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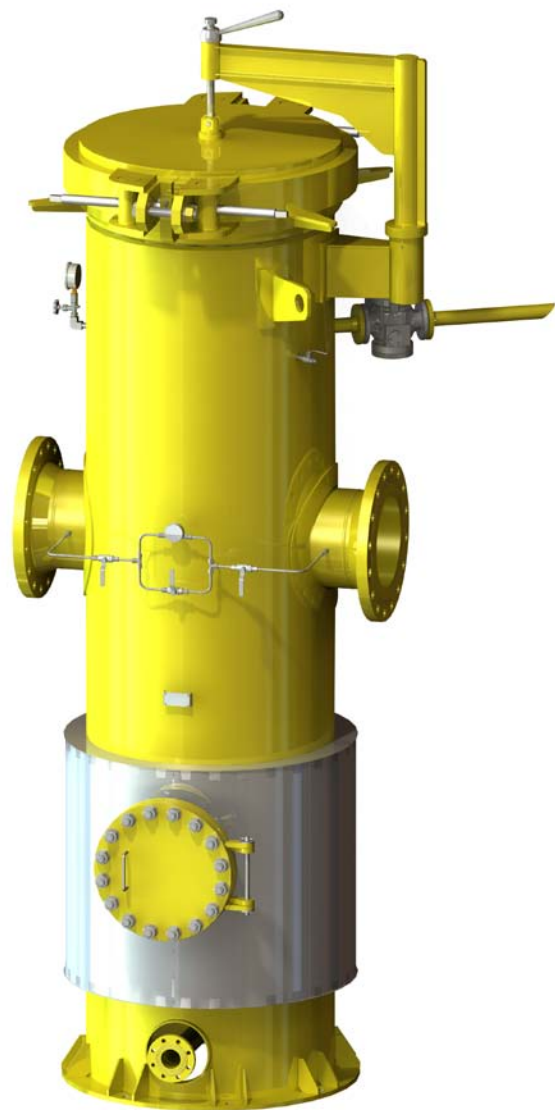
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GAS FILTER SEPARATOR

FS 641, FS 642, FS 643



Introduction

Filter separators are multi-stage units that employ two or more of the gas conditioning methods in order to remove solid and liquid impurities from the laden gas flow and to protect the pipes, equipment and devices which could be damaged because of the particle-contaminated gas.

In most of the applications involving the use of gas media, filters such as FTG type produced by **Totalgaz Industrie** are fairly sufficient. However, the use of this type of filtering devices is not possible if, along with solid contaminants, the gas also contains liquid particles. In such cases, double-stage gas cleaning is necessary. The FS filter separators have been designed for this purpose.

Totalgaz Industrie delivers a wide range of filter separators, making use of various internal parts: filtering cartridges (stainless steel, cellulose, fiber glass, etc.), cyclones, demisters (vane type, knitted wire mesh). Upon request, **Totalgaz Industrie** can offer customer - specific solutions to meet the most demanding client requirements.

All **Totalgaz Industrie** gas filter separators are manufactured in accordance with *European Pressure Equipment Directive (PED)*, *ASME Code for unfired vessels*, *IS CIR (Romanian Authority for Vessels and Hoisting Units)* or any other local, state or province provisions, as indicated by the client.

In order to increase safety during operation, the filter separators can be provided (optionally) with a level indicator to monitor the liquid level in the collection chamber.

The filtering cartridge is an independent unit and can be easily changed. The cartridge can have one or several layers and, depending on size, one or more filter elements can be used. The filtering element retains particles with minimum sizes of 5, 10, 50, 160 or 300 microns. A filtering surface is indicated for each model. On request, the filter separator can be equipped with a filtering element with the filtration rating greater or smaller than the one indicated above. When the beneficiary does not specify the filtration rating, the filter separator is delivered with a cartridge filtration rating of 160 microns.

Advantages of FS filter separators:

- high filtering efficiency and low pressure loss
- excellent liquid and solid particles removal
- excellent operational reliability due to the high quality materials, precise processing and regular control
- multiple applications
- size range providing proper solution to any encountered problem
- design based on international standards governing this type of products, ISO 9001 certified production system.

Technical characteristics

Table 1 – Technical characteristics of filter separators

Filter separator type	FS 641, FS 642, FS 643
Inlet / outlet connection diameter	Flanges DN 25 ÷ DN 600
Working medium	Natural gas or other non-corrosive gases
Ambient temperature [°C]	-20 ÷ 80 (optionally, -30 ÷ 80)*
Working medium temperature [°C]	-10 ÷ 60 (optionally, -20 ÷ 60)*
Design pressure [bar]	6, 16, 25, 40, 64, 100

* On request, lower temperatures can be considered.

Materials

Table 2 – Materials employed for FS filter separators

Part	Material
Body, flanges, cover	Carbon steel
Gaskets	NBR, Viton
Coalescer	Fiberglass, stainless steel, polyester, polypropylene
Demister	Stainless steel, carbon steel
Cyclones	Cast iron, stainless steel, carbon steel
Filter	Pleated paper, cellulose, stainless steel, polyester, polypropylene

Customer-specific design filter separators can be manufactured using materials upon request.

Constructive variants

FS 641 filter separator

FS 641 is a 2-stage filter separator, where the first stage is an axial cyclone or a multicyclone bundle and the second stage consists of filter elements. Cellulose or glass fiber filter elements are usually employed but other filtering media are also available. Depending on the size of the filter separator, one or more filter columns can be present.

Operation

The gas enters the filter separator via the inlet nozzle and then deflects into the centrifugal element which forces the gas into a rotary movement. As a result, the contaminants present in the gas are subjected to high centrifugal forces and are thrown out of the gas flow.

The gas enters the filter separator via the inlet nozzle and then deflects into the centrifugal element which forces the gas into a rotary movement. As a result, the contaminants present in the gas are subjected to high centrifugal forces and are thrown out of the gas stream. The liquid particles fall downwards and are collected at the lower part of the filter separator body. The cleaned gas is deflected through 180° and enters the filter elements above the centrifugal element via the vertical rise pipe.

When a cellulose filter element is used (Figure 1), the gas flows through this one from outside to inside. This removes any contaminants remaining in the gas. Finally, the clean gas is guided to the top of the filter from where is deflected downwards into the exit channel before being exhausted through the outlet connection.

In the case of glass fiber filter elements (Figure 2) the gas flows from inside to outside. The solid particles are retained in the filter element while the liquid ones move through the outside surface of the element. Here, the droplets coalesce together until they drop by their own weight into the upper collecting compartment. Finally, the clean gas is guided to the filter top where is deflected downwards into the exit channel before being exhausted through the outlet connection.

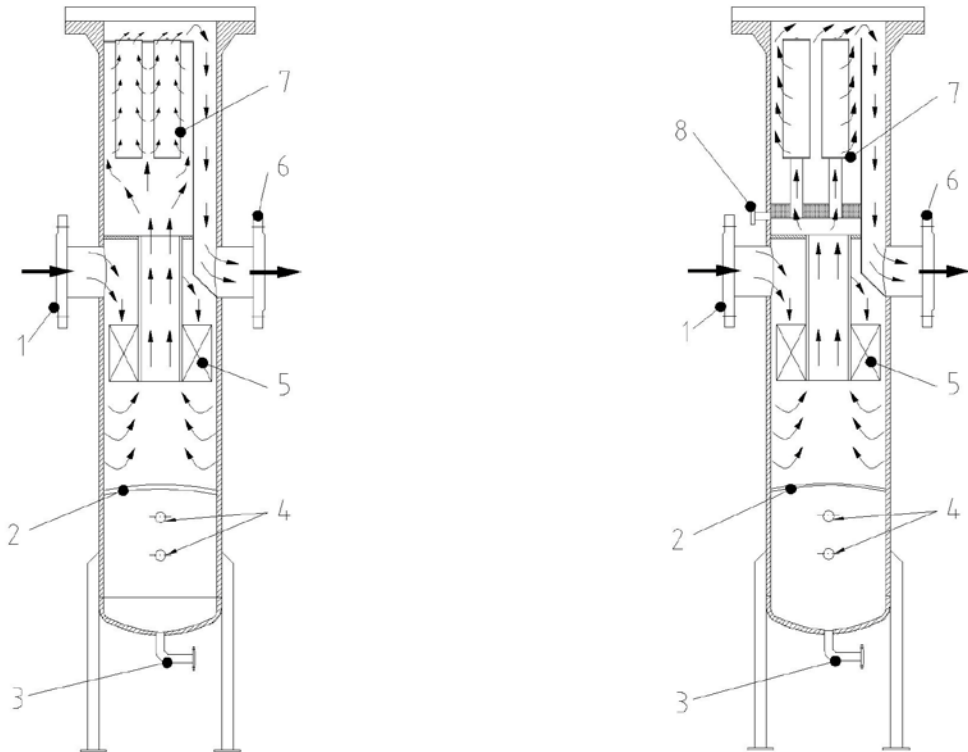


Figure 1 – FS 641 with cellulose filter element *Figure 2 – FS 641 with glass fiber filter element*
 1 - gas inlet; 2 – baffle plate; 3 – drain; 1 - gas inlet; 2 – baffle plate; 3 – drain; 4 - level
 4 - level indicator connection; 5 – axial cyclone (or indicator connection; 5 – axial cyclone (or
 cyclone (or multicyclone); 6 – gas outlet; 7 – multicyclone); 6 – gas outlet; 7 – filter cartridge;
 filter cartridge. 8 – drain.

Efficiency

The FS 641 provides a high separation rate of both liquid and solid particles:

- 99.5 % separation of solid and liquid particles greater than 3 microns;
- 99 % separation of solid particles greater than 2 microns;
- 99 % separation of liquid particles greater than 2 microns.

Standard configurations and overall dimensions

Several variants of the FS 641 filter separators are currently produced by **Totalgaz Industrie**.

Figure 1 presents the version with axial-cyclone and cellulose filter element, while Figure 2 shows the one with fiber glass filter element. Figure 3 schematizes the variant with axial-

cyclone and one stainless steel filter cartridge only. Multicyclones can be used instead of axial-cyclones. The overall dimensions of the FS 641 can be found in Figure 4 and Table 3.

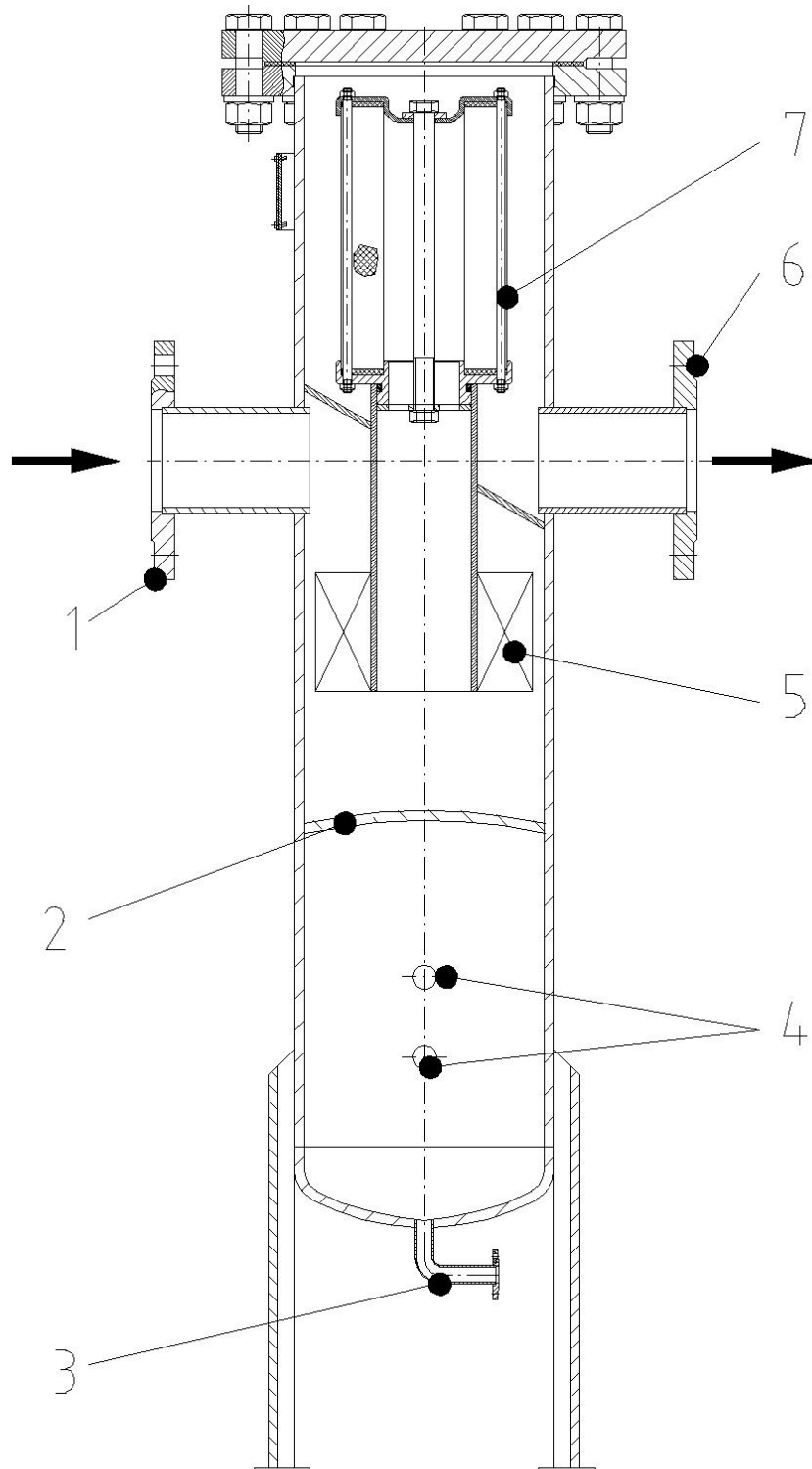


Figure 3 – FT 641 filter separator

*1 - gas inlet; 2 – baffle plate; 3 – drain; 4 - level indicator connection; 5 – axial cyclone;
6 – gas outlet; 7 – filter cartridge.*

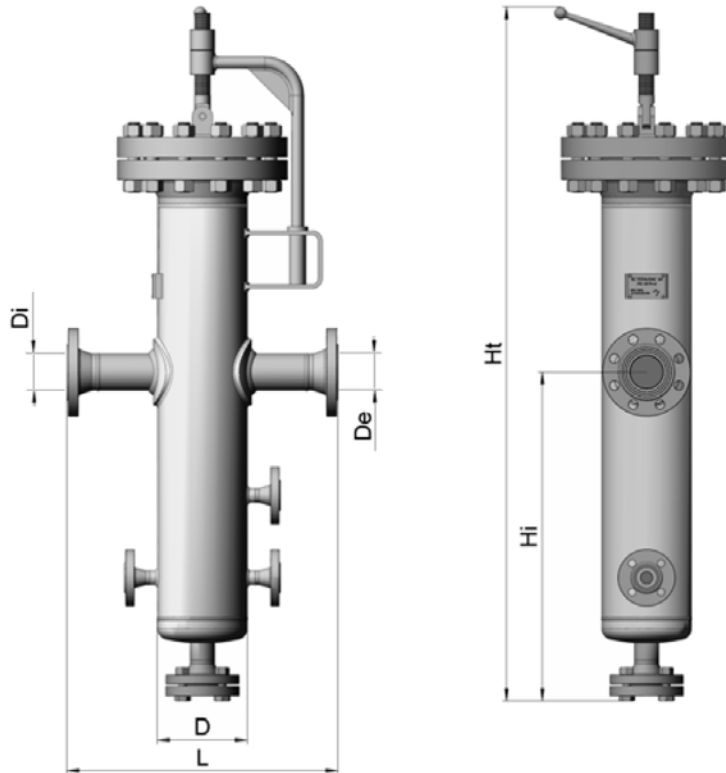


Figure 4 – Overall dimensions - vertical FS 641 filter separator

Table 3 – Overall dimensions of the FS 641 vertical filter separator

FS model	Di [mm]	De [mm]	Hi [mm]	Ht [mm]	D [mm]	L [mm]
FS 641	25	25	300	650	141.3	400
	32	32	300	650	168.3	400
	40	40	300	650	168.3	400
	50	50	400	850	168.3	450
	65	65	400	900	219.1	500
	80	80	400	900	219.1	500
	100	100	500	1000	219.1	600
	125	125	500	1200	323.9	800
	150	150	500	1400	323.9	800
	200	200	700	2400	406.4	900
	250	250	700	2400	508	1000
	300	300	950	2650	508	1100
	350	350	950	2650	508	1100

	400	400	1100	2900	610	1300
	500	500	1300	3100	610	1500

FS 642 filter separator

FS 642 is a horizontal multi-stage filter separator, where the first stage is a filter - coalescer and the second stage consists of a demister. Glass fiber filter elements are usually employed for the first stage. The demister can be vane type, wire-mesh, cyclone or multicyclone.

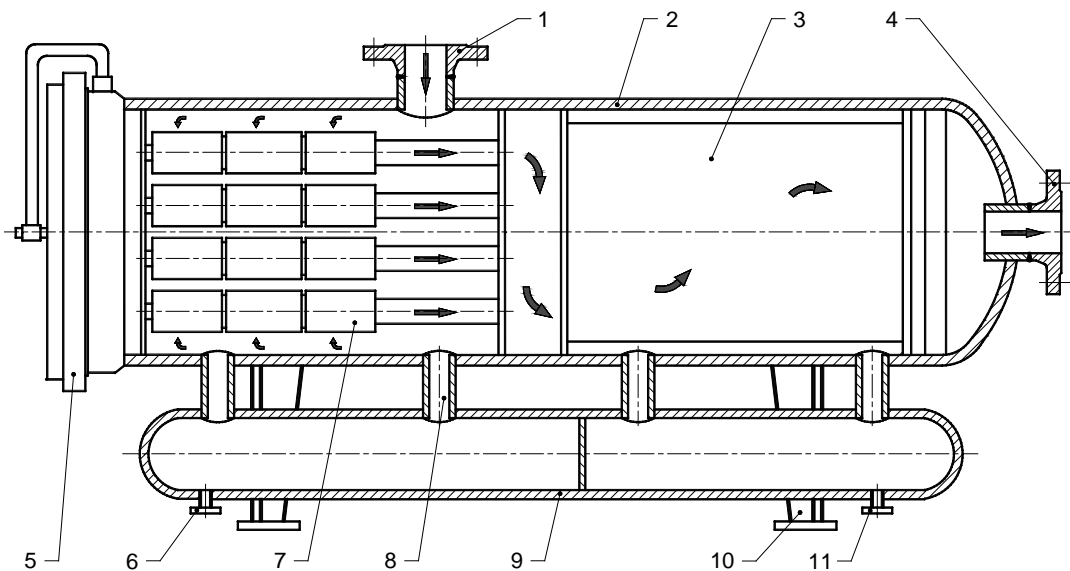


Figure 5 – Horizontal FS 642 (multi cartridge) filter separator

1 – gas inlet; 2 – body; 3 – demister (vane type, wire-mesh, cyclone, multicyclone); 4 – gas outlet; 5 – cover; 6 – purge nozzle; 7 – filtering cartridge (single or multiple layer); 8 – collection chamber connection; 9 – collection chamber; 10 – support leg; 11 – drain

Operation

The gas enters the vessel through top or laterally located gas inlet and reaches the pre-separation section. Here the gas stream is slowed down and strikes the bundle of pipes which are the extensions of filter element supports. Gravity causes the 10-micron particles to fall to the bottom of the filter, into the sump. Then, the gas flows through the coalescer- cartridges from outside to inside. This way, the particles are restrained at the outside and the mist particles collide with each other coalescing to larger droplets for better separation. The downstream liquid separation is done in the second stage, the demister. The liquid is drained into the collecting chamber while the clean gas exits the outlet nozzle.

Standard configurations and overall dimensions

Several variants of FS 642 filter separators are currently produced by **Totalgaz Industrie**.

The main differences consist of the demister type.

The overall dimensions of FS 642 can be found in Figure 6 and Table 4.

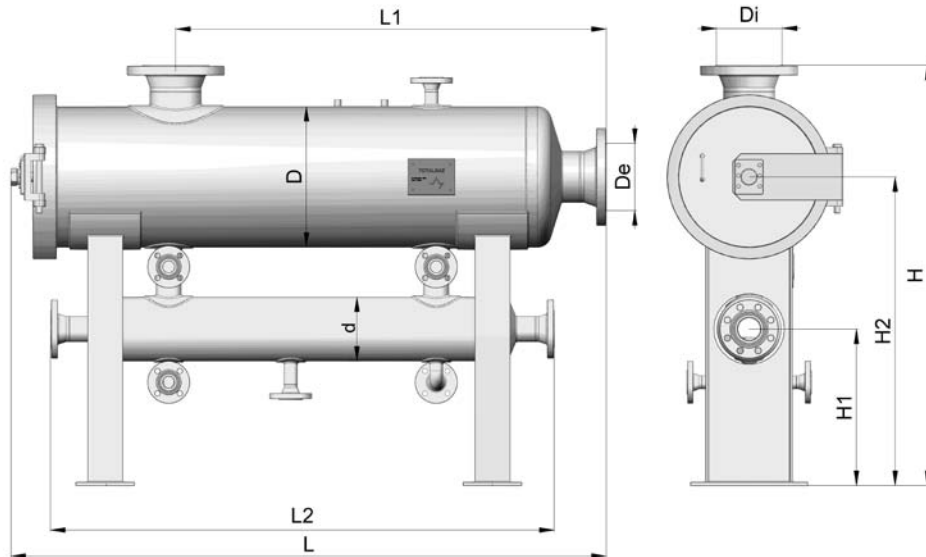


Figure 6 – Overall dimensions of FS 642 filter separator

Table 4 - Overall dimensions of FS 642 filter separator

FS model	Di [mm]	De [mm]	D [mm]	d [mm]	H1 [mm]	H2 [mm]	H [mm]	L1 [mm]	L2 [mm]	L [mm]
FS 642	25	25	168.3	168.3	300	650	900	700	1000	1200
	32	32	168.3	168.3	300	650	900	700	1000	1200
	40	40	168.3	168.3	300	650	900	800	1300	1500
	50	50	168.3	168.3	300	650	900	800	1300	1500
	65	65	219.1	168.3	300	650	900	800	1300	1500
	80	80	219.1	219.1	400	900	1200	800	1300	1500
	100	100	219.1	219.1	400	900	1200	800	1300	1500
	125	125	323.9	219.1	400	900	1200	1200	2000	2200
	150	150	323.9	219.1	400	900	1200	1200	2000	2200
	200	200	406.4	323.9	500	1100	1500	1400	2000	3000
	250	250	508	323.9	500	1100	1500	1400	2700	3000
	300	300	508	323.9	500	1100	1500	1400	2700	3000
	350	350	508	323.9	500	1100	1500	1400	2700	3000
400	400	610	406.4	600	1300	1800	1600	3500	3800	

	500	500	610	406.4	600	1300	1800	1600	3500	3800
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Efficiency

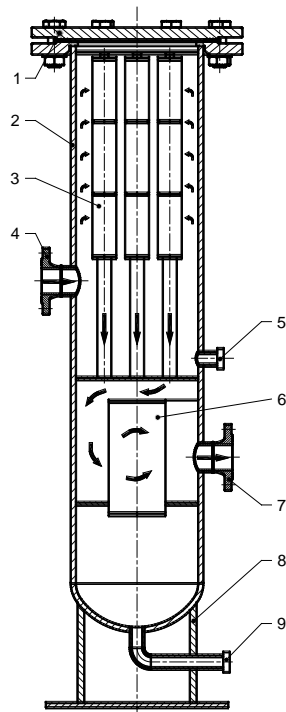
The FS filter separators manufactured by **Totalgaz Industrie** provide a high separation rate of both liquid and solid particles. The efficiency depends on particle size and distribution, particle loading, element face velocity and pressure drop. Typical performance efficiency:

- 100 % separation of solid particles greater than 3 microns;
- 99 % separation of solid particles between 0.5 -3 microns;
- 100 % separation of liquid particles greater than 3 microns.

FS 643 filter separator

FS 643 is a vertical 2 – stage filter separator, where the first stage provides filtration and the second stage the separation process. In order to ensure filtration / separation, FS 643 can be fitted to the inner side with elements such as demister, distributor, cyclone, multicyclone, coalescer cartridge or filtering cartridges.

The impurities, both liquid and solid, retained in the filtration / separation process shall be collected at the lower part of the filter separator and exhausted; the exhaustion shall be manually or automatically operated.



- 1 - cover
- 2 - body
- 3 - filtering cartridge (single or multiple layer)
- 4 - gas inlet
- 5 - drain
- 6 - demister (vane type, wire-mesh, cyclone, multicyclone)
- 7 - gas outlet
- 8 - support leg
- 9 - drain

Figure 7 – Possible configuration of FS 643 filter separator

Operation

The gas enters the vessel through the gas inlet and reaches the pre-separation section. Here, the gas stream is slowed down and strikes the bundle of pipes which are extensions of the filter element supports.

The gravity causes the 10-micron particles to fall in the lower collecting compartment, being eventually drained through the drain nozzle (5) (Figure 7). Then, the gas flows through the coalescer cartridges, from outside to inside. This way, the particles are retained outside and the mist particles collide with each other, coalescing to larger droplets for better separation. The downstream liquid particles are separated in the second stage consisting of the demister. The liquid is exhausted at the bottom while the gas exits the outlet nozzle.

Standard configurations and overall dimensions

Several variants of FS 643 filter separators are currently produced by **Totalgaz Industrie**. The main differences consist of the filtration-separation customized solution depending on the working conditions.

The overall dimensions of the FS 643 are indicated in Figure 8 and Table 5.

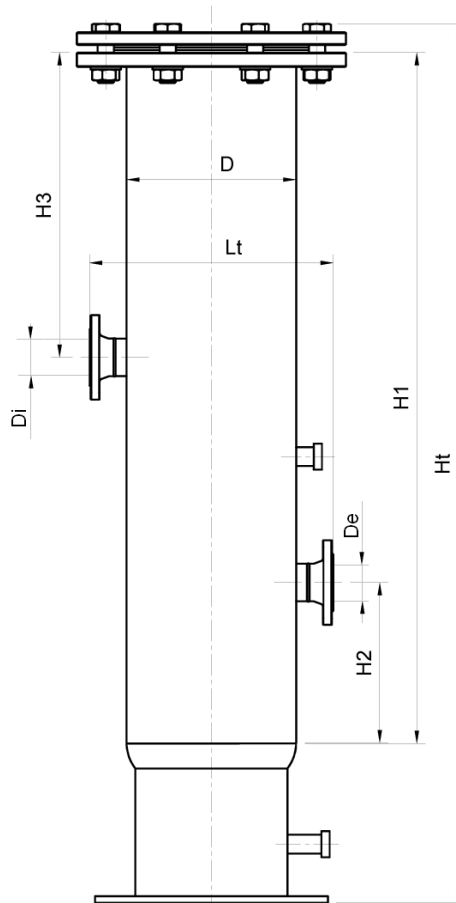


Figure 8 – Overall dimensions of the FS 643 filter separator

Table 5 – Overall dimensions of the FS 643 filter separator

FS model	Di [mm]	De [mm]	Ht [mm]	H1 [mm]	H2 [mm]	H3 [mm]	D [mm]	Lt [mm]
FS 643	25	25	3200	2600	580	1000	219.1	580
	32	32	3200	2600	580	1000	219.1	580
	40	40	3200	2600	580	1000	219.1	580
	50	50	3200	2600	580	1000	219.1	580
	65	65	3200	2600	580	1000	219.1	580
	80	80	3450	2750	650	1100	323.9	700
	100	100	3450	2750	650	1100	323.9	700
	125	125	3450	2750	650	1100	323.9	700
	150	150	3650	2950	750	1200	406.4	920
	200	200	3650	2950	750	1200	406.4	920
	250	250	3900	3100	850	1250	508	1000
	300	300	3900	3100	850	1250	508	1000

	350	350	3900	3100	850	1250	508	1000
	400	400	4000	3200	900	1300	610	1100
	500	500	4200	3300	1000	1300	711	1200

Configuration options

Totalgaz Industrie provides a wide range of filter separator configurations. The common options for vertical separators are specified in Figure 9, and for horizontal separators are indicated in Figure 10. Other configurations can also be manufactured upon request, as well as customer-specific filter separators designed for any type of application, size, material and pressure.

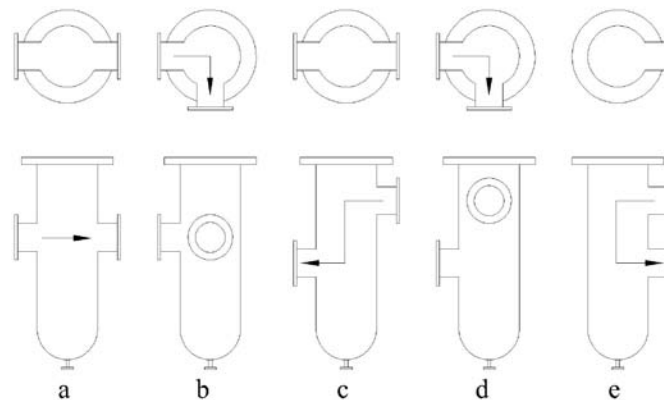


Figure 9 – Optional configurations of vertical filter separators

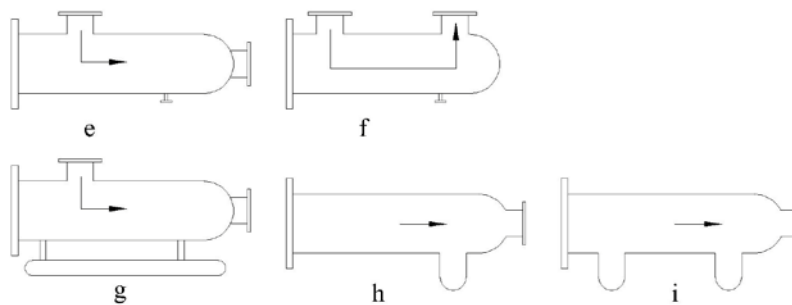


Figure 10 – Optional configurations of horizontal filter separators

g, h, I – with liquid collector

In order to meet the client installation requirements, the gas filter separators are available in 3 types of base support arrangements (Figure 11).

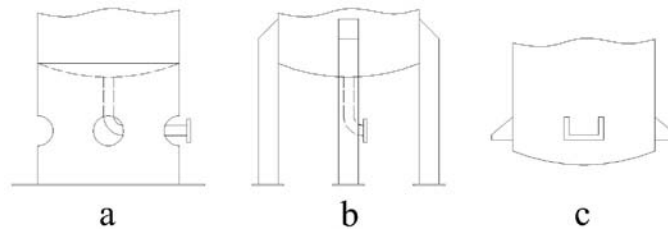
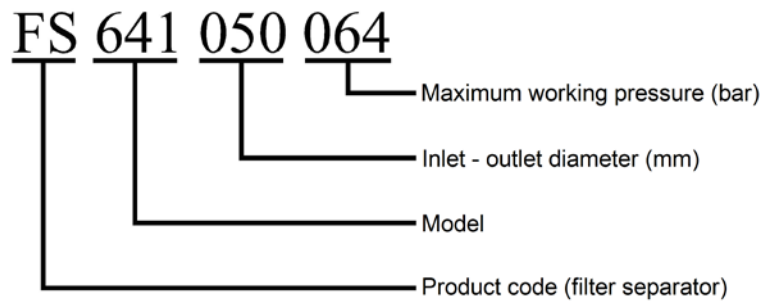


Figure 11 – Base supports

a – „skirt” and base ring support; b – „leg” support; c – „lug” support

Ordering code

Totalgaz Industrie gas filter separators can be ordered by indicating the product type, nominal diameter of the inlet – outlet connections and maximum working pressure.



For example, FS 641-050-064 ordering code designates a vertical FS 641 separator with inlet-outlet nominal diameter of 50 mm and maximum working pressure 64 bar.

Additional requirements, if any, must be specified when placing the order.

The manufacturer reserves the right to make modifications without any prior notification.

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