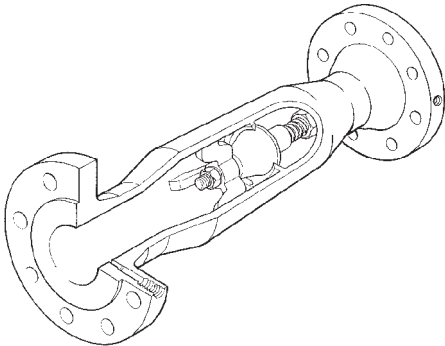


Gilflo 'B' type Flowmetering Systems

Installation and Maintenance Instructions





1. Safety information
2. General system information
3. General product information
4. Mechanical installation of Gilflo pipeline unit
5. Impulse lines
6. Maintenance
7. Initial start-up
8. Fault finding

1. Safety information

Safe operation of these products can only be guaranteed if they are properly installed, commissioned, used and maintained by qualified personnel (see Section 1.11 on this document) in compliance with the operating instructions. General installation and safety instructions for pipeline and plant construction, as well as the proper use of tools and safety equipment must also be complied with.

1.1 Intended use

Referring to the Installation and Maintenance Instructions, name-plate and Technical Information Sheet, check that the product is suitable for the intended use/application.

The products listed below comply with the requirements of the Pressure Equipment Directive (PED) and carry the  /  mark when so required.

The products fall within the following Pressure Equipment Directive categories:

Product			Group 1 Gases	Group 2 Gases	Group 1 Liquids	Group 2 Liquids
Gilflo 'B'	DN50 - 80	PN40) ASME 300	2	1	-	SEP
	DN100 - 150	PN40) ASME 300	3	3	-	SEP
	DN200 - 400	PN40) ASME 300	3	3	-	1

- i) The products have been specifically designed for use on steam, air or condensate which are in Group 2 of the above mentioned Pressure Equipment Directive. It can also be used on propane or methane gases which are in Group 1 of the above mentioned Pressure Equipment Directive. The products' use on other fluids may be possible but, if this is contemplated, Spirax Sarco should be contacted to confirm the suitability of the product for the application being considered.
- ii) Check material suitability, pressure and temperature and their maximum and minimum values. If the maximum operating limits of the product are lower than those of the system in which it is being fitted, or if malfunction of the product could result in a dangerous overpressure or overtemperature occurrence, ensure a safety device is included in the system to prevent such over-limit situations.
- iii) Determine the correct installation situation and direction of fluid flow.
- iv) Spirax Sarco products are not intended to withstand external stresses that may be induced by any system to which they are fitted. It is the responsibility of the installer to consider these stresses and take adequate precautions to minimise them.
- v) Remove protection covers from all connections and protective film from all name-plates, where appropriate, before installation on steam or other high temperature applications.

1.2 Access

Ensure safe access and if necessary a safe working platform (suitably guarded before attempting to work on the product. Arrange suitable lifting gear if required.

1.3 Lighting

Ensure adequate lighting, particularly where detailed or intricate work is required.

1.4 Hazardous liquids or gases in the pipeline

Consider what is in the pipeline or what may have been in the pipeline at some previous time. Consider: flammable materials, substances hazardous to health, extremes of temperature.

1.5 Hazardous environment around the product

Consider: explosion risk areas, lack of oxygen (e.g. tanks, pits), dangerous gases, extremes of temperature, hot surfaces, fire hazard (e.g. during welding), excessive noise, moving machinery.

1.6 The system

Consider the effect on the complete system of the work proposed. Will any proposed action (e.g. closing isolation valves, electrical isolation) put any other part of the system or any personnel at risk?

Dangers might include isolation of vents or protective devices or the rendering ineffective of controls or alarms. Ensure isolation valves are turned on and off in a gradual way to avoid system shocks.

1.7 Pressure systems

Ensure that any pressure is isolated and safely vented to atmospheric pressure. Consider double isolation (double block and bleed) and the locking or labelling of closed valves. Do not assume that the system has depressurised even when the pressure gauge indicates zero.

1.8 Temperature

Allow time for temperature to normalise after isolation to avoid danger of burns.

1.9 Tools and consumables

Before starting work ensure that you have suitable tools and / or consumables available. Use only genuine Spirax Sarco replacement parts.

1.10 Protective clothing

Consider whether you and/or others in the vicinity require any protective clothing to protect against the hazards of, for example, chemicals, high/low temperature, radiation, noise, falling objects, and dangers to eyes and face.

1.11 Permits to work

All work must be carried out or be supervised by a suitably competent person. Installation and operating personnel should be trained in the correct use of the product according to the Installation and Maintenance Instructions.

Where a formal 'permit to work' system is in force it must be complied with. Where there is no such system, it is recommended that a responsible person should know what work is going on and, where necessary, arrange to have an assistant whose primary responsibility is safety.

Post 'warning notices' if necessary.

1.12 Handling

Manual handling of large and/or heavy products may present a risk of injury. Lifting, pushing, pulling, carrying or supporting a load by bodily force can cause injury particularly to the back. You are advised to assess the risks taking into account the task, the individual, the load and the working environment and use the appropriate handling method depending on the circumstances of the work being done.

1.13 Residual hazards

In normal use the external surface of the product may be very hot. If used at the maximum permitted operating conditions the surface temperature of some products may reach temperatures of 450 °C (842 °F).

Many products are not self-draining. Take due care when dismantling or removing the product from an installation (refer to 'Maintenance instructions').

1.14 Freezing

Provision must be made to protect products which are not self-draining against frost damage in environments where they may be exposed to temperatures below freezing point.

1.15 Disposal

Unless otherwise stated in the Installation and Maintenance Instructions, this product is recyclable and no ecological hazard is anticipated with its disposal providing due care is taken.

1.16 Returning products

Customers and stockists are reminded that under EC Health, Safety and Environment Law, when returning products to Spirax Sarco they must provide information on any hazards and the precautions to be taken due to contamination residues or mechanical damage which may present a health, safety or environmental risk. This information must be provided in writing including Health and Safety data sheets relating to any substances identified as hazardous or potentially hazardous.

2. General system information

2.1 Introduction

This booklet gives full details of the recommended procedures for the installation and maintenance of the Spirax Sarco Gilflo flowmeter. Abbreviated details of how to install the M610 transmitter assembly, EL2600 pressure transmitter and EL2271 temperature transmitter are also given (full details are supplied with the equipment).

Initial start-up procedures as well as fault finding guidelines are also included.

2.2 The Spirax Sarco Gilflo flowmetering system consists of 3 major parts:

2.2.1 The Gilflo pipeline unit

This is installed in the line where the flow is to be measured. Using impulse pipework, this is connected to:

2.2.2 The M610 transmitter assemblies

The M610 measures the differential pressure across the Gilflo pipeline unit and converts it to a 4-20 mA output signal for onward transmission to other equipment.

2.2.3 Readout equipment

This can be either an M850 flow computer or an M750 display unit for non density compensated applications on steam, liquids or gases. Note that all these items of equipment are used to linearise the output signal from the Gilflo pipeline unit.

Caution: M750 display units can be uniquely configured at the factory to work with a single, specific Gilflo flowmeter. For correct operation a configured M750 display must always be installed with its allocated flowmeter. Labels on the packaging give the serial numbers of the matched products.

2.3 Additional equipment

2.3.1 F50C isolation valves which are installed close to the Gilflo unit to provide primary isolation.

2.3.2 EL2600 pressure transmitter which is connected to the impulse lines using a 'tee' piece in the high pressure (upstream) impulse line. This gives a 4-20 mA output signal proportional to line pressure and is used where density compensation based on pressure is required.

2.3.3 EL2271 temperature transmitter which is installed directly in the pipework upstream of the Gilflo pipeline unit. This gives a 4-20 mA signal proportional to line temperature and is used where density compensation based on temperature is required.

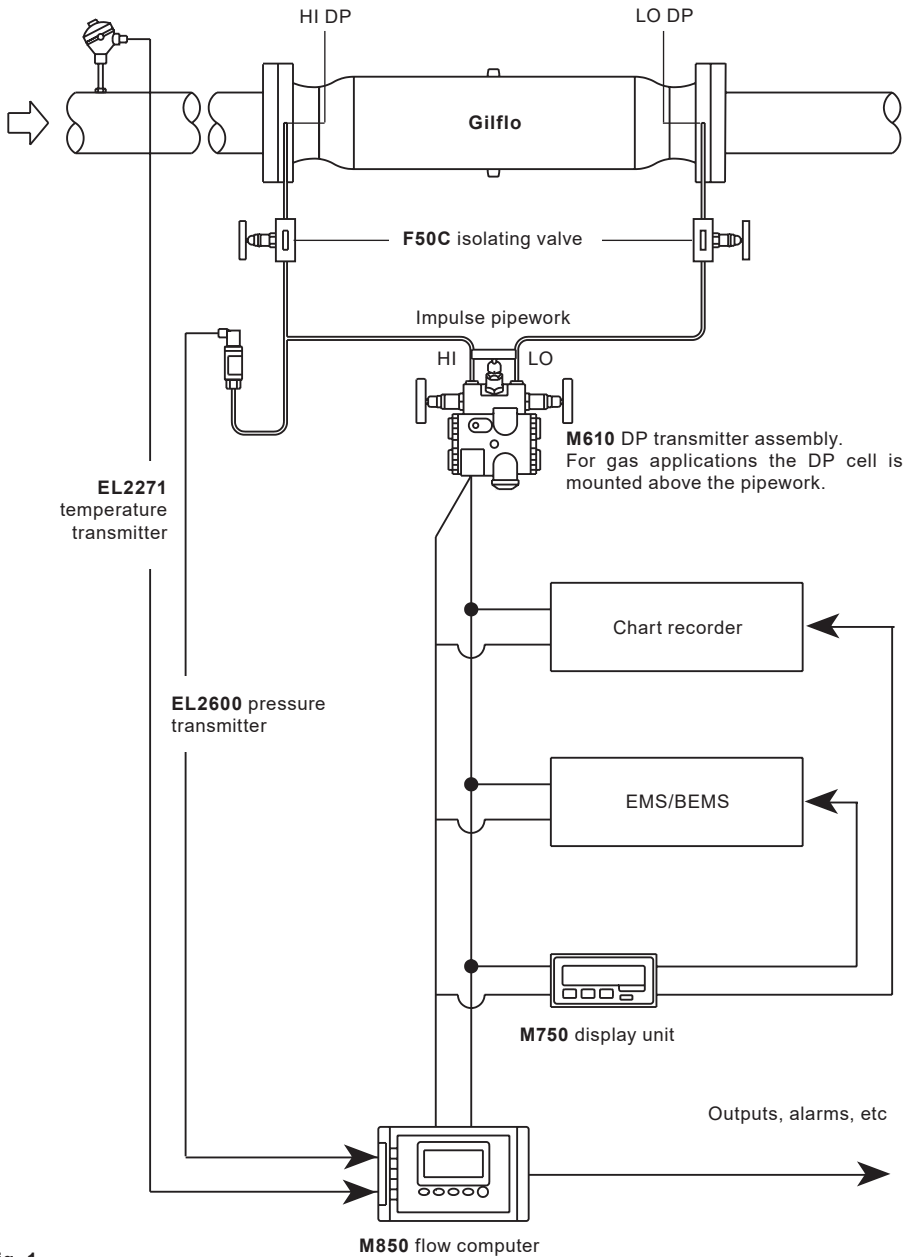


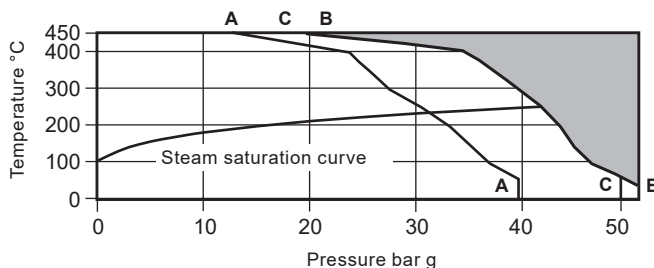
Fig. 1

3. General product information

3.1 Description

The Gilflo B pipeline units operate on the spring loaded variable area principle and supply a differential pressure signal which is proportional to the rate of flow through the unit. The pipeline unit is installed in the line where the flow is to be monitored. It can be used with most industrial fluids, gases and vapours.

3.2 Pressure/temperature limits



The product **must not** be used in this region.

- A - A** Flanged EN 1092-1 PN40
- B - B** Flanged ASME 300 DN50-DN300
- C - C** Flanged ASME 300 DN400

Body design conditions		ASME 300
PMA	Maximum allowable pressure	50 bar g @ 50°C
TMA	Maximum allowable temperature	450°C @ 20 bar g
Minimum allowable temperature		0°C
PMO	Maximum operating pressure	50 bar g @ 50°C
		DN400 49 bar g @ 50°C
Minimum operating pressure		0.6 bar g
TMO	Maximum operating temperature	450°C @ 20 bar g
Minimum operating temperature		0°C
Note: For lower operating temperatures consult Spirax Sarco.		
Maximum viscosity		30 centipoise
ΔPMX	Maximum differential pressure	349 m bar
Designed for a maximum cold hydraulic test pressure of:	ASME	78 bar g
	PN40	60 bar g

Note: On 'B' type flowmeters larger than DN150, a downstream steady and modified spring location are incorporated.

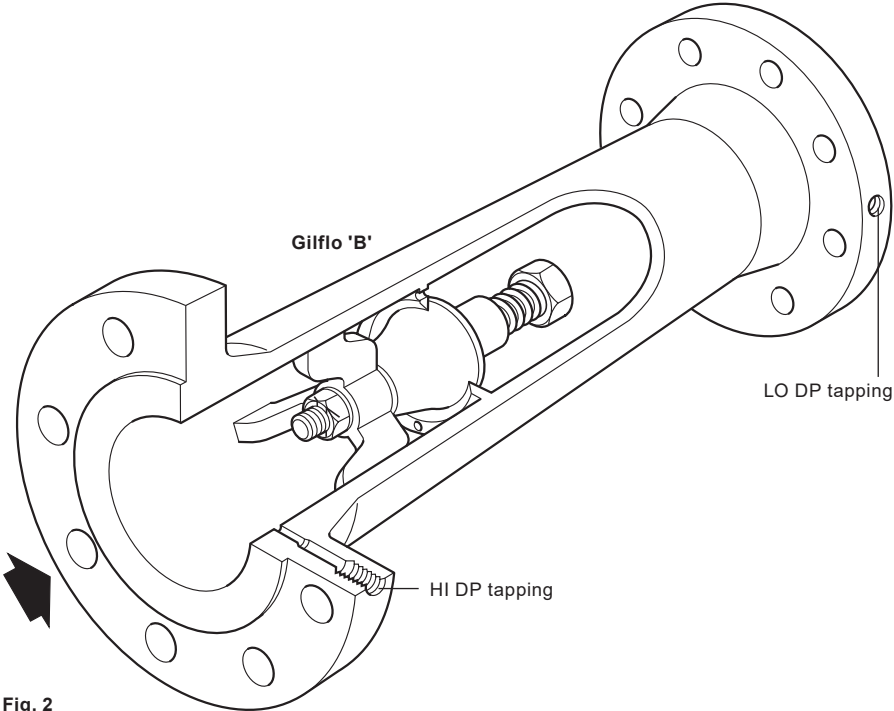


Fig. 2

3.3 Operating range

Pressure drop

Less than 140 inches H₂O (349 mbar) at rated capacity.

3.4 Materials

Body	Carbon steel ASTM A105/A106/A234
Internals	Mostly stainless steel S304/S316
Spring	Inconel X750

3.5 Sizes and pipe connections

DN50, 80, 100, 150, 200, 250, 300 and 400

Flanges available to EN 1092-1 PN40* and ASME B 16.5 class 300

3.6 Dimensions/weights (approximate) in mm and kg

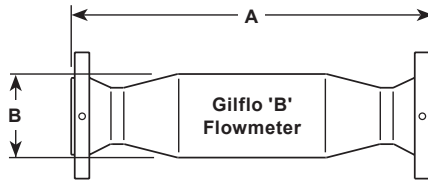


Table 1

Size	A	B	Weight
DN50	480	89	14
DN80	543	114	22
DN100	716	168	48
DN150	797	219	87
DN200	990	324	123
DN250	1458	406	257
DN300	1599	457	340
DN400	1995	610	900

Notes:

On the DN50 flowmeter, flanges to PN40 are thicker than standard (22.2 mm) to accommodate pressure tapplings.

On the DN400 flowmeter, the pressure tapplings are on the body.

HI and LO pressure tapplings are threaded ¼" NPT (female).

4. Mechanical installation of Gilflo pipeline unit

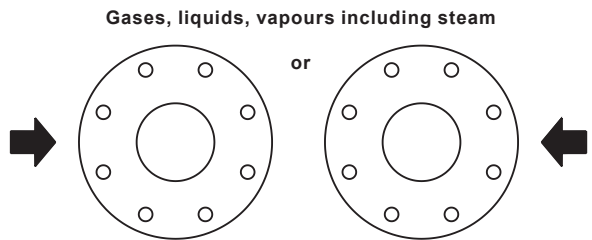
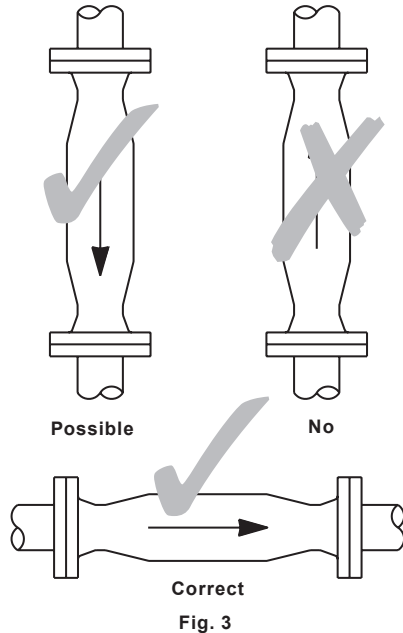
Caution: In order that the flowmeter can meet its specified accuracy and performance, it is essential that the following guidelines for installation are followed carefully. For steam flow measurement, good basic steam engineering practices should be adhered to - see Section 4.5. Ensure that all debris is removed from the line prior to and during installation of the Gilflo thus ensuring that no weld scale or other swarf can find its way into the unit.

4.1 Orientation

The Gilflo should be installed in a horizontal line. It is acceptable to mount the Gilflo vertically with downward flow. However it is essential that this is specified at the time of ordering. **Upward flow is not acceptable** (see Figure 3).

The Gilflo is clearly marked with a direction flow arrow.

For gas, liquid and vapour service (including superheated and saturated steam), the pressure tappings in the flanges should be positioned horizontally. (i.e. 3 o'clock or 9 o'clock, see Figure 4).



4.2 Upstream/downstream pipework

The Gilflo requires a minimum of 6 D (pipe diameters) upstream and 3 D downstream of clear straight pipe. These dimensions assume a measurement from a right angled bend in a single plane (see Figure 5).

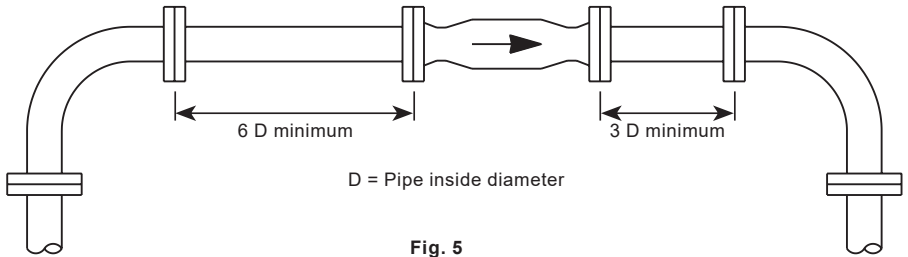
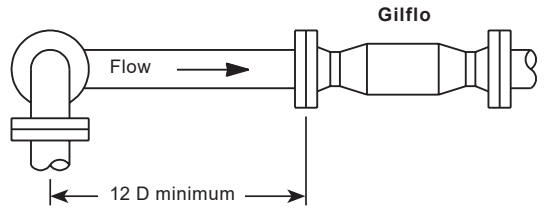


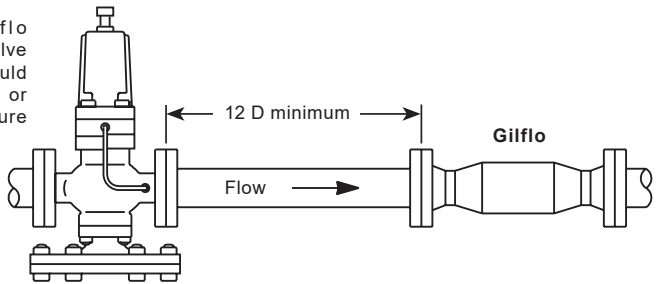
Fig. 5

If any of the following configurations are present upstream of the Gilflo, then it is recommended that the minimum upstream clear pipework is doubled to 12 diameters:

- Two right angled bends in two planes.
- Pressure reducing valve.
- Partly open valve.
- Pipe diameter cross sectional area changes.



Avoid installing the Gilflo downstream of an actuated valve as rapid cycling of the valve could give rise to inaccurate results or damage the flowmeter (see Figure 6).



D = Pipe inside diameter

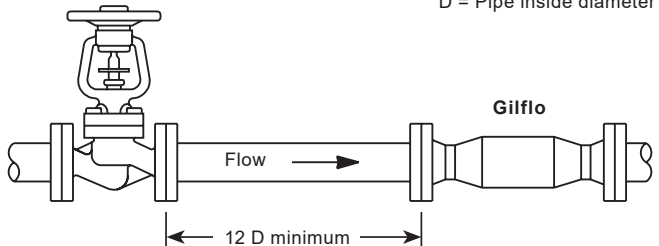


Fig. 6

4.3 Gaskets

Take care to avoid protrusion of gaskets into the pipework as incorrectly located gaskets may interfere with pressure sensing within the Gilflo and give rise to inaccuracies. Use bolt ring gaskets with an internal diameter $\frac{1}{2}$ " (12.5 mm) larger than the pipework bore.

4.4 Pressure tapplings

The upstream (HI) and downstream (LO) differential pressure tapplings are located in the flanges of the Gilflo pipeline unit and are threaded $\frac{1}{4}$ " NPT. Orientation is described in Section 4.1

4.5 Steam use - recommendations

In addition to the general recommendations for installing a Gilflo outlined in Sections 4.1 to 4.4, the following points are particularly important when measuring steam flow.

For steam applications, good basic steam engineering practice should be followed:

- Ensure all pipework is adequately lagged.
- Ensure correct line drainage through adequate trapping.
- Where practicable, fit a steam separator upstream of the flowmeter. This should be drained using a float trap set.
- Ensure good alignment and support of all associated pipework.
- Achieve line size reduction by the use of eccentric reducers.
- Avoid close installation (less than 12 pipe diameters) upstream or downstream of a pressure reducing valve or modulating valve.

5. Impulse lines

- 5.1** These should be of a suitable pressure rating and be as short as possible. However, for high temperature applications they should be long enough to prevent damage to the M610 transmitter through excessive temperature. (85 °C (185 °F) maximum).
- 5.2** Recommended minimum inside diameter is 9.5 mm (0.375").
- 5.3** Lines should run vertically downwards for steam and liquids applications and upwards for gases wherever possible but in no case should a gradient less than 1 in 12 be permitted.
- 5.4** Lines should run over the same route (preferably clipped together) to avoid temperature differentials.
- 5.5** Consideration should be given to allowing the impulse lines to be blown through or 'rodded' to remove excessive build-up of dirt or sludge.
- 5.6** If impulse lines are filled with water and may be subject to freezing, trace heating or use of antifreeze is recommended.
- 5.7** The orientation of the impulse lines and M610 transmitter assembly depends on the service application. See Figures 8 to 13.

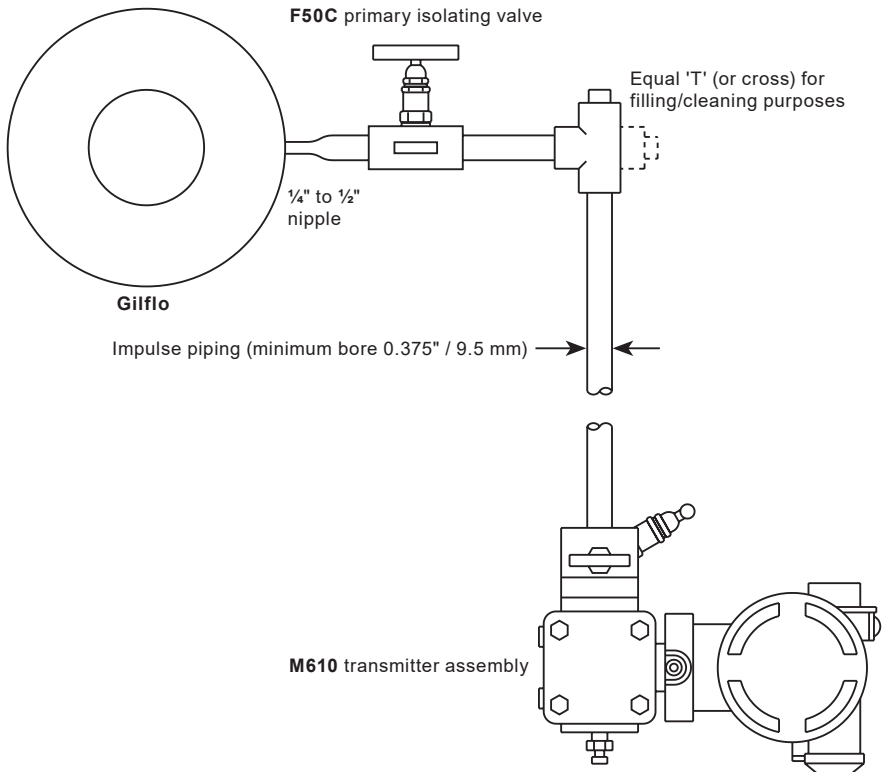


Fig. 7

Fig. 8

For liquids, vapours and steam where the Gilflo is installed in a horizontal line, the M610 should be mounted below the Gilflo as shown opposite.

**Liquids,
vapours,
steam**

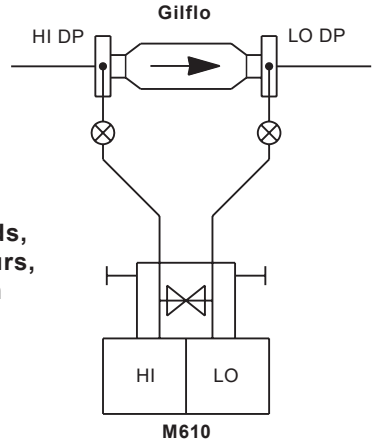


Fig. 9

If, for space limitations, the configuration described in Figure 8 is not possible then the arrangement shown opposite should be used (with vented gas collecting chambers at **A** for liquids).

**Liquids,
vapours,
steam**

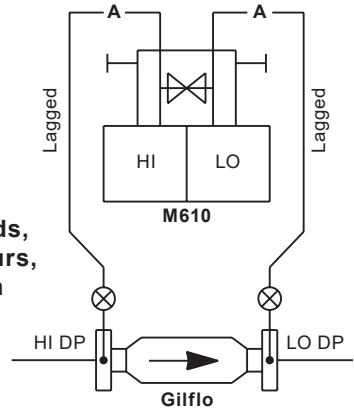


Fig. 10

For gases where the Gilflo is installed in a horizontal line, the M610 should be mounted above the Gilflo as shown opposite.

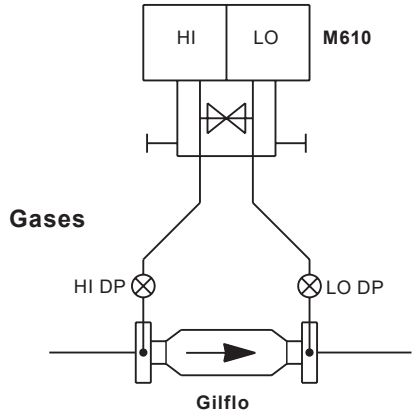


Fig. 11

If, for space limitations the configuration described in Figure 10 is not possible, then the arrangement shown opposite should be used. The condensate pots shown at **B** are only required if the gas is wet.

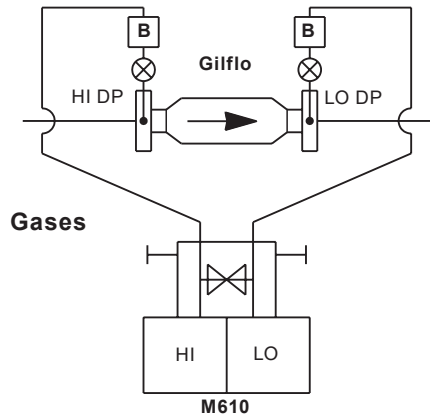


Fig. 12

For liquids, vapours and steam where the Gilflo is installed in a vertical line (flow downwards), the M610 should be mounted below the Gilflo as shown opposite.

Note: For this configuration, it is necessary to re-zero the M610 transmitter.

See Section 7.2 or 7.3 noting that the central valve on the 3-way manifold should be left closed to maintain the impulse lines full.

**Liquids,
vapours,
steam**

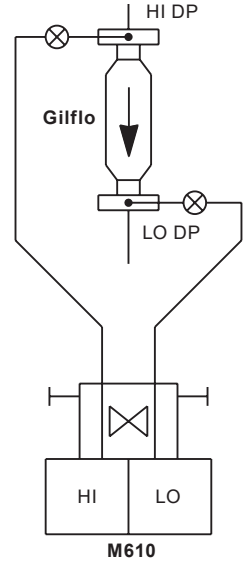
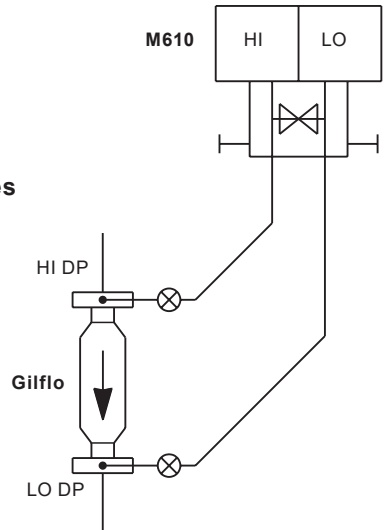


Fig. 13

For gases where the Gilflo is installed in a vertical line (flow downwards), the M610 should be mounted above the Gilflo as shown here.

Gases



6. Maintenance

After all mechanical and electrical work has been completed, the initial start-up procedures should be followed.

Note: The 3-way manifold which forms part of the M610 transmitter assembly is supplied with **all valves closed**.

6.1 Steam systems, vapour systems and all applications where the impulse lines must be filled with water.

- 6.1.1 Close both F50C isolation valves adjacent to the Gilflo pipeline unit.
- 6.1.2 Open all the valves on the 3-way manifold on the M610 transmitter assembly.
- 6.1.3 Fill both impulse lines with water (with antifreeze if required) to the same level.
- 6.1.4 Ensure that no air bubbles are trapped in the impulse lines by using the bleed screws on the M610 transmitter.
- 6.1.5 Where an EL2600 pressure transmitter is fitted to the system, remove the pressure transmitter and fill the vertical cooling leg with water. Refit the pressure transmitter and ensure that its isolation valve is open.
- 6.1.6 Reassemble all impulse pipework (if applicable).
- 6.1.7 Close the LO valve on the 3-way manifold.
- 6.1.8 Open both F50C isolation valves. Adjust zero on M610 to read 4.00 mA (see Sections 7.2 and 7.3).
- 6.1.9 Close the central equalisation valve on the 3-way manifold.
- 6.1.10 Open LO valve on the 3-way manifold.

The system is now operational.

Note: To commission the flow computer the Gilflo commissioning option should be chosen on the M200 Series flow computer and coefficients ABCDE should be used. Please refer to separate literature and the Gilflo calibration pack enclosed with the flowmeter.

6.2 Liquids, gases and all applications where the impulse lines are filled with the fluid/gas being metered.

Note: for all applications where the working fluid is above 85 °C (185 °F), care should be taken to avoid subjecting the M610 transmitter to excessive temperatures as this could result in permanent damage. The impulse line configuration shown in Figure 10 is suitable.

6.2.1 Close both F50C isolation valves adjacent to the Gilflo pipeline unit.

6.2.2 Close the LO valve on the 3-way manifold.

6.2.3 Open the central equalisation valve and HI valve on the 3-way manifold.

6.2.4 Open both the F50C isolation valves adjacent to the Gilflo unit.

6.2.5 Slowly bleed the air/gases from the system using the bleed screws on the M610. Adjust zero on M610 to read 4.00 mA (see Section 7.2).

6.2.6 Close the central equalisation valve on the 3-way manifold.

6.2.7 Open the LO valve on the 3-way manifold.

6.2.8 Where an EL2600 pressure transmitter is being used for density compensation, ensure that its isolation valve is open.

The system is now operational.

Note: To commission the flow computer the Gilflo commissioning option should be chosen on the M200 Series flow computer and coefficients ABCDE should be used. Please refer to separate literature and the Gilflo calibration pack enclosed with the flowmeter.

7. Initial start-up

There are several basic checks that should be carried out on a regular basis:

7.1 Impulse lines

Periodic cleaning of the impulse lines to prevent excessive build-up of sludge or deposits is recommended.

7.2 M610 DP transmitter

Zero and span checks on the DP transmitter should be carried out on a regular basis (ideally every 6 months). The 3-way manifold that forms part of the M610 assembly makes this easy. The procedure for checking the DP transmitter without removing it from site or shutting down the flow is as follows:

- 7.2.1 Ensure that the DP transmitter is powered up.
- 7.2.2 Close the F50C primary isolation valves adjacent to the Gilflo flowmeter.
- 7.2.3 Open all the valves on the 3-way manifold. This will allow the pressure in the two impulse lines to equalise.
- 7.2.4 Using a suitable milliammeter, check that the output of the DP transmitter is 4.00 mA across terminals CK+ and CK- as shown in Figure 14. (If a flow display is being used, it should read zero.) Set the mode switch (SW1) to the zero position and using the output adjuster on the M610 DP transmitter, adjust the zero output until a value of exactly 4.00 mA is achieved. See Figure 15.

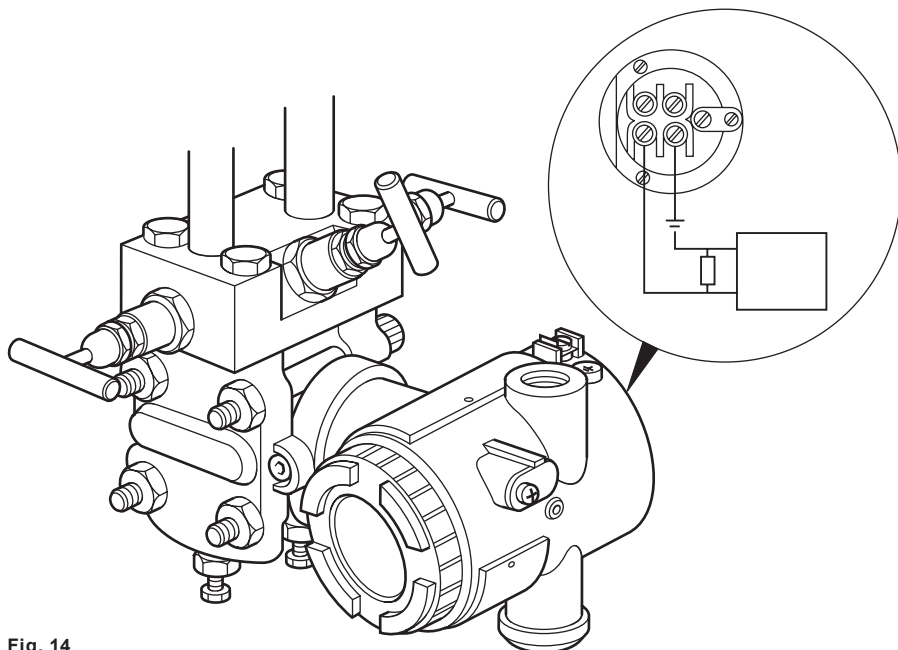


Fig. 14

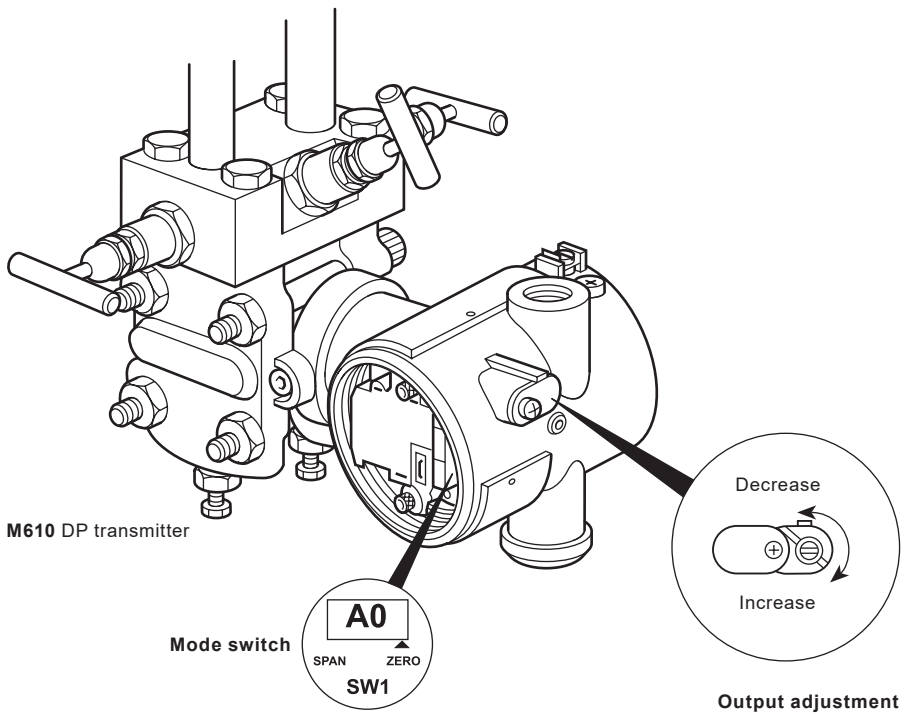
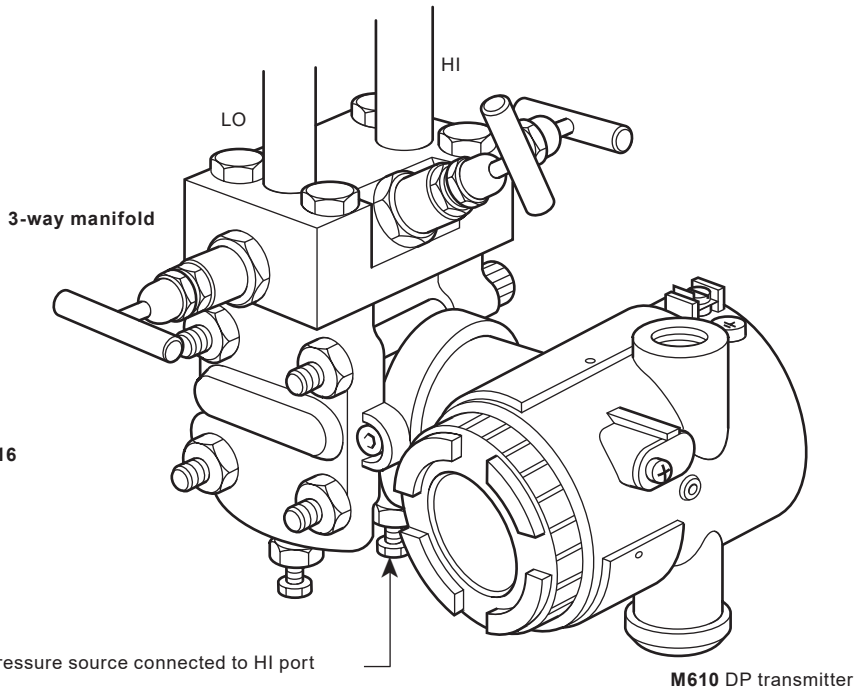


Fig. 15

- 7.2.5 Remove both bleed plug assemblies on the DP transmitter, and drain the impulse lines if applicable.
- 7.2.6 Close central equalisation valve on 3-way manifold.
- 7.2.7 Using a suitable precision pressure source attached to the HI pressure port of the DP transmitter as shown in Figure 16, apply a pressure corresponding to the set pressure of the unit.
- 7.2.8 Set the mode switch (SW1) to the span position and using the output adjuster on the M610 DP transmitter, adjust the output until a value of exactly 20.00 mA is achieved.
- 7.2.9 Remove pressure source, open the central equalisation valve and then refit and tighten the bleed plug assemblies.
- 7.2.10 If applicable, fill both impulse lines with water (with antifreeze if required) to the same level dismantling the impulse pipework if necessary.
- 7.2.11 Ensure that no air bubbles are trapped in the impulse lines by using the bleed screws on the M610 transmitter.
- 7.2.12 Reassemble all impulse pipework (if applicable).
- 7.2.13 Close the LO valve on the 3-way manifold.
- 7.2.14 Open both the F50C isolation valves adjacent to the Gilflo unit.
- 7.2.15 Close the central equalisation valve on the 3-way manifold.
- 7.2.16 Open the LO valve on the 3-way manifold.
- 7.2.17 Where an EL2600 pressure transmitter is being used for density compensation, ensure that its isolation valve is open.
- 7.2.18 Remove test leads and replace all covers on the M610 transmitter.



7.3 Gilflo pipeline unit

It is also possible to carry out some simple checks on the Gilflo flowmeter on site to confirm its correct operation. To do this, it is necessary to remove the unit from the line.

Checks possible

1. Cone free to move on shaft.
2. Reference dimensional check.
3. DP tappings clear.

7.3.1 Cone free on shaft

With the Gilflo positioned vertically as shown in Figure 17 or Figure 18 check that the cone is free to move up and down the shaft against the resistance of the spring.

7.3.2 Reference dimensional check

Having confirmed that the cone is free to move on the shaft, it is possible to check the reference 'F/C' dimension using a height gauge or vernier and comparing it with the value engraved on the Gilflo name-plate.

7.3.2.1 If the measured value is within $\pm 1\%$ of the original value, no adjustment is necessary.

7.3.2.2 If the measured value is within $\pm 2\%$ of the original value, the free cone position may be readjusted to obtain the correct 'F/C' dimension.

7.3.2.3 If the measured value is greater than $\pm 2\%$ of the original value, please consult Spirax Sarco.

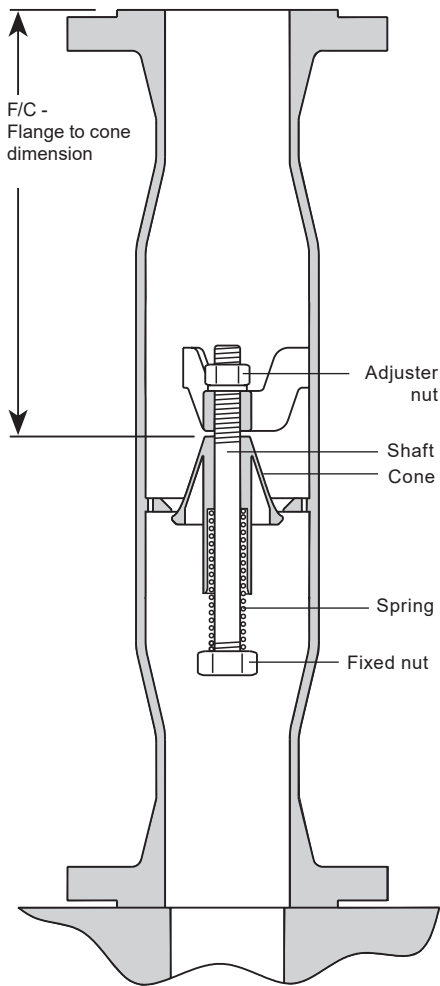


Fig. 17

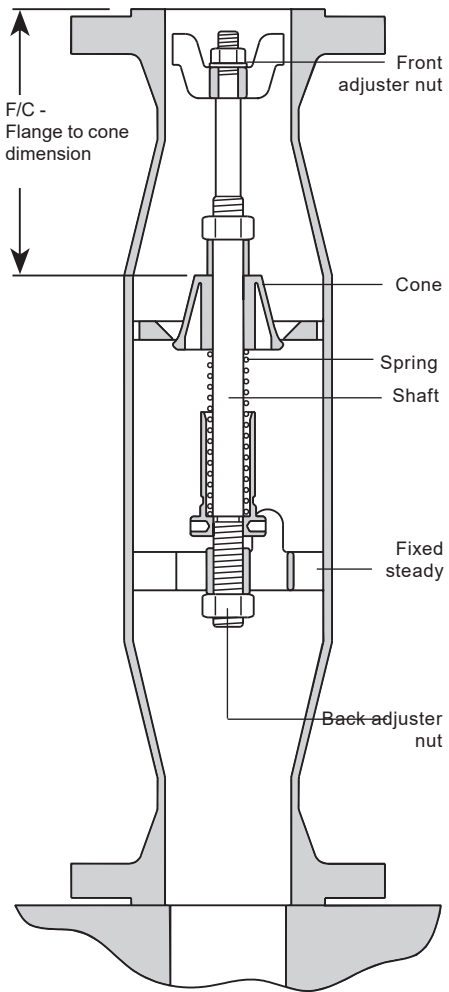


Fig. 18

To adjust the 'F/C' dimension for the DN50 'B' to DN150 spool flowmeter sizes:

1. With the Gilflo standing vertically with the direction of flow arrow pointing downwards. Loosen the adjuster nut on the front of the Gilflo shaft. Note that this nut is torqued to a high value and may require considerable effort and possibly the application of a proprietary loosening agent.
2. Gently rotate the shaft using the fixed nut at the rear of the flowmeter until the correct 'F/C' dimension is achieved.
3. Tighten adjuster nut to the torque value, shown in Table 3.
4. Recheck that the 'F/C' dimension is within tolerance if necessary, repeat Steps 1 to 3.

Important: Make sure that the adjuster nuts are correctly torqued up after all adjustments are complete.

Table 3 Adjuster nut tightening torques

Size	Front adjuster nut	Back adjuster nut	Torque	
			N m	lbf ft
DN50	M10	M10	30	22
DN80	M16	M16	113	83
DN100	M24	M24	372	272
DN150	M24	M24	372	272

7.3.3 DP tappings clear

Check that the DP tappings are not blocked. The Gilflo is now ready to be reinstalled in the line.

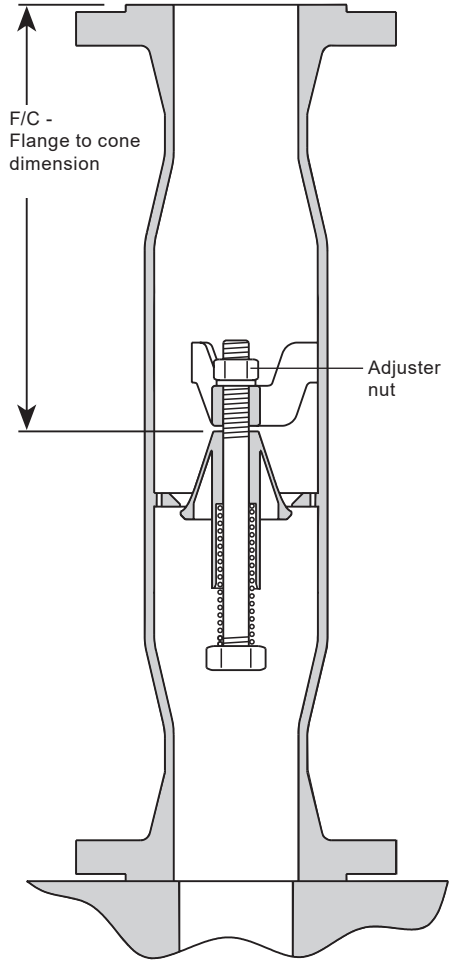


Fig. 19

To adjust the 'F/C' dimension for the DN200 'B' to DN300 'B' flowmeter sizes:

1. With the Gilflo standing vertically with the direction of flow arrow pointing downwards. Loosen both adjuster nuts at each end of the shaft. Note that these nuts are torqued to a high value and may require considerable effort and possibly the application of a proprietary loosening agent.
2. Gently rotate the shaft until the correct 'F/C' dimension is achieved.
3. Retighten adjuster nuts to the correct torque value, shown in Table 4.
4. Recheck the 'F/C' dimension and check that it is within the tolerances stated above. If necessary, repeat Steps 1 to 3 until the correct 'F/C' value is achieved.

Important: Make sure that the adjuster nuts are correctly torqued up after all adjustments are complete.

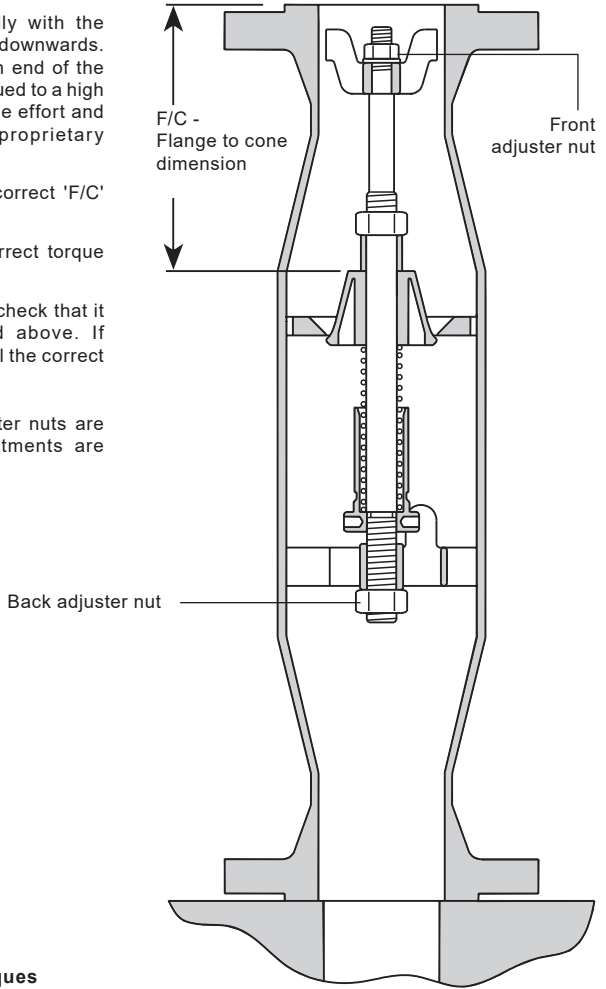


Fig. 20

Table 4 Adjuster nut tightening torques

Size	Front adjuster nut	Torque		Back adjuster nut	Torque	
		N m	lbf ft		N m	lbf ft
DN200	M20	230	168	M30	634	462
DN250	M20	230	168	M30	634	462
DN300	M24	372	272	M30	634	462
DN400	For DN400 'B' units please contact Spirax Sarco					

7.3.3 DP tappings clear

Check that the DP tappings are not blocked. The Gilflo is now ready to be reinstalled in the line.

8. Fault finding

Symptom	Possible cause	Action
1. With flow in line, system reads zero.	Primary isolation valves adjacent to Gilflo closed	Commission system (see Section 6)
	Isolation valves on 3-way manifold closed	
	Equalisation valve on 3-way manifold open	
	M610 transmitter incorrectly wired	Check wiring (see flow computer IMI)
	Impulse line(s) blocked	Clear lines. Commission system (see Section 6)
2. With no flow in line, system does not read zero.	Impulse lines reversed (HI to LO, LO to HI)	Rectify. Commission system (see Section 6)
	Gilflo unit fitted the wrong way round	Reinstall. Commission system (see Section 6)
	M610 transmitter out of calibration.	See Section 7
	Zero drift on M610 transmitter.	
3. System appears to read incorrectly.	Dirt / air in impulse lines	Clear lines and commission (see Section 6)
	Impulse lines blocked	
	Any one or combination of the above causes.	See relevant actions above
	Damaged Gilflo pipeline unit	Remove and check (see Section 7)