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Federal Office for Civil Protection FOCP
SPIEZ LABORATORY

TPH-06

Technical specifications (TPH)

for the production of gas filters (NBC filters) of types GF 40, 75, 150, 300 and 600 for civil defence structures

14 April 2015

ID number/Vers. 10013641534/01 Reference: 640-06

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1 Fundamentals

- Bundesgesetz über den Bevölkerungsschutz und den Zivilschutz (BZG).
  Federal Act on Civil Protection and Civil Defence (CPDA).
- Verordnung über den Zivilschutz (ZSV).
  Civil Defence Ordinance (CDO).
- Technische Weisungen für die Schutzanlagen der Organisation und des Sanitätsdienstes (TWO)
  Technical directives for protective facilities of the organisation and the medical services (TWO)
- Technische Weisungen für spezielle Schutzräume (TWS)
  Technical directives for special shelters (TWS)
- Technische Weisungen für den Pflicht-Schutzraumbau (TWP)
  Technical directives for private shelter construction (TWP)
- Technische Weisungen für die Erneuerung von Anlagen und speziellen Schutzräumen (TWE Anlagen)
  Technical directives for the renewal of facilities and special shelters (TWE facilities)
- Technische Weisungen für die Erneuerung von Schutzräumen bis zu 200 Schutzplätzen (TWE Schutzräume)
  Technical directives for the renewal of shelters for up to 200 places (TWE) shelters
- Technische Weisungen für die Schocksicherheit von Einbauteilen in Zivilschutzbauten (TW Schock)
  Technical directives for shock resistance of components installed in civil defence facilities (TW shock)
- Technische Weisungen Qualitätsmanagement für prüfpflichtige Komponenten im Bereich Zivilschutz
  Technical directives for quality management for civil defence components subject to testing

2 Supplementary regulations

- Technische Weisungen Typenschilder, Montage-, Betriebs- und Wartungsanleitungen von BABS-prüfpflichtigen Einbauteilen
  Technical directives for type plates, instructions for assembly, operations and maintenance of installation parts that are subject to testing by the FOCP
- Technisches Pflichtenheft für Oberflächenschutz von Metallen TPH-12 des BABS
  Technical directives for surface protection of metals TPH-12 of the FOCP
- Technisches Pflichtenheft für Formteile und Halbzeug aus Thermoplasten, Duromeren und Elastomeren (Kunststoff und Gummi), für Vergussmassen, für Klebstoffe TPH-10 des BABS
  Technical directives for moulded and semi-finished elements out of thermoplastic or thermoset material and elastomers (plastics and rubber), for casting compounds, adhesives TPH-10 of the FOCP
- Technisches Pflichtenheft für Aktivkohle in ABC-Schutzfiltern TPH-07 des BABS
  Technical directives for activated charcoal used in NBC filters ,TPH-07 of the FOCP
- Technisches Pflichtenheft für Schwebstofffilterpapier in ABC-Schutzfiltern TPH-08 des BABS
  Technical directives for aerosol filter paper used in NBC filters ,TPH-08 of the FOCP
- Technisches Pflichtenheft für Staubschutzmaterial in ABC-Schutzfiltern TPH-09 des BABS
  Technical directives for dust protection material used in NBC filters ,TPH-09 of the FOCP
- Prüfvorschriften und Prüfpläne des LABOR SPIEZ. (Prüfvorschriften und Prüfpläne unterliegen dem Änderungsdienst des LABOR SPIEZ. Sie können vor Ort eingesehen werden. Keine Publikation im Internet)
  Test procedures and test schedules of the SPIEZ LABORATORY. (Test procedures and test schedules are subject to the modification service of the SPIEZ LABORATORY. They can be read on location. No publication in the Internet)

Basic documents can be downloaded from the Internet at:
www.bevölkerungsschutz.admin.ch.

3 Scope of application

Gas filters that meet the requirements of these technical specifications, can be installed in new protective facilities and shelters, which are designated for renewal according to TWE.

The gas filters are important components of protective facilities.

The following gas filters are foreseen in the single protective facilities:

TWP shelters	GF 40
TWP and TWS shelters	GF 75
TWP- und TWS shelters, TWO-facilities	GF 150
TWS shelters	GF 300
TWS shelters und TWO facilities	GF 600

4 Type of operation

The following operational modes of ventilation are foreseen in protective facilities:

- Air circulation mode
- Filter mode
- Fresh air mode
- Emergency mode
- Maintenance mode.

Filters manufactured according to these technical specifications are used in filter and emergency mode and are designed to move the following volumes of air and overcome the following flow resistance:

Type of filter	**Volume of air**	**Flow resistance**
GF 40 for	40 m^3/h (0.011 m^3/s)	max. 600 Pascal
GF 75 for	75 m^3/h (0.021 m^3/s)	max. 600 Pascal
GF 150 for	150 m^3/h (0.042 m^3/s)	max. 600 Pascal
GF 300 for	300 m^3/h (0.083 m^3/s)	max. 650 Pascal
GF 600 for	600 m^3/h (0.167 m^3/s)	800 ±40 Pascal[1)]

[1)] with vertical pipe

The nominal volume of air is the amount of air the gas filter must be designed to handle and for which it is tested. It is based on an atmospheric pressure of 945 mbar and a temperature of 20 °C.

Filters with a capacity of up to 300 m^3/h are each operated with a respective ventilation unit, whereas the GF 600 in combination with a central ventilation unit.

5 Parameters

5.1 Ground shock resistance

The gas filters must meet TW shock requirements.

The anchor bolts must be approved by the BZS and of such a size that they can withstand the forces that may be transferred from the (normed) assembly rail.

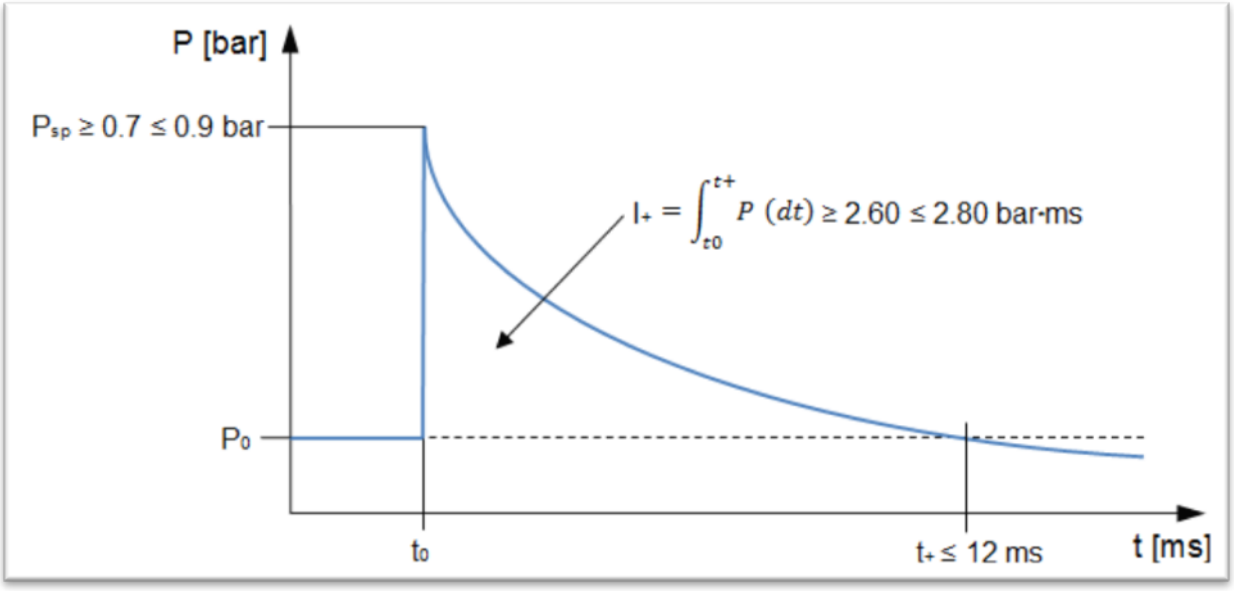
The following connections (dimensions according to drilling template) should be used for the GF 600 gas filters:

- With base frame embedded in concrete foundation and machine screws
- With BZS approved anchor bolts

5.2 Air blast resistance

The gas filters must stand up to the following air blast loading profile:

- peak incident overpressure: $p_{sp} \geq 0.7 \leq 0.9$ bar
- Impulse of positive pressure phase duration: $I_+ \geq 2{,}60 \leq 2{,}80$ bar·ms
- Positive pressure phase duration: $t_+ \leq 12$ ms



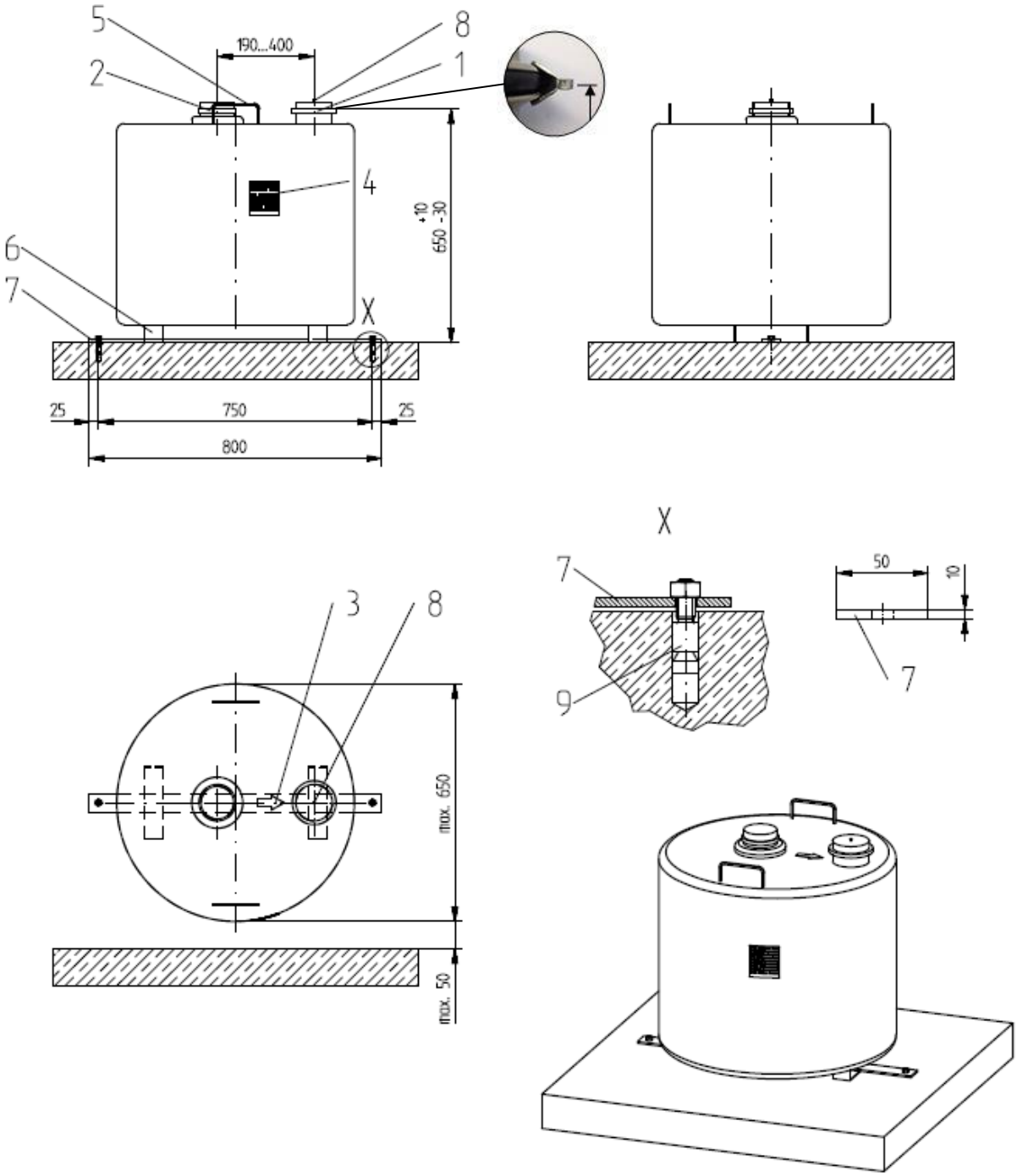
Simplified graph of air blast loading profile

The air blast is applied to the gas filter's air intake

The function, in particular the air tightness of the housing as well as the aerosol and gas separation performance must also be ensured after the ground shock and air blast loading test.

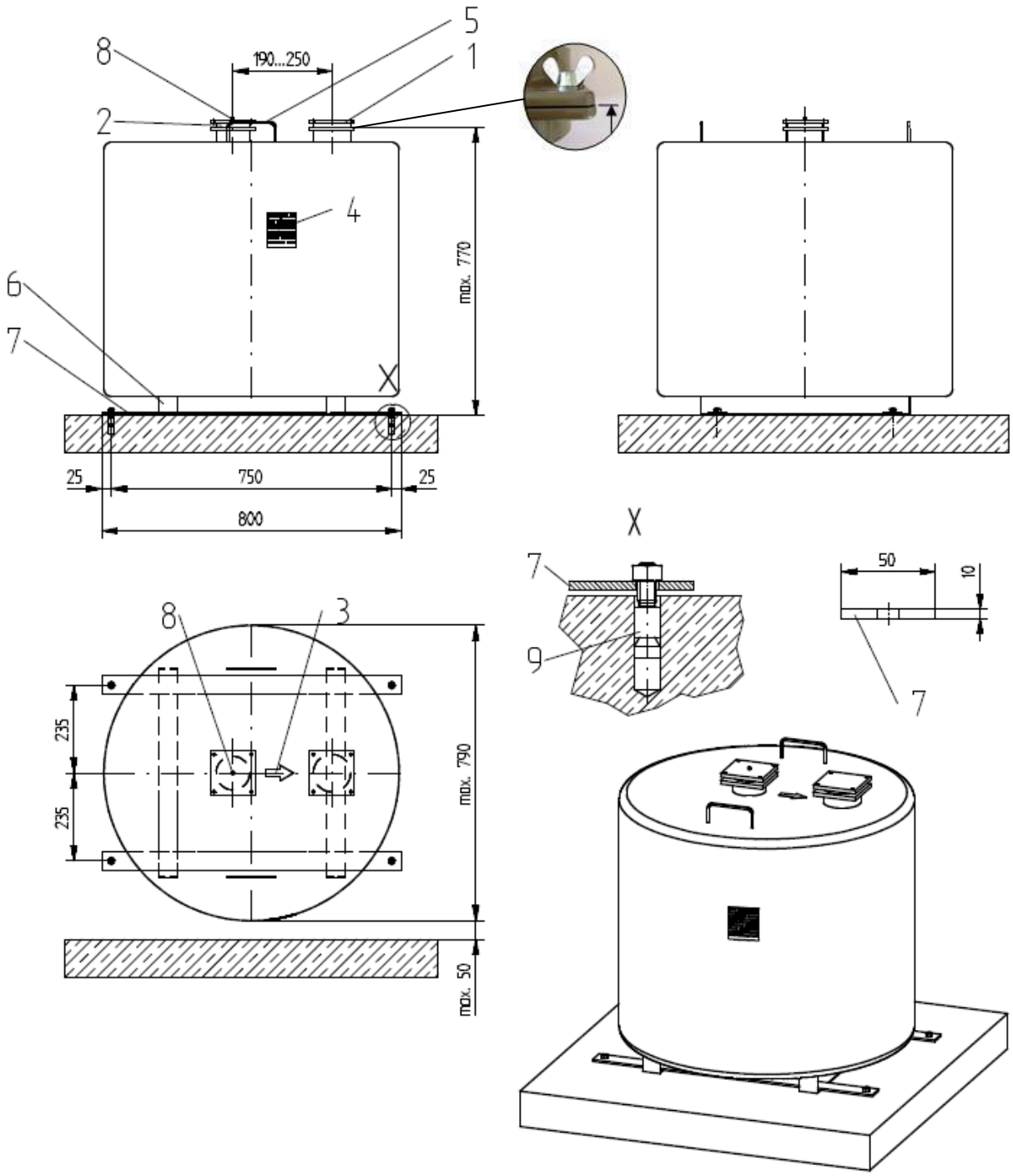
6 Schematic construction of gas filters

6.1 Schematic construction of GF 40, 75 and 150



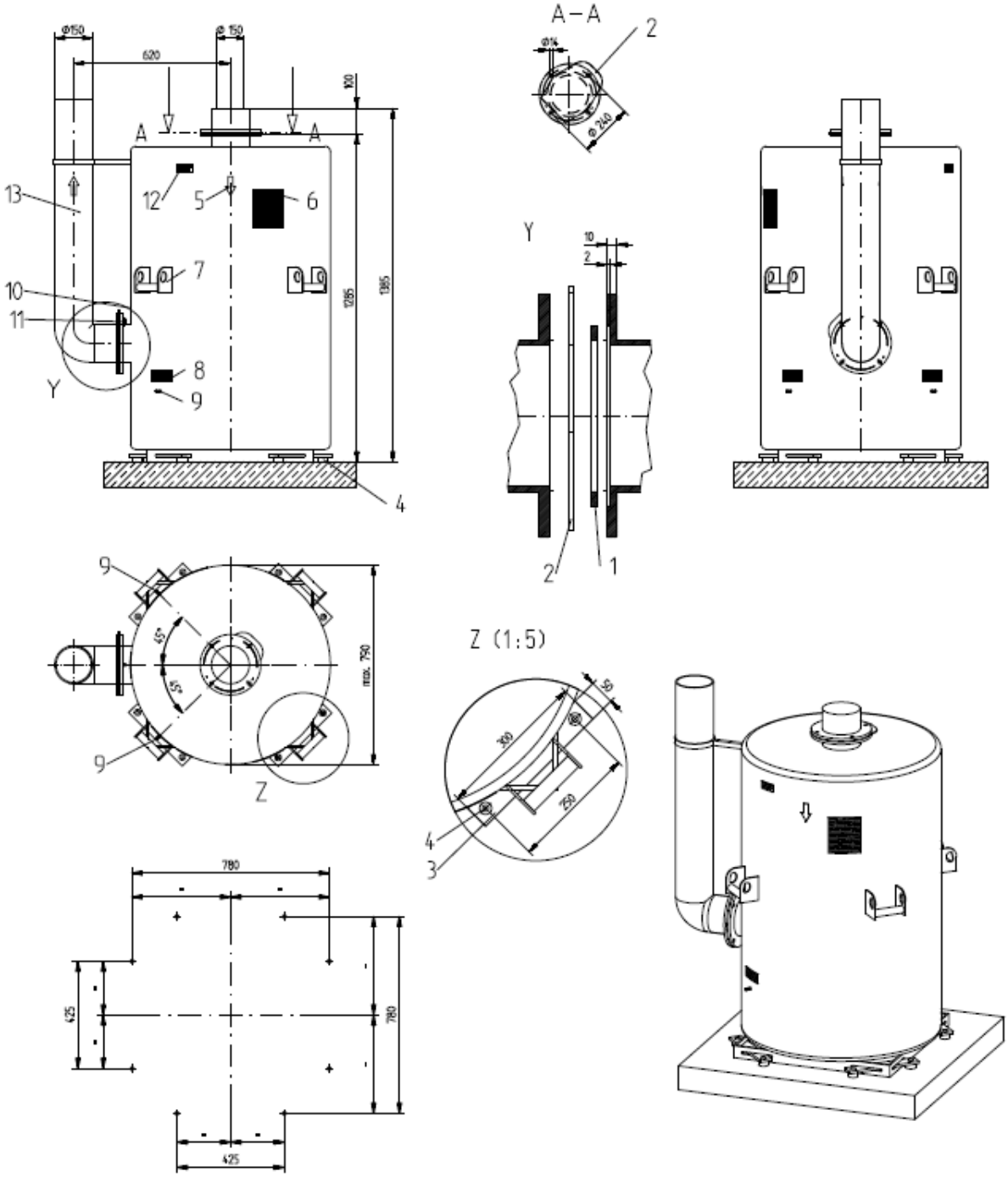
Key		No of pieces
1	Clasp according to BZS drawing No. 65 - 5/1	1
2	Clasp according to BZS drawing No. 65 - 5/2	1
3	Arrow indicating direction of airflow	1
4	Type plates	1 or 2
5	Transport handles	2
6	Assembly pods	2
7	Assembly rail / steel 37.2	1
8	M8 pressure relief screw	1
9	BZS-approved anchor bolts	2

6.2 Schematic construction of GF 300



Key		No. of pieces
1+2	Breech plate as in BZS drawing No. 92 - 027.1 to 5	1
3	Arrow indicating direction of airflow	1
4	Type plate	1 or 2
5	Transport handles	2
6	Assembly pods	2
7	Assembly rail / steel 37.2	1
8	M8 pressure relief screw	1
9	BZS-approved anchor bolts	2

6.3 Schematic construction of GF 600



Key		No. of pieces
1	Gasket Ø 178/158 x 5	2
2	Blind disk	2
3	Assembly rail 50 x 10	4
4	Spacer	8
5	Arrows indicating direction of airflow	4
6	Type plate	2
5	Transport tabs	4
8	Potential equalisation plate	2
9	Potential equalisation screw	2
10	Pressure relief plate	1
11	M8 pressure relief screw	1
12	‘DON’T TILT’ notice	2
13	Vertical pipe	1

7 Description of components, construction, specification, test requirements

7.1 Description of gas filter

The gas filter is a combined filter consisting of an aerosol and a gas filter part. These two filter parts are to be positioned in such a way that they are penetrated in the sequence mentioned.

7.2 Encasing

The directives must be observed as under 6.1 to 6.3 (dimensions, equipment).

The filter case must be pressure resistant and leak-proof:

- Gas-tight plugs or blind discs on air inlet and outlet stubs
- An over or under pressure of ± 50 kPa (GF 600 =+ 70 / - 50 kPa) due to temperature fluctuations must not affect the function of the filter.
- For test pressure of ± 3‘000 Pa within the encasing, the pressure loss is not allowed to be more than ± 20 Pa per minute.

To prevent the gas filter from being damaged during handling the air intake duct must be protected by a grid or perforated plate.

The casing must be constructed in such a way that it can be opened by the manufacturer for revision purposes without being destroyed.

All closures (caps or blind discs, locking rings and pressure relief screw) must be sealed with wire in such a way that opening them is evident from destruction of the seal.

7.3 Aerosol filter section

To remove aerosols the filter air must be passed through a package of pleated aerosol filter medium. The latter must meet the requirements laid down in the technical specifications TPH-08 for aerosol filter paper in NBC filters.

The overall surface of the aerosol filter medium must be of such a size that the face velocity does not exceed 1.5 cm/s.

Its permeability for aerosols is tested with DEHS [Di (2-ethylhexyl)-sebacic acid-ester]; Test procedure according to EN 1822-5. The initial permeability for the MPPS (most penetrating particle size) must not exceed 0.005 % of the total number of particles.

7.4 Gas filter section

To remove gases (sorption) the filter air must be passed through a layer of/with granulated active charcoal which must meet the requirements laid down in the technical specifications for active charcoal in NBC filters (TPH-07). It must be filled in in such a way that best packing density is achieved. Humidity after encapsulation (within the finished, closed filter) must not exceed 5 percent by weight.

The active charcoal bed (the sorption layer) should have a specific volume of at least 0.44 L active charcoal per m^3/h filtered air, i.e.:

- GF40: at least 17.6 L
- GF75: at least 33 L
- GF150: at least 66 L
- GF300: at least 132 L
- GF600: at least 264 L

The gas separation performance or the gas sorption capacity of the filter is tested with cyclohexane. The following requirements apply:

- Leakage: initial leakage of filter no more than 0.01 % of test concentration
- Capacity: absorption of filter at least the same as in laboratory testing of the respective active charcoal lot, extrapolated to the minimum volume of active charcoal required.

A charcoal bed filled with active charcoal granulate must be protected by an elastic (spring) closure against leakage due to possible settlement. The gas separation performance must be also be ensured after impacts from transport and handling or after exposure to air blast and physical shock.

7.5 Coupling and clasps

The coupling connecting to the flexible conduit during fresh air operation or as to the gas filter during filter operation must precisely fit with the air intake and exhaust socket of the gas filter.

The clasps are listed in the following table:

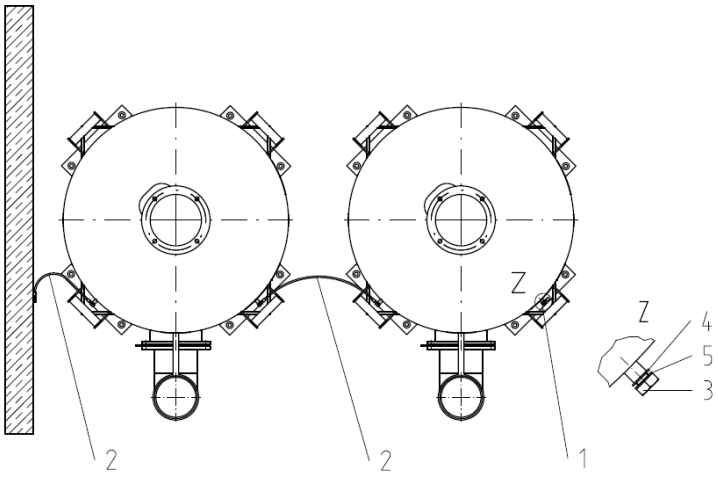
Closure for	Production according to
GF 40 to 150	BZS approval No. T 65-005
GF 300	BZS drawing No. 92 - 027.1 to 5 (NW175)
GF 600	Drawing pos. 6.3

7.6 Sealing material

Seals, adhesive seams and casting polymers must meet the technical requirements (TPH-10) specified for moulded thermoplasts, thermoset materials elastomers or semi-finished elements (plastics and rubber), for casting compounds and adhesives (TPH-10).

7.7 Potential equalisation

The GF 600 has two grounding screws with which the potential equalisation lead should be connected as shown in the drawings in accordance with 6.3 (bent 90°).



Key
1 Fixation point for potential equalisation lead (WeZS)
2 Potential equalisation lead
3 M10 x 16 hexagonal screw
4 M 10 washer
5 M10 spring lock ring

7.8 Labelling of gas filters

The gas filters must be labelled according to the technical directives concerning type plate, assembly, operation and maintenance instructions for installation parts subject to FOCP testing.

7.8.1 Type plate

The type plate (two should be mounted when attached to side of the gas filter) must contain the following information:

- Manufacturer
- Type of filter
- Fabrication number
- Approval number
- Approval number of active charcoal
- Active charcoal lot number
- Weight of filter (precision according to information below)
- Date of manufacture
- Attachment

Weight of filter stated as follows:

- Maximum deviation:
  - GF 40 and GF 75: 0.1 kg
  - GF 150 and GF 300: 0.2 kg
  - GF 600: 0.5 kg
- Included in weight:
  - GF 40, GF 75, GF 150 und GF 300:
    - with closure caps, pods and screws,
    - without plastic cover, assembly rail and anchor bolts
  - GF 600:
    - with all connecting flanges (blind discs, entry conduits and vertical pipe)
    - without flexible hoses, brackets, assembly rails, anchor bolts or screws

7.8.2 Direction of air flow

The direction of air flow must be indicated by an arrow
(for GF with vertical pipe at least 4 arrows).

7.8.3 Further labels for GF 600

- Marking of pressure relief screw
- Marking of potential equalisation screws
- ‘DON’T TILT’ notice

7.9 Surface treatment

All modules must consist of anti-corrosive material or be treated against corrosion in accordance with technical specifications for surface protection of metals used in civil protection (TPH-12).

7.10 Dust protection

The active charcoal bed must be protected on both entry and exhaust side against dust. The material used to protect against dust must meet the respective technical requirements for NBC filters (TPH-09).

7.11 Packaging

To protect them against transport damage, gas filters must be delivered in their original package.

7.12 Plastic cover

A plastic cover must be must be delivered with the GF 40, 75, 150 and 300 gas filters. (protection against dust and dirt)

8 Technical documents

Instructions according to the technical directives concerning type plates, assembly, operation and maintenance must be included in every delivery of installation parts subject to testing by the FOCP.

9 Quality management

Quality is assured according to the quality management directives for civil protection components subject to testing.

10 Final stipulations

These technical specifications shall become effective on 1 July 2015 and replace:

- Technical specifications for the production of gas filter (NBC filter) types GF 40, 75, 150, 300 und 600 for civil protection structures of 1 January 1994
- All existing concessions will remain valid until their official expiry date.
- These technical specifications have priority over the technical specifications TWO / TWP / TWS / TWE / TWK or TW-Shock.

These technical specifications shall fully apply to all concession applications the FOCP receives after 1 July 2015.