User's Manual

Model Y/13FA, Y/13FEA and Y/15FA Pneumatic Flange Mounting Differential Pressure Transmitters

IM 02C01D02-01E

vigilantplant.®

YOKOGAWA
Yokogawa Electric Corporation

IM 02C01D02-01E
5th Edition

Model Y/13FA, Y/13FEA and Y/15FA
Pneumatic Flange Mounting Differential Pressure Transmitters

IM 02C01D02-01E 5th Edition

CONTENTS

1. Introduction

Thank you for purchasing the Yokogawa's instrument.

The instrument is correctly calibrated at the factory before shipment. To ensure correct and efficient use of the instrument, please read this manual thoroughly and fully understand how to operate the instrument before operating it.

■ Regarding This Manual

- This manual should be provided to the end user.
- The contents of this manual are subject to change without prior notice.
- All rights reserved. No part of this manual may be reproduced in any form without Yokogawa's written permission.
- Yokogawa makes no warranty of any kind with regard to this material, including, but not limited to, implied warranty of merchantability and fitness for a particular purpose.
- If any question arises or errors are found, or if any information is missing from this manual, please inform the nearest Yokogawa sales office.
- The specifications covered by this manual are limited to those for the standard type under the specified model number break-down and do not cover custom-made instrument.
- Please note that changes in the specifications, construction, or component parts of the instrument may not immediately be reflected in this manual at the time of change, provided that postponement of revisions will not cause difficulty to the user from a functional or performance standpoint.

■ Safety Precautions

- For the protection and safety of the operator and the instrument or the system including the instrument, please be sure to follow the instructions on safety described in this manual when handling this instrument. In case the instrument is handled in contradiction to these instructions, Yokogawa does not guarantee safety.
- Yokogawa assumes no responsibilities for this product except as stated in the warranty.
- If the customer or any third party is harmed by the use of this product, Yokogawa assumes no responsibility for any such harm owing to any defects in the product which were not predictable, or for any indirect damages.
- The following safety symbols are used in this manual:

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 or moderate injury. It may also be used to alert against unsafe practices.

IMPORTANT

Indicates that operating the hardware or software in this manner may damage it or lead to system failure.

NOTE

Draws attention to information essential for understanding the operation and features.

1.1 Safety Precautions

WARNING

- Instrument installed in the process is under pressure. Never loosen or tighten the process connector bolts as it may cause dangerous spouting of process fluid.
- During draining condensate or venting gas in transmitter pressure-detector section, take appropriate care to avoid contact with the skin, eyes or body, or inhalation of vapors, if the accumulated process fluid may be toxic or otherwise harmful.
  Since draining condensate or bleeding off gas gives the pressure measurement disturbance, this should not be done when the loop is in operation.
- If the accumulated process fluid may be toxic or otherwise harmful, take appropriate care to avoid contact with the body, or inhalation of vapors even after dismounting the instrument from process line for maintenance.

IMPORTANT

- Supply air must be clean and dry.
  - Supply air (pressurized) must not be dewed event at -40°C.
  - Air filter with 5μm (0.0002 inch) of filter element maximum opening shall be recommended.
  - Oil filter should be provided to remove oil in the supply air.
- Maximum supply air pressure of transmitter without fixed pressure regulator (GAS or NAS type) is 215 kPa. Should the pressure exceed 215 kPa, it is possible to break the pneumatic amplifier, bellows etc.
- When weling piping during construction, take care not to allow welding currents to flow through the transmitter.
- Do not step on this instrument after installation.
- Applying a leakag-detecting fluid to the instrument may damage the plastic parts resulting from corrosion or cracking.

1.2 Warranty

- The warranty shall cover the period noted on the quotation presented to the purchaser at the time of purchase. Problems occurred during the warranty period shall basically be repaired free of charge.
  - In case of problems, the customer should contact the Yokogawa representative from which the instrument was purchased, or the nearest Yokogawa office.
  - If a problem arises with this instrument, please inform us of the nature of the problem and the circumstances under which it developed, including the model specification and serial number. Any diagrams, data and other information you can include in your communication will also be helpful.
  - Responsible party for repair cost for the problems shall be determined by Yokogawa based on our investigation.
- The Purchaser shall bear the responsibility for repair costs, even during the warranty period, if the malfunction is due to:
  - Improper and/or inadequate maintenance by the Purchaser.
  - Failure or damage due to improper handling, use or storage which is out of design conditions.
  - Use of the product in question in a location not conforming to the standards specified by the Yokogawa, or due to improper maintenance of the installation location.
  - Failure or damage due to modification or repair by the party except Yokogawa or who is requested by Yokogawa.
  - Malfunction or damage from improper relocation of the product in question after delivery.
  - Reason of force majeure such as fires, earthquakes, storms/floods, thunder/lightening, or other natural disasters, or disturbances, riots, warfare, or radioactive contamination.

2. General

2.1 Outline

Models Y/13FA, Y/13FEA and Y/15FA Transmitters are pneumatic force-balance instruments that continuously measure liquid level or density, and transmit the measurement as a proportional 0.2 to 1.0 kgf/cm^2 or bar, 20 to 100 kPa, or 3 to 15 psi air signal. Model Y/13FEA has an extended diaphragm which permits the diaphragm to be flush with the inside of the tank, or to extend slightly inside the tank.
These transmitters are used with viscous, corrosive, or slurry-type liquids, eliminating the need for complicated piping arrangements, and for those applications requiring a flanged connection.

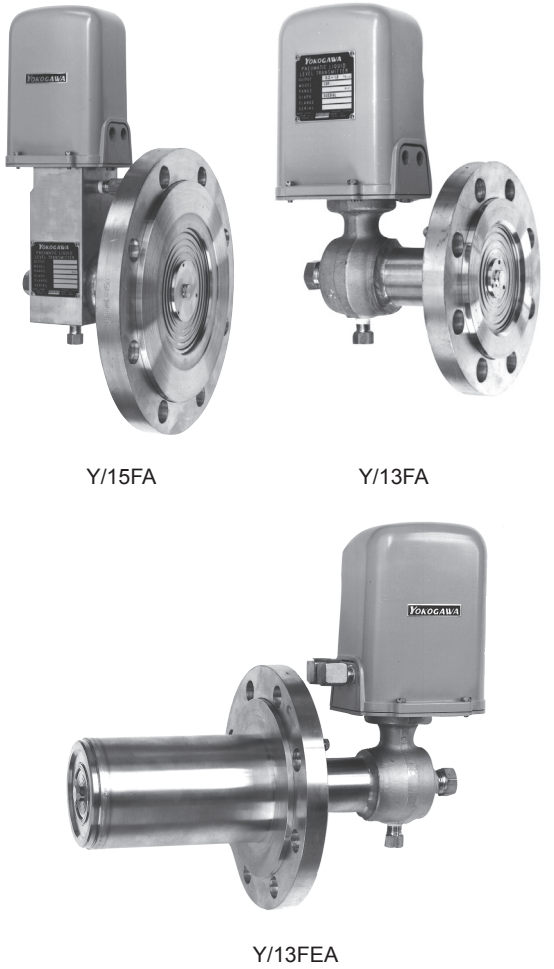


Figure 2.1 Outline

2.2 Principle of Operation

Pressure due to a head of liquid is applied to the high pressure side of a diaphragm capsule. The opening on the low pressure side of the transmitter is either vented (for open tanks) or serves as a pressure balancing connection (for closed tanks). The force on the diaphragm capsule is transmitted through a flexure to the lower end of the force bar. The diaphragm seal serves both as a fulcrum for the force bar and as a seal for the low pressure chamber. The force is transmitted through the flexure connector to the range rod, which pivots on the range adjustment wheel. Any movement of the range rod causes a minute change in the clearance between the flapper and nozzle. This produces a change in the output pressure from the amplifier to the feedback bellows until the force in the bellows balances the force on the diaphragm capsule.
The output pressure, which establishes the force-balance, is the transmitted pneumatic signal which is proportional to the level in the tank. This output signal is used by the receiver to record, indicate, and/or control.

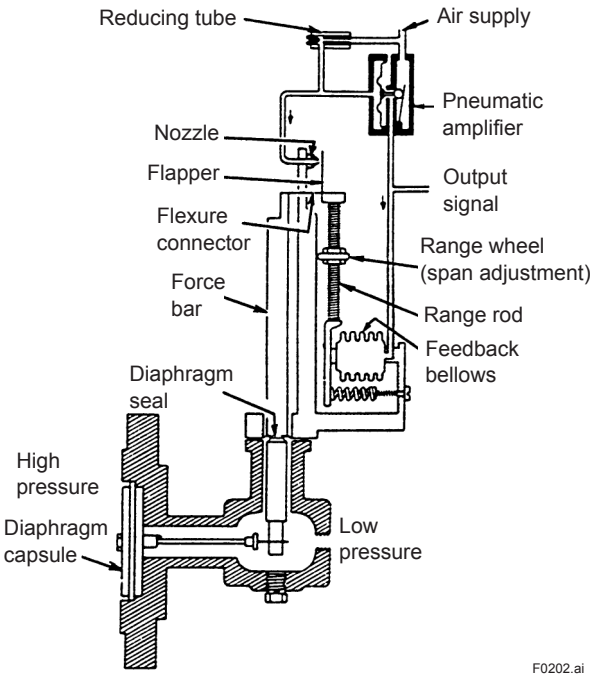


Figure 2.2 Principle of Operation

2.3 Standard Specifications

Span Limits:
Refer to Table 2.1.
Span is continuously adjustable within range limits.

Range Limits *:
Refer to Table 2.1.
*: When lower range-value is other than zero, optional kit for elevated-zero or suppressed-zero ranges is installed.

Static Pressure Limits:
Full vacuum and the flange rating per JIS B 2201 or ANSI B16.5.

Output Signal:
20 to 100 kPa.

Accuracy (includes linearity, hysteresis and repeatability):
Spans between 1.25 and less than 130 kPa, 125 and less than 13400 mmH_2O, 12.5 and less than 1300 mbar, or 5 and less than 525 inH_2O differential pressure (ΔP): ±0.5 % of span.
Spans between 130 and 210 kPa, 13400 and 21600 mmH_2O, 1300 and 2100 mbar, or 525 and 850 inH_2O differential pressure (ΔP): ±0.75 % of span.

Repeatability:
0.1 % of span.

Dead Band:
0.1 % of span.

Supply Pressure:
140 kPa, 1.4 kgf/cm^2 or bar, or 20 psi.

Air Consumption:
0.5 m^3/h at 0 °C, 101.3 kPa {1.033 kgf/cm^2} absolute (0.3 scfm).

Ambient Operating Temperature Range:
-40 to 120 °C (-40 to 250 °F).

Process Temperature Limits:
-40 and 120 °C (-40 and 250 °F) at capsule.

Mounting:
Direct to process with connection flange in any position. For Model Y/15FA, diaphragm must be in vertical plane.

Air Connection:
Tapped for JIS R1/4 or 1/4NPT, whichever specified.

Process Connection:
High Pressure Side:
Y/15FA: Nominal 150 mm JIS 10K raised face (RF), nominal 6 inches ANSI Class 150 RF modified flange, or nominal 6 inches JPI Class 150 RF modified flange. RF surface serrated.
Y/13FA: Nominal 80 mm JIS 10 or 20K RF, nominal 3 inches ANSI Class 150 or 300 RF modified flange, or nominal 3 inches JPI Class 150 or 300 RF modified flange.
RF surface serrated.
Y/13FEA: Nominal 100 mm JIS 10 or 20K RF, nominal 4 inches ANSI Class 150 or 300 RF modified flange, or nominal 4 inches JPI Class 150 or 300 RF modified flange.
Low Pressure Side: Tapped for JIS Rc1/2 or 1/2 NPT, whichever specified.

Flange Extension Length (X_1 in Dimensions):
X_1 = 129 mm (5 inches) (standard).

Diaphragm Extension Length (X_2 in Dimensions):
X_2 = 50.8 mm (2 inches) (standard). For other length, refer to Options.

Wetted Parts Material:
Body and Flange: Forged JIS SUS 316 stainless steel.
Diaphragm Capsule: SUS 316L stainless steel.
Retaining Ring: SUS 316 stainless steel.
Diaphragm Extension: SUS 316 stainless steel.
Force Bar: SUS 316 stainless steel.
Force Bar Seal: Cobalt-nickel alloy.
Capsule Gaskets: SUS 316L stainless steel coated with Teflon (Y/13FA, Y/15FA), Teflon (Y/13FEA) (see Note 1).
Force Bar Seal Gasket: Silicone elastomer.

Table 2.1 Span and Range Limits.

Capsule		–	M-calibration	P-calibration	bar-calibration
L	Span Limits	1.25 to 6.2 kPa	125 to 635 mmH_2O	5 to 25 inH_2O	12.5 to 62 mbar
	Range Limits	-12.5 to 12.5 kPa	-1270 to 1270 mmH_2O	-50 to 50 inH_2O	-125 to 125 mbar
M	Span Limits	5 to 51 kPa	0.5 to 5.2 mH_2O	20 to 205 inH_2O	50 to 510 mbar
	Range Limits	-51 to 51 kPa	-5.2 to 5.2 mH_2O	-205 to 205 inH_2O	-510 to 510 mbar
H	Span Limits	50 to 210 kPa	5 to 21.6 mH_2O	200 to 850 inH_2O	0.5 to 2.1 bar
	Range Limits	-210 to 210 kPa	-21.6 to 21.6 mH_2O	-850 to 850 inH_2O	-2.1 to 2.1 bar
Output Signal		20 to 100 kPa	0.2 to 1.0 kgf/cm^2	3 to 15 psi	0.2 to 1.0 bar
Option Code		Standard Specifications	CAL-M	CAL-E	CAL-B

Cover:

Cast aluminum, finished with gray polyurethane paint. Gasketed for National Electrical Manufacturers Association (NEMA) (USA) Type 3 weatherproof service.

Approximate Weight:

Y/15FA, JIS 10K flange version: 24 kg (53 lb).
Y/13FA, JIS 10K flange version: 8.9 kg (20 lb).
Y/13FEA, JIS 10K flange version: 11 kg (24 lb).

2.4 Model and Suffix Codes

Model	Suffix Codes	Description
Y/15FA	. . . . .	Low differential pressure use.
Y/13FA	. . . . .	Medium and High differential pressure use.
Diaphragm Capsule	**-L**	Low range capsule. Span: 1.25 to 6.2 kPa. (For Y/15FA only)
	-M	Medium range capsule. Span: 5 to 51 kPa. (For Y/13FA only).
	-H	High range capsule. Span: 50 to 210 kPa. (For Y/13FA only)
Body Material *1	**S**	Forged SUS 316 stainless steel.
Flange Size, Rating and Flange Extension Length (X_1 = 129 mm)	**615**	150 mm JIS 10K or 6 inches ANSI 150/JPI 150 (For Y/15FA only).
	315	80 mm JIS 10K or 3 inches ANSI 150/JPI 150 (For Y/13FA only).
	335	80 mm JIS 20K or 3 inches ANSI 300/JPI 300 (For Y/13FA only).
Flange Standard	**J**	JIS standard.
	A	ANSI standard.
	P	JPI standard.
Options		/ ☐ / ☐

Model	Suffix Codes	Description
Y/13FEA	. . . . .	Medium and High differential pressure use.
Diaphragm Capsule	**-M**	Medium range capsule. Span: 5 to 51 kPa
	-H	High range capsule. Span: 50 to 210 kPa
Body Material *1	**S**	Forged SUS 316 stainless steel.
Flange Size and Rating	**415**	100 mm JIS 10K or 4 inches ANSI 150/JPI 150
	435	100 mm JIS 20K or 4 inches ANSI 300/JPI 300
Flange Standard	**J**	JIS standard.
	A	ANSI standard.
	P	JPI standard.
Diaphragm Extension Length	**2**	X_2 = 50.8 mm (2 inches) (standard).
	4	X_2 = 101.6 mm (4 inches) (Optional).
	6	X_2 = 152.4 mm (6 inches) (Optional).
Options		/ ☐ / ☐

*1 ⚠ Users must consider the characteristics of selected wetted parts material and the influence of process fluids. The use of inappropriate materials can result in the leakage of corrosive process fluids and cause injury to personnel and/or damage to plant facilities. It is also possible that the diaphragm itself can be damaged and that material from the broken diaphragm and the fill fluid can contaminate the user's process fluids.
Be very careful with highly corrosive process fluids such as hydrochloric acid, sulfuric acid, hydrogen sulfide, sodium hypochlorite, and high-temperature steam (150 ºC [302 ºF] or above). Contact Yokogawa for detailed information of the wetted parts material.

2.5 Options

Air Set:

Fixed combination pressure regulator and filter with 35 mm diameter pressure gauge mounted and piped to transmitter. Also available without gauge.

Supply pressure: 0.2 to 1 MPa, 2 to 10 kgf/cm^2 or bar, or 30 to 150 psi.

Output pressure: 140 kPa, 1.4 kgf/cm^2 or bar, or 20 psi.

Maximum operating temperature : 80 °C (180 °F).

Air Connection	Gauge Scale	Option Code
JIS Rc 1/4 female	0 to 200 kPa 0 to 2 kgf/cm^2 0 to 30 psi 0 to 2 bar Without gauge	GAS-FP GAS-FM GAS-FE GAS-FB GAS-F
1/4 NPT female	0 to 200 kPa 0 to 2 kgf/cm^2 0 to 30 psi 0 to 2 bar Without gauge	NAS-FP NAS-FM NAS-FE NAS-FB NAS-F

Kit for Elevated-Zero or Suppressed-Zero Ranges:

Permits adjustments up to range-limits of capsule. Upper range-value must not exceed upper range-limits of capsule.
Option code: R for kit for suppressed-zero ranges and L for kit for elevated-zero ranges.

Low Differential Spans:

Refer to Table 2.2.
Option code: LD.

Cover Color Other Than Standard Finish:

Specify in color block ☐ by color code. Refer to GS 22D01F01-00E.
Option code: SCF-☐.

High Process Temperature:

Glass reinforced Teflon gaskets are used in the capsule seal and force bar seal. Maximum process temperatures to 190 °C (375 °F).
Option code: DG5.

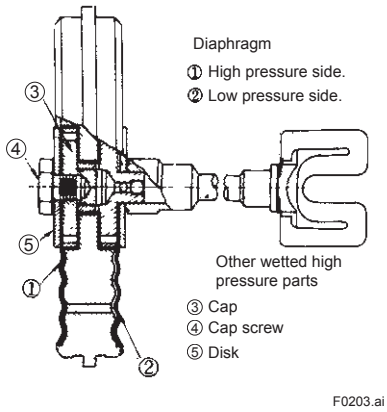
Table 2.2 Low Differential Spans

Capsule	Span (kPa)	Accuracy (%)	
		Suffix Code LD	Suffix Code LD+R (L)
L	0.5 to 3.1	±0.5	±1.0
M	2.5 to 25	±0.5	
H	25 to 65	±0.5	
	65 to 105	±0.75	

Table 2.3 Special Wetted Parts Material-High Pressure Side (For Y/13FA)

Capsule Material		Retaining Ring (Raised Face Portion of Flange)	Gasket *1	Option Codes *3
Diaphragm	Other Wetted Parts			
Hastelloy C-276	Hastelloy C (see Note 4)	Hastelloy C	Teflon (PTFE) (see Note 1)	D-CSC-C-☐
Hastelloy C-276	Hastelloy C	Tantalum sheathed JIS SUS 316 stainless steel (SS)	(PTFE)	D-CSC-T-☐
Tantalum *4	None *2	Tantalum sheathed JIS SUS 316 SS	(PTFE)	D-TSO-T-M

*1: Maximum temperature for Teflon (TFE) gasket is 175 °C (347 °F)
*2: Diaphragm without cap screw and disc.
*3: Capsule Code (M or H) will be specified in ☐.
*4: Capsule Code "M" only.



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High Damping Capsule:

Available only for low and medium range capsule. Filled with high viscosity fluid (time constant is approximate 1.3 sec-approximate 6 times of standard capsule.
Option code: HVC.

Optional Flange Extention Length (X_1 in Dimensions):

For Y/13FA only. X_1 = 205 mm (8 inches). Suffix code: 8. (Standard length X_1 = 129 mm (5 inches).

Optional Diaphragm Extention Length (X_2 in Dimensions):

For Y/13FEA only. Suffix code: 4 for X_2 = 101.6 mm (4 inches), 6 for X_2 = 152.4 mm (6 inches).

FEP Teflon (see Note 2) Diaphragm Protector Kit:

For field installation only. Provides temporary chemical protection for standard SUS 316L stainless steel diaphragm during maintenance or when repairing another transmitter with a special material diaphragm. Can use also for anti-stick characteristics. Kit includes an FEP Teflon diaphragm protector, Daifloil (see Note 3), and instruction. Process temperature limits 20 and 150 °C (70 and 300 °F).

Option code: FEPTC. (For Y/13FA and Y/15FA)

Special Wetted Parts Material for High Pressure Side:

For Y/13FA only. Refer to Table 2.3.

ANSI Connection:

For transmitters with ANSI process flange, air, low pressure process, drain and vent plug connections with tapped for ANSI NPT threads.

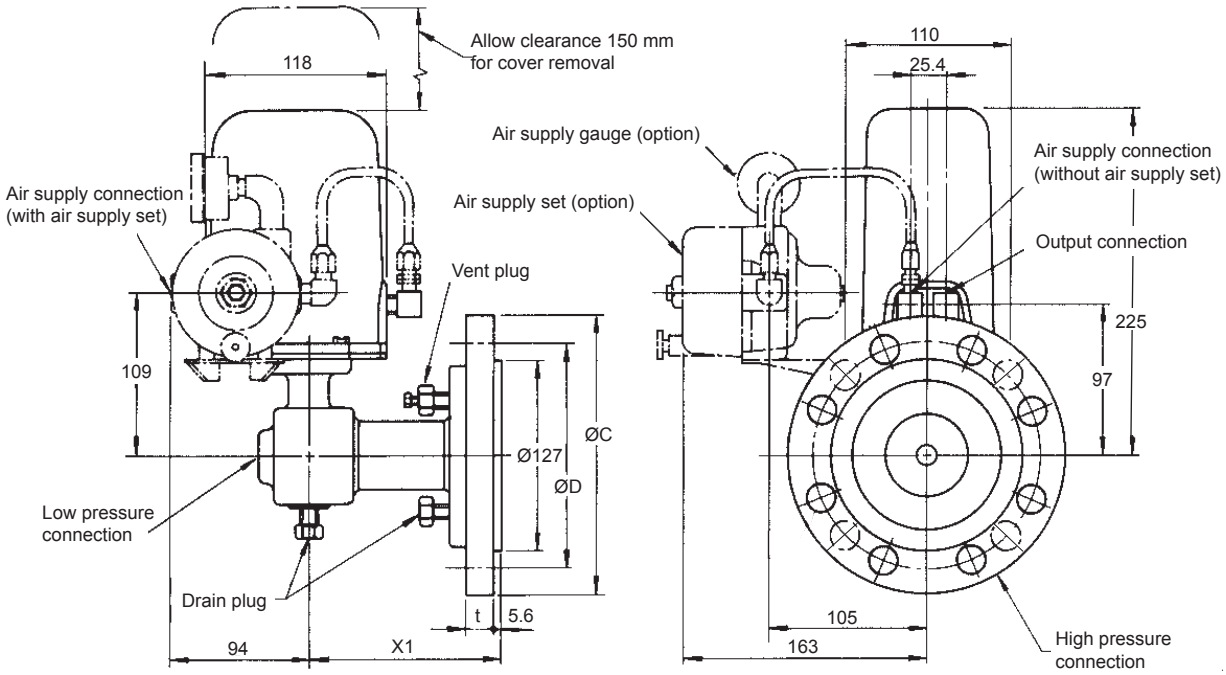
Option code: NPT

Note:
1. Teflon (PTFE): Trademark of E.I. DuPont de Nemours & Company (USA) for polytetrafluoroethylene coating.
2. FEP Teflon is abbreviation for tetrafluoroethylen-hexafluoropropylene polymer.
3. Daifloil: Trademark of Daikin Kogyo Company (Japan) for chlorotrifluoroethylene.
4. Hastelloy C: Trademark of Union Carbide Corporation (USA) for nickel-molybdenum alloy.

2.6 Dimensions

Model Y/13FA

Unit: mm



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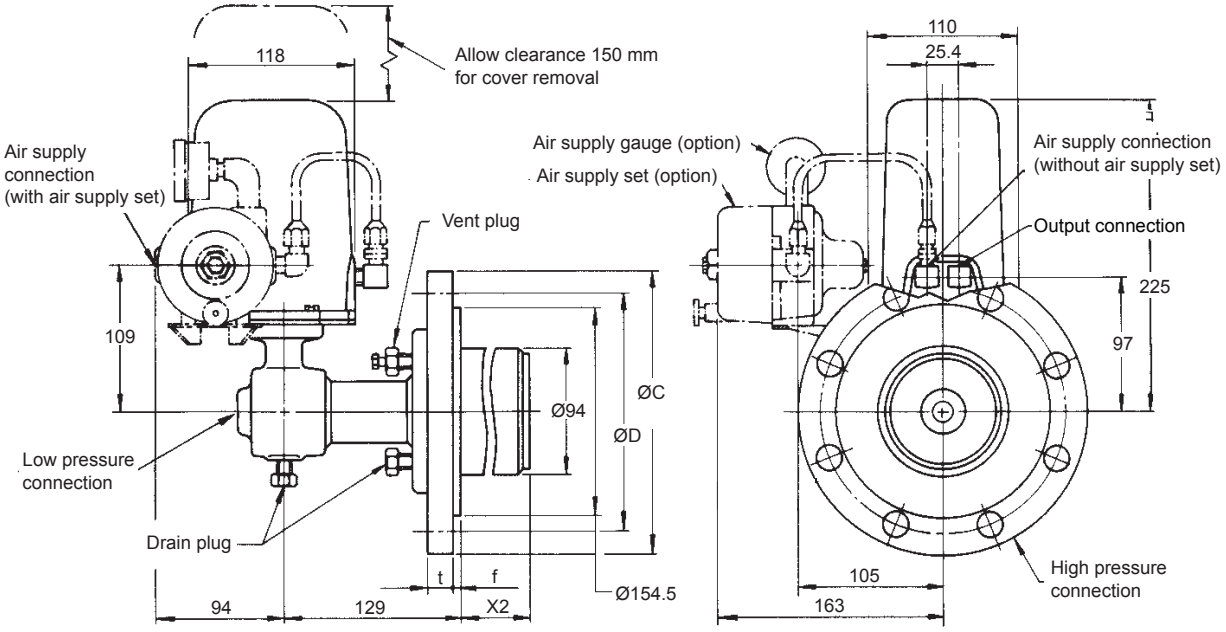
Raised face modified flange	Bolt holes		ØD	ØC	t
	No.	DIA.			
80 mm JIS 10K	8	19	150	185	18
80 mm JIS 20K	8	23	160	200	22
3 inch ANSI Class 150	4	19.1	152.4	190.5	23.8
3 inch ANSI Class 300	8	22.2	168.3	209.6	28.6
3 inch JPI Class 150	4	19	152.4	190	24
3 inch JPI Class 300	8	22	168.1	210	28.5

Model Y/13FEA

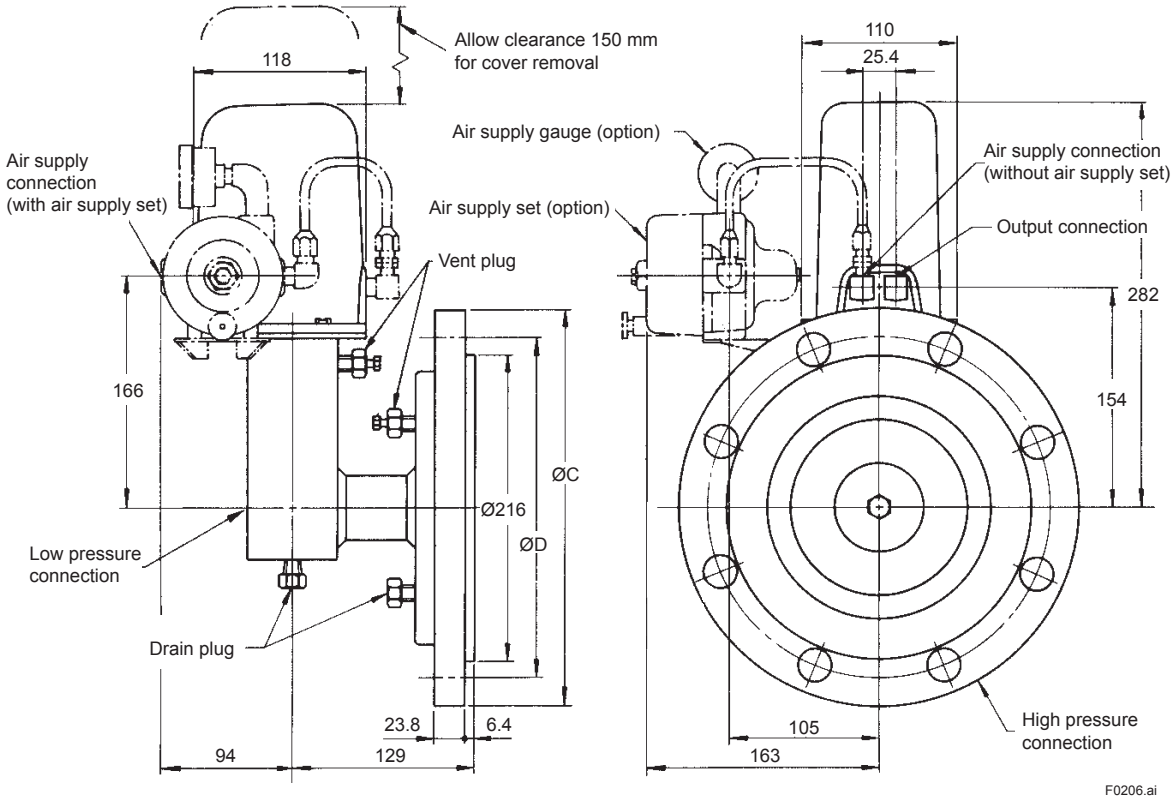
Unit: mm



Raised face modified flange	Bolt holes		ØD	ØC	t	f
	No.	DIA.				
100 mm JIS 10K	8	19	175	210	18	4.8
100 mm JIS 20K	8	23	185	225	24	6.4
4 inch ANSI Class 150	8	19.1	190.5	228.6	22.2	4.8
4 inch ANSI Class 300	8	22.2	200	254	30.2	6.4
4 inch JPI Class 150	8	19	190.5	229	24	4.8
4 inch JPI Class 300	8	22	200.2	254	32	6.4

Model Y/15FA

Unit: mm



Raised face modified flange	Bolt holes		ØD	ØC
	No.	DIA.		
150 mm JIS 10K	8	23	240	280
6 inch ANSI Class 150	8	22.2	241.3	279.4
6 inch JPI Class 150	8	22	241.3	279

3. Installation

3.1 Installing Transmitter

Transmitter may be mounted in any position.
Optional air set can be mounted as illustrated below.
Tighten bolts gradually and uniformly.
Opening on low pressure side to be vented (for open tank) or connected to wet or dry leg (for closed tank).

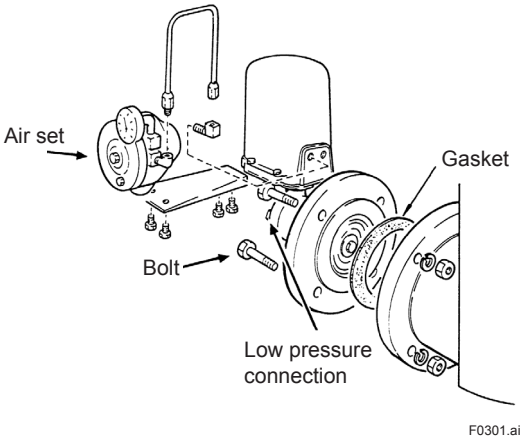


Figure 3.1 Installing Transmitter

3.2 Air Supply and Transmission Piping

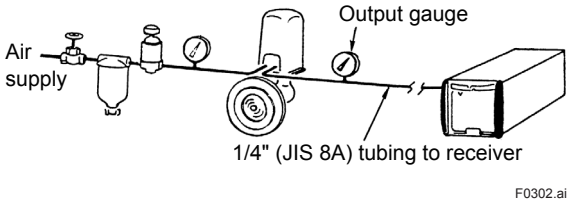


Figure 3.2 Air Supply and Transmission Piping

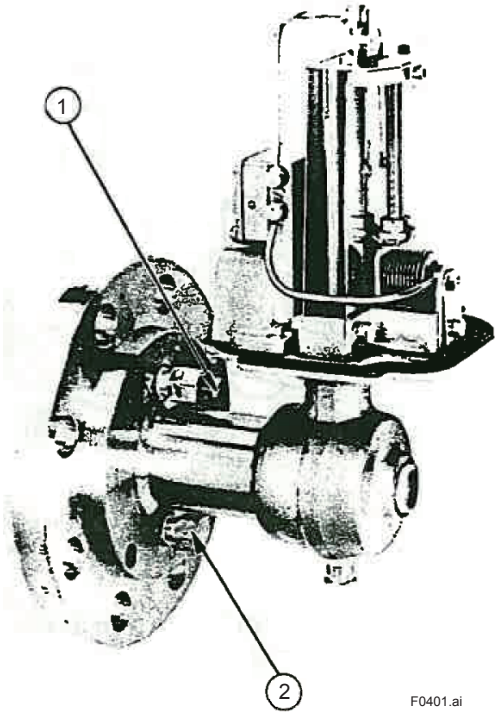
NOTE

- Air supply must be regulated at a fixed pressure 1.4 kgf/cm^2 or bar, 140 kPa, or 20 psi.
- Transmitter uses 0.5 Nm^3/h of air in normal operation.
- Air must be clean and dry. Blow out filter regularly.
- Transmission line must be free of leaks.

4. Operation

4.1 Piping and Operating

In the closed tank equations below, the density of the gas or vapor in the tank is disregarded for simplicity.
Install the transmitter, tightening the flange bolts securely.
On open tank applications, to prevent entrance of dirt through the vented connection, install a pipe elbow in the opening with the elbow pointing downward.
A vent plug ① and a drain plug ② are provided on the low pressure side of the diaphragm capsule.



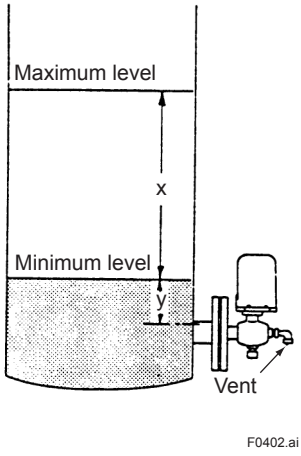


Figure 4.1 Open Tank

Span = xG_L
Zero Suppression = yG_L
G_L = specific gravity of liquid in tank
Example: If G_L = 1.2, x = 2.5 m, and y = 0.25 m
Span = 2.5 × 1.2 = 3 mH_2O
Zero Suppression = 0.25 × 1.2
= 0.3 mH_2O
Range = 0.3 to 3.3 mH_2O

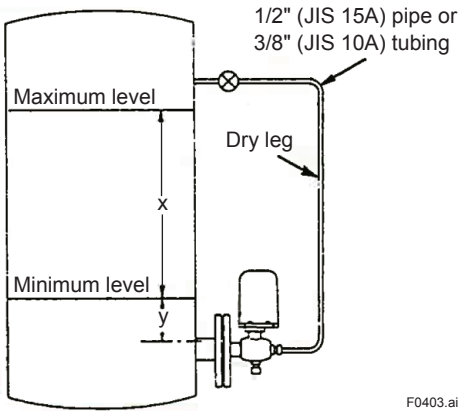


Figure 4.2 Closed Tank with Dry Leg

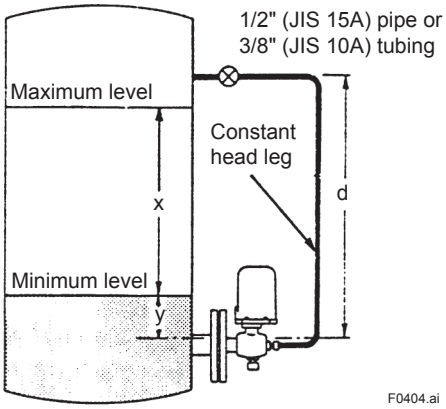


Figure 4.3 Closed Tank with Wet Leg

Span = xG_L
Zero elevation = $dG_S - yG_L$
G_L = specific gravity of liquid in tank
G_S = specific gravity of liquid leg
Example: Closed tank with wet leg
x = 2 m, y = 0.5 m, and d = 2.5 m
G_L = 0.8, G_S = 0.9
Span = 2 × 0.8 = 1.6 m H_2O
Zero Elevation = (2.5 × 0.9) – (0.5 × 0.8)
= 2.25 – 0.4 = 1.85 mH_2O
Range = – 1.85 to – 0.25 m H_2O
(Minus sign indicates that the higher pressure is applied to the low pressure side of transmitter.)

4.2 Transmitter with Zero Elevation or Zero Suppression Kit

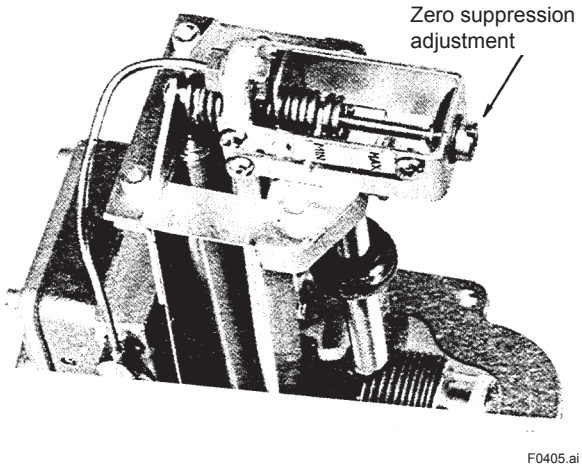


Figure 4.4 Zero Suppression Kit

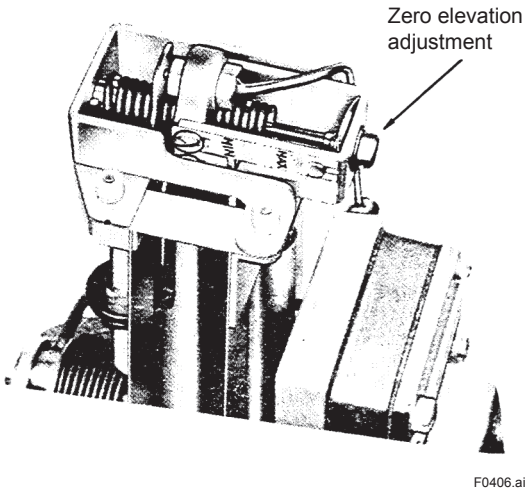


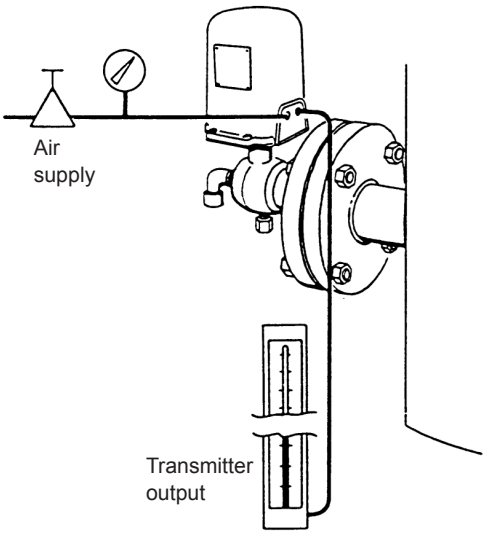
Figure 4.5 Zero Elevation Kit

If the transmitter requires zero elevation or zero suppression, it is equipped with a zero elevation or zero suppression spring. The spring exerts a force through the force bar to the diaphragm capsule. The tension of a zero suppression spring can be adjusted to cancel any initial force or pressure exerted on the high pressure side of the diaphragm capsule; the tension of the zero elevation spring can be adjusted to cancel any initial force on the low pressure side of the capsule. Procedures for making these adjustments are given in the section 4.3 and in the section 5.1.

Note: During manufacture, each transmitter with a zero elevation spring is calibrated with the spring adjusted for a specified amount of zero elevation. (If the customer does not specify the amount of zero elevation desired, the transmitter is calibrated for an amount of zero elevation equal to zero.) A change in the amount of zero elevation causes the span of the transmitter to change by a small amount. If it is necessary to change the zero elevation by more than 25% of span, the transmitter should be recalibrated if maximum accuracy is desired (Refer to section 4.3).

4.3 Zero Adjustment

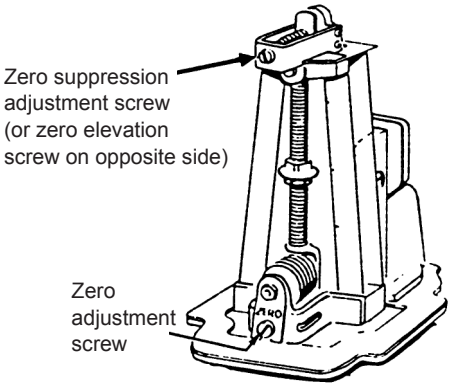
1. Bring the tank to minimum level or to a known reference level.
2. If a constant-head wet leg is used, fill the leg with vessel or sealing liquid in such a way that no air or vapor is trapped in the system.
3. Adjust air supply to pressure at which transmitter will operate.
4. Connect a 0 to 1.5 kgf/cm^2 or bar, 0 to 150 kPa, or 0 to 22 psi mercury manometer of test gauge to output connection.



5. If a differential pressure corresponding to minimum level is applied to transmitter, adjust output reading to 0.2 kgf/cm^2 or bar, 20 kPa, or 3 psi. If the differential pressure corresponds to a level above minimum level, output reading should be adjusted to the calculated value (Refer to section 4.4). Make the adjustment as follows:
   a. For transmitters without zero elevation or zero suppression kit, adjust zero adjustment screw until correct output is obtained.

b. For transmitters with zero elevation or zero suppression kit, adjust zero elevation or zero suppression screw until correct reading is obtained. Fine adjustments may be made with zero adjustment screw.

6. Reconnect output line. If necessary, adjust receiver until reading is correct.



4.4 To Calculate Output

Output pressure =

$$(0.8)\left(\frac{\text{reference level} - \text{minimum level}}{\text{maximum level} - \text{minimum level}}\right) + 0.2$$

Example: Reference level is 1200 mmH_2O above minimum level.
Maximum level is 2000 mmH_2O above minimum level.
Calculate output pressure.
Output pressure =

$$(0.8)\left(\frac{1200}{2000}\right) + 0.2 = 0.68\ kgf/cm^2$$

For transmitters with reverse output:
Output pressure =

$$(0.8)\left(\frac{\text{maximum level} - \text{reference level}}{\text{maximum level} - \text{minimum level}}\right) + 0.2$$

Note: With 20 to 100 kPa or 3 to 15 psi output, substitute 20 and 80 or 3 and 12 for 0.2 and 0.8 respectively in the equation above.

5. Maintenance

5.1 Calibration Notes

Calibration is required if transmitter has been taken apart for cleaning or parts replacement, if range is to be changed, or if amount of zero elevation or zero suppression is to be changed substantially. Transmitter can be calibrated to 0.2 to 1.0 kgf/cm^2 or bar, 20 to 100 kPa, or 3 to 15 psi signal pressure range. These four ranges are not exactly equivalent; therefore transmitter must be calibrated to same signal pressure range as receiver with which it is used.
Transmitter is calibrated by applying a known input and adjusting output to corresponding value (Refer to section 5.1.2).

5.1.1 Piping for Bench Calibration

Calibrating signals are generated by applying an air pressure (Models Y/13FA and Y/13FEA) or a head of liquid (Model Y/15FA) to the diaphragm. A suggested calibration fixture is a mating blind flange with a tapped hole as the pressure connection (illustrated below). (With Model Y/13FEA, use a ring flange with a capped nominal 100 mm (4-inch) pipe welded to it.) Note that a calibration fixture is not required for a transmitter with a zero elevation kit.

■ Model Y/13FA, Y/13FEA

① Regulate air supply to pressure at which transmitter will be operating.
② 0 to 1.5 kgf/cm^2 or bar, 0 to 150 kPa, or 0 to 22 psi output test gauge or manometer.
③ Manometer for reading calibrating signal pressure. Use water column for levels up to 2.0 mH_2O, 20 kPa, 0.2 bar, or 80 inH_2O. Use mercury column for levels of 2.0 to 21.6 mH_2O, 20 to 210 kPa, 0.2 to 2.1 bar, or 80 to 850 inH_2O.
④ Vent low pressure side.

With zero elevation kit, apply calibrating pressure to low pressure side (use amount of zero elevation for 0.2 kgf/cm^2 or bar, 20 kPa, or 3 psi, and amount of zero elevation minus span for 1.0 kgf/cm^2 or bar, 100 kPa, or 15 psi).

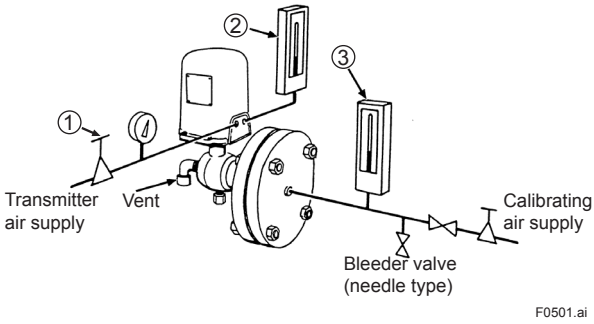


Figure 5.1 Piping for Bench Calibration (Y/13FA,Y/13FEA)

■ Model Y/15FA

Instead of using air pressures as calibrating signals, these signals may be generated either by varying the level in the tank (this dose not require removal of transmitter), or by using the calibration flange illustrated below.

- Drill and tap hole in blind flange for nipple. Attach hose to nipple.
- Attach stick to flange. Make marks on stick at heights above flange center line, equal to liquid levels corresponding to 0.2 kgf/cm^2 outputs.
- Fill hose with tank liquid. Hose must be full of liquid when held at marks on stick.
- With elevated-zero range apply air pressure to connection opposite flange equal to amount of zero elevation.

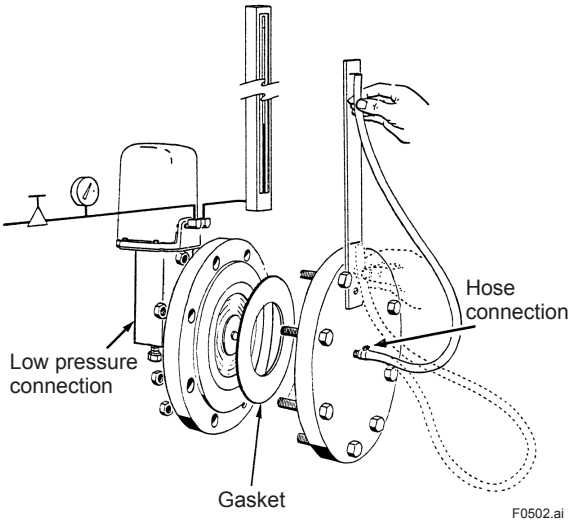
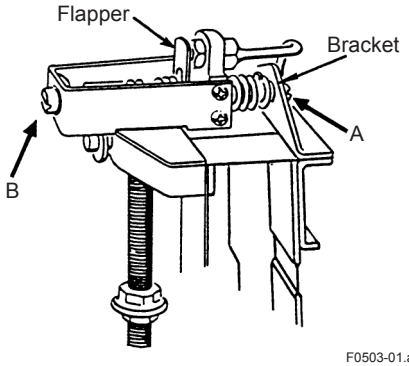


Figure 5.2 Piping for Calibration (Y/15FA)

5.1.2 Calibration Procedure

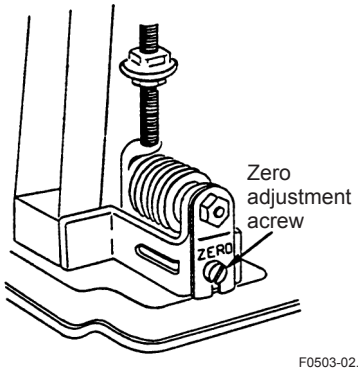
Step 2, 4, and 5 in procedure below pertain only to transmitters with zero suppression or zero elevation kit. Illustrations for these steps show zero suppression kit. If transmitter has zero elevation kit, location of the 2 screws mentioned is reversed. If transmitter has neither zero suppression nor zero elevation, skip these steps.

1. Set up calibration equipment as shown on section 5.1.1.
2. If transmitter has zero elevation or zero suppression kit, disconnect spring from force bar as follows:
   A. Remove screw from end of spring.
   B. Turn adjustment screw clockwise until spring is clear of bracket. Spring must not bind against flapper or casting.



F0503-01.ai

3. With no pressure on transmitter, adjust zero screw so that output on test gauge reads 0.2 kgf/cm^2 or bar, 20 kPa, or 3 psi.
   If screw was removed in Step 2-A, replace it.



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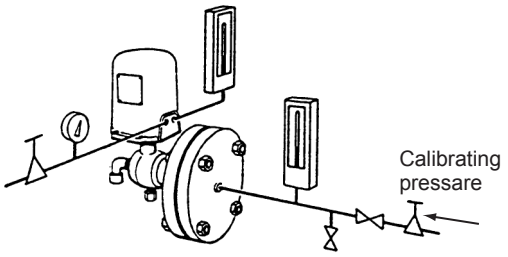
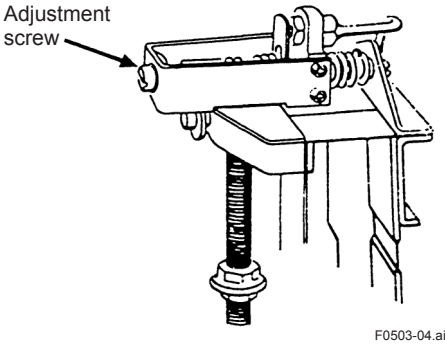
4. With zero suppression or zero elevation kit, set calibrating pressure equal to lower range limit. (With zero elevation kit, apply both calibrating pressures to low pressure side of transmitter; no calibration flange is required.)



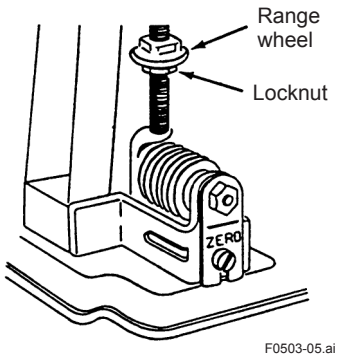
F0503-03.ai

5. Turn adjustment screw so that output is 0.2 kgf/cm^2 or bar, 20 kPa, or 3 psi. Fine adjustment can be made with zero screw.



F0503-04.ai

6. Set calibrating pressure equal to upper limit. The output should be 1.0 kgf/cm^2 or bar, 100 kPa, or 15 psi.
7. If output is incorrect, loosen locknut and adjust range wheel for correct output. Turning range wheel down increases output. Retighten locknut after each adjustment.

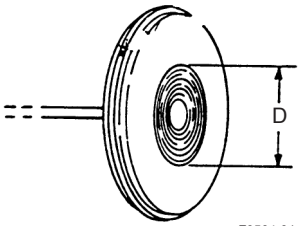


F0503-05.ai

8. Repeat Step 3 through 7 until the desired accuracy is obtained. Tighten range wheel locknut securely.
9. Make zero adjustment.

5.1.3 To Change Range of Transmitter

The range of the transmitter, as calibrated at the factory, is stamped on the data plate. By recalibration, the range can be changed to any value within the limits of the diaphragm capsule assembly.
With Models Y/13FA and Y/13FEA, if the desired range is outside the limits of the particular capsule installed in the transmitter, but within the limits of the other available capsule, install this other capsule. Listed below are the range limits and identifications of the various capsules. The data plate should be altered to indicate the new range.



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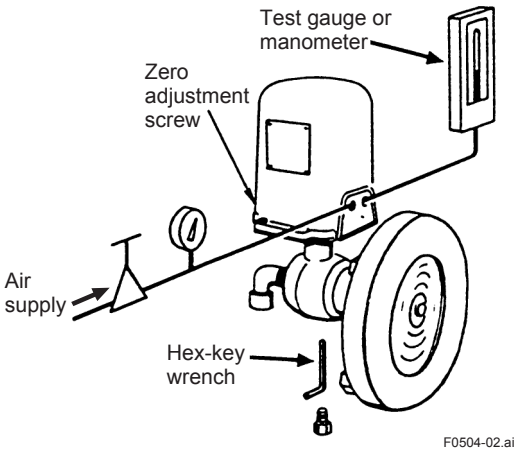
Capsule Identification	D (mm)	Model	Range			
			mH_2O	kPa	mbar	inH_2O
L	121	Y/15FA	0-0.125 to 0-0.635	0-1.25 to 0-6.2	0-12.5 to 0-62	0-5 to 0-25
M	73	Y/13FA Y/13FEA	0-0.5 to 0-5.2	0-5 to 0-51	0-50 to 0-510	0-20 to 0-205
H	41	Y/13FA Y/13FEA	0-5 to 0-21.6	0-50 to 0-210	0-500 to 0-2100	0-200 to 0-850

5.1.4 Flexure Locknut Adjustment

Make this adjustment if diaphragm assembly was removed or if flexure locknut was loosened.
This procedure is not applicable to Model Y/13FEA.

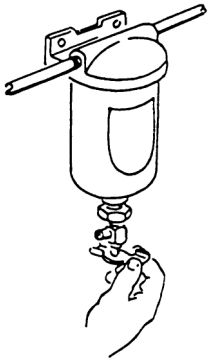
1. Connect air supply and output reading test gauge or manometer.
2. Disconnect zero elevation or zero suppression kit (if present), refer to Step 2 of section 5.1.2.
3. Remove bottom drain plug, and loosen flexure locknut with a 1/4" hex-key wrench.
4. With no pressure on diaphragm capsule, adjust zero screw so that output is 0.2 kgf/cm^2 or bar, 20 kPa, or 3 psi.
5. Carefully tighten flexure locknut so that output pressure does not change by more than ±0.027 kgf/cm^2 or bar, ±2.7 kPa, or ±4 psi.
   If output pressure is not within these limits, loosen locknut and carefully retighten.
   If output pressure is still not within limits, it indicates that index marks on capsule and body are not aligned. Correct by repositioning capsule (Refer to Step 6 of section 5.7).
6. When output pressure is within limits after tightening locknut, replace bottom plug and calibrate transmitter (Refer to section 5.1.2).



F0504-02.ai

Figure 5.3 Flexure Locknut Adjustment

5.2 Supply Air Filter



Blow filter out at least once a day.

Figure 5.4 Air Filter

5.3 To Clean Restrictor

A plugged restrictor will cause low output pressure.

1. Remove amplifier (Refer to section 5.6).
2. Lift out restrictor with tweezers.
3. Clean with a 0.18 mm dia. wire
4. Apply thin film of Vaseline, or similar lubricant to O-ring.

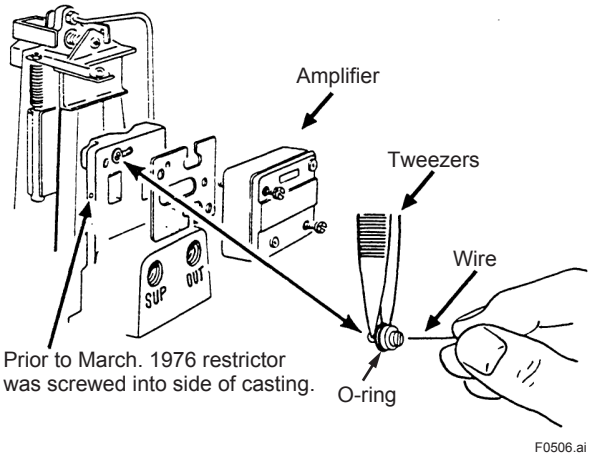
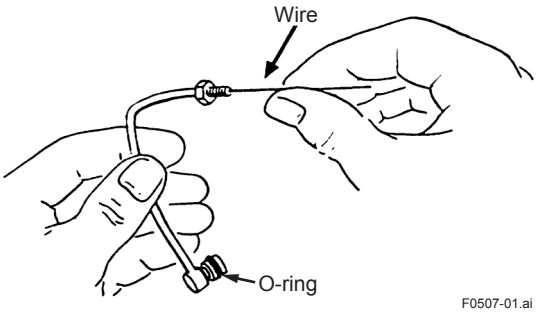


Figure 5.5 Cleaning of Restrictor

5.4 To Clean Nozzle Assembly

An accumulation of dirt at the flapper nozzle may cause a zero shift.

1. Unscrew nozzle nut. Do not let soldered nut on opposite side of casting turn.
2. Ease nozzle out of casting.
3. Loosen clamp screw and rotate S-clamp. Withdraw nozzle O-ring connection with twisting motion. Do not bend tubing.
4. Clean nozzle with 0.73 mm dia. wire, compressed air, or suitable solvent. Wipe top of flapper clean.



5. Before replacing, apply a thin film of Vaseline or similar lubricant to O-ring. Replace nozzle assembly in reverse order. Check reference adjustment. (Refer to section 4.3).

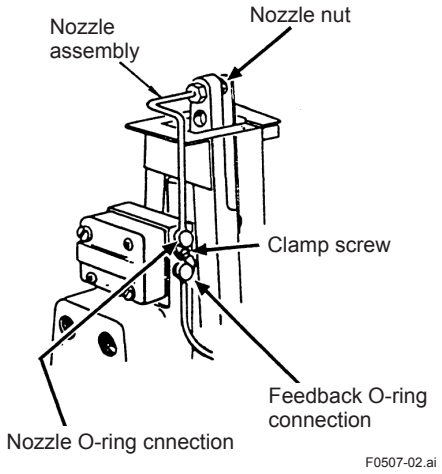


Figure 5.6 Cleaning of Nozzle Assembly

5.5 To Clean or Replace Screen Filters

If fine screen air filters become clogged, remove with a pointed tool for cleaning or replacement.

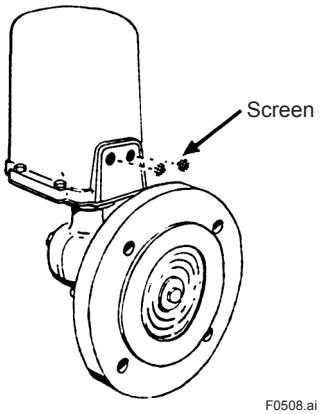


Figure 5.7 Cleaning or Replace of Screen Filters

5.6 To Remove Pneumatic Amplifier

To remove pneumatic amplifier, remove 2 large screws and pry off. A gasket is furnished with each replacement amplifier. When replace the pneumatic amplifier, tighten the screws by the torgue of 1.6 to 1.8 N·m (16 to 18 kgf·cm). For servicing details, refer to Appendix 1.

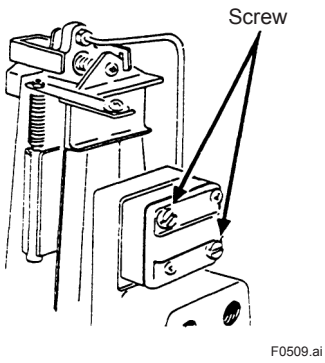
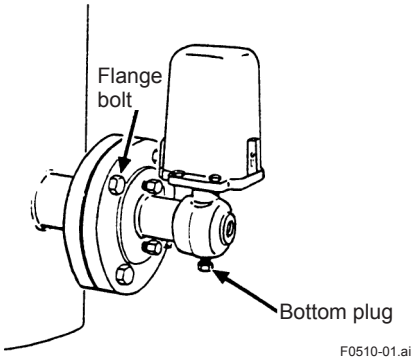


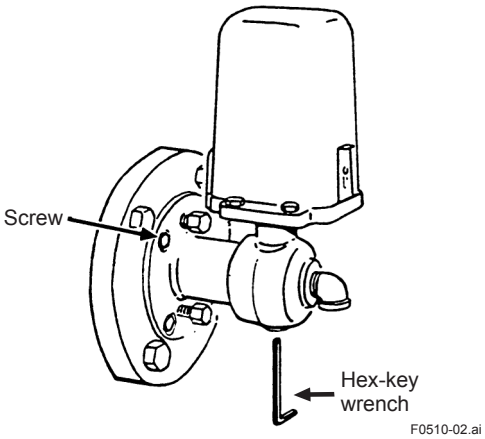
Figure 5.8 Remove Pneumatic Amplifier

5.7 To Remove Diaphragm Capsule Assembly

1. Disconnect transmitter piping. Remove flange bolts and lift transmitter off tank.
2. Remove bottom plug.

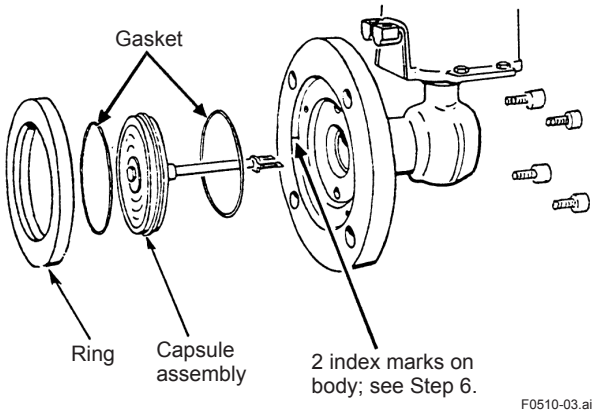


3. Remove screws holding outer ring to flange. Do not lose spacers in bolt holes.
   Note that with Model Y/13FEA (transmitter with extended diaphragm), ring is part of capsule assembly; see illustration below.
4. Insert 1/4" hex-key wrench into bottom opening and loosen flexure locknut (see illustration below).

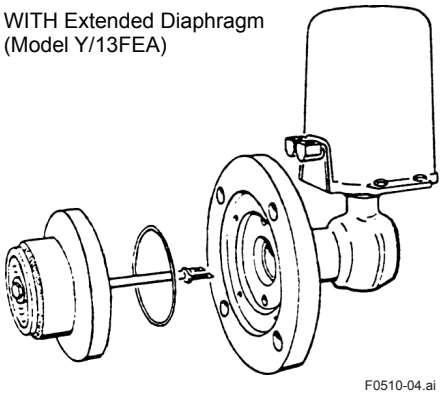


5. Carefully ease capsule assembly out of transmitter body without twisting assembly. Inspect gaskets. If surface is not perfectly smooth, replace gasket.

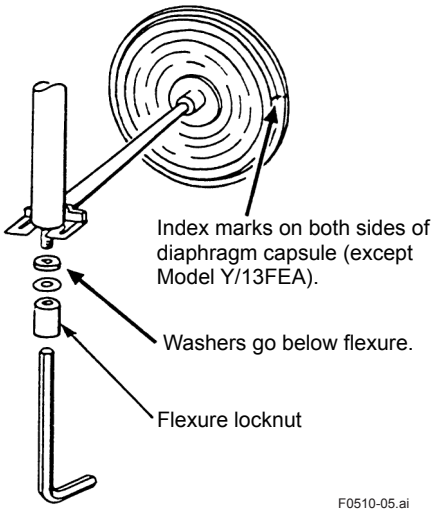
WITHOUT Extended Diaphragm
(Models Y/13FA and Y/15FA)



WITH Extended Diaphragm
(Model Y/13FEA)



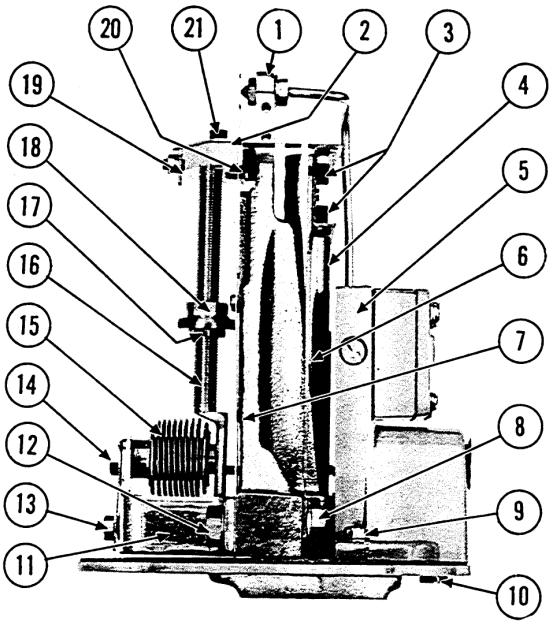
6. Reinstall parts in reverse order of disassembly. Use care when inserting flexure onto force bar to avoid damaging flexure. Position diaphragm capsule so that index marks on body and on capsule are in line.
   (With Model Y/13FEA, after flexure is positioned on force bar, loosely tighten nuts removed in Step 3, tighten flexure locknut, and then finish tightening nuts.)
7. Make flexure locknut adjustment (Refer to section 5.1.4) (except Model Y/13FEA), check static alignment (Refer to section 5.8.7), and then calibrate transmitter (Refer to section 5.1).



5.8 Further Disassembly

IMPORTANT

Normal servicing of the transmitter does not require removal of any parts other than those already mentioned. Further disassembly is not recommended by YOKOGAWA. The following procedures are described for emergency use only and the user must assume responsibility for loss of accuracy or damage to the transmitter.



5.8.1 To Remove Feedback Bellows and Zero Spring (behind Zero Screw)

1. Carefully pry out feedback O-ring connection at amplifier (Refer to section 5.4).
2. Using 7/16" open-end wrench, remove the two 1/4" cap screws ⑫ holding bracket ⑪.
3. Unscrew completely zero adjustment screw ⑬ to release zero spring. Bracket ⑪ and feedback bellows ⑮ can now be removed.
4. Remove nut ⑭ to disconnect feedback bellows from bracket.
5. Remove zero spring by unscrewing it from range bar ⑯. Be careful not to change alignment on the spring clamp.

6. Reverse this procedure to reassemble, making sure that post on bracket is within zero spring alignment clamp. Tighten zero adjustment screw until about 6 mm of thread remains exposed. When replacing feedback connection, apply a thin film of Vaseline or similar lubricant to O-ring.
7. Calibrate transmitter (Refer to section 5.1).

5.8.2 To Remove Back Flexures

Unless front flexure ⑥ has already been removed. 7/64" hex-key wrench used in Step 2 must be cut down to fit into screws ⑳.

1. Using 7/16" open-end wrench, remove 1/4" cap screws ⑫ holding bracket ⑪).
2. Using a 7/64" hex-key wrench, remove two screws and plates ⑳ holding back flexures ⑦, and remove back flexures.
3. Reverse this procedure to reassemble. Do not tighten cap screws ⑫.
4. Loosen cap screws ⑧ and force bar screws ③. Apply 10 kgf/cm^2 or bar, 1 MPa, or 150 psi to both side of transmitter. Tap the body lightly and tighten all screws.
5. Calibrate transmitter (Refer to section 5.1).

5.8.3 To Remove Force Balance Unit

1. Remove relay mounting assembly ⑤ (Refer to section 5.8.4).
2. Remove diaphragm capsule assembly (Refer to section 5.7).
3. Using a 3/16" hex-key wrench, remove the three socket-head screws holding force balance unit to body. In removing screws, be careful not to damage flexures ⑥ and ⑦. Withdraw force balance unit from body.
4. Reverse this procedure to reassemble. When tightening screws removed in Step 3, follow procedure on section 5.8.9 to maintain original static alignment accuracy. Replace O-ring that fits around force bar on top of body, and the two gaskets that go on each side of diaphragm capsule.
   Apply a thin film of Vaseline or a similar lubricant to the O-ring.
5. Calibrate transmitter (Refer to section 5.1).

5.8.4 To Remove Relay Mounting Assembly

1. Carefully pry out nozzle and feedback O-ring connections at amplifier (Refer to section 5.4).
2. Remove relay mounting assembly ⑤ by unscrewing the two screws ⑨ above mounting plate and small screw ⑩ beneath mounting plate.
3. Reverse this procedure to reassemble. When replacing O-ring connections, apply a thin film of Vaseline or similar lubricant to O-rings.

5.8.5 To Remove Front Flexure

1. If transmitter has optional zero elevation or zero suppression kit, remove this assembly.
2. Carefully pry out both feedback and nozzle O-ring connections at amplifier and remove nozzle tubing from casting ① (Refer to section 5.4).
3. Remove relay mounting assembly ⑤ (Refer to section 5.8.4).
4. Using a 7/64" hex-key wrench, remove top plate ② by removing two plate screws ㉑.
5. Using a 9/64" hex-key wrench, remove force bar screws ③.
6. Remove cap screws ⑧ and plates and lift front flexure ⑥ off of dowel.
7. Reverse this procedure to reassemble. If force bar has been removed or force balance unit loosened from body, top of front flexure should be visually lined up with casting ①, so that there is no twist evident in flexures. Then tighten plate screws ㉑. Do not tighten cap screws ⑧.
8. Loosen cap screws ⑫ and force bar screws ③. Apply 10 kgf/cm^2 or bar, 1 MPa, or 150 psi to both sides of transmitter. Tap body lightly and tighten all screws.
9. Check static alignment (Refer to section 5.8.7).

5.8.6 To Remove Force Bar

1. Remove force balance unit (Refer to section 5.8.3).
2. Using a 9/64" hex-key wrench, remove the two force bar screws ③. Force bar ④ can now be removed. This unit should not be further disassembled; if its diaphragm seal is removed from force bar, leaks are likely to occur after reassembly. If either force bar or its seal requires replacing, they both should be replaced as a unit.
3. Reverse this procedure to reassemble. Replace O-ring at force bar seal. Before inserting force bar into top-works, lubricate O-ring and top of force bar with Vaseline or similar lubricant. Carefully ease force bar into O-ring recess to avoid damaging O-ring.

4. When reassembled, loosen the four cap screws ⑧ and ⑫ and two force bar screws ③. Apply 10 kgf/cm^2 or bar, 1 MPa, or 150 psi to both sides of transmitter.
   Tap body lightly and tighten all screws.
5. Check static alignment (Refer to section 5.8.7).

5.8.7 Static Alignment

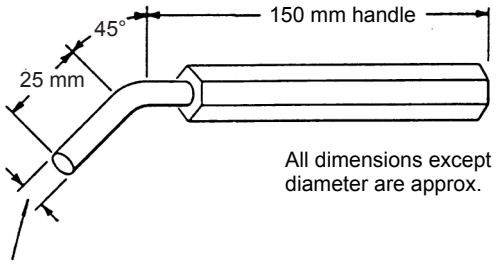
This adjustment is required if front flexure or force bar is replaced.

1. Set up calibration equipment (Refer to section 5.1.1) and connect input line to both flange and low pressure side of transmitter.
2. Check with a 1/4" hex-key wrench through bottom plug hole that capsule flexure locknut is tightly fastened to force bar. Replace bottom plug.
3. Rotate range wheel ⑱ to approximate operating position. Tighten locknut ⑰.
4. Vent both sides of transmitter and adjust zero screw ⑬ so that output is 0.2 kgf/cm^2 or bar, 20 kPa, or 3 psi.
5. Apply gradually and simultaneously to both sides of transmitter (output must not go off scale), a pressure equal to highest static pressure anticipated during normal operation.
   Note: Do not exceed static pressure limits.
6. After 2 minutes observe transmitter output. If output has not changed, static alignment is correct. If output change is more than desired, slowly vent pressure and make static alignment as follows.
   Loosen the two plate screws ㉑ and adjust static alignment wheel ⑲ to bring output back to 0.2 kgf/cm^2 or bar, 20 kPa, or 3 psi. Turn wheel clockwise to lower output. Tighten plate screws ㉑ after each adjustment of alignment wheel.
7. Remove bottom plug and loosen, then carefully retighten capsule flexure locknut. (except Model Y/13FEA).
8. Repeat Steps 6 and 7 until output change is satisfactory. Calibrate transmitter (Refer to section 5.1.2).

5.8.8 Flapper Alignment

The flapper is aligned at the factory; a realignment is required only if the force balance unit has been disassembled. This alignment procedure requires a spacing tool (see illustration), a 1/8" open-end wrench, and a small screwdriver. (The wrench and screwdriver are included in tool kit Model 6925-6000, obtainable from YOKOGAWA.)

Caution: Use care in turning thin flexure alignment screw to prevent shearing.



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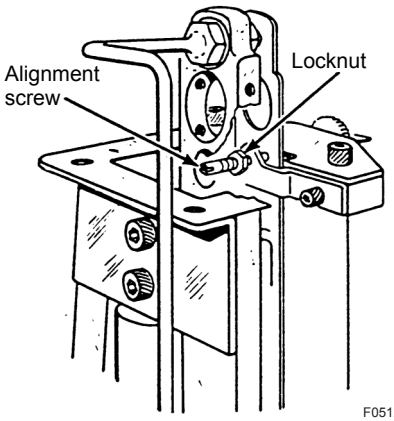

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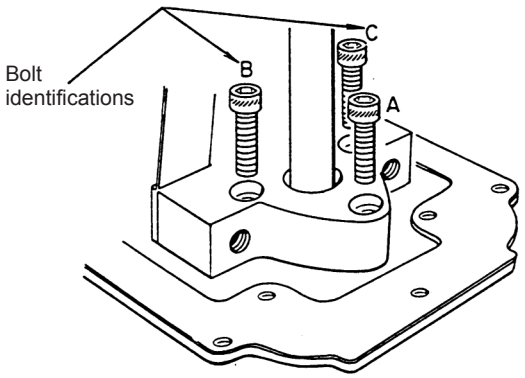
1. If transmitter has optional zero elevation or zero suppression kit, remove this assembly.
2. Connect an air supply regulated at a fixed pressure 1.4 kgf/cm^2 or bar, 140 kPa, or 20 psi to input, and a 0 to 1.5 kgf/cm^2 or bar, 0 to 150 kPa, or 0 to 22 psi test gauge or manometer to output.
3. Loosen flexure locknut at bottom of force bar (Refer to section 5.1.4).
4. Turn range wheel to top of range bar.
5. Using spacing tool as feeler gauge, insert tool at lower end of range bar between threaded surface and machined casting surface. Adjust zero screw to get correct spacing for tool.
6. Loosen flapper alignment screw locknut and adjust screw so that output is 0.2 kgf/cm^2 or bar, 20 kPa, or 3 psi.
7. Repeat Step 5. If output is not between 0.23 and 0.33 kgf/cm^2 or bar, 23 and 33 kPa, or 3.4 and 4.8 psi, repeat Steps 5 and 6 until output is within these limits.
8. Retighten flapper alignment screw locknut. Reinstall optional zero elevation or zero suppression kit. Tighten flexure locknut and check calibration. (Refer to section 5.1.2 and 5.1.4).

5.8.9 Bolt Tightening Procedure - Force Balance Unit

When reinstalling the 3 socket-head bolts that hold the force balance unit to the transmitter body, follow the bolt tightening procedure shown below.



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Step No.	Bolt	Torque (N·m)
1	A	0.6
2	B	0.6
3	C	0.6
4	B	3.5
5	C	3.5
6	A	2.3
7	B	5.2
8	C	5.2
9	A	3.5
10	B	7.5
11	C	7.5
12	A	5.8

Appendix 1. 80A Pneumatic Amplifier (Part No. F9138YA)

The function of the pneumatic amplifier is to convert a small change in the input signal (an air pressure signal) to a large change in the output signal. Typically a 0.07 kgf/cm^2 (0.07 bar, 7 kPa, or 1 psi) change in the input will produce approximately a 0.8 kgf/cm^2 (0.8 bar, 80 kPa, or 12 psi) change in the output.

A1.1 Principles of Operation

The air supply enters the pneumatic amplifier through a port on the surface of the instrument on which the amplifier is mounted. The input signal (nozzle pressure) enters the amplifier through another port and acts on the diaphragm. Since the stem valve is mounted on the diaphragm, the two move in unison.

As the input signal increases, the stem pushes against a ball valve which in turn moves a flat spring, allowing the supply air to enter the amplifier body. Further motion of the stem valve, causes it to close off the exhaust port. Thus, when the input pressure increases, the stem (exhaust) valve closes and the supply valve opens; when the input decreases, the stem valve opens and the supply valve closes. This varies the pressure to the output.

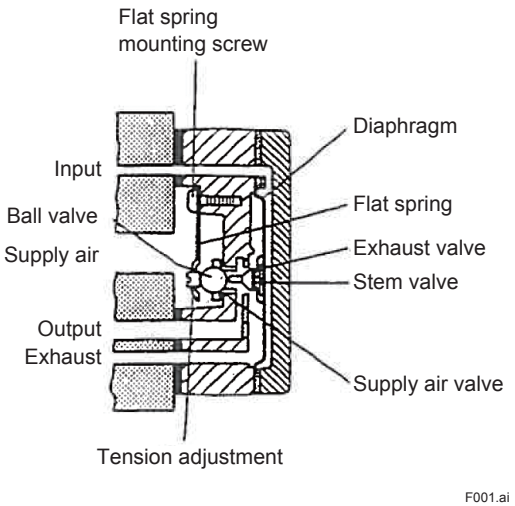


Figure A1. Cross Sectional View

A1.2 Cleaning the Pneumatic Amplifier

Should the pneumatic amplifier require cleaning, remove it from the instrument. Loosen the two cover screws and the spring mounting screw to disassemble the pneumatic amplifier. Clean the disassembled parts with a suitable solvent (do not allow solvent to contact the gasket) and dry them carefully with compressed air. When reassembling the pneumatic amplifier, all corresponding holes must line up and all outside edges must coincide with other edge of the amplifier body casting. Tighten all screws.

CAUTION

After reassembling the amplifier, perform a calibration with the calibrator. (Refer to section A1.3)

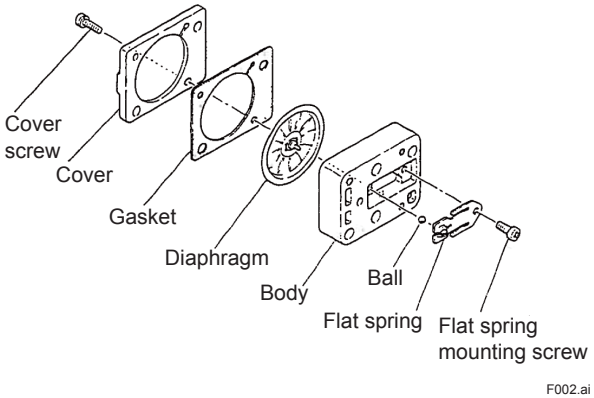


Figure A2. Exploded View

A1.3 Calibration Procedure using Calibrating Fixture

This procedure requires a Model 6971 calibrator, which is available from Yokogawa.

(1) Mount the amplifier on the calibrator with the flat spring mounting screw to the left. (Be sure to mount the amplifier in the correct direction.) Fasten the amplifier with the two wing nuts.

(2) Air supply.
Apply air at 1.4 kgf/cm^2 or bar, 140 kPa, or 20 psi to air supply coupling ②.

(3) Self-centering the stem valve.
   a. Seal nozzle ③ by manual contact for several seconds, until the nozzle pressure (diaphragm back-up pressure) is 1.4 kgf/cm^2 or bar, 140 kPa, or 20 psi and confirm that the nozzle pressure exceeds 1.0 kgf/cm^2 or bar, 100 kPa, or 15 psi.
   b. Open nozzle ③ and manually close the air check valve, until the nozzle input pressure is zero (atmospheric pressure).
   c. Repeat steps a and b above.

(4) Nozzle input pressure adjustment.
Turn nozzle ③ with a wrench while observing nozzle input pressure gauge ⑤, so the nozzle input pressure is 0.25 kgf/cm^2 or bar, 25 kPa, or 3.6 psi.

(5) Output pressure confirmation.
Read the output pressure on output pressure indicator ⑥. When output pressure falls between 0.55 and 0.60 kgf/cm^2 (0.55 and 0.60 bar, 55 and 60 kPa, or 7.8 and 8.5 psi), apply air pressure at 0 and 1.4 kgf/cm^2 (0 and 1.4 bar, 0 and 140 kPa, or 0 and 20 psi) by one cycle the same as step (2). Next, confirm that output pressure falls between 0.55 and 0.60 kgf/cm^2 (0.55 and 0.60 bar, 55 and 60 kPa, or 7.8 and 8.5 psi) under the same condition as step (4). When the output pressure falls within this range, output adjustment is completed, but if it does not, perform output pressure adjustment as per step (6).

(6) Output pressure adjustment.
   a. Close the air supply valve.
   b. Remove plug ⑨ using a 3/16" Allen wrench.
   c. Insert a screwdriver in the plug hole and turn the tension adjustment (turn it clockwise to decrease output, and counterclockwise to increase output).
   d. Install plug ⑨.
   e. Repeat steps (2) through (6).

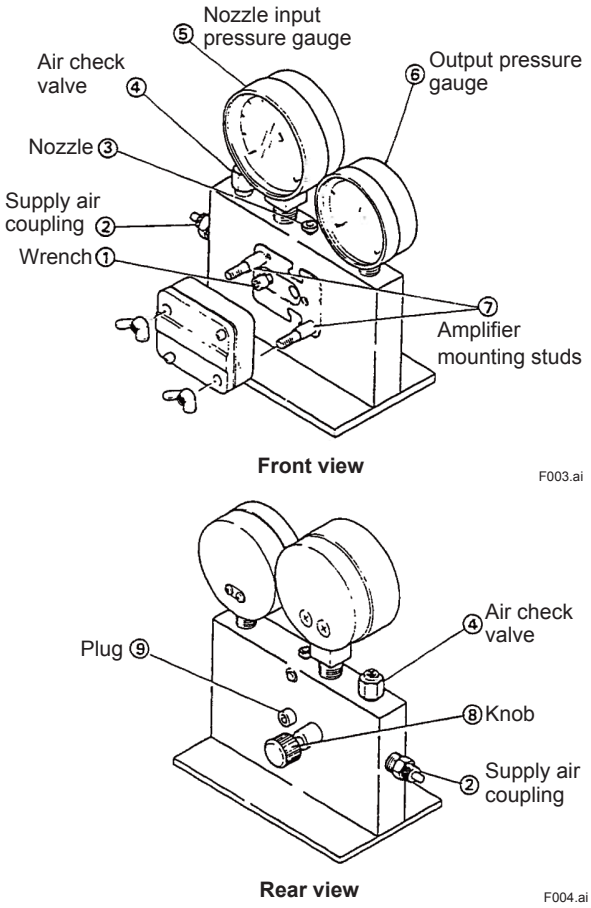
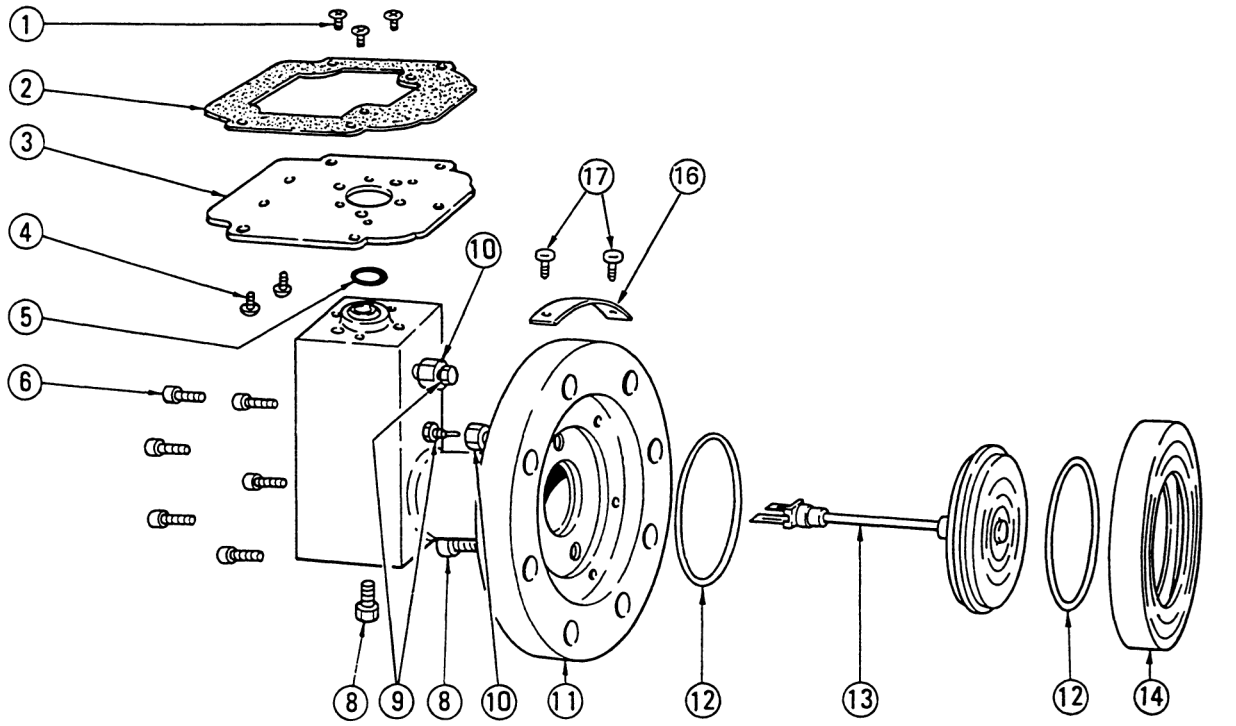


Figure A3. Model 6971 Pneumatic Amplifier Calibrator

NOTE: The above amplifier output pressure adjustment can be performed by removing the amplifier from the calibrator.

Customer Maintenance Parts List

Model Y/15FA (Style C)
Pneumatic Flange Mounting
Differential Pressure Transmitter



Item	Part No.	Qty	Description
1	0012691	3	8-32×3/8 F.H.Screw
2	F9100AT	1	Gasket
3	U0102RC	1	Plate
4	X0100SB	2	1/4-28×3/8 R.H.Screw
5	Below	1	*O-Ring
	U0102MY		Silicone Elastomer (standard)
	0051652		Glass Fiber Filled Teflon (to 190°C)
	F9101ZJ		Glass Fiber Filled Teflon (clean for oxygen service)
6	X0100YC	6	Screw (SCM435)
8	Below	2	Plug (SUS316 Stainless Steel)
	F9200CS		JIS connection
	D0114RZ		ANSI connection
9	D0114PB	2	Vent Screw (SUS316 Stainless steel)
10	F9101AB	2	Vent Plug (JIS connection) (SUS316B)
	D0114PA	2	Vent Plug (ANSI connection) (SUS316B)
11	See Table1	1	Flange Assembly
12	F9202QW	2	*Gasket (standard)
	F9101ZL	2	*Gasket (clean for oxygen service)
13	Below	1	Capsule Assembly
	N0150XT		Standard
	N0151VB		Clean for oxygen service
	F9200GA		High viscosity fill
14	D0120PP	1	Ring (SUS316 Stainless Steel)
16	Below	1	Tag Plate (blank)
	D0117BP		Standard
	F9146NS		Clean for Oxygen Service
17	0046879	2	Self-tapping Screw
-	F9145FX	1	FEP Teflon Diaphragm Protector
-	F9145YN	2	Oil, 15cc (for protector)

Table 1. Flange Assembly Part Number

Flange Rating	Material: SUS 316 Stainless Steel	
	JIS Connection	ANSI Connection
JIS 10K-150A ANSI 6"-150 lb	F9101HF F9101HB	— A072317

*Denotes parts more frequently replaced.

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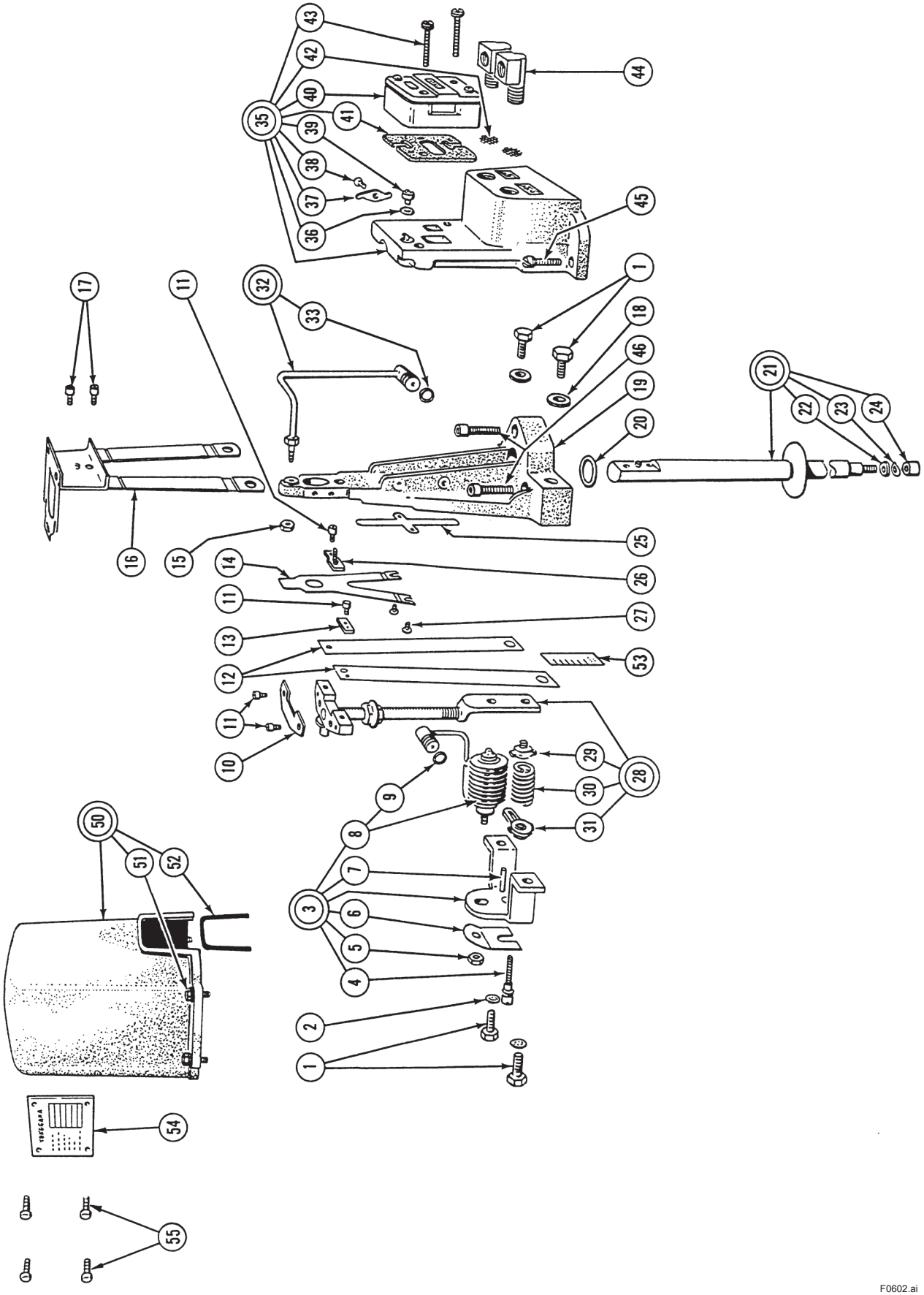
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Force Balance Unit (items 1 through 33)

Part No.N0999SL: with Stainless Steel Force Bar (standard)

Part No.N0999SG: Low Spans
(for Model Y/15FA-□ /LD)

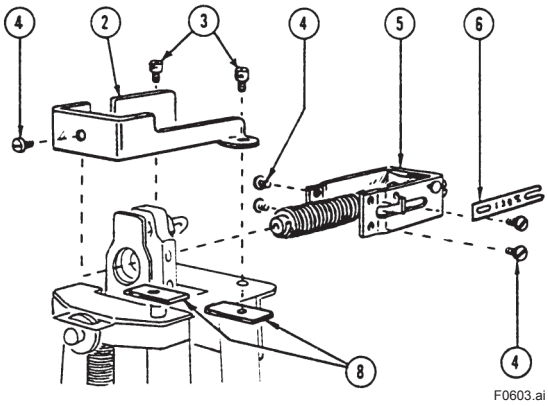
Item	Part No.	Qty	Description
1	U0102LN	4	1/4-28 × 1/2 Hex H.Screw
2	0048219	2	Lockwasher
3	U0119TA	1	Bracket Assembly (N0999SL)
	U0119TF	1	Bracket Assembly (N0999SG)
4	U0102FY	1	Screw
5	0017611	1	Nut
6	U0102FZ	1	Spring
7	U0102NA	1	Pin
8	U0119TC	1	Bellows Assembly (N0999SL)
9	D0123MZ	1	*O-Ring
8	U0119TG	1	Bellows Assembly (N0999SG)
9	D0123MZ	1	*O-Ring
10	U0102KP	1	Plate
11	X0100MK	4	6-32 × 3/16 Socket H.Cap Screw
12	U0102KL	2	Flexure
13	U0102LP	1	Plate
14	N0999MH	1	Flapper
15	X0104EB	1	Nut
16	N0999FM	1	Flexure Assembly
17	X0100ML	2	8-32 × 1/4 Socket H.Cap Screw
18	X0166MX	2	Washer
19	N0999ML	1	Base
20	N0143XN	1	O-Ring
21	N0143MK	1	Force Bar Assembly (SUS 316 s.s.)
22	N0143SB	1	Washer (SUS 316 s.s.)
23	U0102MX	1	Dished Washer (cobalt alloy)
24	U0102LE	1	Nut (SUS 316 s.s.)
25	N0142NY	1	Spacer
26	U0102TE	1	Bracket Assembly
27	0023442	2	3-48 × 3/16 Fil.H.Screw
28	N0999MP	1	Range Bar Assembly (N0999SG)
	N0999QA	1	Range Bar Assembly (N0999SL)
29	U0102KR	1	Spring Holder
30	N0999MG	1	Spring (N0999QA)
	N0999MC	1	Spring (N0999MP)
31	U0102KC	1	Spring Holder
32	U0119TB	1	*Nozzle Assembly
33	D0123MZ	1	*O-Ring

Other Parts (items 35 through 55)

Item	Part No.	Qty	Description
35	D0124JD	1	Relay Mounting Assembly (ANSI connection)
	F9101DF	1	Relay Mounting Assembly (JIS connection)
36	A037744	1	*O-Ring
37	U0102MF	1	Clamp
38	X0100AA	1	6-32 × 7/32 Fil.H.Screw
39	D0124JG	1	*Restrictor
40	F9138YA	1	*Pneumatic Amplifier,80A
41	C0100EM	1	*Gasket
42	U0103FP	2	*Screen
43	X0116CS	2	10-32 × 1 Pan H.Screw
44	0050506	2	Elbow (ANSI connection)
	0050509	2	Elbow (JIS connection)
45	0006535	2	10-32 × 3/4 Fil.H.Screw
46	X0100YC	3	1/4-28 × 7/8 Cap Screw
50	U0102MM	1	Cover Assembly
51	X0100RP	4	10-32 × 9/16 Hex H.Screw
52	U0102MS	1	Gasket
53	Below	1	Scale
	F9103AD		Standard (kPa)
	D0117TX		(psi)
	D0117TX-J		(kgf/cm^2)
54	—	1	Data Plate
55	0046879	4	Self-tapping Screw

* Denotes parts more frequently replaced.

Zero Elevation Kit (Suffix Code : L)



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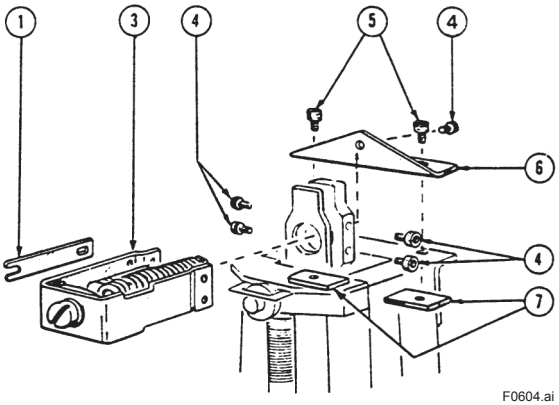
Item	Part No.	Qty	Description
-	U0122BS	1	Zero Elevation Kit
2	U0122BT	1	Bracket
3	A0100YC	2	6-32 × 1/4 Socket H.Screw
4	F9147CV	5	5-40 × 5/32 Pan H.Screw
5	U0122BB	1	Spring Assembly
6	U0102TF	1	Scale (MIN-MAX)
8	N0138BS	2	Plate

Zero Suppression Kit (Suffix Code : R)



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Item	Part No.	Qty	Description
-	U0122BA	1	Zero Suppression Kit
1	U0102TF	1	Scale (MIN-MAX)
3	U0122BB	1	Spring Assembly
4	F9147CV	5	5-40 × 3/16 Socket H.Screw
5	A0100YC	2	6-32 × 1/4 Socket H.Screw
6	U0102RW	1	Bracket
7	N0138BS	2	Plate

Integral Air Filter Set

Item	Part No.	Qty	Description
1	F9140DA-B	1	Filter Regulator (JIS connection)
	F9140DB-B	1	Filter Regulator (ANSI connection)
2	0050392	1	Elbow Assembly (JIS connection) (prior to Aug.1987)
	0050332	1	Elbow Assembly (ANSI connection) (prior to Aug.1987)
	G9611CD	1	Elbow Assembly (JIS connection) (since Aug.1987)
	G9611CN	1	Elbow Assembly (ANSI connection) (since Aug.1987)
3	0051237	1	Tube (prior to Aug.1987)
	F9101FM	1	Tube (since Aug.1987)
4	0050386	1	Connector Assembly (JIS connection) (prior to Aug.1987)
	0050325	1	Connector Assembly (ANSI connection) (prior to Aug.1987)
	G9611AD	1	Connector Assembly (JIS connection) (since Aug.1987)
	G9611AW	1	Connector Assembly (ANSI connection) (since Aug.1987)
5	F9145BF	1	Plug (JIS connection)
	D0114PN	1	Plug (ANSI connection)
6	0041292	2	1/4-28×3/8 R.H.Screw
7	U0123AF	1	Bracket
8	0040190	2	1/4-20 × 3/8 F.H.Screw
9	See Table 2	1	Pressure Gauge
10	Below	1	Elbow
	G9612DB		For JIS connection } Prior to
	G9612DD		For ANSI connection } Apr.1998
	F9140FH		For JIS connection } Since
	F9140FJ		For ANSI connection } Apr.1998

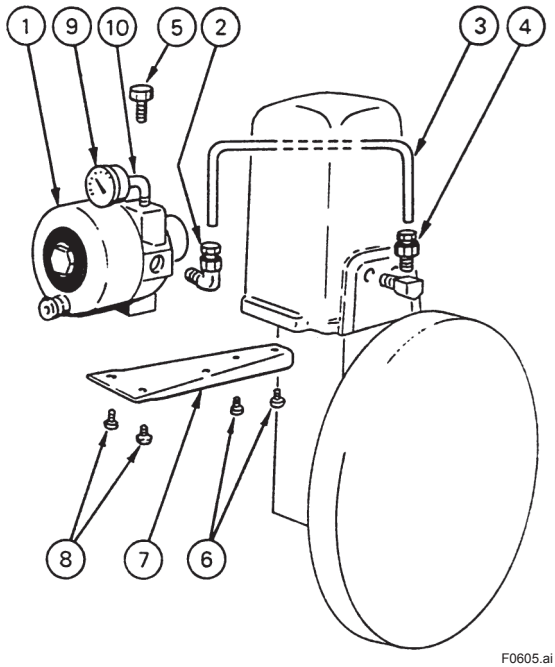

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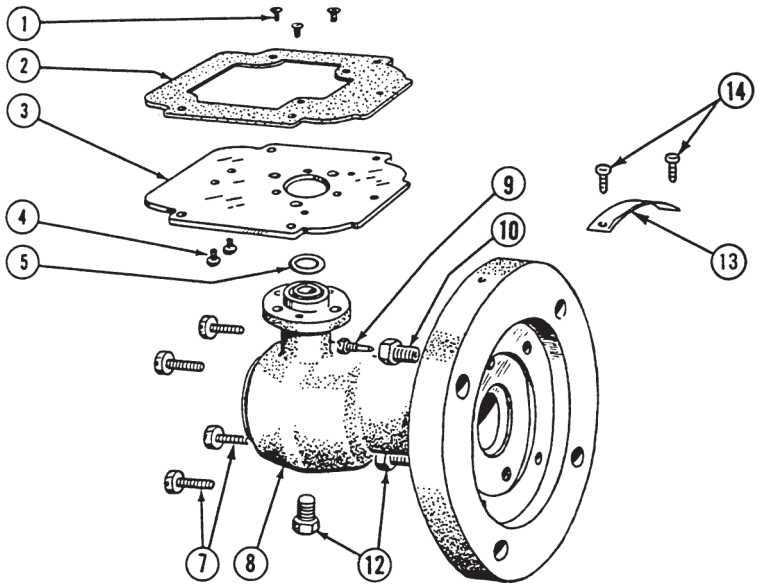
Table 2. Pressure Gauge

Suffix Code	Prior to Apr.1998	Since Apr.1998
/G(N)AS-FM	G9615AA	G9615AT
/G(N)AS-FE	G9615AE	G9615EK
/G(N)AS-FP(0 to 200 kPa)	G9615AH	G9615EA
/G(N)AS-FB(0 to 2 bar)	G9615AM	G9615EC

Note) In order for gauge shipped befor April, 1998 to be replaced, please use gauge and elbow, which part numbers are effective April, 1998.

Customer Maintenance Parts List

Models Y/13FA and Y/13FEA (Style C)
Pneumatic Flange Mounting
Differential Pressure Transmitters



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Item	Part No.	Qty	Description
1	0012691	3	8-32×3/8 F.H.Screw
2	F9100AT	1	Gasket
3	U0102RC	1	Plate
4	X0100SB	2	1/4-28×3/8 R.H.Screw
5	Below	1	*O-Ring
	U0102MY		Silicone Elastomer (standard)
	0051652		Glass Fiber Filled Teflon (to 190°C)
	F9101ZJ		Glass Fiber Filled Teflon (clean for oxygen service)
7	Below	4	Cap Screw (SCM435)
	X0100YC		For Model Y/13FA
	X0100YW		For Model Y/13FEA, JIS
	F9147AE		For Model Y/13FEA, ANSI 150 lbs
	X0100MM		For Model Y/13FEA, ANSI 300 lbs
8	—	1	Flange Assembly (see Page 2 or 3)

Item	Part No.	Qty	Description
9	D0114PB	1	Vent Screw (SUS316 Stainless steel)
10	F9101AB	1	Vent Plug (JIS connection) (SUS316B s.s)
	D0114PA	1	Vent Plug (ANSI connection) (SUS316B s.s)
12	Below	2	Plug(SUS316 Stainless Steel)
	F9200CS		JIS connection
	D0114RZ		ANSI connection
13	Below	1	Tag Plate
	D0117BP		Standard
	F9145NS		Clean for Oxygen Service (for model Y/13FA)
	F9147WP		Clean for Oxygen Service (for model Y/13FEA)
14	0046879	2	Screw
-	Below	1	FEP Teflon Diaphragm Protector
	F9145AL		For Model Y/13FA Medium Range
	F9145AM		For Model Y/13FA High Range
-	F9145YN	1	Oil,15 cc (for protector)

* Denotes parts more frequently replaced.

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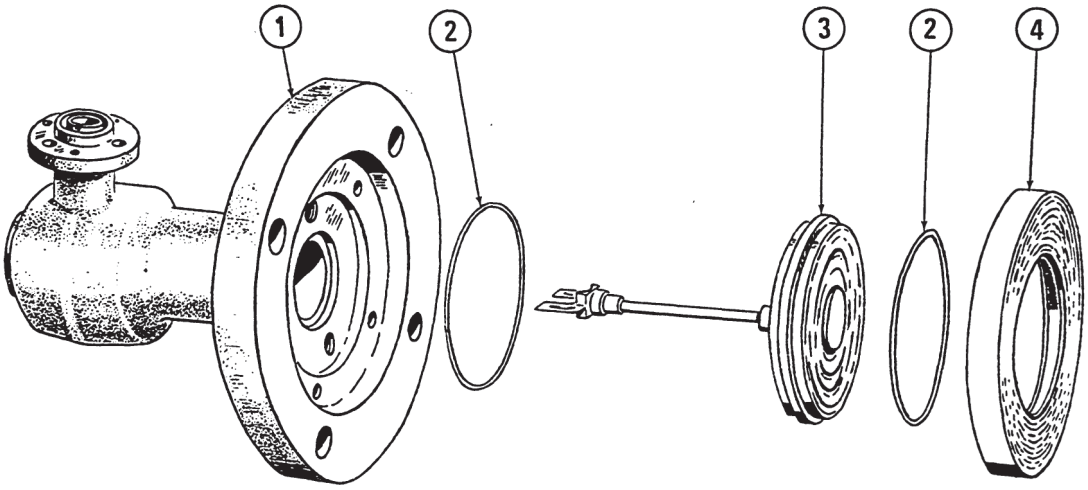
Model Y/13FA Flanged Cells



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Item	Part No.	Qty	Description
1	See Table 1	1	Flange Assembly
2	Below	2	Gasket
	F9202XQ		Teflon Coating SUS 316L S.S. (standard)
	D0114TP		Teflon (PTFE)
	F9101ZK		Teflon Coating SUS 316L S.S. (clean for oxygen service)
3	See Table 2	1	Diaphragm Assembly
4	See Table 3	1	Ring

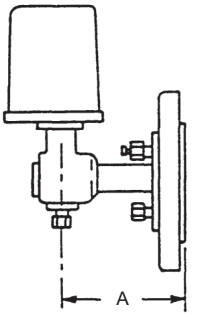

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Table 1. Flange Assembly Part Number.

Extension A	Flange Rating	Body Material (SUS 316 Stainless Steel)	
		JIS Connection	ANSI Connection
5"	JIS 10K-80A ANSI 3"-150 lb JIS 20K-80A ANSI 3"-300 lb	F9101BQ F9101BB F9101HK F9101BE	— D0117ZE — D0120EB
8"	JIS 10K-80A ANSI 3"-150 lb JIS 20K-80A ANSI 3"-300 lb	F9101BR F9101BD F9101HL F9101BF	— D0120BL — D0120EF

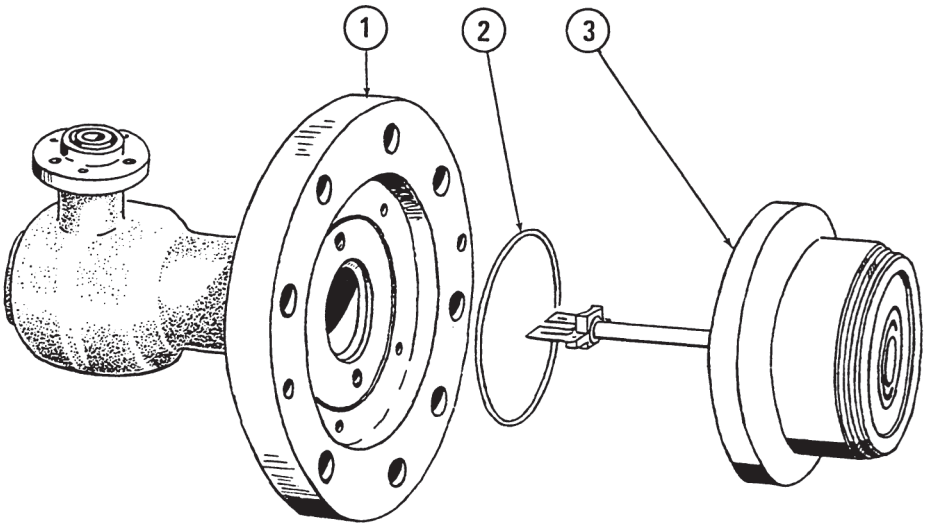
Table 2. Diaphragm Assembly Part Number.

Extension A	Body Material (SUS 316 Stainless Steel)		Wetted Parts Material
	Medium Range	High Range	
5"	F9200PA F9200XW F9200TN F9200WH A0104XE	F9200PN N0151UY — A081815 —	SUS 316L S.S.(standard) SUS 316L S.S.(for oxygen service) SUS 316L S.S.(high viscosity fill) Hastelloy C (D-CSC) Tantalum Sheathed (D-TSO)
8"	F9200PB F9200XX F9200WL F9200HR	F9200PP N0151VA A092353 —	SUS 316L S.S.(standard) SUS 316L S.S.(for oxygen service) Hastelloy C (D-CSC) Tantalum Sheathed (D-TSO)

Table 3. Retaining Ring Part Number.

Part No.	Material
D0117CZ	SUS 316L S.S. (standard)
D0120RZ	Tantalum Sheathed (RR-T)
D0120CZ	Hastelloy C (RR-C)

Model Y/13FEA Flanged Cells with Capsule Extension



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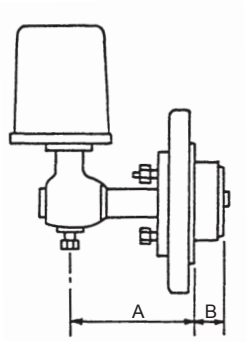

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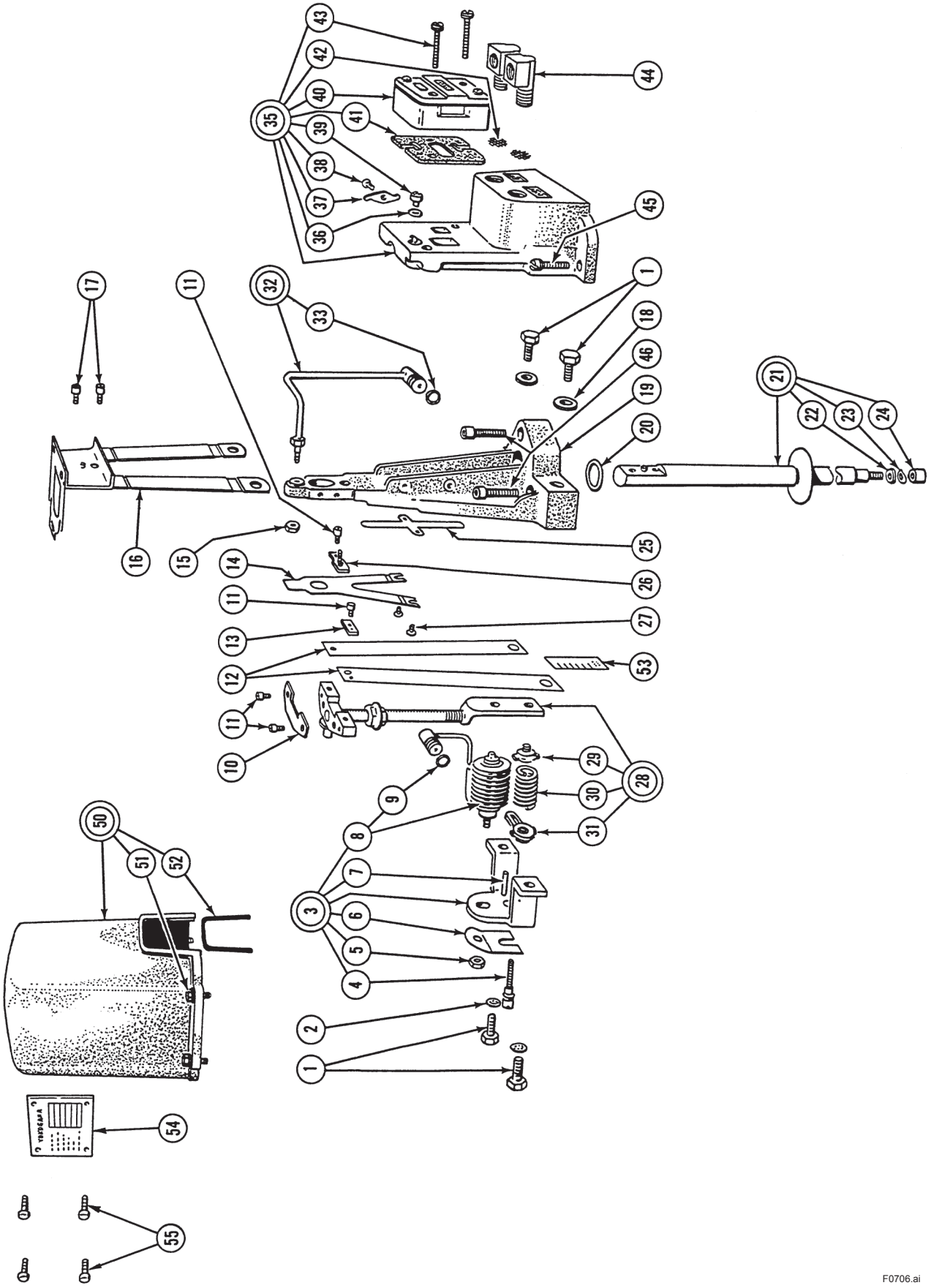
Item	Part No.	Qty	Description
1	See Table 4	1	Flange Assembly
2	D0120FF	1	Gasket (standard)
	A090658	1	Gasket (to 190°C)
	F9101ZW	1	Gasket (clean for oxygen service)
3	See Table 5	1	Extended Diaphragm Assembly

Table 4. Flange Assembly Part Number.

Extension A	Flange Rating	Body Material (SUS 316 Stainless Steel)	
		JIS Connection	ANSI Connection
5"	JIS 10K-100A ANSI 4"-150 lb JIS 20K-100A ANSI 4"-300 lb	F9101CN F9101CB F9101CS F9101CC	— D0120BX — A081696

Table 5. Diaphragm Assembly Part Number.

Extension B	Body Material (SUS 316 Stainless Steel)		Wetted Parts Material
	Medium Range	High Range	
2" 4" 6"	F9100LA F9100LF F9100LK	F9200FG F9200FH F9200FJ	SUS 316L Stainless Steel SUS 316L Stainless Steel SUS 316L Stainless Steel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Force Balance Unit (items 1 through 33)

Part No.N0999SH: with Stainless Steel Force Bar (standard)

Part No.N0999SE: Low Spans (for Models Y/13FA-□ /LD and Y/13FEA-□ /LD)

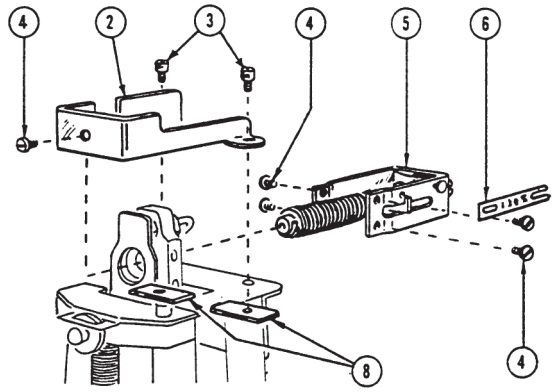
Item	Part No.	Qty	Description
1	U0102LN	4	1/4-28 × 1/2 Hex H.Screw
2	0048219	2	Lockwasher
3	U0119TA	1	Bracket Assembly (N0999SH)
	U0119TF	1	Bracket Assembly (N0999SE)
4	U0102FY	1	Screw
5	0017611	1	Nut
6	U0102FZ	1	Spring
7	U0102NA	1	Pin
8	U0119TC	1	Bellows Assembly (N0999SH)
9	D0123MZ	1	*O-Ring
8	U0119TG	1	Bellows Assembly (N0999SE)
9	D0123MZ	1	*O-Ring
10	U0102KP	1	Plate
11	X0100MK	4	6-32 × 3/16 Socket H.Cap Screw
12	U0102KL	2	Flexure
13	U0102LP	1	Plate
14	N0999MH	1	Flapper
15	X0104EB	1	Nut
16	N0999FM	1	Flexure Assembly
17	X0100ML	2	8-32 × 1/4 Socket H.Cap Screw
18	X0166MX	2	Washer
19	N0999ML	1	Base
20	N0143XN	1	O-Ring
21	N0143NL	1	Force Bar Assembly (SUS 316 s.s.)
22	N0143SB	1	Washer (SUS 316 s.s.)
23	U0102MX	1	Dished Washer (cobalt alloy)
24	U0102LE	1	Nut (SUS 316 s.s.)
25	N0142NY	1	Spacer
26	U0102TE	1	Bracket Assembly
27	0023442	2	3-48 × 3/16 Fil.H.Screw
28	N0999MP	1	Range Bar Assembly (N0999SE)
	N0999QA	1	Range Bar Assembly (N0999SH)
29	U0102KR	1	Spring Holder
30	N0999MG	1	Spring (N0999QA)
	N0999MC	1	Spring (N0999MP)
31	U0102KC	1	Spring Holder
32	U0119TB	1	*Nozzle Assembly
33	D0123MZ	1	*O-Ring

Other Parts (items 35 through 55)

Item	Part No.	Qty	Description
35	D0124JD	1	Relay Mounting Assembly (ANSI connection)
	F9101DF	1	Relay Mounting Assembly (JIS connection)
36	A037744	1	*O-Ring
37	U0102MF	1	Clamp
38	X0100AA	1	6-32 × 7/32 Fil.H.Screw
39	D0124JG	1	*Restrictor
40	F9138YA	1	*Pneumatic Amplifier, 80A
41	C0100EM	1	*Gasket
42	U0103FP	2	*Screen
43	X0116CS	2	10-32 × 1 Pan H.Screw
44	0050506	2	Elbow (ANSI connection)
	0050509	2	Elbow (JIS connection)
45	0006535	2	10-32 × 3/4 Fil.H.Screw
46	X0100YC	3	1/4-28 × 7/8 Cap Screw
50	U0102RA	1	Cover Assembly
51	X0100RP	4	10-32 × 9/16 Hex H.Screw
52	U0102MS	1	Gasket
53	Below	1	Scale
	F9103AE		for M Range (kPa) standard
	F9103AF		for H Range (kPa) standard
	D0117BL		for M Range (psi)
	D0117FC		for H Range (psi)
	D0117BL-J		for M Range (kgf/cm^2)
	D0117FC-J		for H Range (kgf/cm^2)
54	—	1	Data Plate
55	0046879	4	Self-tapping Screw
—	N0138GA	1	Dashpot Assembly (not shown) (clean for oxygen service)

* Denotes parts more frequently replaced.

Zero Elevation Kit (Suffix Code : L)



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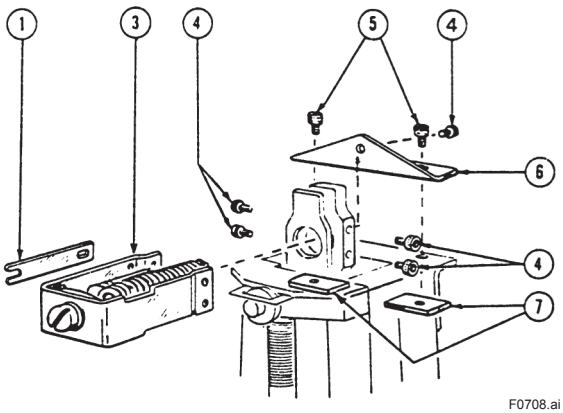
Item	Part No.	Qty	Description
-	U0122BS	1	Zero Elevation Kit
2	U0122BT	1	Bracket
3	A0100YC	2	6-32 × 1/4 Socket H.Screw
4	F9147CV	5	5-40 × 5/32 Pan H.Screw
5	U0122BB	1	Spring Assembly
6	U0102TF	1	Scale (MIN-MAX)
8	N0138BS	2	Plate

Zero Suppression Kit (Suffix Code : R)



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Item	Part No.	Qty	Description
-	U0122BA	1	Zero Suppression Kit
1	U0102TF	1	Scale (MIN-MAX)
3	U0122BB	1	Spring Assembly
4	F9147CV	5	5-40 × 3/16 Socket H.Screw
5	A0100YC	2	6-32 × 1/4 Socket H.Screw
6	U0102RW	1	Bracket
7	N0138BS	2	Plate

Integral Air Filter Set

Item	Part No.	Qty	Description
1	F9140DA-B	1	Filter Regulator (JIS connection)
	F9140DB-B	1	Filter Regulator (ANSI connection)
2	0050392	1	Elbow Assembly (JIS connection) (prior to Aug.1987)
	0050332	1	Elbow Assembly (ANSI connection) (prior to Aug.1987)
	G9611CD	1	Elbow Assembly (JIS connection) (since Aug.1987)
	G9611CN	1	Elbow Assembly (ANSI connection) (since Aug.1987)
3	0051237	1	Tube (prior to Aug.1987)
	F9101FM	1	Tube (since Aug.1987)
4	0050386	1	Connector Assembly (JIS connection) (prior to Aug.1987)
	0050325	1	Connector Assembly (ANSI connection) (prior to Aug.1987)
	G9611AD	1	Connector Assembly (JIS connection) (since Aug.1987)
	G9611AW	1	Connector Assembly (ANSI connection) (since Aug.1987)
5	F9145BF	1	Plug (JIS connection)
	D0114PN	1	Plug (ANSI connection)
6	0041292	2	1/4-20×3/8 R.H.Screw
7	U0123AF	1	Bracket
8	0040190	2	1/4-20 × 3/8 F.H.Screw
9	See Table 6	2	Pressure Gauge
10	Below	1	Elbow
	G9612DB		For JIS connection } Prior to
	G9612DD		For ANSI connection } Apr.1998
	F9140FH		For JIS connection } Since
	F9140FJ		For ANSI connection } Apr.1998

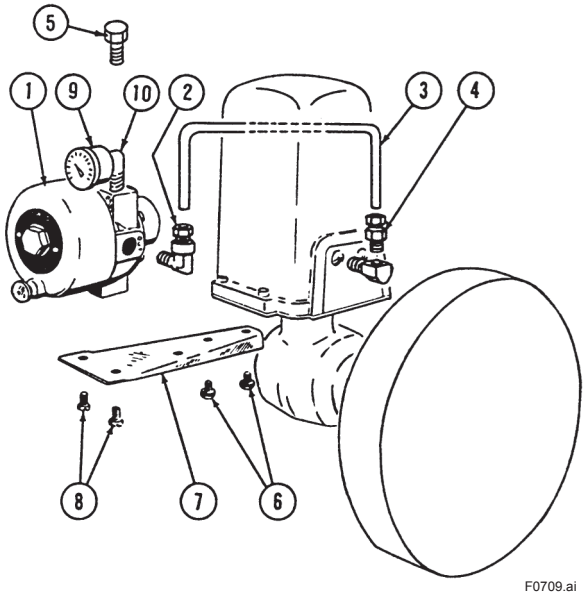

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Table 6. Pressure Gauge

Suffix Code	Prior to Apr.1998	Since Apr.1998
/G(N)AS-FM	G9615AA	G9615AT
/G(N)AS-FE	G9615AE	G9615EK
/G(N)AS-FP(0 to 200 kPa)	G9615AH	G9615EA
/G(N)AS-FB(0 to 2 bar)	G9615AM	G9615EC

Note) In order for gauge shipped befor April, 1998 to be replaced, please use gauge and elbow, which part numbers are effective April, 1998.