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شرکت ملی گاز ایران

مدیریت پژوهش و فنآوری

امور تدوین استانداردها

IGS

مشخصات فنی خرید

دستگاه جداکننده ذرات از گاز

Filter - Separator

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دفترمدیرعامل

شرکت ملی گازایران

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ابلاغ مصوبه هیأت مدیره

مدیر محترم پژوهش و فناوری

باسلام،

به استحضار می‌رساند در جلسه ۱۹۰۲ مورخ ۱۳۹۹/۰۹/۱۶ هیات مدیره، نامه شماره گ۹/۱۰۶۲۸۰/۰۰۰ مورخ ۱۳۹۹/۰۹/۰۳ آن مدیریت درمورد تصویب نهایی مقررات فنی به شرح زیر مطرح و مورد تصویب قرار گرفت.

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۲-دستگاه جداکننده ذرات از گاز	IGS-M-PM-103(1)
۳-حمل، نصب و نگهداری کنتورهای آلتراسونیک	IGS-C-IN-107(0)
۴-اتصالات چدنی مالیبل / داکتیل	IGS-M-PL-037(3)
۵-اتصالات فولادی جوش لب به لب اندازه های ۰/۵ تا ۵۶ اینچ	IGS-M-PL-022(1)
۶-تجهیزات ارسال و دریافت پیگ	IGS-M-PL-028(3)
۷-شیرهای توپی جوشی و فلنجی اندازه ۲ تا ۵۶ اینچ کلاس ۱۵۰، ۳۰۰، ۶۰۰	IGS-M-PL-002-3(1)

این مصوبه در حکم مصوبه مجمع عمومی شرکت‌های تابعه محسوب و برای کلیه شرکت‌های تابعه لازم الاجرا می‌باشد .

الهام ملکی

دبیر هیات مدیره

رونوشت : مدیرعامل محترم شرکت ملی گاز ایران و رئیس هیات مدیره

اعضای محترم هیات مدیره

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Foreword

This technical 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 committees within NIGC technical specification 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 technical specification 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 technical specification 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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Contents

1. Scope

This technical specification covers the general requirements for the design, materials, fabrication, welding, testing, inspection and packing for shipment of the natural gas separator used in gas transmission and distribution systems defined in scope of ASME B31.8.

This specification is part of the enquiry and purchase order, it shall be the supplier's responsibility to clearly indicate any deviation from the specifications, otherwise it is understood that the equipment conforms to the requirements of this specification.

The specification does not supersede the accepted pressure vessel codes but only supplements them with regard to certain conditions not fully covered in the codes.

The equipment shall be designed for full load, unattended continuous operation without the provision of special housing or shelters etc.

The unit shall be completely assembled, tested and painted according to the standards, codes and specification quoted herein and shall require only pipe connections before being placed in to service.

2.References

The latest revisions of all codes and standards their subsequent addenda are intended.

1.1. Normative References

IGS-M-PL-002-3	"Flanged/Welded End Ball Valves 2" to 24" Class 150,300 and 60
IGS-M-PL-002-1	"Flanged/Welded End Plug Valves 2" to 24" Class 150,300 and 60
IGS-M-PL-010 (4)	"Specification for Ball Valves" Class 800 size ½" to 1½"
IGS-M-PL-002-2	"Plug Valves" size ½" to 1½"
IGS-O-CH-042	"Painting Procedure for Gas Industry
IPS-G-GN-210	"Packing & Packages"
IPS-E-PR-880	"Standard for Process Design of Gas (Vapor) Liquid Separators"
API 12J	"Specification for Oil and Gas Separators"
ASME Section VIII:	"Rules for Construction of Pressure Vessels" Division 1
ASME Section VIII:	"Alternatives Rules for Construction of Pressure Vessels" Div. 2
ASME Section II:	"Materials and Specifications"
ASME Section IX:	"Welding Procedure and performance qualification
ASME B16.5/B16.47	"Pipe Flanges and Flanged Fittings
ASME B16.9	"Factory-Made Wrought Butt welding Fitting
ASME B16.11	"Forged Fittings, Socket-Welding and Threaded".
ASME B16.20	"Metallic Gaskets for Pipe Flanges"
ASME B18.2.1	"Square and Hex Bolts and Screws (Inch Series)".
ASME B18.2.2	"Square and Hex Nuts (Inch Series)".
ISO 4572	"Hydraulic Fluid Power Filter Elements"

1.2.Informative References

- Shell Design and Engineering Practice "Gas/Liquid separators Type selection and design rules'' DEP 31.22.05.11-Gen December 2007
- Sivalls, Inc ''General Installation and Safety Instruction Technical Bulletin'', Odessa. Texas 1989
- Gas Processors Suppliers Association (GPSA) Engineering Data book -12th Edition
- Pressure vessel hand book tenth edition F. megyesy

3.Definitions

3.1.Filter Separators: Filter separators, whether constructed in a horizontal configuration, are basically two stage vessels. The first stage is an area which is filled with multiple sock type filter elements for removing foreign solid particle contamination from the gas stream. The filter elements also aid in coalescing very small particles of liquid into larger droplets, where they will drain by gravity into the liquid settling section of the vessel. The gas flow is from the outside of the filter elements to the inside, and through a perforated mandrill located inside each element, to the next stage of the vessel. The inlet section also acts as a slug catcher for receiving surges of liquid where they may be trapped and passed into the liquid settling section of the vessel.

3.2.Separation (Filtration) Efficiency: The rate at which solids / Liquids in the feed are retained by the filter. It depends on the characteristics of the filter, the particle size distribution and nature of the solids.

3.3.Design Pressure: The maximum operating pressure used for vessel mechanical calculations. Design pressure shall be selected based on ASME SEC VIII Div.1.

It is recommended to design a vessel and its parts for a higher pressure than the operating pressure. A design pressure higher than the operating pressure with 30 psi or 10 percent, whichever, is the greater, will satisfy this requirement.

3.4.M.A.W.P (Maximum Allowable Working Pressure): Maximum pressure for selected material, thickness, weld quality, etc. calculated from ASME Sec. VIII Div. 1 for each specific part or nozzle. M.A.W.P of complete package is the minimum allowable working pressure of all vessel parts.

3.5.Filtration Rate: The maximum flow rate of gas passing through one square meter of filtration media to meet restricted differential pressure is known as the filtration capacity.

3.6.Filtration area: Outer surface area of all filter cartridges.

3.7.Gas Handling Capacity: The gas capacity of mist extractor is almost universally specified by defining a load or sizing factor, K, as utilized in the Souders and Brown equation.

3.8.Medium Filtrate Velocity: Maximum recommended gas velocity passing through the filter medium to ensure a proper coalescing process.

4. Symbols and Abbreviations

Abbreviations of parameters used in this Standard and their units of measurement:

Q_A:	Actual Gas Flow Rate, m3/hr
A:	Cross Section Area, m2
FA:	Minimum Required Filtration Area, m2
FR:	Filtration Rate, m3/s/m2
D_i:	Inside Diameter of Shell
D_O:	Outside Diameter of Shell
n:	Number of Cartridge in Separator
L_e:	Filter Element Length, mm
d_e:	Filter Element Outside Diameter, mm

5.Technical Specifications

The manufacturer shall establish and maintain a quality assurance system in accordance with ISO 9001, or an approved equivalent. The Purchaser's nominated inspector(s) or representative(s) shall have the right to undertake such audits as he deems necessary to assess the effectiveness of the manufacturer's quality assurance system.

The vendor shall furnish complete operating units including all necessary items such as valves, piping system, gages and etc. to ensure satisfactory, safety operation.

The skid mounted horizontal natural gas filter separator shall be designed but not limited to the following:

5.1.General Terms

Filter-separator shall be designed, fabricated, inspected in accordance with the latest edition of the ASME boiler and pressure vessel code, section VIII, Division I, and its subsequent addenda. The vessels will be operating in outdoor condition, under direct sun and rain. Filter-separator shall be designed to withstand the loads exerted by internal pressure, weight of the vessels, wind, earthquake, reaction of supports, impact, and temperature.

5.1.1.1.Filter Separator Efficiency

Removal efficiency of liquid shall be 100% down to 5 microns and removal efficiency of gas particle shall be 100% down to 10 microns.

5.1.1.2.Cartridge Material and Tests

- Materials for deep (sock type) cartridge filter shall be according to the request of purchaser/client. This specification recommends woven poly propylene fiber or phenolic resin bonded glass fiber with cotton outer cover. On the other hand, methods for disposal of wasted element filters (after use) shall be described by supplier/producer. Described methods shall be in accordance with national and/or local regulations and regarded standards for waste disposal. All required tests (ISO 4572 or equivalent) such as following items shall be done in national laboratories certified by NIGC (based on ISO 17025) or accredited international laborites.

- Inner core (guard):

Machine perforated corrugation or spiral perforated tube which shall be in opposite site of the media. It shall be electro galvanized or cold rolled oil carbon steel sheet metal with galvanized coating (min. 15 µm), minimum 500 hours operating salt spray according to ASTM B117 or ISO 9227, and minimum 0.7 mm thickness. When tested in accordance with ASTM B 117 or ISO 9227, using a salt solution with the PH given in 3.2.2 of ISO 9227 (neutral salt spray test), the sample shall be exposed to the salt spray over 500 hours.

- Outer guard:

It shall be in according to the request of purchaser/client. This technical specification does not recommend any outer guard.

Test

- Cartridge Material
- Performance Test
- Dirt holding capacity at test conditions and description of test conditions, e.g. as determined with ISO 4572 or equivalent.
- Grade efficiency data (filter rating) of the filter elements at test conditions, e.g. as determined using ISO 4572 or equivalent.
- Expected grade efficiency of the filter elements under actual test conditions.
- Expected dirt holding capacity under actual process conditions.

5.1.1.3.Cartridge Classification and Dimensions

Following table is the most common cartridge size in international designs.

Model	OD Inches (mm)	ID Inches (mm)	Length Inches (mm)	Filtration Area (m^2)	α* (mm)	B** (mm)
FG-312	4.5 (114)	3.24 (82)	12 (305)	0.109	145	80
FG-324	4.5 (114)	3.24 (82)	24 (610)	0.218	145	80
FG-336	4.5 (114)	3.24 (82)	36 (915)	0.328	145	80
FG-372	4.5 (114)	3.24 (82)	72 (1830)	0.655	145	80
FG-536	5.5 (140)	4.18 (106)	36 (915)	0.402	180	95
FG-572	5.5 (140)	4.18 (106)	72 (1830)	0.805	180	95

Note:

***Required distance between center-center of each cartridge shall be consider as "α" value in above table.**

****Required distance between center of cartridge to shell inside diameter shall be consider as "β" value in above table.**

5.1.1.4Importance of Cartridge Sealing

- A filter element is only as good as the seal that is achieved between the dirty and clean side of the filter vessel. The difficulty of sealing the element is primarily a function of the vessel manufacture's element support and sealing hardware. Elements with open ends and flat gaskets are subject to bypassing contaminant under the following conditions:
- The element appears to be bowed or sagging.
- The gasket at both ends does not contact the sealing surface with adequate pressure all the way around the gasket.
- The sealing surfaces are dirty or damaged.

5.1.1.5Top and Bottom Seal Gasket for Cartridge

Bottom sealing surfaces are made in two primary configurations; knife-edge and flat washer.

Top sealing surfaces are also made in two primary configurations; dimpled and flat. A knife-edge seal

has a ridge on the vessel's bottom element seat that cuts into the gasket. A dimpled seal has a rounded ridge that pushes out against the inside surface and down on the flat surface of the gasket. Flat surfaces fit flush against the flat surface of the gasket. Knife-edge and dimpled designs are less prone to bypass.

5.1.2. Vane Pack Design

Vane Pack (Mist Elimination) section of filter separator shall remove most of liquid droplet coalesced in cartridge section. Following requirements shall be considered in Vane Section design and fabrication:

Vane Pack assembly shall be totally made from stainless steel plates, profiles and accessories.
Vane Pack assembly shall be designed in a manner that most possible face area could be achieved.
Gas pressure drop in vane section shall be calculated and reported to client to consider in total plant process design diagrams. Also high amount of pressure drop, may force some of trapped droplets to back in gas phase.
Drainage holes (if required) at the bottom of section shall be located in parts with most drain efficiency.
Size of connecting pipe between vane section to sump collector (commonly 2~4 inch) shall be selected based on liquid volume and vessel size.
Vane elements shall be fitted / welded completely to chamber with shaped edges.
In case of using Z-Shape plates as Vane Section, all of angles shall be necessarily fitted with droplet drainage traps. Without this traps, Z-Shape Vane has no removing efficiency.

5.1.3.Required Filtration Area

To determine minimum filtration area and number of filter elements required, the following instruction shall be proceeded:

FA = Q_A / FR

Area of each filter element (m^2) is: $\pi \times d_e \times L_e \times 10^{-6}$

Total Filter Surface Area is (m^2) is: $n \times \pi \times d_e \times L_e \times 10^{-6}$

Number of cartridges is sufficient whenever total selected surface area is larger than "FA" (Total required surface area)

Figure 1 Cartridge Element

-FR = Filtration Rate

Filtration Rate shall be considered max as 0.1 $m^3/s/m^2$ (360 $m^3/hr/m^2$).

Some shell body sizing estimation are illustrated in appendix B. Results of this charts are not mandatory and can used to have a rough estimation about shell sizing.

-Gas velocity

Gas velocity through any cross section of separator such as inlet and outlet, body, filter element (internal bore) shall not exceed 20 m/s.

-Body

Body typical size should be in accordance to API 12J. The following table is for nominal industry standards. Available sizes and working pressure may vary from the stated ratings. Other sizes, pressure, and temperature ratings may be furnished by agreement between purchaser and manufacturer.

Nominal Diameter, inches									
12¾	16	20	24	30	36	42	48	54	60

5.1.4.Nozzle Arrangement, Size and Class

Feed inlet and outlet nozzles shall be positioned to enhance uniform distribution of the feed over the filter elements and to prevent distortion of the filter elements.

All 2 inches and larger nozzles on the vessel shall be flanged (Raised Face Type).

Openings on the vessel of 1½ inches and smaller shall be 6000lb forged steel.

Two drain lubricated plug valves or combination of plug and globe valves shall be flanged (R.F.) to each sump drain line with minimum size 2".

Vent connections shall be flanged (R.F.) with a ball valve.

All drain nozzles calculation shall meet paragraph UG-45.

5.1.5.Quick Opening Closure

The Filter Separator shall be provided with a full diameter quick opening end closure to allow a man operation for both opening and closing position without use of additional device. Quick opening closure shall be designed in accordance with ASME section VIII division 1.

The end closures should incorporate a mechanical interlocking vent to prevent the closure being opened before the release of pressure from the components. Alternative rules for design and construction of quick opening closure may be used according to ASME section VIII division 2.

5.1.5.1.Quick Opening Closure Types

Quick opening closure with body size NPS 16 inches and larger shall be designed and

fabricated as following types. Regardless of closure type selection, any closure shall be equipped with safety bolt to prevent and protect against over pressure during vessel services.

Bayonet Type Closure: consists of two main components, hub and door that a couple of the cams have involved together. Door open or close as turning of door inside the hub.

Ring lock type closure: this closure mechanism is a duplex stainless steel conical trust ring that fitted between the door and hub, transmitting the pressure load uniformly around the full 360° circumferential of hub

Hub & Clamps (Yoke) type closure: consists of three main components, hub, clamp and door that a clamp involves both hub and door together by retainer power screw.

5.1.5.Liquid Accumulator Section (Sump)

Filter separator shall be equipped with liquid accumulator or settling section (sump) and size of this section shall be considered as the following below table. Sump length shall not be smaller than 65% of body length.

Item	Shell Diameter, inches	Accumulator (Sump) Min Diameter, inches
1	6-5/8'' (Same as NPS 6 Pipe)	6-5/8'' (Same as NPS 6 Pipe)
2	8-5/8'' (Same as NPS 8 Pipe)	6-5/8'' (Same as NPS 6 Pipe)
3	10-3/4'' (Same as NPS 10 Pipe)	6-5/8'' (Same as NPS 6 Pipe)
4	12-3/4'' (Same as NPS 12 Pipe)	6-5/8'' (Same as NPS 6 Pipe)
5	14''	6-5/8'' (Same as NPS 6 Pipe)

6	16''	6-5/8'' (Same as NPS 6 Pipe)
7	20''	8-5/8'' (Same as NPS 8 Pipe)
8	24''	8-5/8'' (Same as NPS 8 Pipe)
9	30''	10-3/4'' (Same as NPS 10 Pipe)
10	36''	10-3/4'' (Same as NPS 10 Pipe)
11	42''	14''
12	48''	14''
13	54''	16''
14	60''	16''

5.1.6.Instrumentation

Filter Separator shall be equipped but not limited with the following instrumentation:

Instrument for measuring differential pressure in cartridge section shall be considered equipped with a three-way manifold. Range of this instrument is 0-25 or 0-30 psig. Differential pressure gauge should be either bellow or piston type. Bellow type shall be equipped with

a 3-way valve for zero calibration. Piston type can be connected to the filter body via needle valves in both the high and low pressure lines.

Two level indicators shall be considered on sump for each section.

Note: Level indicator may be changed to level switch or transmitter by agreement between purchaser and manufacture.

Filter separator shall be equipped with safety relief valve according to API 520 / 526

One pressure indicator for display filter inlet pressure shall be considered.

6.Order Form

The first successful step of a good project could be a correct order from purchaser to supplier. So designing a correct separator is highly depending on what initial values is giving to designer. Using a wide range of process parameters (pressure, temperature, flow rate, etc.), reduces design accuracy. Also design of some items requires necessarily all Minimum, Normal and Maximum value of parameters such as pressure.

So to have a proper final design, following form shall be filled by client / purchaser during technical and price inquiry.

Flow Rate: • Normal Flow Rate • Maximum Design Flow Rate	(SCMH)
Operating Pressure: • Minimum Pressure / Maximum Pressure • Normal Operating Pressure (from gas line history)	Psig barg
Operating Temperature: • Minimum Temperature / Maximum Temperature • Normal Operating Temperature (from gas line history)	°C
Water Dew Point in specified gas pressure According to IGS-CH-033 or different data by purchaser (shall be attached to order).	°C
Hydrocarbon Dew Point in specified gas pressure According to IGS-CH-033 (max dew point -7 °C) or different data by purchaser (shall be attached to order).	°C
Gas Composition: According to IGS-CH-033 or different data by purchaser (shall be attached to order).	
Gas Physical Properties @ normal condition (such as S.G., viscosity, Molecular Weight, etc.)	
Gas Total Sulphur Content	ppm

7.Commissioning and Performance Test

After the filter has been installed at site it shall be checked whether the installation has been executed in accordance with the Manufacturer's instructions.

7.1.Actual Pressure Drop

The site commissioning and performance test is at least observing actual cartridge section pressure drop with standard limitation and project specification.

7.2.Closure Safe and Fast Opening / Closing

Possibility of filter isolation in order to clean and replace the cartridges shall be checked according to approved drawings. Prior to opening, the vessel shall be drained. It shall be possible to open the vessel, replace the cartridges and close the vessel safely and quickly to minimize the time that the filter is out of operation.

7.3.Cartridge Section Sealing

When installing an element ensure that all sealing surfaces are clean and undamaged. Center the element against the sealing surfaces, tighten the securing mechanism (nuts, cams, etc.) as specified by the manufacturer. Always double check for loose elements because some elements shrink as they are tightened.

7.4.Isolation of Drain / Vent Valves

With a safe pressure, check the isolation of all nozzle (especially vent and drains) before commissioning. All valves shall completely block the line in close position.

8.Materials

- Separators furnished to this specification shall conform to the material requirements stipulated in the latest edition of the ASME. e.g. Section II Part D for under pressure parts.
- Material selection for corrosive fluids should be selected based on a review of related API or NACE publications for materials. Consideration should be given to material selection as it relates to weight loss, sulphide stress cracking, chloride stress cracking, or other forms of corrosion. It is the responsibility of the user to determine what consideration for corrosion should be made to the vessel during its intended life.
- Corrosion consideration for separators furnished to this specification shall be for the pressure containing parts of the vessel only, and as can be identified as falling within the requirements of the applicable section of the ASME Code.
- Corrosion considerations for vessel internals (non-pressure parts) is by mutual agreement between the purchaser and the manufacturer and not a part of this specification.

- Chemical content of materials shall conform to the materials specification stated except that carbon content for any welded component shall not exceed 0.23%.the maximum carbon equivalent shall be 0.42% based on the formula:

$$C_{eq} = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Co}{15}$$

- Based on ladle analysis and 0.45% when based on product design.
- For carbon steel vessels, all steel plates for vessel supports shall have weld-ability to shell.
- All external attachments material to shell such as pads, wear plates shall have the same material as shell.
- For Filter Separators saddles, support legs, external lugs for platforms and ladders, insulation and pipe supports, internal supports and other internal non-pressure parts, shall be in accordance with ASTM A36, ASTM A283, ASTM A285 or ST-37(2).
- All materials used in the fabrication of parts under pressure shall have a material certificate issued by the steel mill specifying chemical analysis and mechanical tests, in accordance with appropriate specifications. Certificates relating to additional examinations and tests requested by the Purchaser shall also be submitted. In the case of materials used in the fabrication of components that are not under pressure, material certificates issued by the steel mills or a declaration of conformity issues by the vessel fabricator shall be submitted. Vendor shall keep original copies of the above- mentioned certificates, which shall specify the identification code marked on semi-finished products. A copy of these certificates shall be submitted to the purchaser.
- Minimum corrosion allowance of 1.6 mm (1/16 inch) shall be provided for all carbon steel and low alloy steel vessels, unless otherwise noted.
- End cartridge holder plates and seat shall be stainless steel.
- Vane Pack assembly shall be completely fabricated by stainless steel low carbon.

9.Fabrication and Welding

- All fabricated vessels must be designed, manufacturer tested and inspected according to ASME code section VIII division1.
- All welds shall be made by the shielded metal arc welding are using electrode sofa composition and quality compatible with the vessel materials, in accordance with "b" part UW of the ASME code, section VIII and section IX.
- The suppliers shall specify the make and quality of electrodes which the proposes to utilize in fabrication. All welders shall be qualified under section IX of ASME code, work involving welding shall not be in conflict to any other codes without the prior approval of purchaser.

- Welding by automatic or semi-automatic equipment is permitted, gas, bare wire, carbon–arc or forged welding will not be permitted unless specified by the purchaser.
- All nozzles and small connections and their utilities shall be attached to the vessel with full penetrate.
- Welding shall be done by qualified welders and operators.
- Welding shall be carried out with calibrated equipment.
- Removable internals shall be installed after stress relieving.
- Pining in shells and heads shall be studded in accordance with the applicable code and shall be adequate f o r pressure and temperature to be stamped on the vessel. Each reinforcement pad or segment shall be provided with a ¼" UNC "Tel l - tale" hole.

10.Heat Treatment

- Heat treatment including pre or post-weld heat treatment, of vessels shall be in accordance with ASME pressure vessel code, section VIII division1.
- Heat Treatment procedure shall be issued by manufacture and approved by client.
- All flanged facings and threaded connections must be adequately protected against o
- xidization during the heat treatment.
- If the vessel is post-welded, no welding is permitted after stress relieving.
- Non-destructive tests shall be carried out and interpreted accordance ASME Sec. VIII.

11.NDT (NON-Destructive Test)

11.1.NDT PERSONNEL

Non-destructive testing personnel shall be certified in accordance with ASNT Recommended Practice SNT-TC-IA for the test method used approved by the Company. Only level II or III personnel shall interpret the test results.

11.2.NDT Procedures and Interpretation

Non-destructive tests procedures shall be prepared by manufacture and approved by client in accordance with ASME Sec. V, and after confirmation by the level III personnel and employer should be used.

- Non-destructive tests shall be interpreted accordance ASME Sec. VIII.
- Interpretation of the radiographic films and other non-destructive tests shall be carry out by the approved companies of the NIGC in the related field. Also, Interpreter of the radiographic films shall be separate from the radiographer.

12.Pressure Testing

- All vessels shall be tested in accordance with the ASME SECVIII rules.
- All welded attachments provided with "Tell–Tale" holes shall be tested by pneumatic pressure prior to the thermal stress relief and final hydrostatic test.
- All test certificates must be containing the purchaser's name and order number whether they emanate directly from the main supplier or a sub- contractor.
- Test certificates must be approved by the purchaser before dispatch instructions are given.
- All gages shall be calibrated by approved Lab. by NIGC.
- The range of pressure gauges shall be min. 1.5 and max. 4 times the test pressure.
- Test shall be carried out by at least two calibrated gauge and one pressure recorder.
- After the hydrostatic test, the filter separator's closure shall be opened in front of the Employer's Inspector to ensure that it is rapidly opened and closed and certified.

15.Painting

Unless otherwise specified by client, surface preparation and painting shall be in accordance to technical specification IGS-O-CH-042.

14.Inspection

- Inspection shall be done base on ITP and manufacturer QCP which is approved by client and pre-inspection meeting. An informative sample with classified steps of inspection is shown in appendix C.

- The purchaser reserves the right of inspection.

- Mandatory inspection shall be carried out to meet the requirements of ASME code Section VIII Division1.

- Prior to final inspection, all slag, loose scale, dirt, grit, weld spatter, print, oil and other foreign matter shall be thoroughly removed so that inspection may be carried out to the best advantage.

- Any defects shall be repaired and the repair weld shall be re-heat treated, if originally required and re-examined by the prescribed method for freedom from defects (procedures shall be approved by purchaser). If correction is required and involves serious alteration, the written approval of the purchaser shall be obtained before proceeding with such corrections.

- The supplier shall give adequate notice to the purchaser prior to all inspection/ test visits required by the specification and design codes.

- The supplier shall allow free access to the purchaser to all parts of his or his sub-contractors works, for the purpose of carrying out any inspection or witnessing test, etc.

- The supplier shall afford the purchaser, without charge, all reasonable facilities to enable him to verify that vessels are being manufactured and tested in accordance with this specification.

15.Acceptance

- The purchaser's approval of work and acceptance for shop tests and/or releasing shipment note shall not relieve supplier's responsibility for carrying out all provisions of the specification, codes and/or fulfillment of the guarantee, nor does the purchaser by such approval and/or release, assume any responsibility what so ever for such provisions and/or guarantee.

- Release notes shall be issued by the purchaser for each vessel after final inspection and testing at the works and vessels shall not be dispatched until such release notes have been issued.

16.Shipment, Packing and Packaging

- Prior to shipment, the vessel shall be thoroughly cleaned and all water, dirt, weld metal spatter and other foreign matter shall be removed.

- All testing liquids shall be removed and units dried before packing.

- All flanged openings properly protected with suitable covers. Tapped openings shall be protected with threaded steel plugs screwed in.
- All loose gaskets shall be packed in a separate wooden case.
- Before shipment is made, the purchaser's written approval of the proposed method of shipment must be obtained.

- Export packing shall be carried out in accordance with good practice, the minimum acceptable standard shall be as defined in the applicable parts of IPS-g-gn-210. The packaging shall be appropriate for storage without cover on site for up to three months prior to installation.

17.Reports and Data Sheets (Documentation) and Name plate

17.1.Document Index

Following table should be followed as document index of supplier if there is no other MR or document list agreed with client.

Document	Type	Required with Offer	Required in Final Book
General Datasheet	P / E	Yes	Yes
Detailed Datasheet (Mechanical and Process)	P / E	No	Yes
General P&ID	P / E	No	Yes
General Drawing of Filter Separator	P / E	No	Yes
Report of Code Calculation according to Standard	P / E	No	Yes
Required Two Years Spare Part	P / E	Yes	Yes
Commissioning Manual	P / E	No	Yes
Operation and Maintenance (O&M) Manual	P / E	No	Yes
Test Procedures	P / E	No	Yes
Packing and Shipping Procedure	P / E	No	Yes
Equipment Final Book Including all QC document (WPS, PQR, Weld and Test Reports, etc.), Final Release Note, As Built Drawings (if any) and all above documents.	P / E	No	

P= Paper, E= Electrical files

17.2.Name Plate

The completed vessel shall be provided with a name plate (with St. Steel material) securely attached to the vessel. The name plate shall include the following information:

- Manufacturer Name
- Type and Model
- Tag No.
- Size/Class
- Working Pressure
- Design Pressure / M.A.W.P
- Test Pressure
- Working temp.
- Weight
- Radiography
- PWHT
- Serial No,
- Month/year of Built

18.Guarantee

- Manufacturer shall guarantee the compliance of material and performance of the supplied equipment with this specification.
- The period of guarantee shall be one year after equipment goes on stream or eighteen months after date of shipment, whichever occurs first, or according to the contract.
- Manufacturer shall repair or replace any equipment which proves to be defective during the above mentioned period. This does not involve bad operation.

Appendix A
Typical Vane Sections

Some typical constructions for vane section which is introduced in "Perry's Chemical Engineers' Handbook".

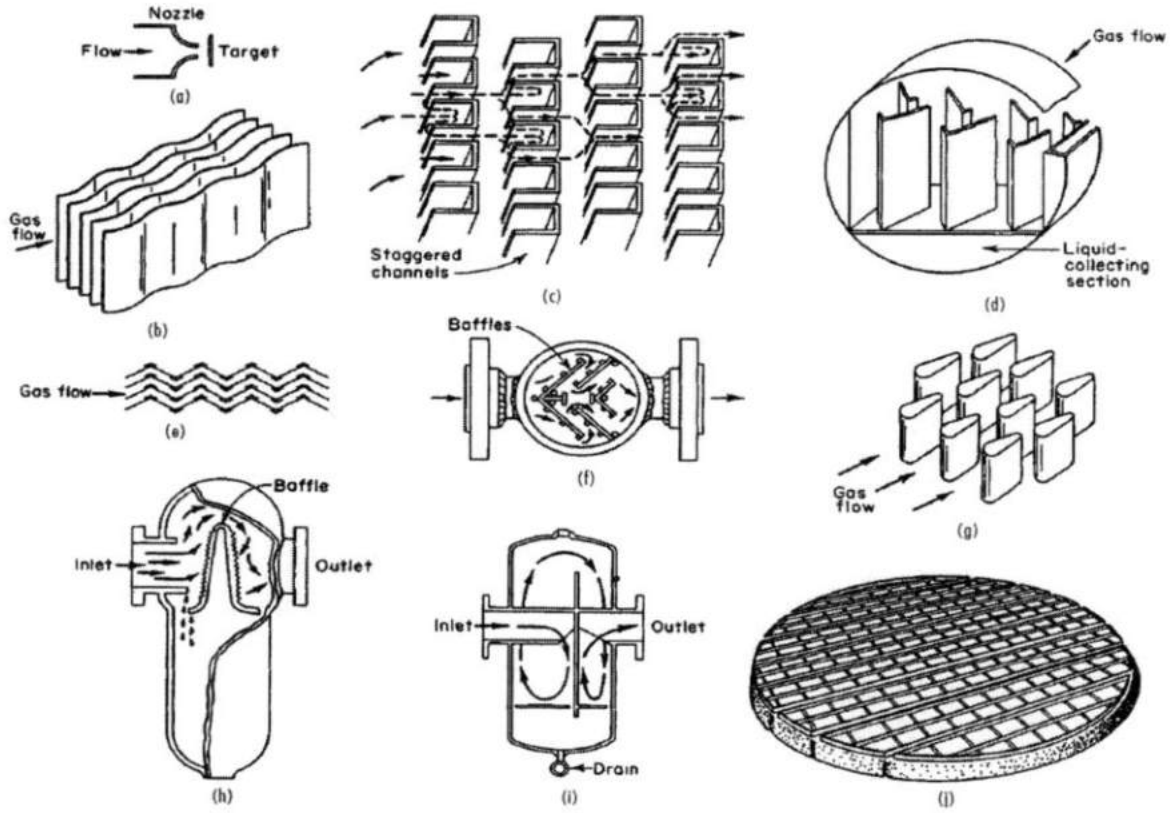
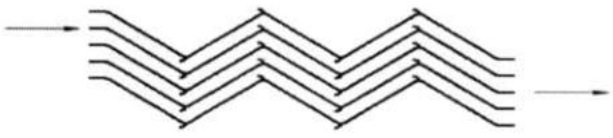
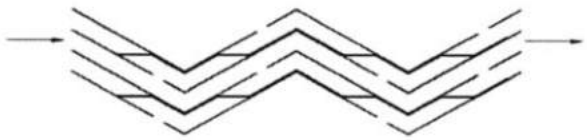


FIG. 14-110 Typical impingement separators. (*a*) Jet impactor. (*b*) Wave plate. (*c*) Staggered channels. (*Blaw-Knox Food & Chemical Equipment, Inc.*) (*d*) Vane-type mist extractor. (*Maloney-Crawford Tank and Mfg. Co.*) (*e*) Peerless line separator. (*Peerless Mfg. Co.*) (*f*) Strong separator. (*Strong Carlisle and Hammond.*) (*g*) Karbate line separator. (*Union Carbide Corporation*) (*h*) Type E horizontal separator. (*Wright-Austin Co.*) (*i*) PL separator. (*Ingersoll Rand.*) (*j*) Wire-mesh demister. (*Otto H. York Co.*)



(b) single-pocket vane; top view
(to be used in horizontal flow)



(c) double-pocket vane; top view
(to be used in horizontal flow)

Appendix B
Separator Shell Size Estimation

For example, **if use element in size 4½" x 72"** the minimum shell diameter calculated for the filter separator finally checked with the rapid sizing charts contained in figure 1 through 2.

FIGURE 1
GAS CAPACITY OF HORIZONTAL
HIGH PRESSURE FILTER/ SEPARATOR

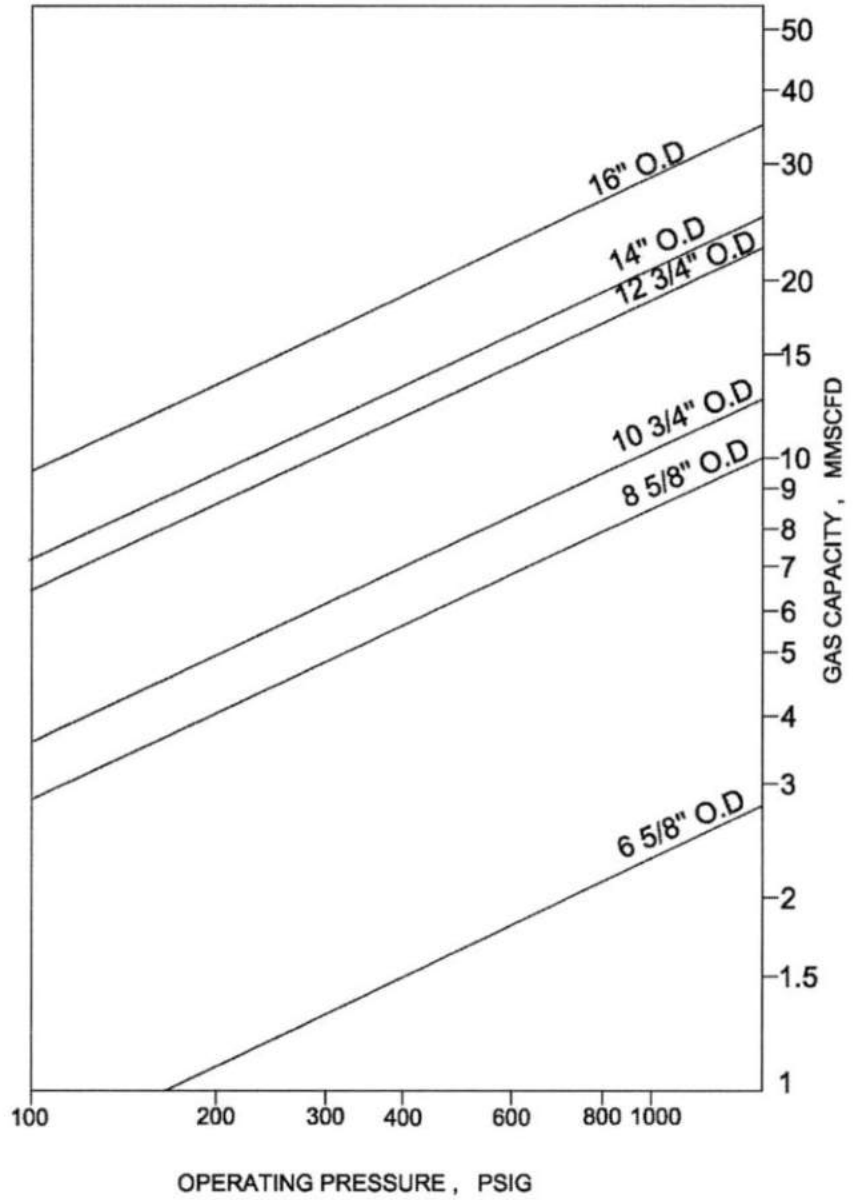
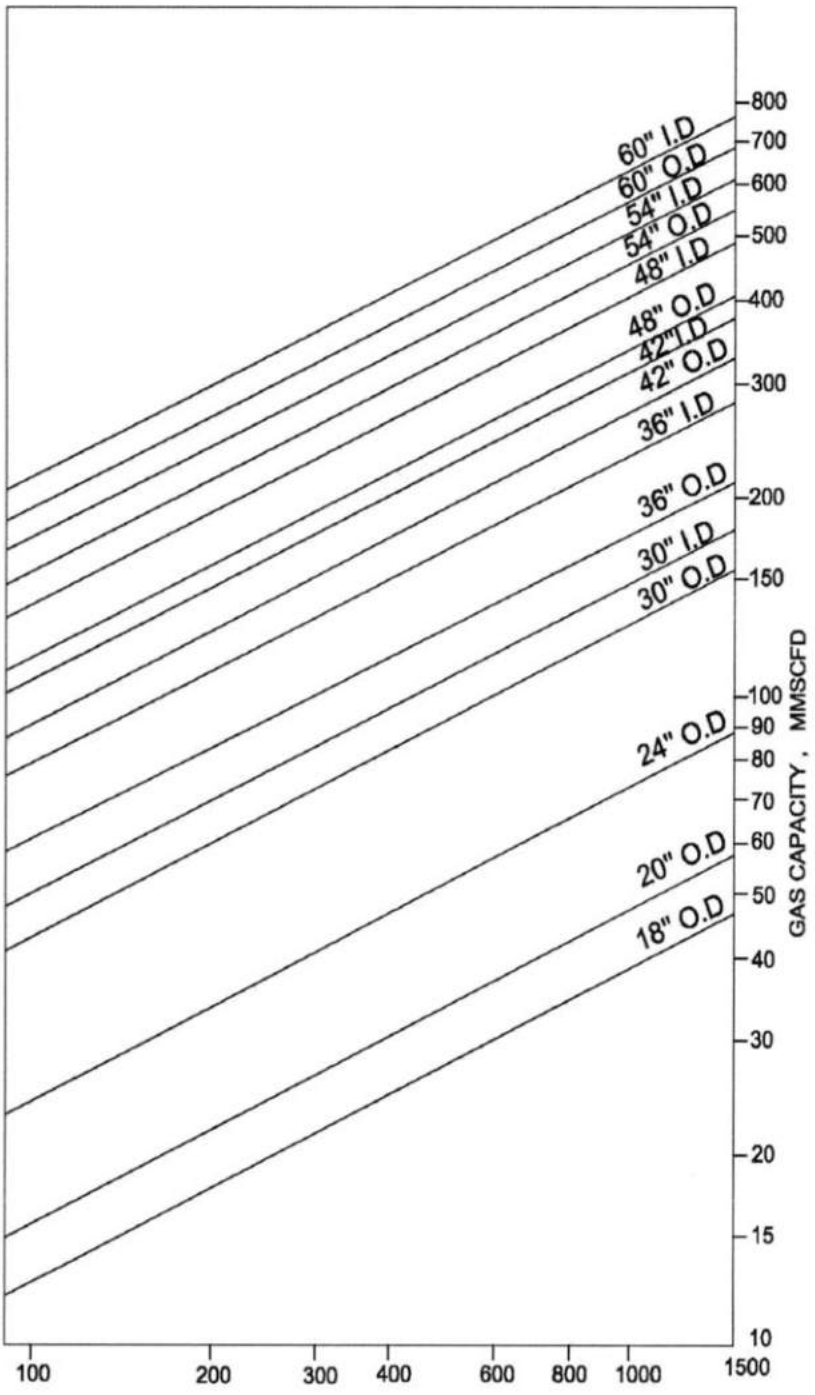


FIGURE 2
GAS CAPACITY OF HORIZONTAL
HIGH PRESSURE FILTER/ SEPARATOR



Appendix C
Typical Datasheet for Filter Separator

DATA	CLIENT REQUIREMENTS	TO BE SPECIFIED / CONFIRMED BY SUPPLIER	
Type	Cartridge and Vane Type	Yes ☐	Other ☐
Manufacture	From NIGC Approved AVL	Yes ☐	
Position	Horizontal / Vertical	Horizontal ☐	Vertical ☐
Tag Number			
Construction Standard	ASME SECTION VIII Div. 1 IGS-M-PM-103	Yes ☐	Other ☐
FLUID			
Media	Natural Gas (Sweet, Non-Corrosive)		
Flow Rate			
Flow Rate Unit	VTC	NCMH☐ SCMH☐ kg/hr☐	
Working Pressure (psig)	Min.: Normal: Max.:		
Gas Temperature (°C)	Min.: Normal: Max.:		
Gas Composition	According to IGS-CH-033 ☐ Other ☐		
Specific Gravity of Gas			
Molecular weight			
Viscosity (cp)			
CP/CV			
MECHANICAL DESIGN DATA BASIS			
Seismic Design Code / Zone		Confirmed ☐	No ☐
Importance factor		Confirmed ☐	No ☐
Corrosion Allowance (mm)		Confirmed ☐	No ☐

Wind Design Speed (km/hr)		Confirmed ☐	No ☐
Design Pressure (psig)		Confirmed ☐	No ☐
M.A.W.P (psig)	VTC		
Test Pressure (psig)	VTC		
Design Temperature (°C)	Min.: Max.:	Confirmed ☐	No ☐

ELEMENT				
Cartridge Type	VTC	FG-312 ☐	FG-324 ☐	FG-336 ☐
		FG-372 ☐	FG-536 ☐	FG-572 ☐
Number of Cartridge	VTC			
Filtration rate				
Filtration area				
Solid Removal Size	Acc. to IGS-M-PM-103	Yes ☐	Other ☐	
Removal Efficiency	Acc. to IGS-M-PM-103	Yes ☐	Other ☐	
Pressure Drop @ Clean	Acc. to IGS-M-PM-103	Yes ☐	Other ☐	
Max Pressure Drop	Acc. to IGS-M-PM-103	Yes ☐	Other ☐	
Cartridge Manufacture	VTC			
Cartridge Tested by Cert. Lab.	Required ☐ / Not Required ☐	Confirmed ☐	No ☐	
Cartridge Test Laboratory	VTC