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شرکت ملی گاز ایران

مدیریت پژوهش و فناوری

امور تدوین استانداردها

# IGS

مشخصات فنی

کارتریج فیلتر گاز خشک

Dry Gas Filter Cartridge



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شرکت ملی گاز ایران



دفتر مدیرعامل

## ابلاغ مصوبه هیأت مدیره

مدیر محترم پژوهش و فناوری

باسلام،

به استحضار می‌رساند در جلسه ۲۰۳۱ مورخ ۱۴۰۲/۰۷/۳۰ هیأت مدیره، نامه شماره گ/۹/۰۰۰/۲/۱۲۶۹ مورخ ۱۴۰۲/۰۷/۲۲ مدیر پژوهش و فناوری در مورد تصویب نهایی مقررات فنی شرکت ملی گاز ایران به شرح زیر مطرح و مورد تصویب قرار گرفت.

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## Foreword

This standard specification is intended to be mainly used by N.I.G.C. and contractors, and has been prepared base on interpretation of recognized standards and technical documents, as well as knowledge, backgrounds and experiences in gas industries at national and international levels.

Iranian Gas Specification (IGS) are prepared, reviewed and amended by technical standard committees within NIGC standardization division of research and technology management and submitted to "the standards council of NIGC" for approval.

IGSs are subjected to revision, amendment or withdrawal, if required, and thus the latest edition of IGS shall be checked / inquired by NIGC'S users.

This standard must not be modified or altered by NIGC employees or its contractors. Any deviation or conflicts between this specification and other applicable standards, codes, procedure or well-known manufacturer's specifications must be resolved in writing by the user or its representative through Manager, Engineering Department or standardization division of NIGC.

The technical standard committee welcomes comments and feedbacks from concerned or interested corporate and individuals about this standard, and may revise this document accordingly based on the received feedbacks.

## General Definitions

Throughout this standard the following definitions, where applicable, should be followed:

- 1- "STANDARDIZATION DIV." is organized to deal with all aspects of industry standards in NIGC. Therefore, all enquiries for clarification or amendments are requested to be directed to mentioned division.
- 2- "COMPANY": refers to National Iranian Gas Company (NIGC).
- 3- "SUPPLIER": refers to a firm who will supply the service, equipment or material to IGS specification whether as the prime producer or manufacturer or a trading firm.
- 4- "SHALL ": is used where a provision is mandatory.
- 5- "SHOULD": is used where a provision is advised only.
- 6- "MAY": is used where a provision is completely discretionary.

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## 1. Scope

This standard specification covers the minimum requirements for material, design, testing, inspection, marking, packing and packaging of elements for the dry gas filters which are used in metering and regulating gas stations and to remove the solid particles present in a gas flow. This specification is the main part of the enquiry and purchase order. It shall be the supplier responsibility to clearly indicate any deviation from this specification.

## 2. References

Throughout this standard specification the following standards are referred to. For all references, the latest edition of the following referenced documents shall be applied. The applicability of changes in standards that occur after the date of this standard specification shall be mutually agreed upon by the purchaser and the supplier.

**ASHRAE 52.2:** "Method of testing general ventilation air-cleaning devices for removal efficiency by particle size".

**ASTM F316-03:** "Standard test methods for pore size characteristics of membrane filters by bubble point and mean flow pore test".

**ASTM B633:** "Standard specification for electro deposited coatings of zinc on iron and steel".

**ISO 11057:** "Air quality- Test method for filtration characterization of cleanable filter media".

**ISO 1817:** "Rubber, vulcanized or thermoplastic- Determination of the effect of liquids".

**ISO 2941:** "Hydraulic fluid power- Filter elements- Verification of collapse/burst pressure rating".

**ISO 48:** "Rubber, vulcanized or thermoplastic- Determination of hardness (hardness between 10 IRHD and 100 IRHD)".

**ISO 815-1:** "Rubber, vulcanized or thermoplastic- Determination of compression set - Part 1: At ambient or elevated temperatures".

**ISO 9073-1:** "Textiles -Test methods for nonwovens- Part 1: Determination of mass per unit area".

**ISO 9073-2:** "Textiles -Test methods for nonwovens- Part 2: Determination of thickness".

**ISO 9073-3:** "Textiles -Test methods for nonwovens- Part 3: Determination of tensile strength and elongation at break using the strip method".

**ISO 9073-4:** "Textiles -Test methods for nonwovens- Part 4: Determination of tear resistance".

**ISO 9237:** "Textiles -Determination of the permeability of fabrics to air".

**ISO 17025:** "General requirements for the competence of testing and calibration laboratories".

**DIN 53438 Part 3:** "Testing of Combustible Materials; Response to Ignition by a Small Flame; Surface Ignition"

**ISO 2768-1:** “General tolerances Part: tolerances for linear and angular dimensions without individual tolerance indications”

### 3. Definition

**3.1. Actual Filtration Area:** A measure of the usable media surface in the cartridge.

**3.2. Cartridge:** The inside element of the dry gas filter.

**3.3. Corrugation:** Corrugated metal folded into a series of small parallel folds to make it stronger.

**3.4. Dry gas filter:** A device which is designed to remove solid particles.

**3.5. Efficiency:** Fraction or percentage of number of particles which is removed by the cartridge.

**3.6. Media:** The dust removing part of the cartridge.

**3.7. Particle size:** Light scattering equivalent size expressed as a diameter in micrometer ( $1 \mu\text{m} = 10^{-6} \text{m}$ ).

**3.8. Pressure drop:** A measure of the cartridge resistance to gas flows through it.

### 4. Technical Specification

The cartridge shall separate  $5 \mu\text{m}$  solid particles with the initial efficiency  $\geq 60\%$  and the average efficiency  $\geq 95\%$ . Performance test procedure of the cartridge is according to ASHRAE 52.2 and/or ISO 11057 for  $4.0\text{-}5.5 \mu\text{m}$  particles. Meanwhile, the complete cartridge shall be made of F1 class flame retardant materials which is suitable for and resistant against odorant and natural gas components according to DIN 53438 Part 3. The cartridge of dry gas filters shall be open ended type.

#### 4.1. Material

**4.1.1. Media:** Materials shall be selected according to the request of purchaser/client and the valid certification of listed tests in 5.1.1 shall be presented. This standard recommends polypropylene or polyester media or composite synthetic. On the other hand, methods for disposal of wasted element filters (after use) shall be described by supplier. Described methods shall be in accordance with national and/or local regulations and regarded standards for waste disposal. It also shall be in accordance with N.I.G.C relevant waste management and disposal procedures.

**4.1.2. Adhesive:** It shall be two-component polyurethane type for end caps, and industrial type for gaskets. The adhesive shall be resistant to hydrocarbons.

**4.1.3. Inner core:** Machine perforated corrugation or spiral perforated tube which shall be in opposite side of the media.

It shall be electro galvanized or cold rolled oil carbon steel sheet metal with galvanized coating (min.  $8 \mu\text{m}$  in moderate service condition- according to ASTM B633)

If the carbon steel sheet is galvanized by the sheet producer, certificate is adequate. Otherwise, the thickness shall be tested according to ASTM B633.

**4.1.4. Outer guard:** It shall be in according to the request of purchaser/client. This standard does not recommend any outer guard.

**4.1.5. Caps:** It shall be made of carbon steel with minimum 0.7 mm thickness which is externally galvanized coated, and with no wrinkle.

**4.1.6. Gasket:** It shall be made of NBR (Buna-N) or two-component polyurethane with  $3\pm 0.5$  mm thickness for cartridges up to height of 320 mm and  $5\pm 0.5$  mm thickness for cartridges larger than G3, and with 80% coverage of the caps area. In addition, gaskets shall have  $70\pm 5$  hardness (test methods are presented in ISO 48), maximum compression set of 25% (test methods are presented in ISO 815), and maximum resistance to lubricant of 5% (test methods are presented in ISO 1817).

Note: This gasket shall be fixed by industrial adhesive for the top and bottom caps.

## 4-2 Design

Nominal dimensions of the cartridges should be designed according to the following table:

**Table 1.** Nominal dimensions of the cartridges

Type	G0.5	G1	G1.5	G2	G2.5	G3	G3.5	G4	G5	G6
H* (mm)	120 $\pm$ 0.8	165 $\pm$ 1.2	210 $\pm$ 1.2	270 $\pm$ 1.2	283 $\pm$ 1.2	320 $\pm$ 1.2	350 $\pm$ 1.2	415 $\pm$ 2	470 $\pm$ 2	625 $\pm$ 2
OD (mm)	80 $\pm$ 0.8	95 $\pm$ 0.8	120 $\pm$ 0.8	165 $\pm$ 1.2	200 $\pm$ 1.2	252 $\pm$ 1.2	299 $\pm$ 1.2	299 $\pm$ 1.2	390 $\pm$ 1.2	475 $\pm$ 2
ID (mm)	35 $\pm$ 0.8	50 $\pm$ 0.8	69 $\pm$ 0.8	86 $\pm$ 0.8	110 $\pm$ 0.8	138 $\pm$ 0.8	186 $\pm$ 1.2	186 $\pm$ 1.2	246 $\pm$ 2	320 $\pm$ 1.2
Actual Filtration Area (m <sup>2</sup> )	0.060	0.125	0.230	0.470	0.725	0.950	1.200	1.450	2.300	4.200

\* H: Height of the element with caps and gaskets

This table does not violate the purchaser/client requests with other dimensions provided that they can meet the technical specifications.

In operation conditions, initial pressure drop, replacement pressure drop, and collapse pressure drop shall be considered according to table2.

**Table 2.** Operational data

Initial pressure drop	$\leq 2$ PSI
Replacement pressure drop	20 PSI
Collapse pressure drop	$\geq 45$ PSI



## 5. Tests, Certifications and Inspections

### 5.1. Tests

All specified tests shall be done in national laboratories certified by NIGC (based on ISO 17025) or accredited international laborites.

#### 5.1.1 Media Test

- 5.1.1.1. Pore size characteristics of membrane filters (ASTM F316-03)
- 5.1.1.2. Mass per unit area of textiles (ISO 9073-1)
- 5.1.1.3. Textiles thickness (ISO 9073-2)
- 5.1.1.4. Tensile strength and elongation of textiles (ISO 9073-3)
- 5.1.1.5. Textiles tear resistance (ISO 9073-4)
- 5.1.1.6. Permeability of fabrics to air (ISO 9237)

**5.1.2. Gasket tests:** In order to conformity of materials with technical specification in this standard, manufacturers shall give valid certifications to client.

- 5.1.2.1. Hardness of rubber, vulcanized or thermoplastic (ISO 48)
- 5.1.2.2. Compression set of rubber, vulcanized or thermoplastic (ISO 815-1)
- 5.1.2.3. maximum resistance to lubricant (ISO 1817).

**5.1.3. Collapse test:** Collapse test shall be done with the maximum resistance of 45 psi pressure drop using ISO-2941 and according to one of the three following methods:

- 5.1.3.1. Providing a valid certificate
- 5.1.3.2. Performing collapse test according to table 3.
- 5.1.3.3. Applying at least 0.7 mm thickness of sheet which is reinforced by the use of spiral method.

**5.1.4. Performance tests:** According to ASHRAE 52.2, following tests shall be done with the maximum initial pressure drop of 150 Pa, maximum final resistance of 450 Pa, and calculation of the efficiency for the geometric mean particle size 4.69  $\mu\text{m}$  (lower limit 4.0  $\mu\text{m}$  and upper limit 5.5  $\mu\text{m}$ ). For cartridges rated G3 or lower (Table 1), the test shall be performed using ISO 11057 test rig with ASHRAE 52.2 procedure.

- 5.1.4.1. Initial pressure drop
- 5.1.4.2. Initial efficiency
- 5.1.4.3. Average efficiency
- 5.1.4.4. Dust holding capacity

**5.1.5. Test reports:** All test reports have to contain:

- 5.1.5.1. Name and address of the client
- 5.1.5.2. Order No./Client
- 5.1.5.3. Name and address of the test laboratory
- 5.1.5.4. Date of tests
- 5.1.5.5. Number of samples



5.1.5.6. Type of test (material tests, performance tests)

5.1.5.7. Test results and evaluation

**Note:** For more information, see Appendix A.

**5.1.6. Compliance Certificate:** The certificate of conformity of the manufactured Product with the relevant documents shall be issued by the manufacturer.

## 6. MARKING

### 6.1. Marking of cartridges

Each lot of cartridges which have successfully passed the aforementioned tests, shall be marked suitably and traceably on its cap with at least the following information on each cartridge:

6.1.1. Name and/or trade mark of the manufacturer

6.1.2. G number/Size

6.1.3. Production date

### 6.2. Marking of Cartridge Box

Each box of packing shall be legibly marked with at least the following information:

6.2.1. Name and/or trade mark of the manufacturer

6.2.2. Manufacturer's address

6.2.3. IGS No.

6.2.4. G number/Size

6.2.5. Number of cartridges

6.2.6. Production date

6.2.7. Order No./client

## 7. Packing and Packaging

The cartridges shall be wrapped in nylon and sealed to prevent the entrance of moisture, and packaged in three-layer carton boxes. The cartridges shall be transported according to purchaser/client request; otherwise with no breakage and permanent deformation due to weather conditions, and stored in proper storages.



## APENDIX A

This section provides a sample cartridge inspection and test plan. Reference documents for the preparation of the technical inspection procedure shall include:

- a) Contract
- b) Conditions prepared by the cartridge manufacturer and agreed by the client
- c) Test procedures of this document

The conditions stated in the manufacturer's quality control plan (QCP) for cartridge inspection shall include sampling conditions, number of tests, test conditions, safety considerations, analysis of results and reporting. QCP shall be approved by the Company

### A.1. Visual Inspection

Visual inspection of filter includes identification and verification of filter media, metallic parts, adhesive and other consuming materials. This inspection shall be assumed mandatory. Also, production capability and quality control procedures shall be verified by checking drawings, certificates of raw materials and production equipment.

### A.2. Dimensional Check

Dimensional check shall be applied based on the approved production drawings. Mentioned drawings shall include, but not limited to, all dimensions, tolerances, outer diameter of cartridge, inner diameter of cartridge, length and thickness of gaskets, thickness of metal plates, and metal sheets punching.

### A.3. Raw Material Inspection

Inspection of raw materials includes the following items based on the order content and conditions:

- A.3.1. metal sheet
- A.3.2. media
- A.3.3. adhesive
- A.3.4. gasket

### A.4. Performance Test

Performance tests shall be done according to 5.1.3 and 5.1.4

### A.5. Sampling Method

- A.5.1. Inspection sampling for each order shall be verified by client representative.
- A.5.2. Sampling is required for each G rate class and shall be done as table 3.
- A.5.3. If consignment is delivered in more than one stage, inspection shall be repeated for each stage separately according to the agreement between purchaser and manufacturer.
- A.5.4. Any changes in production process or raw materials require aforementioned tests according to table below.

A.5.5. Product should be traceable. If there is no possibility of doing this, the frequency of inspections could be increased according to the agreement between purchaser and manufacturer.

**Table 3.** Inspection sampling and testing method

Number of each order item (G rate/ size*)	Stage of Sampling and Testing	Quantity of samples
Up to 100	AP	According to the manufacturer and client agreement
Between 101-500	AP	1 number
Between 501-1000	AP	2 number
More Than 1000	BP	1 number
	AP	3 number

\* refers to cartridge filters which are not specified in table 1.

**BP:** Before starting the Production, filters shall be sampled by the manufacturer and examination must be carried out in accordance with the requirements of clause 5.

**AP:** After the completion of Production, filters shall be sampled by inspector of National Iranian Gas Company (NIGC) and examinations must be done according to the requirements of clause 5.

**A.5.6: For each order item, two Element filters are needed to be selected and marked by inspector. One of them to be hold by manufacturer as a witness sample and the other one to be send for testing.**

**The samples shall be kept until the end of the tests.**



**A.6. Data Sheet**

Technical Data			
Items	Unit	Minimum requirements given by NIGC	To be Filled by Supplier
Fluid	mol %	IGS-M-Ch-033	
Cartridge dimensions (according to table1)	mm		OD: ..... ± ..... ID: ..... ± ..... H:..... ± ..... (with cap and gasket)
Flow direction		Out to in <input type="checkbox"/> In to out <input type="checkbox"/>	
Initial pressure drop	psi	≤ 2	
Collapse pressure drop	psi	45	
Caps (according to 4.1.5)	mm		Material: .....
			Thk. : .....
Inner core (guard) (according to 4.1.4)	mm		Coating: .....
			THK:.....
Outer guard	mm	Yes <input type="checkbox"/> / No <input type="checkbox"/>	Material: .....
			Thk. : .....
Main media (test method according to 4.1.1)			Coating: .....
			THK:.....
			Material: .....
	g/m <sup>2</sup>		Mass per unit area:
	mm		Thickness: .....
	kPa		Tensile strength:
	%		Elongation:
		Permeability:	
	kN/m		Tear resistance:
		flame retardant : Yes	flame retardant :
Gasket (according to 4.1.6)	mm	70±5	Material: .....
			Thk:
			Hardness:
			maximum compression set and maximum resistance to lubricant:
Adhesive (according to 4.1.2)	kPa		Material: .....
			Tensile strength:

Deviations: