES:

- 1) The apparatus must be installed in accordance with the manufacturer's instruction manuals and the National Electrical Code (NEC, ANSI/NFPA 70 : for USA) or the Canadian Electrical Code (CEC: for Canada).
- 2) Suitable dust tight seals must be used when installed in Class II or III locations.
- 3) Cable between Electrode field wire terminals (A, B, G) of the Converter and the remote Detector is nonincendive field wiring and may be installed using any of the methods suitable for wiring unclassified locations. The maximum permissible cable length is 5000 feet or 1500 meters for all Groups.
- 4) Coil excitation, power supply and input/output Field wiring must be installed in accordance with Division 2 Wiring methods per the National Electrical Code (for USA) or the Canadian Electrical Code (for Canada).

図面番号 DRAWING NO.
3S8A2602

承認 APPROVED BY M. Nozawa Apr. 19-06		検査 CHECKED BY T. Iijima Apr. 19-06		名称 TITLE EMF	
設計 DESIGNED BY H. Nojiri Apr. 19-06		図面 DRAWN BY H. Nojiri Apr. 19-06		A system block diagram (Separate type)	
配管 CONTENTS 変更者 REVISED BY R. Nishitani Changed the GS of OLI from "F" to "2B".		配管 REGISTERED 図面番号 DRAWING NO. 3S8A2602		配管先 PRESENT TO 区 分 ②	
年日 DATE 15. 08		年日 DATE 17. 06		保管 REGISTERED 1 2 3 4 5 6 7	
承認者 APPROVED BY M. Nozawa		検査者 CHECKED BY R. Nishitani		保管 REGISTERED 1 2 3 4 5 6 7	
設計者 DESIGNED BY M. Ishikawa		図面者 DRAWN BY R. Nishitani		保管 REGISTERED 1 2 3 4 5 6 7	
Add "LF612F"		Changed the GS of OLI from "F" to "2B".		保管 REGISTERED 1 2 3 4 5 6 7	

**USER'S FORM
NOTES**

Write down the address and phone number of the distributor from which you purchased this product, the product code, SER.NO. and so on.

Distributor	Address _____
	Name _____
	Phone number () —
Product code	<u>GF</u> _____
SER.NO.	_____

TOSHIBA CORPORATION
