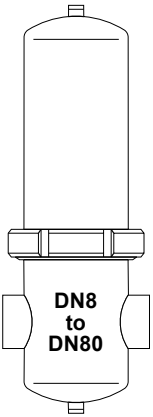
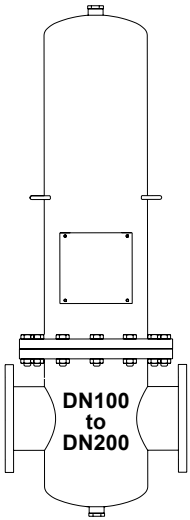
IM-P185-02
ST Issue 10

CSF16 and CSF16T
Stainless Steel Steam and Sterile Air Filters
Installation and Maintenance Instructions





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) 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. These products comply with the requirements of the European Pressure Equipment Directive 97/23/EC and carry the CE 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
CSF16 and CSF16T	DN8 to DN25		-	SEP	-	SEP
	DN32 to DN40		-	SEP	-	SEP
	DN50 to DN65		-	1	-	SEP
	DN80 to DN100		-	2	-	SEP
	DN150	L	-	2	-	SEP
		H	-	3	-	SEP
	DN200		-	3	-	SEP

i) **These products have been specifically designed for use on steam, air, inert industrial gases and liquids which are in Group 2 of the 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. Reaction forces must be considered and are the responsibility of the person installing the valve.**

v) **Remove protective covers from all connections and protective film from all name-plates, where applicable, 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. 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 may reach temperatures in excess of 178°C (352°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

The product is recyclable. No ecological hazard is anticipated with the disposal of this product 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.

1. General product information

2.1 Description

The CSF16 and CSF16T are horizontal, in-line high efficiency filters used to remove contaminate particles from steam and compressed air systems. The filter housing is available in a choice of:
- Austenitic stainless steel (1.4301) designated **CSF16**.
- Austenitic stainless steel (1.4404) designated **CSF16T**.

The DN8 to DN80 (¼" to 3") housing is externally polished with an internal natural finish whereas the DN100 to DN200 (4" to 8") housing will have a natural finish both internally and externally. The housings are constructed in two halves:
- DN8 to DN80 (¼" to 3") will be joined by a food industry fitting to DIN 11851.
- DN100 to DN200 (4" to 8") will be joined by bolts and nuts.

In some pipe sizes **the element is available in a choice of low capacity designated 'L'** and **high capacity designated 'H'**.

Steam filter - Replaceable elements in sintered austenitic stainless steel are available with either 1, 5 or 25 micron absolute rating.
The CSF16 and CSF16T, when fitted with a 5 micron element are capable of removing 95% of particles 2 microns and larger in size, in accordance with the requirements for the production of culinary steam to 3A accepted practice number 609-03. Accepted in the U.S. Department of Agriculture for use in federally inspected meat and poultry plants.

Sterile air filters - Replaceable borosilicate depth filter elements are available with a retention rate of >than 99.9998% related to 0.01 µm.

Options

Filter element	**CSF16-S** designed for steam applications	See Sections 2.3 and 2.4 for Pressure / temperature limits
	CSF16-A designed for air applications	
* **Filter element seal**	**EPM** as standard for steam applications	
	Silicone VMQ as standard for air applications	

* **Please note:** For higher temperatures, or more agressive applications other materials are available on request. Please consult Spirax Sarco.

Standards - These products fully comply with the requirements of the European Pressure Equipment Directive 97 / 23 / EC and carry the CE mark when so required.
All materials meet the requirements as stipulated by the US FDA Regulations.

Certification - The product can be supplied with a modified housing in order to provide certification to EN 10204 3.1. **Note:** All certification / inspection requirements must be stated at the time of order placement.

Supply - The CSF16 and CSF16T are supplied in two parts:
1. The filter housing head and bowl with housing seal packed in one carton.
2. The filter element complete with filter element and two seals.
   (DN100 - DN200 CSF16 and CSF16T have multiple elements - See Table 2, page 15.

Note - For additional information see the following Technical Information Sheets:
- TI-P185-01 for steam filters.
- TI-P185-11 for sterile air filters.

2.2 Sizes and pipe connections

Screwed

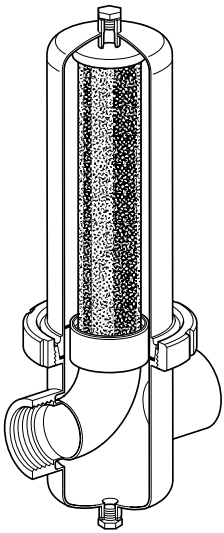
BSP and NPT: ¼", ⅜", ½", ¾", 1", 1¼", 1½", 2", 2½" and 3".

Flanged

EN 1092 PN16: DN8, DN10, DN15, DN20, DN25, DN32, DN40, DN50, DN65 and DN80.
EN 1092 PN10: DN100, DN150 and DN200.
ASME 150: ¼", ⅜", ½", ¾", 1", 1¼", 1½", 2", 2½", 3", 4", 6" and 8".

Steam filters

DN8 to DN80



DN100 to DN200

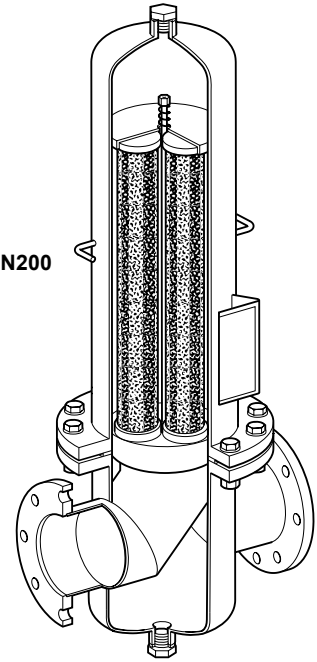
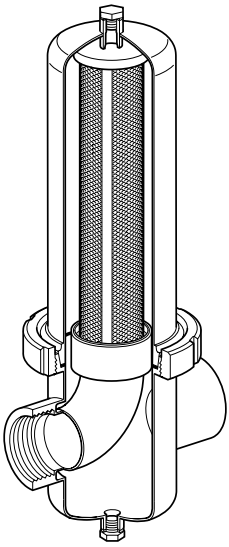


Fig. 1

Sterile air filters

DN8 to DN80



DN100 to DN200

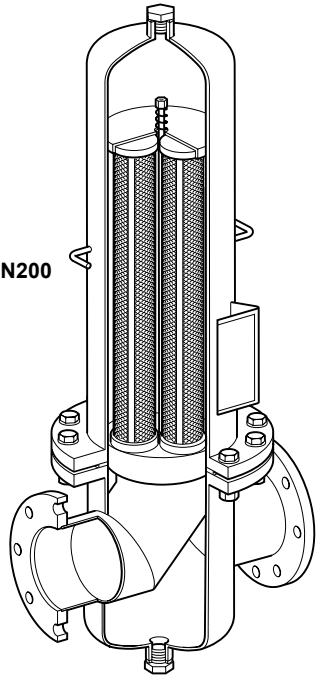
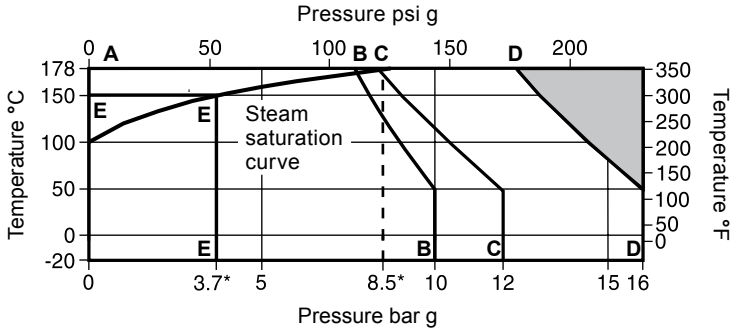


Fig. 2

2.3 Pressure / temperature limits for steam applications

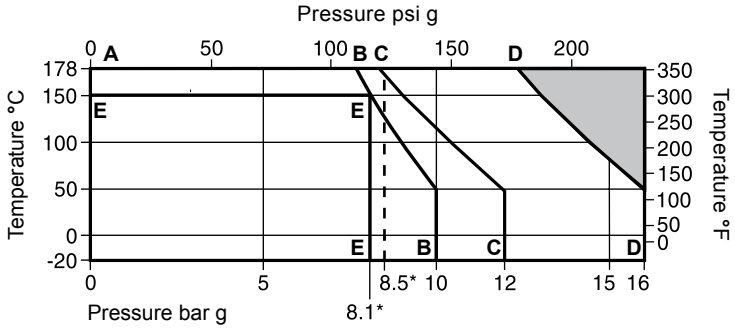


The product **must not** be used in this region.

A-B-B Flanged PN10.
A-C-C Maximum allowable pressure for the DN80H.
A-D-D Screwed BSP or NPT, flanged PN16 and ASME 150.
E-E-E Maximum operating limits for sizes DN100 to DN200.

Body design rating					PN16
PMA	Maximum allowable pressure	DN8 - DN65 (¼" to 2½")		16 bar g	232 psi g
		DN80 (3")	L version	16 bar g	232 psi g
			H version	12 bar g	174 psi g
		DN100 - DN200		10 bar g	145 psi g
TMA	Maximum allowable temperature	DN8 - DN80		178°C @ 8.5 bar g	352°F @ 123 psi g
		DN100 - DN200		150°C @ 3.7 bar g	302°F @ 53 psi g
Minimum allowable temperature				-20°C	-4°F
* PMO	Maximum operating pressure	DN8 - DN80		8.5 bar g @ 178°C	123 psi g @ 352°F
		DN100 - DN200		3.7 bar g @ 150°C	53 psi g @ 302°F
TMO	Maximum operating temperature	DN8 - DN80		178°C @ 8.5 bar g	352°F @ 123 psi g
		DN100 - DN200		150°C @ 3.7 bar g	302°F @ 53 psi g
Minimum operating temperature				0°C	32°F
ΔPMX	Maximum differential pressure			5 bar g	72 psi g
Designed for a maximum cold hydraulic test pressure of:		DN8 - DN65 (¼" to 2½")		27.5 bar g	399 psi g
		DN80 (3")	L version	27.5 bar g	399 psi g
			H version	20.6 bar g	298 psi g
		DN100 - DN200		18.3 bar g	265 psi g

2.4 Pressure / temperature limits for sterile air applications



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

A-B-B Flanged PN10.
A-C-C Maximum allowable pressure for the DN80H.
A-D-D Screwed BSP or NPT, flanged PN16 and ASME 150.
E-E-E Maximum operating limits for sizes DN100 to DN200.

Body design rating					PN16
PMA	Maximum allowable pressure	DN8 - DN65 (¼" to 2½")		16 bar g	232 psi g
		DN80 (3")	L version	16 bar g	232 psi g
			H version	12 bar g	174 psi g
		DN100 - DN200		10 bar g	145 psi g
TMA	Maximum allowable temperature	DN8 - DN80		178°C @ 8.5 bar g	352°F @ 123 psi g
		DN100 - DN200		150°C @ 8.1 bar g	302°F @ 117.5 psi g
Minimum allowable temperature				-20°C	-4°F
* PMO	Maximum operating pressure	DN8 - DN80		8.5 bar g @ 178°C	123 psi g @ 352°F
		DN100 - DN200		8.1 bar g @ 150°C	117.5 psi g @ 302°F
TMO	Maximum operating temperature	DN8 - DN80		178°C @ 8.5 bar g	352°F @ 123 psi g
		DN100 - DN200		150°C @ 8.1 bar g	302°F @ 117.5 psi g
Minimum operating temperature				0°C	32°F
ΔPMX	Maximum differential pressure			5 bar g	72 psi g
Designed for a maximum cold hydraulic test pressure of:		DN8 - DN65 (¼" to 2½")		27.5 bar g	399 psi g
		DN80 (3")	L version	27.5 bar g	399 psi g
			H version	20.6 bar g	298 psi g
		DN100 - DN200		18.3 bar g	265 psi g

3. Installation

Note: Before actioning any installation observe the 'Safety information' in Section 1.

Refering to the Installation and Maintenance Instructions, name-plate and Technical Information Sheet, check that the product is suitable for the intended installation:

Note: The CSF16 and CSF16T are supplied in two parts:

1. The filter housing head and bowl with housing seal packed in one carton.

2. The filter element complete with 2 off filter element seals.

3.1 Installation

There are 6 main criteria which need to be met in order to ensure that the CSF16 and CSF16T filters works effectively and for a long trouble free life.

1. When used on steam or gas services a separator should be installed upstream of the filter to remove droplets of condensate held in suspension. Not only will this help the condition of the steam or gas but it will also prolong the life of the filter element. For certain applications, such as culinary steam a separator is mandatory in order to comply with sanitary standards.

2. It is recommended that for maximum service life a Y-type strainer complete with 100 mesh stainless steel screen is installed upstream of the CSF16 and CSF16T.

3. The filter must be installed in horizontal pipework with the filter bowl vertically above the interconnecting pipes (DN100 to DN200 CSF16 and CSF16T have multiple elements - See Table 2 on page 17 for further information).

4. While at the same time the direction of flow for compressed air and liquids can be in any direction through the filter, **for steam the flow must be from outside to inside.** This can be checked by looking into the filter head before installation in the pipeline, see Figure 3 and Figure 4.

5. When used on steam the plugs and gaskets on the filter head should be removed and pipework connected to a steam trap installed below the filter. The condensate from this trap should then be piped away to drain, or to the receiver of a pump, providing no backpressure, i.e. lift, is imposed upon the steam trap (see Figure 5).
Should it not be possible to install a steam trap at the drain point itself, then a full size equal tee drain point should be incorporated into the horizontal pipework prior to the filter, this to be drained by a steam trap, unless a separator with drain trap is upstream of the filter.
For those steam systems where air can be present, air can collect in the upper portion of the filter. In this situation a suitable air vent should be connected to the air vent connection.

6. Pressure gauges should be installed before and after the filter to check the differential pressure across the filter itself. Once the differential pressure reaches 0.7 to 1 bar (10 to 14 psi) the filter element should be removed for cleaning and/or replacement.

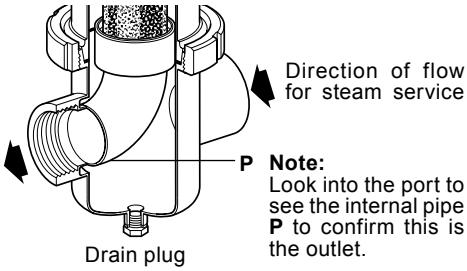


Fig. 3 Steam filter - DN8 to DN80

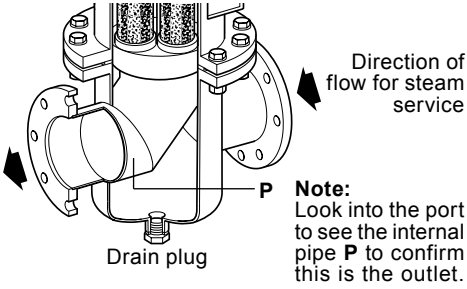
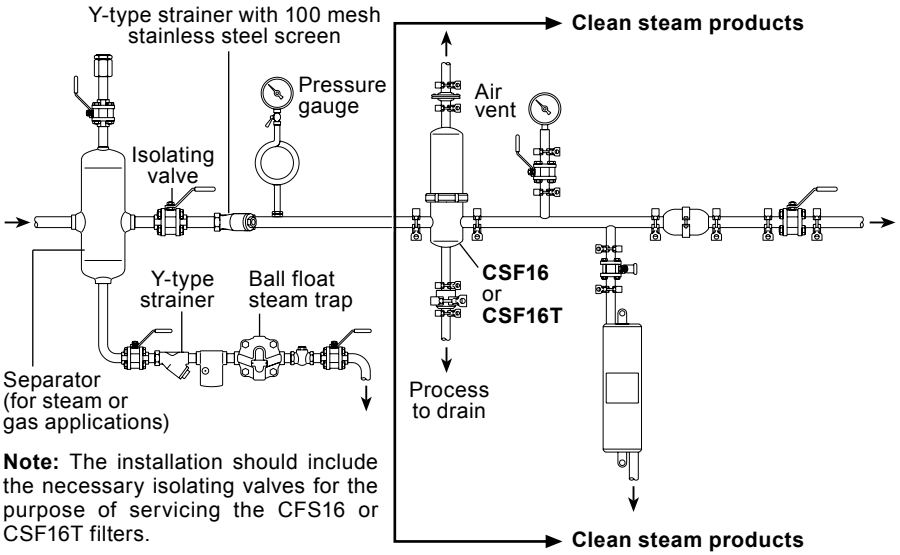


Fig. 4 Steam filter - DN100 to DN200



Note: The installation should include the necessary isolating valves for the purpose of servicing the CFS16 or CSF16T filters.

Fig. 5 Typical installation for steam

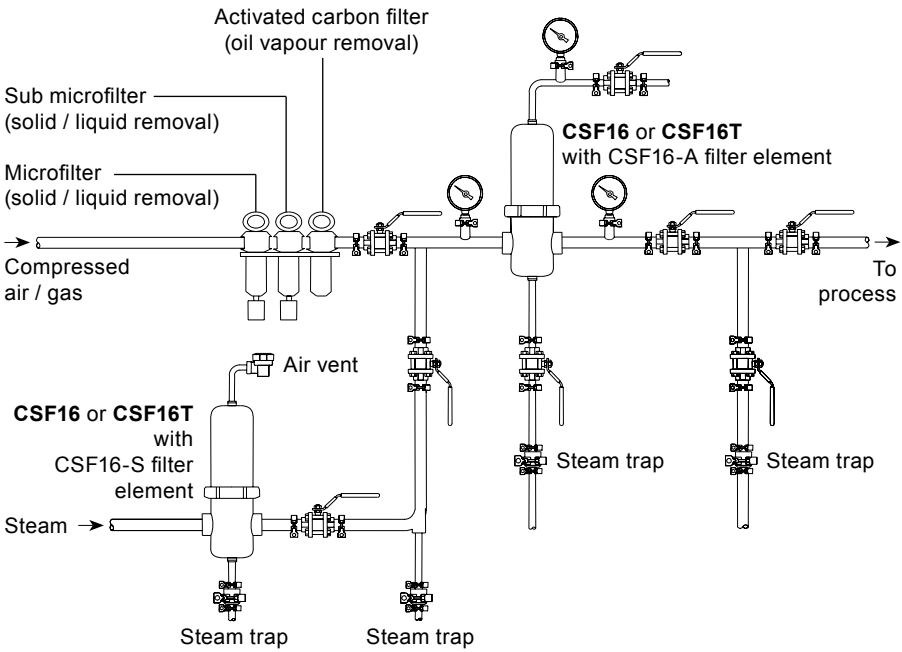


Fig. 6 Typical installation for sterile air

4. Commissioning

Once the pipework installation has been completed the following steps should be taken in sequence, referencing Figures 7 and 8, to commission the CSF16 and CSF16T filters:

1. All isolating valves should be closed.
2. The housing ring (**4**) or housing bolts (**10**) holding together the filter housing head (**2**) and the filter housing bowl (**1**) should be unscrewed using the appropriate spanner. The filter housing head (**2**) can then be removed.
3. The filter element seals (2 off, item **6**) should then be lubricated using FDA or DAB approved Vaseline or silicone oil, before fitting to the filter housing bowl (**1**).
4. The filter element (**5** - please note that there are multiple elements for the larger sizes) needs to be gently pushed into the filter housing bowl (**1**).
5. **When multiple elements are fitted**, the filter support assembly (**11**) must be assembled and fitted as shown in Figure 8.
6. Ensure the filter housing seal (**3**) is fitted.
7. **For sizes DN8 to DN80:** The housing ring (**4**) should then be carefully placed into the seating land on the filter housing head (**2**), before then gently lowering the filter housing bowl (**1**) over the filter element and tightening the housing ring (**4**). The housing ring (**4**) is designed with a coarse thread to minimise the possibility of galling. Thread lubrication is not normally necessary. However, a FDA or DAB approved Vaseline or silicone oil may be used if required.
   For sizes DN100 to DN200: Gently lower the housing head (**2**) over the filter elements and place them onto the housing bowl (**1**). Tighten the housing bolts to the recommended torque - See Table 1.
8. Once Steps 1-7 have been completed the upstream isolating valve can be cracked open slowly to admit the medium into the CSF16 or CSF16T filter then proceed with Steps 8 to 12, page 14.

Table 1 Recommended tightening torques

Item		 or mm 		N m
4		use C spanner		As required
7	DN8 - DN80		¼" BSP	As required
	DN100 - DN200		1"BSP	As required
10	DN100	A/F 30	M20	340
	DN150L	A/F 30	M20	235
	DN150H	A/F 30	M20	270
	DN200	A/F 36	M24	400

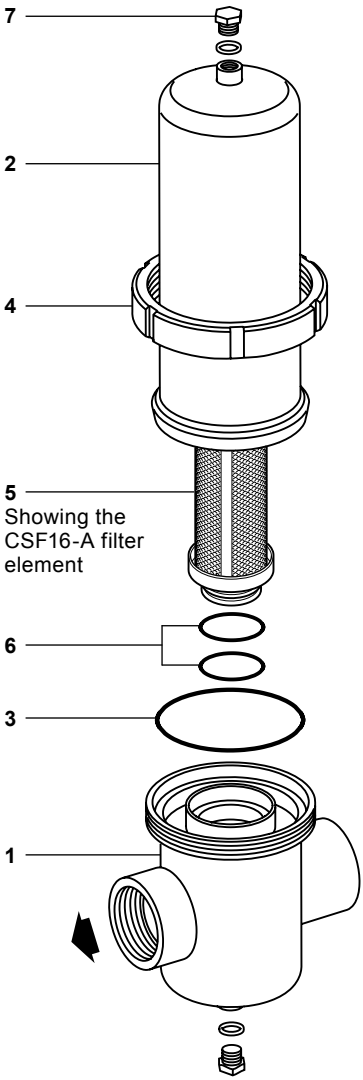


Fig. 7 DN8 to DN80

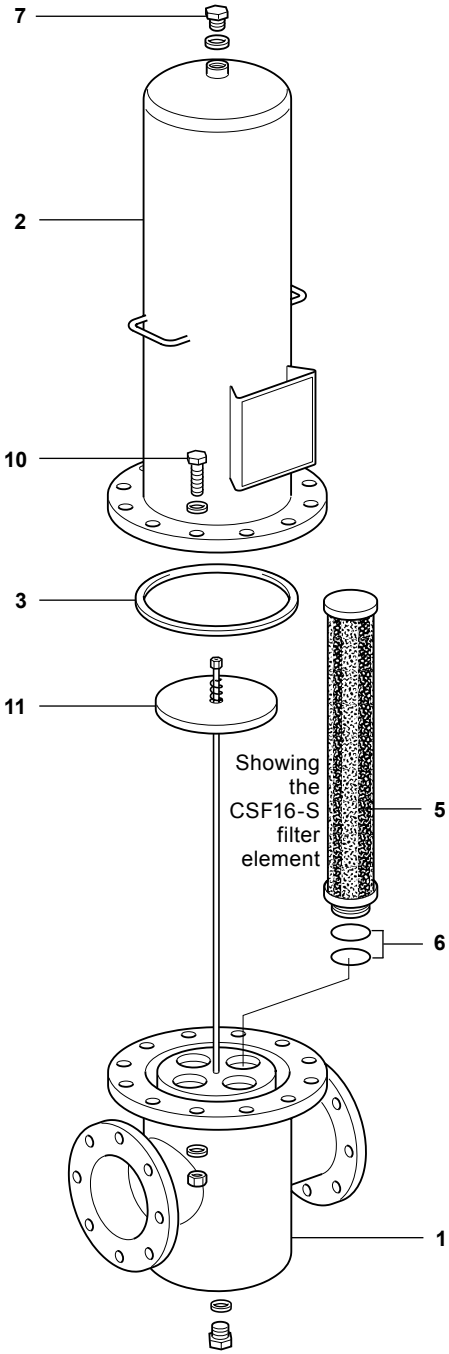


Fig. 8 DN100 to DN200

9. **If on gas or steam service an audible signal (whistling tone) is heard** then the filter housing has been incorrectly assembled and **the upstream isolating valve should be closed immediately.**
   In checking the filter housing, the plug (**7**) on top of the filter housing head must be loosened slowly and carefully, in order to ensure time for any pressure within the CSF16 or CSF16T filter to disperse. Once this has happened the housing ring (**4**) or housing bolts (**10**) can be undone, the filter housing bowl and head (**1** and **2**) plus filter element (**5** - please note that there are multiple elements for the larger sizes) and especially the filter housing seal (**3**) can be carefully checked, before reassembly.

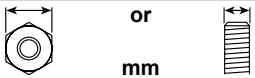
10. **Should no audible signal be heard after the upstream isolating valve has been** opened, then the downstream valve can be opened slowly until fully open. The medium will now be flowing through the CSF16 or CSF16T filter and at this stage a note should be taken of the pressure gauge readings before and after the CSF16 or CSF16T filter, in order to check the differential pressure.

11. All interconnecting pipework, fixtures and fittings should then be checked for leakage especially if steam is the operating medium. This check should include steam traps.

12. **Within the first few days of commissioning a new CSF16 or CSF16T filter**, the filter should be isolated and the new strainer preceding the filter checked by removing the screen. Any pipe debris can be removed and the strainer screen replaced before commissioning takes place.

13. **After the CSF16 or CSF16T filter has been in use for some time (determined by experience)** the pressure gauges should be checked to establish the differential pressure. If this has reached 0.7 bar to 1 bar (10 to 14 psi) then the filter element(s) must be removed for cleaning or replacement (see Section 6, Maintenance).

Table 1 Recommended tightening torques

Item				N m
4		use C spanner		As required
7	DN8 - DN80		¼" BSP	As required
	DN100 - DN200		1"BSP	As required
10	DN100	A/F 30	M20	340
	DN150L	A/F 30	M20	235
	DN150H	A/F 30	M20	270
	DN200	A/F 36	M24	400

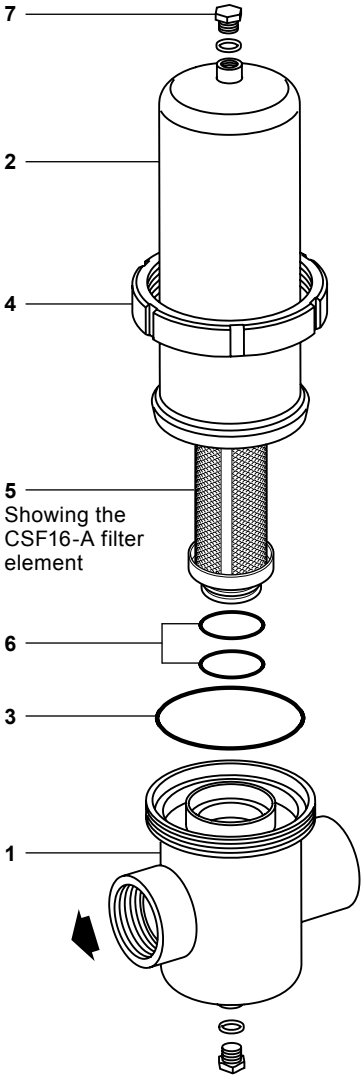


Fig. 9 DN8 to DN80

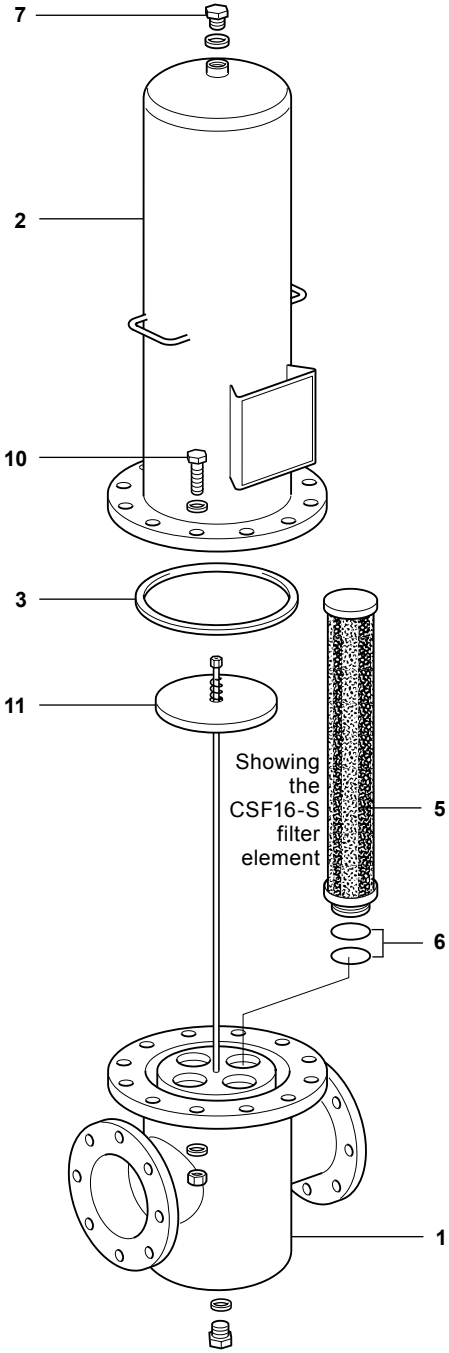


Fig. 10 DN100 to DN200

5. Operation

5.1 Steam filters

The CSF16-S are sintered austenitic stainless steel filter elements with a 1, 5 or 25 micron absolute rating. They allow steam to be filtered such that all sub-visible solid and liquid particles are removed.
The rating for the filter element means that for steam and gas service 100% of liquid and gas particles larger than the rating will be retained by the filter element. In order to minimise pressure drop and extend filter element life the coarsest rating compatible with the application shoud be selected. As well as retaining all particles larger than the pore size, the filter element will also stop a percentage of smaller particles. For example the 1 micron filter element has an efficiency of 99.7% based on 0.2 micron particles.

5.2 Sterile air filters

The CSF16-A are borosilicate depth filter elements used to remove contaminate particles from compressed air systems.
Filter elements have a retention rate of >than 99.9998% related to 0.01 µm.

6. Maintenance

Note: Before actioning any maintenance observe the 'Safety information' in Section 1.

6.1 General information

Before undertaking any maintenance on the filter, it must be isolated from both the supply line and return line and any pressure allowed to safely normalise to atmosphere. The filter should then be allowed to cool. When reassembling, ensure that all joint faces are clean.

6.2 How to clean or replace the filter element(s):

Reference Figures 9 and 10, page 15, for part recognition.

- Remove the housing ring (**4**) or housing bolts (**10**) holding together the filter housing head and bowl (**2** and **1**). Then proceed to remove the filter housing head (**2**) being careful not to damage the filter element(s).
- Remove the filter element(s) (**5**) carefully.
- **CSF16-S clean steam filter element:** Cleaning can be by immersion or preferably back flushing, with dilute hydrochloric acid, clean water or air, or alternatively by immersion in an ultrasonic bath, depending upon the type of contamination. If hydrochloric acid is to be used it should be in a 1-2% solution at around room temperature (no greater than 40°C (104°F)) and should take ½ - 2 hours depending on the degree of contamination. Gentle brushing may be used to aid cleaning. If after replacement back into the filter itself the pressure drop quickly reaches 0.7 to 1 bar (10 to 14 psi), then the filter element should be completely replaced.
  Note: The service life of the filter element is solely dependant upon the degree of solid particle contamination. Thus, in time, the filter element will become saturated.
  It is strongly recommended that a spare filter element set is carried in stock to minimise downtime.
  CSF16-A sterile air element: When installed as per Figure 6 (page 11), the air filter element can withstand a minimum of 1 hundred (100) inline sterilization cycles with steam filtered by an CSF16-S element at 121°C for 30 minutes.
- Reassemble and commission following Steps 3 to 12 laid down in Section 4 'Commissioning'. (DN100 - DN200 CSF16 and CSF16T have multiple elements - See Table 2 below.

Table 2 Seal kit contents

Unit size		Housing seal (Part number 3)	Element seals (Part number 6)
DN8 - DN80		1	2
DN100		1	6
DN150	**L**	1	6
	H	1	12
DN200	**L**	1	16
	H	1	20

7. Spare parts

7.1 Spares

The spare parts are shown in solid outline. Parts drawn in broken line are not supplied as spares.

Available spares

CSF16-**S** filter element kit for **steam** applications	**5, 6** (2 off)
CSF16-**A** filter element kit for **sterile air** applications	**5, 6** (2 off)
Seal kit	**3**, **6** (please see the seal kit contents table below for quantities)

Seal kit contents

Unit size		Housing seal (Part number 3)	Element seals (Part number 6)
DN8 - DN80		1	2
DN100		1	6
DN150	**L**	1	6
	H	1	12
DN200	**L**	1	16
	H	1	20

How to order spares

Always order spares by using the description given in the column headed 'Available spares' and state the size and type of filter housing. **For steam filters only** also quote the filter element rating and housing / filter element seal material required.

CSF16 for steam applications

Example: 1 off 5 micron CSF16-S filter element kit for a Spirax Sarco DN25 CSF16 clean steam filter, with EPM filter element seals.

CSF16 for sterile air applications

Example: 1 off Seal kits for a Spirax Sarco DN200H CSF16 sterile air filter.

Table 1 Recommended tightening torques

Item		 or mm 		N m
4		use C spanner		As required
7	DN8 - DN80		¼" BSP	As required
	DN100 - DN200		1"BSP	As required
10	DN100	A/F 30	M20	340
	DN150L	A/F 30	M20	235
	DN150H	A/F 30	M20	270
	DN200	A/F 36	M24	400

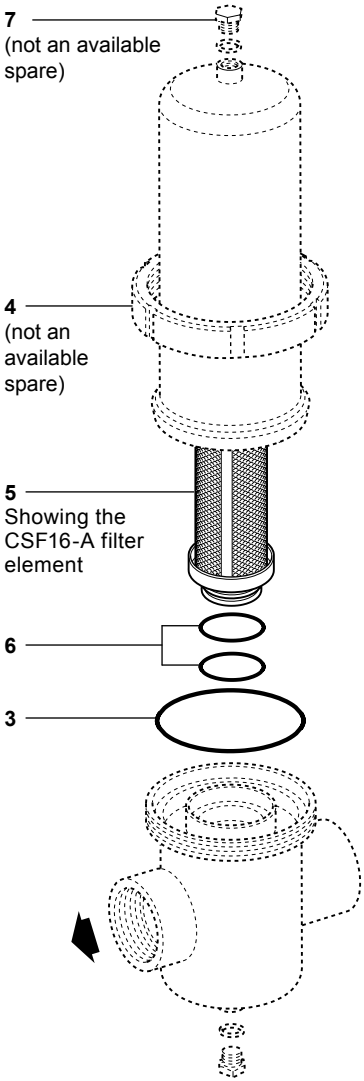


Fig. 11 DN8 to DN80

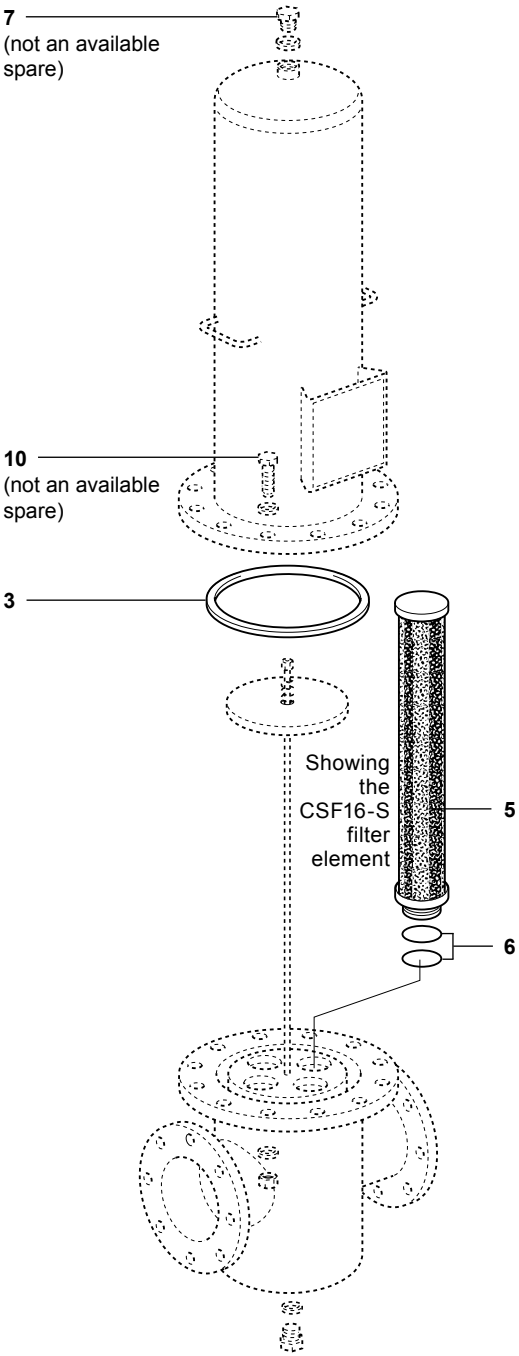


Fig. 12 DN100 to DN200