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شرکت ملی گازایران

مدیریت پژوهش و فنآوری

امور تدوین استانداردها

I G S

مشخصات فنی خرید

کارتریج فیلتر گاز خشک

Dry Gas Filter Cartridge

براي استفاده ازاستانداردها فقط به آخرین نسخه منتشرشده درسایت استانداردها مراجعه گردد

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ابلاغ مصوبه هیأت مدیره

مدیر محترم پژوهش و فناوری و رئیس شورای استاندارد

باسلام،

به استحضار می‌رساند در جلسه ۱۵۵۶ مورخ ۱۳۹۲/۶/۳۱ هیأت مدیره، نامه شماره گ۹/۸۷۰۸۴/۰۰۰ مورخ ۹۲/۶/۲۵ مدیر پژوهش و فناوری و رئیس شورای استانداردددرموردتصویب نهایی استاندارد تحت عنوان « کارتریج فیلتر گازخشک » به شماره تقاضای IGS-M-PM-111(0) مطرح و مورد تصویب قرارگرفت .

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FOREWORD

This standard is intended to be mainly used by NIGC and contractors and has been prepared based on interpretation of recognized standards, technical documents and experience in natural gas industry at national and international level.
Iranian Gas Standards (IGS) are prepared, reviewed and amended by technical standard committees within NIGC Standardization division and submitted to the NIGC's "STANDARDS COUNCIL" for approval.
IGS Standards are subject to revision, amendment or withdrawal, if required. Thus the latest edition of IGS shall be checked/inquired by NIGC employees and contractors.
This standard must not be modified or altered by NIGC employees or its contractors. Any deviation from normative references and / or well-known manufacturer's specifications must be reported to Standardization division.
The technical standard committee welcomes comments and feedbacks 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 a committee 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. SCPOE

This Iranian gas standard specification is related to design and produce cartridge of dry gas filter that is used in metering and regulating gas stations.

This standard specification covers the minimum requirements for material, design, testing, inspection, marking and packaging cartridge of dry gas filters at class rating 150, 300 and 600.

This specification is the main part of the enquiry and purchase order; it shall be the supplier responsibility to clearly indicate any deviation from the specification.

2. NORMATIVE REFERENCES

Throughout this standard specification the following standards are referred to. The editions of these standards that are in effect of the time of issue of this standard specification (2013) shall form part of this standard specification. 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.

EN 779 2012: *Particulate Air Filters for General Ventilation Requirements, Testing, Marking*

ASHRAE 52-1 1992: *Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter*

ASHRAE 52-2 1999: *Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size Errata*

ASTM D 828-97: *Standard Test Method for Tensile Breaking Strength of Paper and Paper Board*

ASTM D774-97: *Standard Test Method for Bursting Strength of Paper*

BS 6410 1991: *Filter Paper*s

JIS 1611-1995 *Automotive Parts – Test Methods of Lubricating Oil Filters*

ISO 536-1997: *Determination of Gram Mage Renumbering*

ISO 534 -2011*Paper and Board – Determination of Thickness, Density and Specific Volume*

ISO 1817-1999: *Rubber, Vulcanized Determination of the Effect of Liquids*

ISO 48-2007: *Rubber, Vulcanized or Thermoplastic -Determination of Hardness (hardness between 10 IRHD and 100 IRHD)*

M.Sc *thesis* ***"Methods of evaluation for Cartridge of Dry Gas Filters"****, M.R Pirzadi*

3. DEFINITIONS

Media: Part of the device which is the actual dust removing.

Actual Filtration Area: The measure of usable media in a filter.

Particle size: Light scattering equivalent size expressed as a diameter in micrometer (μm: 10^{-6}m)

Efficiency: Particles removing from gas by measuring the concentration of the material upstream and downstream of the filter.

Pressure drop: The resistance of a device to the flow of a fluid through it. The pressure drop of a filter is a measurement of its resistance to gas flow through it.

Cartridge: It is a kind of dry gas filter element that can be easily removed and replaced when it is worn out.

Corrugation: corrugated metal has been folded into a series of small parallel folds to make it stronger

4. ABBREVIATIONS

MD	*Machine Direction*
CD	*Cross Direction*
WC	*Water Column*
BP	*Bubble point*
OD	*Outside Diameter*
ID	*Inside Diameter*

5. TECHNICAL SPECIFICATION

This cartridge shall separate dust with particle size more than or equal 5 micron with efficiency 95-98% (F9 class See Appendix *A*). Meanwhile the complete filter cartridge shall be made of material suitable and resistant against odorant and natural gas components and not flammable. Cartridge of dry gas filter shall be open ended type.

5.1 Material

5 .1.1 Media

- *Non woven Polypropylene or Polyester media needle felt*: 400 gr/m² (±5%) (Test methods are presented in ISO 536) with support (filament polyester layer) coated with hydrophobic resin, thickness 2 mm (±20%) (Test methods are presented in ISO 534) pleated with galvanized iron wire netting reinforced (weld line surface) and secondary media spun bond layer 40gr/m² (±2%).

- *Cellulose paper:* with synthetic fiber (15-20%) impregnated with the chemical resins and pleated by rotary pleat machine with spacer. Specifications are shown in Table 1.

5.1.2 Glue: for the end caps glue shall be polyurethane type but for the gasket is industrial type.

5.1.3 Inner core: Machine perforated ø5 mm. Perforation direction on plate shall be opposite site of media(open area will be 50-55% of total area) electro galvanized or cold rolled oil steel sheet metal ST-1303 with galvanized coating (15μm) (operating salt spray according to ASTM B117), 0.6 – 1 mm thickness, corrugation reinforced.

5.1.4 Outside case: Machine perforated ø5 mm. Perforation direction on plate shall be opposite site of media (open area will be 50-55% of total area) electro galvanized or cold rolled oil steel sheet metal ST-1303 with galvanized coating (15μm) (operating salt spray according to ASTM B117), 0.6 – 1 mm thickness.

Table 1. Properties of Cellulose paper

Property	Value	Unit
Not Cured Gram mage	118	g/ m^2
Thickness	310	μ m
Corrugation	410	μ m
Not Cured burst strength	420	K Pa
Not Cured burst strength after wetting	430	K Pa
Tensile strength - MD Dry	7.0	KN/m
Tensile strength - CD Dry	4.0	KN/m
Tensile strength - CD wet	3.0	KN/m
Air Permeability	130	l/ m^2sec
Bubble Test-1BP	200	mm WC
Bubble Test-FAOP	300	mm WC
Max pore size – max	50	μm

5.1.5 Caps: Carbon Steel ST-1303, 0.6-1mm thickness, in addition the thickness of this material shall be selected from class ratting Galvanized externally coated and with no shrinkage.

5.1.6 Gasket: Buna-N/needle felt media with min thickness 5 mm and 500 gr/m^2.

With 70±5 hardness (Test methods are presented in ISO 48) and compression set max 25% (Test methods are presented in ISO 815) and resistance to lubricant max 5% (Test methods are presented in ISO 1817).

Note: This gasket shall be fixed by industrial glue top and bottom caps

5.2 Design

Table 2. Dimension of Cartridge

Type	*G1*	*G1.5*	*G2*	*G2.5*	*G3*	*G4*	*G5*	*G6*
H*(mm)	*165*	*210*	*270*	*283*	*320*	*415*	*470*	*625*
OD (mm)	*95*	*120*	*165*	*200*	*252*	*299*	*390*	*475*
ID (mm)	*50*	*69*	*86*	*110*	*138*	*186*	*246*	*320*
Filtration Area (m^2) Polypropylene or Polyester Media	*0.125*	*0.23*	*0.47*	*0.725*	*0.95*	*1.45*	*2.30*	*4.20*
Filtration Area (m^2) Cellulose paper Media	*0.42*	*0.77*	*1.87*	*2.9*	*4.6*	*7.4*	*13.4*	*28.7*

**H: height of element with caps*

NEEDLEFELT MEDIA SURFACE (Polypropylene or Polyester Media)=S

$S = d \times 2 \times n \times h$*

0.015 ×2×27 × 0.155 = *0.125*							
0.015×2×39×0.200=	*0.23*						
0.020×2 ×45×0.260 =		*0.47*					
0.025×2×53×0.273=			*0.725*				
0.025× 2 × 61 × 0.310 =				*0.95*			
0.025× 2 × 72 × 0.405 =					*1.45*		
0.030× 2 × 83 ×0. 460 =						*2.3*	
0.040× 2 × 85 ×0. 615 =							*4.2*

**: S= Filtration Area*
d= depth (in accordance to design manufacture that dependent to filtration area)
n= number of pleated
h= filter element height without caps

CELLULOSE PAPER *MEDIA SURFACE= S = d × 2 × n × h* *

0.015 × 2 × 90 × 0.155 = *0.42*							
0.015×2×129×0.200=	*0.77*						
0.020×2×180×0.260=		*1.87*					
0.025×2×219×0.273=			*2.9*				
0.025× 2 × 297 × 0.310 =				*4.6*			
0.025× 2 × 367 ×0. 405 =					*7.4*		
0.030×2×489×0. 460 =						*13.4*	
0.040×2×585×0. 615 =							*28.7*

**: S= Filtration Area*
d= depth
n= number of pleated
h= filter element height without caps

For more information of different cartridge classes and capacities of dry gas filter see Appendix B.

6.TESTS, CERTIFICATIONS AND INSPECTIONS

6.1 Tests

Three type tests shall be done as below:

6.1.1 Material Tests: In order to conformity of material with technical specification in this standard, manufacturers shall give valid certifications to client.

6.1.2 Routine Tests of Cartridge: These tests include:

A) Tensile breaking strength of paper and paper board [ASTM D 828-97]

B) Bursting strength of paper [ASTM D774-97]

C) Filter paper, stiffness and flexibility [BS 6410-23 1991]

D) Filter papers, brittleness [BS 6410-24 1991]

E) Bubble test[JIS 1611-1995]

6.1.3 Performance Tests: In according to EN 779-2012 following tests shall be done:

A) Initial pressure drop

B) Initial efficiency

C) Dust loading

In addition all test reports have to contain:

A) Name and address of testing agency.

B) Place and date of testing.

C) Number of test report.

D) Name and address of client.

E) Type of test (Material tests, Type tests, Routine tests)

F) Performance characteristics of filter.

G) Test result and evaluation.

The manufacturer and/or supplier shall furnish the purchaser with certification that samples representing each lot* have been either tested or inspected a directed in this standard (EN 779-2012).

*: samples under tests will be at least 3 pieces or one percent of total lot (each one is greater)

6.2. Inspection:

The client shall have the right to make inspections during fabrication and to witness any tests when he has requested.

Inspection by the client shall not relieve the manufacturer of his responsibilities.

7. MARKING

Each lot of cartridges which have successfully undergone type testing carried out; they shall be suitably marked with at least the following information:

A) Manufacturer or supplier.

B) Number of order.

C) Cartridge class rating and G number.

D) Production date.

8. PACKING AND PACKAGING

The Cartridge(s) shall be wrapped in nylon and sealed, to prevent the entrance of moisture, and packaged in three layer carton boxes. The cartridge(s) shall be transported on pallets or other suitable flat surfaces to prevent breakage and permanent deformation due to weather conditions and stored in proper storages.

9.DATA SHEET

Subject	**unit**	**To be filled by Purchaser/Client**	**To be filled by manufacturer/Supplier**
Process Fluid		Natural Gas	
Flow Direction		OUT to IN ☐	OUT to IN ☐
Gas Inlet Pressure	barg	Min: Max:	Min: Max:
Material of media		Polypropylene or Polyester Media ☐ Cellulose Paper Media ☐	Polypropylene or Polyester Media ☐ Cellulose Paper Media ☐
G number of element			
Element ID	mm		
Element OD	mm		
Element H	mm		
Element Filtration Area	m^2		
Caps Thickness	mm		
Inner Core Thickness	mm		
Outside Case Thickness	mm		
Manufacturer/Supplier			
Date and Signature			

APPENDIX A

MINIMUM EFFICIENCY REPORTING VALUE (MERV) PARAMETERS

ASHRAE 52.2-1999 MERV	Composite Average Particle Size Efficiency in Size Range, µm			Average Arrestance by 52.1-1992	Typical Average Dust Spot Efficiency ASHRAE 52.1	Typical Euro Class EN 779
	Range 1 0.3 – 1.0	Range 2 1.0 – 3.0	Range 3 3.0 – 10.0			
1	N/A	N/A	$E_3 < 20\%$	$A_{avg} < 65\%$	< 20%	G1
2	N/A	N/A	$E_3 < 20\%$	$65 \le A_{avg} < 70$	< 20%	G2
3	N/A	N/A	$E_3 < 20\%$	$70 \le A_{avg} \le 75$	< 20%	G2
4	N/A	N/A	$E_3 < 20\%$	$75 \le A_{avg}$	< 20%	G2
5	N/A	N/A	$20\% \le E_3 < 35\%$	N/A	25 –30%	G3
6	N/A	N/A	$35\% \le E_3 \le 50\%$	N/A	25 –30%	G3
7	N/A	N/A	$50\% \le E_3 \le 70\%$	N/A	25 –30%	G4
8	N/A	N/A	$70\% \le E_3$	N/A	25 –30%	G4
9	N/A	$E_2 < 50\%$	$85\% \le E_3$	N/A	40 – 50%	F5
10	N/A	$50\% \le E_2 < 65\%$	$85\% \le E_3$	N/A	50 – 60%	F5
11	N/A	$65\% \le E_2 \le 80\%$	$85\% \le E_3$	N/A	60 – 70%	F6
12	N/A	$80\% \le E_2$	$90\% \le E_3$	N/A	70 – 80%	F6
13	$E_1 < 75\%$	$90\% \le E_2$	$90\% \le E_3$	N/A	80 – 90%	F7
14	$75\% \le E_1 \le 85\%$	$90\% \le E_2$	$90\% \le E_3$	N/A	90 - 95%	F8
15	$85\% \le E_1 < 95\%$	$90\% \le E_2$	$90\% \le E_3$	N/A	95 – 98%	F9
16	$95\% \le E_1$	$95\% \le E_2$	$95\% \le E_3$	N/A	98%+	F9

NOTE: This table is for relative comparison purposes only. While actual efficiency values are obtained by different standardized test methods, Dust Spot and EN 779 values are generally typical of MERV that can be achieved with a well-constructed filter.

NOTES:

MERV (Minimum Efficiency Reporting Value): The average minimum efficiency of a filter device in the particle size range is shown. The MERV is determined by running an ASHRAE 52.2 test using potassium chloride particles as challenge under strictly controlled conditions.

Arrestance: Efficiency by weight. Literally, a calculated average efficiency value determined by comparing the weight of ASHRAE test dust introduced upstream of a test filter and that caught in a 95% bag filter on the downstream side of the test filter during the sequences of an ASHRAE 52.1-1992 test. It is generally applied on filters that are able to capture only larger particles (i.e. PM10) but allow multitudes fine particles (i.e. PM2.5) pass.

Dust Spot : The average ability of a filter to capture and retain particles that may tend to cause staining in air conditioning systems. Obtained Efficiency by challenging a test filter with atmospheric air and averaging the relative opacities of high efficiency media pads locate upstream and downstream during the sequences of an ASHRAE 52.1-1992 test.

EN 779: The current European standard for rating filters. Filters are categorized in different classes based on their gravimetrically determined arrestance for synthetic dust (e.g. AC-Fine, ASHRAE dust, those filters with a "G") or photometrically determined average dust spot efficiency for atmospheric aerosols (those filter with an "F" designation. The measuring principle of EN 779 corresponds to a large extent to the American ASHRAE standard 52.1-1992.

APPENDIX B

Class 150 (MIN. WORKING PRESSURE = 45 PSIG - MAX.WORKING PRESSURE = 60 PSIG)

CAPACITY, SCMH	400	1000	2500	4000	5000	6500	10000	15000
Actual FA (m^2)	0.25	0.46	1.45	1.9	2.9	2.9	4.6	8.4
Element ID (mm)	50	69	110	138	186	186	246	320
Element OD (mm)	95	120	200	252	299	299	390	447
Element H (mm)	165	210	283	320	415	415	470	625
	Polypropylene or Polyester Media							
Element QTY	2	2	2	2	2	2	2	2
G number of element	1	1.5	2.5	3	4	4	5	6
G Element filtration area, (m^2)	0.125	0.23	0.725	0.95	1.45	1.45	2.3	4.2
	Cellulose Paper *Media*							
Element QTY	1	1	1	1	1	1	1	1
G number of element	1	1.5	2.5	3	4	4	5	6
G Element filtration area, (m^2)	0.42	0.77	2.9	4.6	7.4	7.4	13.4	28.7
	Polypropylene Or Polyester Media and Cellulose Paper *Media*							
Caps Thickness (mm)	0.6	0.6	0.6	0.7	0.8	0.8	0.8	1
Inner Core Thickness (mm)	0.6	0.6	0.6	1	1	1	1	1
Outside case Thickness (mm)	0.6	0.6	0.6	0.6	0.6	0.6	1	1

Class 300 (MIN. WORKING PRESSURE = 150 PSIG - MAX.WORKING PRESSURE = 250 PSIG)

CAPACITY, SCMH	400	1000	2500	5000	10000	15000	20000	25000
Actual FA (m^2)	0.25	0.25	0.46	1.45	1.9	2.9	2.9	4.6
Element ID (mm)	50	50	69	110	138	186	186	246
Element OD (mm)	95	95	120	200	252	299	299	390
Element H (mm)	165	165	210	283	320	415	415	470
	Polypropylene or Polyester Media							
Element QTY	2	2	2	2	2	2	2	2
G number of element	1	1	1.5	2.5	3	4	4	5
G Element filtration area, (m^2)	0.125	0.125	0.23	0.725	0.95	1.45	1.45	2.3
	Cellulose Paper *Media*							
Element QTY	1	1	1	1	1	1	1	1
G number of element	1	1	1.5	2.5	3	4	4	5
G Element filtration area, (m^2)	0.42	0.42	0.77	2.9	4.6	7.4	7.4	13.4
	Polypropylene Or Polyester Media and Cellulose Paper *Media*							
Caps Thickness (mm)	0.6	0.6	0.6	0.6	0.7	0.8	0.8	0.8
Inner Core Thickness (mm)	0.6	0.6	0.6	0.9	1	1	1	1
Outside case Thickness (mm)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	1

Class 600 (MIN. WORKING PRESSURE = 400 PSIG- MAX.WORKING PRESSURE = 1050 PSIG)

CAPACITY, SCMH	2500	4000	5000	10000	15000	25000	30000	40000
Actual FA (m^2)	0.25	0.25	0.25	0.94	1.45	1.9	1.9	2.9
Element ID (mm)	50	50	50	86	110	138	138	186
Element OD (mm)	95	95	95	165	200	252	252	299
Element H (mm)	165	165	165	270	283	320	320	415
	Polypropylene or Polyester Media							
Element QTY	2	2	2	2	2	2	2	2
G number of element	1	1	1	2	2.5	3	3	4
G Element filtration area, (m^2)	0.125	0.125	0.125	0.47	0.725	0.95	0.95	1.45
	Cellulose Paper Media							
Element QTY	1	1	1	1	1	1	1	1
G number of element	1	1	1	2	2.5	3	3	4
G Element filtration area, (m^2)	0.42	0.42	0.42	1.87	2.9	4.6	4.6	7.4
	Polypropylene Or Polyester Media and Cellulose Paper Media							
Caps Thickness (mm)	0.6	0.6	0.6	0.6	0.6	1	1	1
Inner Core Thickness (mm)	0.6	0.6	0.6	1	1	1	1	1
Outside case Thickness (mm)	0.6	0.6	0.6	0.6	0.6	1	1	1

Class 600 (MIN. WORKING PRESSURE = 400 PSIG - MAX.WORKING PRESSURE = 1050 PSIG)

CAPACITY, SCMH	50000	60000	75000	100000	150000
Actual FA(m2)	2.9	4.35	4.6	6.9	12.6
Element ID (mm)	186	186	246	246	320
Element OD(mm)	299	299	390	390	475
Element H (mm)	415	415	470	470	625
	Polypropylene or Polyester Media				
Element QTY	2	3	2	3	3
G number of element	4	4	5	5	6
G Element filtration area,(m 2)	1.45	1.45	2.3	2.3	4.2
	Cellulose Paper Media				
Element QTY	1	1	1	1	1
G number of element	4	4	5	5	6
G Element filtration area, (m 2)	7.4	7.4	13.4	13.4	28.7
	Polypropylene Or Polyester Media and Cellulose Paper Media				
Caps Thickness (mm)	1	1	1	1	1
Inner Core Thickness (mm)	1	1	1	1	1
Outside case Thickness (mm)	1	1	1	1	1

**: And for other capacities that is not mentioned in above tables maximum allowable velocity in cartridge bore cross section shall be less than or equal to 20 m/s.*

***: The arrangement of cartridges is recommended to be in series.*