FOREWORD

The Iranian Petroleum Standards (IPS) reflect the views of the Iranian Ministry of Petroleum and are intended for use in the oil and gas production facilities, oil refineries, chemical and petrochemical plants, gas handling and processing installations and other such facilities.

IPS is based on internationally acceptable standards and includes selections from the items stipulated in the referenced standards. They are also supplemented by additional requirements and/or modifications based on the experience acquired by the Iranian Petroleum Industry and the local market availability. The options which are not specified in the text of the standards are itemized in data sheet/s, so that, the user can select his appropriate preferences therein.

The IPS standards are therefore expected to be sufficiently flexible so that the users can adapt these standards to their requirements. However, they may not cover every requirement of each project. For such cases, an addendum to IPS Standard shall be prepared by the user which elaborates the particular requirements of the user. This addendum together with the relevant IPS shall form the job specification for the specific project or work.

The IPS is reviewed and up dated approximately every five years. Each standards are subject to amendment or withdrawal, if required, thus the latest edition of IPS shall be applicable.

The users of IPS are therefore requested to send their views and comments, including any addendum prepared for particular cases to the following address. These comments and recommendations will be reviewed by the relevant technical committee and in case of approval will be incorporated in the next revision of the standard.

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پیش‌گفتار

استانداردهای نفت ایران (IPS) معنیک رهگوی دیدگاه‌های وزارت نفت ایران است و برای استفاده در تاسیسات توپی نفت و گاز، بالاپشتک‌های نفت و یادداشت‌های شیمیایی و پتروشیمی، تاسیسات انقلاب و فراورش گاز و سایر تاسیسات مشابه نتهایی شده است.

استانداردهای نفت براساس استانداردهای قابل قبول میانالی تهیه شده و شامل گزیده‌هایی از استانداردهای مرجع می‌باشد. همچنین براساس تجربیات صنعت نفت کشور و قابلیت تامین کالا و نیز برحسب نیاز، مواردی بطور تکمیلی و بر اساس تجربیات از این استاندارد لحاظ شده است. مواردی از گزینه‌های فنی که در متن استانداردها آورده شده است در داده برگه‌ای صورت شده گذاری شده برای استفاده مناسب کاربران آورده شده است. استانداردهای نفت، به‌شکل کاملاً انعطاف‌پذیر تدوین شده است که کاربران با توجه به نیازهای خود، با آنها منطبق نمایند. یا حالت ممکن است تأمین نیازمندی‌های پیش‌ریزه و پیش‌بینی مورد نیاز، با توجه به نیازهای خاص آنها بر اساس می‌نماید تهیه و پیوسته نمایند. این الگوی سازماندهی با استاندارد مناسبه، مشخصات فنی آن برپا و یا کار خاصی را تشکیل خواهد داد.

هرچنین در این استانداردهای نفت تقریباً هر یک سال یکبار مورد بررسی قرار گرفته و روزمره می‌گردد. در این بررسی‌ها ممکن است استانداردهای حرف و یا حرفه‌ای‌های آن اضافه شود و نیز این استانداردهای حرف و یا حرفه‌ای‌های آن کم یافته شود.

از کاربران استاندارد درخواست می‌شود نقطه نظرهای و پیشنهادات اصلاحی و یا هرگونه حرفه‌ای‌های که برای موارد خاص تهیه نمودند، به نشانی برای ارسال نمایند. نظرات و پیشنهادات درخواستی در می‌گفتاری فنی مربوط بررسی و در صورت تصویب در تجدید نظرهای به‌دست استاندارد منعکس خواهد شد.

ایران، تهران، خیابان کریمخان زند، خرندمند شمالی، کوچه چهاردهم، شماره 19
اداره تحقیقات و استانداردها
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GENERAL DEFINITIONS:
Throughout this Standard the following definitions shall apply.

COMPANY:
Refers to one of the related and/or affiliated companies of the Iranian Ministry of Petroleum such as National Iranian Oil Company, National Iranian Gas Company, National Petrochemical Company and National Iranian Oil Refinery And Distribution Company.

PURCHASER:
Means the "Company" where this standard is a part of direct purchaser order by the "Company", and the "Contractor" where this Standard is a part of contract document.

VENDOR AND SUPPLIER:
Refers to firm or person who will supply and/or fabricate the equipment or material.

CONTRACTOR:
Refers to the persons, firm or company whose tender has been accepted by the company.

EXECUTOR:
Executor is the party which carries out all or part of construction and/or commissioning for the project.

INSPECTOR:
The Inspector referred to in this Standard is a person/persons or a body appointed in writing by the company for the inspection of fabrication and installation work.

SHALL:
Is used where a provision is mandatory.

SHOULD:
Is used where a provision is advisory only.

WILL:
Is normally used in connection with the action by the "Company" rather than by a contractor, supplier or vendor.

MAY:
Is used where a provision is completely discretionary.
GENERAL STANDARD
FOR
GAS CYLINDERS
SECOND REVISION
JANUARY 2009

برای
سئلدنر های گاز
ویرایش دوم
بهمن 1387

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GAS CYLINDERS .........................30
1. SCOPE

This Standard specifies the technical requirements for the design, material, construction and inspection of the portable refillable various gas cylinders, such as Dissolved Acetylene, L.P.G. Nitrogen, Oxygen, Air, Argon, Helium, Hydrogen, excluding Compressed Natural Gas (CNG). Carbon Dioxide (CO2) and Chlorine (Cl) gases as specified hereinafter in this Standard. Such cylinders are constructed of welded or seamless steel in various nominal water capacities.

Note 1:

This is a revised version of the standard specification by the relevant technical committee on Mar. 2005, which is issued as revision (1). Revision (0) of the said standard specification is withdrawn.

Note 2:

This bilingual standard is a revised version of the standard specification by the relevant technical committee on January 2009, which is issued as revision (2). Revision (1) of the said standard specification is withdrawn.

Note 3:

In case of conflict between Farsi and English languages, English language shall govern.

2. REFERENCES

Throughout this Standard the following dated and undated standards / codes are referred to. These referenced documents shall to the extent specified herein, form a part of this Standard. For dated references, the edition cited applies. The applicability of changes in dated references that occur after the cited date shall be mutually agreed upon by the Company and the Vendor. For undated references, the latest edition of the referenced documents (including any supplements and amendments) applies.

BSI (BRITISH STANDARDS INSTITUTION)

BS 381C:1996 "Specification for Colours for Identification Coding and Special Purposes."

BS EN 837-1:1998 "Pressure Gauges Part 1 - Bourdon tube Pressure Gauges - Dimensions, Metrology, Requirements and Testing"
BS EN 849 :1997 "Transportable Gas Cylinders – Cylinder Valves– Specification and Type Testing"


BS EN 1089-3 :1997 "Transportable Gas Cylinders – Cylinder Identification Part 3: Colour Coding"

BS EN 1800 :1999 "Transportable Gas Cylinders - Acetylene Cylinders - Basic Requirements and Definitions"

BS EN 1964-1:2000 "Transportable Gas Cylinders – Specification for the Design and Construction of Refillable Transportable Seamless Steel Gas Cylinders of Water Capacities from 0.5 Liter up to and Including 150 Liters – Part 1: Cylinders Made of Seamless Steel with an R_m Value of Less than 1100 Mpa "

BS EN 1964-2:2001 "Transportable Gas Cylinders – Specification for the Design and Construction of Refillable Transportable Seamless Steel Gas Cylinders of Water Capacities from 0.5 Liter up to and Including 150 Liters – Part 2: Cylinders Made of Seamless Steel with an R_m Value of 1100 MPa and above"

ISO (INTERNATIONAL ORGANIZATION FOR STANDARDIZATION)

10462 :1995 "Cylinder for Dissolved Acetylene-Periodic Inspection and Maintenance"
3. DEFINITIONS AND TERMINOLOGIES

For the purpose of this Standard, the following definitions shall apply:

3.1 L.P.G. Cylinder( Liquefied Petroleum Gas)

A portable container constructed of specific steel material having water capacity from 0.3 and up to and including 100 liters with the design pressure of 1.72 MPa (250 psi).

3.2 Water Capacity

The amount of water, in either kg or liters, at 15°C (60°F) required to fill a liquid container full of water.

3.3 Filling Ratio

The filling ratio is the ratio of the mass of gas introduced into a container to the mass of water at 15°C that fills the container fitted as for use.

3.4 High Pressure Cylinder

A transportable container constructed of specific steel material having maximum water capacity of 450 kg with the design pressure of not less than 7.2 MPa (1050 psi).
13.17 MPa (1910 psi).

3.5 Dissolved Gas

A gas that is dissolved under pressure in a solvent contained in porous substance at ambient temperature and that is released from that solvent without application of heat.

3.6 Dissolved Acetylene Cylinder

A vessel having a valve, and with or without safety devices, containing a porous mass, a solvent for the storage of dissolved acetylene and at least sufficient acetylene to saturate the solvent at atmospheric pressure and at a temperature of 15°C.

3.7 Tare

The mass of the cylinder, having a valve (but excluding a valve cover), containing a porous substance, a solvent for the storage of dissolved acetylene, the acetylene required to saturate the solvent at atmospheric pressure and at a temperature of 15°C and any valve protection permanently fixed directly to the container.

3.8 Yield Stress

Throughout this Standard the term "yield stress" means the upper yield stress R$_{el}$, or, for steels that do not exhibit a defined yield, the 0.2% proof stress (non-proportional elongation) R$_{p0.2}$.

3.9 Operating Pressure

The pressure of a cylinder at which it normally operates and shall not exceed the maximum allowable working pressure.

3.10 Maximum Allowable Working Pressure

The maximum allowable working pressure (MAWP) of a cylinder stipulates the design limit of the cylinder, and does not represent the operating point.

3.11 Design Pressure

The pressure used in determining the minimum permissible thickness or physical characteristics of the different parts of the cylinders.

3.12 Reference Temperature for Filling Ratio

The temperature at which the liquid density is to
be evaluated for calculating the filling ratio.

3.13 Authorized Body

The authority having jurisdiction is the organization, office or individual responsible for approving equipment, an installation or a procedure.

4. UNITS

This standard is based on International System of Units (SI), as per IPS-E-GN-100 except where otherwise specified.

5. REQUIREMENTS

5.1 Requirements for Transportable Acetylene Cylinders

5.1.1 Material

5.1.1.1 The material used for the cylinders shall be free of crack, breakage, mill-spot, lamination or any other defects. For acetylene cylinder, shell shall conform to the following requirements;

- For seamless steel BS EN 1964-1 (2000) shall be considered
- For chemical composition tables 1 and 2 shall be considered.

5-11-1 مواد

5-1-1 مواد برای سیلندرهای استیلین قابل حمل

- برای ترکیبات شیمیایی با نرخ جدول‌های 1 و 2 در نظر گرفته شود.
TABLE 1 – CHEMICAL COMPOSITIONS TOLERANCES

<table>
<thead>
<tr>
<th>Element</th>
<th>Nominal content %</th>
<th>Maximum permissible range %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon</td>
<td>(&lt; 0.30)</td>
<td>0.06</td>
</tr>
<tr>
<td></td>
<td>(\geq 0.30)</td>
<td>0.07</td>
</tr>
<tr>
<td>Manganese</td>
<td>All values</td>
<td>0.30</td>
</tr>
<tr>
<td>Silicon</td>
<td>All values</td>
<td>0.30</td>
</tr>
<tr>
<td>Chromium</td>
<td>(&lt; 1.50)</td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td>(\geq 1.50)</td>
<td>0.50</td>
</tr>
<tr>
<td>Nickel</td>
<td>All values</td>
<td>0.40</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>All values</td>
<td>0.15</td>
</tr>
</tbody>
</table>

**Note:** The maximum permissible range for each element is not required to be centered on its nominal content. As an example, for steel with nominal carbon content of 0.10%, the following three maximum permissible ranges are equally acceptable:

- +0.00% - 0.06%
- +0.06% - 0.00%
- +0.03% - 0.03%

The combined content of the following elements: V, Nb, Ti, B, Zr, shall not exceed 0.15%.

**TABLE 2 – SULFUR AND PHOSPHORUS LIMIT**

<table>
<thead>
<tr>
<th></th>
<th>(R_m) in Mpa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfur</td>
<td>R_m &lt; 950</td>
</tr>
<tr>
<td></td>
<td>950 ≤ R_m ≤ 1100</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>0.020 %</td>
</tr>
<tr>
<td>Sulfur + Phosphorus</td>
<td>0.030 %</td>
</tr>
</tbody>
</table>

**Note:** Mpa = Mega Pascals
5.1.2 Design

5.1.2.1 Different parts of cylinders shall be designed in accordance with BS EN 1964-1:2000. The reference temperature for calculation shall be 85°C.

5.1.2.2 Welding and heat treatment of cylinders shall be done in accordance with BS EN 1964-1:2000.

5.1.3 Fusible plug

Cylinders shall be equipped with a suitable fusible plug which shall be externally marked to indicate the temperature at which they are designed to relative pressure.

5.1.4 Valve

Cylinders shall be equipped with a valve. The valve shall be in accordance with BS EN 849-1997. Where the valve body is manufactured from an alloy containing copper, the alloy shall not form dangerous acetylides and the copper content shall not exceed 70%.

The manufacturer of the valve shall not employ any process that will result in surface enrichment of copper. The valve shall be protected by a cap. The construction of the cap shall be such that it is nowhere in contact with any part of the valve. The valve cap shall be provided with a side vent(s) of such size as to prevent any gas pressure accumulating inside the cap, unless the cap and its fixing are designed to withstand the pressure that could be developed in the cylinder by the contents at the reference temperature.

5.1.5 Cylinder tests


Note 1:
The reference temperature for tests shall be 85°C instead of 65°C.

Note 2:
Acetone is the preferred solvent.

5-1-2 طراحی

5-1-2-1 قطعات مختلف سیلندرها باید مطابق با ساختمه شده باشند. دمای مرجع برای محاسبات باید 85 درجه سلسیوس در نظر گرفته شود.

5-1-2-2 جوشکاری و عملیات حرارتی سیلندرها باید مطابق با BS EN 1964:2000 شوند.

5-1-3 دربوش ذوب شونده

سیلندرها باید مجهز به دربوش ذوب شونده مناسب باشند که در سطح بیرونی آن دماهی که برای آن در فشار نسبی طراحی شده اند درجه شوند.

5-1-4 سیر

سیلندرها باید دارای شیر باشند. شیر باید مطابق با استاندارد BS EN 849-1997 باشد. در مواردی که بند شیر از همبسته (آلیاژ) دارای مس ساختمه شده است، همبسته باید شده نیابت است. دردسته‌های خطرناک تولید کنند و مقدار من نیابت بیش از 20 درصد باشد.

5-1-5 آزمون های سیلندر


پایداری 1:
دمای مرجع برای آزمون‌ها باید به جای 65 درجه سلسیوس، 85 درجه سلسیوس در نظر گرفته شود.

پایداری 2:
استن به عنوان حلال ترجیح داده می‌شود.
5.1.6 Color identification

Each cylinder shall be painted maroon in accordance with BS EN 1089-3 and Table 1 in Appendix C.

5.1.7 Marking and identification

5.1.7.1 Each container shall be stamped on the shoulder or on a reinforced part of the container or on the collar or neck ring with the following marks:

a) The name of the gas "Acetylene";

b) Identification of the manufacturer together with the serial number of the completed container;

c) Identification of porous mass;

d) Identification mark of owner;

e) Tare (see 3.7) i.e. a number and an indication of the units used;

f) Maximum mass of acetylene to be charged into the container, excluding saturation mass of acetylene;

g) Identification of the solvent when not aceticone;

h) Maximum permissible pressure at 15°C.

5.1.7.2 In addition to the above markings, other markings such as the last date on which the porous mass was examined and found to be satisfactory, may also be included provided that these are made in such a way that they are separate from the above markings.

5.1.8 Information to be available from the manufacturer

The manufacturer shall always be able to provide the following information concerning the completed container:

a) Identification of approving authority;

b) Specification to which the shell is made;

c) Test pressure and date of test;
5.1.9 Information to be available from the owner

A record shall be kept by the owner for the lifetime of the container and shall include the items specified in (a) to (f) of Clause 5.1.8 together with the following information:

a) The dates upon which visual examination was carried out;

b) The name of the company and the address of the works where this was done;

c) Identification of the examiner.

In addition a record of each gas charge and solvent addition shall be retained by the filler for three months from the date of charging.

5.1.10 Periodic inspection and maintenance of dissolved acetylene cylinders shall be done in accordance with ISO 10462:1995.

5.2 Requirements for L.P.G Cylinders

L.P.G cylinders with a water capacity of 0.3 up to 100 liters shall be designed, manufactured, tested and inspected in accordance with ISIRI 473.

5.3 Requirements for High Pressure Seamless Cylinders for Nitrogen, Air, Argon, Helium, Hydrogen and Oxygen

5.3.1 General

This clause covers the specification of high pressure seamless cylinders with a water capacity of up to 450 kg and maximum allowable working pressure of 13.17 MPa (1910 PSI).

The material used for design requirements for high pressure seamless cylinder shall be free of cracks, mill-spots, breakage, lamination or other defects, and tested according to the procedures specified in this Standard.
The following specification shall be considered in the design and manufacturing of cylinders.

5.3.1.1 The maximum percentage of the carbon, phosphorous and sulfur on ladle analysis for steel used on manufacturing of high pressure cylinders shall be as per BS EN 1964-2:2001.

Calculation of high pressure seamless cylinders shall be in accordance with Clause 5.3 of BS EN 1964-2:2001.

In addition, the following shall be considered:

a) The minimum wall thickness of cylindrical shell of cylinders with external diameter of more than 12.7 cm shall not be less than 2.5 mm.

b) The thickness of cylinders in general shall be such that the value of shell stress calculated by formula given in the referenced standard not exceed 367.70 MPa (3750 kg/cm²) or 67% of the tensile strength of the cylinder metal.

c) The thickness of the bottom of the cylinder in any condition shall not be less than twice the minimum thickness of cylindrical part of the cylinder.

5.3.2 Fabrication method

5.3.2.1 Inner and outer surface of cylinder shall be smooth and uniform.

5.3.2.2 All threaded opening for valves, plugs, safety valves, etc. shall be clean, uniform and in a sound condition.

5.3.2.3 The number of engaged threads of valves, plugs, etc.) Shall be at least 6. The calculated shear strength for threads shall be 10 times of test pressure.

5.3.3 Welding

5.3.3.1 Electrical arc welding and brazing shall not be used during fabrication.

5.3.4 Heat treatment

5.3.4.1 Each cylinder, after the completion, shall be uniformly heat treated so that to withstand all required tests (See 5.3.10).
The operations involving heating shall be carried out carefully in furnaces equipped to control temperatures accurately, and the cylinders shall be maintained at the stipulated temperatures for the length of time necessary to ensure that all parts have reached the required temperature and all necessary metallurgical changes have been effected.

5.3.4.2 Heat treatment shall be accomplished after all forming and welding operations.

5.3.5 Materials

Open-hearth, basic oxygen or electric steel of uniform quality shall be used. The chemical analysis of steel shall comply with BS EN 1964-2 (2001). Any equivalent material is acceptable. The mechanical properties of steel in finished cylinder shall comply with the provisions of BS EN 1964-2 (2001).

5.3.6 Cylinder valve

The valve body shall not be manufactured from materials that are subject to porosity or brittleness. Screw-threaded valve outlet connections shall be right-hand on cylinders used for non-flammable gases and left-hand on cylinders used for flammable gases.

5.3.7 Valve protection

5.3.7.1 Containers intended for the transport of toxic and/or flammable gases shall have their valves protected against damage, either by the design of cylinder or by the provision of suitable cap or shroud securely attached to the body of the cylinder.

5.3.7.2 Construction of the cap or shroud shall be such that it is nowhere in contact with any part of the valve.

5.3.7.3 The valve cap or shroud shall be provided with a side vent of such size as to prevent any gas and/or liquid accumulating inside the cap or shroud.

5.3.8 Pressure relief device

5.3.8.1 No pressure relief device shall be fitted to cylinder intended for the conveyance of toxic gases.
5.3.8.2 Material of construction for all pressure relief devices shall be compatible with the gas to be conveyed and other service conditions.

5.3.8.3 All pressure relief devices shall be so designed and fitted as to ensure that the cooling effect of the contents of the cylinder during discharge shall not prevent the effective operation of the devices.

5.3.8.4 The outlets from all pressure relief devices shall be so sited that free discharge from the devices is not impaired.

5.3.9 Painting

Coal tar epoxy paint (IPS-M-TP-190) shall be applied in thickness of 300 micron to the finished external surface of cylinders as a primer. For top coat amine cured epoxy conforming to IPS-M-TP-250 shall be applied with a thickness of 100 micron. The shade of final coat shall conform to BS EN 1089-3.

5.3.10 Testing

5.3.10.1 Hydrostatic pressure test

All manufactured cylinders, after heat treatment operations and before any coating or valve attachments shall be subjected to hydrostatic pressure and water jacket expansion test. The test pressure for each cylinder shall be \( \frac{5}{3} \) of working pressure of the cylinders.

After this test no sign of leakage or crack, lumps penetration or corrosion shall be seen and also the permanent expansion of cylinder shall be less than 10% of its volume.

5.3.10.1.1 For pressure test the method described in Appendix A, shall comply and thus for expansion test the method described in Appendix B shall comply.

5.3.10.2 Number of cylinders to be tested

The hydrostatic pressure test for each lot shall be based on the randomly selected number of cylinders as indicated in the Table below:
5.3.10.2 Physical tests
Physical test shall be required to determine yield strength, tensile strength, elongation, and reduction of area of material. The test procedure shall conform to "ISIRI" Standard No. 1526.

5.3.10.3 Flattening test

For this test the specimen cylinders shall be placed at 60° angle between knife edges such that the bending radius at its edge is 12.7 mm (½") and applied enough force so as to maintain distance between two inner edges of specimen, 6 times that of cylinder wall thickness. The specimen shall be taken at random from each lot of 200 cylinders or less after hydrostatic test.

The acceptable result of physical and flattening tests are as follows:

- a) In physical test, the minimum relative elongation shall be 40% of the 50 mm effective length or 20% for 200 mm effective length and the yield strength shall not exceed 73% of tensile strength of the material. In such a case the flattening test is not necessary;

- b) In physical test, the minimum relative elongation shall be 20% of the 50 mm effective length or 10% for 200 mm effective length and the yield strength shall not exceed 73% of tensile strength of the material. In this case the flattening test shall be applied, and the result shall be as below:

When the level of internal distance between two specimen from each other equals 6 times the thickness of the cylinder, crack or breakage shall not be seen.

### RANDOM CYLINDER SELECTION FOR HYDROSTATIC TEST

<table>
<thead>
<tr>
<th>No. of Cylinders in Each Group (lot)</th>
<th>No. of Cylinders to be Tested</th>
</tr>
</thead>
<tbody>
<tr>
<td>تعداد سیلندرها از هر گروه (دسته)</td>
<td>تعداد سیلندرها که باید آزمون شوند</td>
</tr>
<tr>
<td>200 or less</td>
<td>1</td>
</tr>
<tr>
<td>از 200 تا 1000 باید 1Wennهم (عدد 1) (1000)</td>
<td>(1000)</td>
</tr>
<tr>
<td>از 1000 و بیشتر آن</td>
<td>(1000)</td>
</tr>
</tbody>
</table>

ینمونه برداری اتفاقی سیلندرها برای آزمون فشار استیابی

این آزمون برای تکیه تاب تسیم، تاب کشته، ازدید یا کاهش مساحت ورقه فلزی که در سیلندر به کار رفته است انجام می گیرد. روش آزمون باید مطابق با استاندارد شماره 1526 موسسه استاندارد و تحقیقات صنعتی ایران باشد.

- 5.3-10-2 آزمون نخ تک گردن

در این آزمون باید نمونه سیلندر را بین دو تیغه بنویسیم. در جریه کشش انحنای 60 درجه که شعاع انحنای به اندازه 12.7 میلیمتر (½) باید قرار داد و آنها آنقدر نخ تک گردن که فاصله دو سطح داخلی نمونه از یکدیگر مساوی 6 برابر ضخامت بدن شود نمونه باید بطور اتفاقی از بین هر دسته سیلندر 200 عددي یا کمتر پس از آزمون فشار استیابی انتخاب شود.

نتیجه قابل قبول آزمون های فیزیکی و نخ تک گردن به شرح زیر می باشد:

الف) در آزمون فیزیکی ازدید طول نسیم کمیته به باید درصد طول مورد 5 میلیمتری یا 20 درصد طول مورد مورد 200 میلیمتری باشد و تاب تسیم نباید از 33 درصد تاب کششی ماده تجاوز کند. در جنین حالتی انجام آزمون نخ تک گردن ضرورت ندارد.

ب) در آزمون فیزیکی ازدید طول نسیم کمیته به باید درصد طول مورد 5 میلیمتری یا 10 درصد طول مورد مورد 200 میلیمتری باشد و تاب تسیم نباید از 33 درصد تاب کششی ماده تجاوز کند. در این حالت باید آزمون نخ تک گردن نیز انجام شود و نتیجه باید به شرح زیر باشد:

هگماییکه فصل دو سطح داخلی نمونه از یکدیگر مساوی 6 برابر ضخامت بدن سیلندر گردید در آن هیچگونه تک یا شکستگی دیده نشود.
5.3.10.4 Leakage test

All cylinders shall be tested for leakage by gas or air pressure after the bottom has been cleaned and is free from all moisture. Pressure, approximately the same as but no less than service pressure, shall be applied to one side of the finished bottom over an area of at least \( \frac{1}{16} \) of the total area of the bottom but not less than 20 mm in diameter, including the closure, for at least 1 minute, during which time the other side of the bottom exposed to pressure must be covered with water and closely examined for indication of leakage. Leaks shall be rejected.

5.3.11 Marking

The following information shall be permanently and legibly marked at the shoulder of the high pressure cylinders:

a) The chemical abbreviation formula of the gas it contains as specified in Table below;

b) Name or trade mark of manufacturer;

c) The water capacity of the cylinder in liter;

d) The net weight of the cylinder (excluding valve and cap) in kg;

\[ \begin{array}{c|c|c}
\text{NAME OF GAS} & \text{FORMULA} & \text{NAME} \\
\hline
\text{Argon} & \text{Ar} & \text{ارگون} \\
\text{Air} & * & \text{هو} \\
\text{Acetylene} & \text{C}_2\text{H}_2 & \text{استیلن} \\
\text{Helium} & \text{He} & \text{هلهیم} \\
\text{Hydrogen} & \text{H}_2 & \text{هیدروژن} \\
\text{Nitrogen} & \text{N}_2 & \text{آزمان} \\
\text{Oxygen} & \text{O}_2 & \text{اکسیژن} \\
\end{array} \]

* Abbreviation formula not marked on cylinder in this case.

The chemical abbreviation formula of the gas it contains as specified in Table below:

- Argon
- Air
- Acetylene
- Helium
- Hydrogen
- Nitrogen
- Oxygen

* Abbreviation formula not marked on cylinder in this case.

The name or trade mark of the manufacturer;
e) Serial number of cylinder;

f) Testing pressure in MPa;

g) Date of pressure test (year and month);

h) Maximum allowable working pressure MPa;

i) The name of gas to be filled in cylinder.

5.3.1.2 Color identification

Each cylinder shall be painted in corresponding color as stated in Appendix C.

6. INSPECTION

6.1 The purchaser’s inspector, or his authorized representative shall have free access to the manufacturing plant engaged in the manufacture of the cylinder, to carry out necessary inspection at any stage of work.

6.2 Inspection may include visit to quality control laboratories, workshops, testing bay etc.

6.3 All materials supplied under this Standard shall be subject to timely inspection by the Purchaser or his authorized representative.

6.4 The Purchaser shall have the right to reject any material(s) supplied which is (are) found to be defective under this Standard Specification.

6.5 The cylinder and its valve(s) and Material(s) shall be brand new, otherwise are subject to the rejection by the inspector.

6.6 Inspection of the cylinder shall be made at the manufacturer’s plant, point of shipment or at the place of delivery as agreed upon between the manufacturer and the customer.

6.7 Inspection procedure for weldings shall be approved by the Purchaser.

6.8 The cylinder may be rejected if inspection reveal any discrepancies between quoted figures and purchase order.

6.9 The supplier shall maintain appropriate inspection and test records to substantiate conformance with specified requirements and make the same available on request by purchaser.
6.10 Approval by the Purchaser’s inspector or assigned representative shall not relieve the Vendor of his commitments under the terms of this specification or any associated order.

6.11 All repairs shall meet the inspection requirements and acceptance standards for the original material. After weld repair, cylinder shall be suitably heat-treated. Details of the weld repairs and of the heat-treatment where applicable, shall be recorded and reported to the Purchaser.

6.12 The supplier shall make available technical data, test facilities and samples that the Purchaser’s representative may require for verification in conjunction with pertinent product.

7. DRAWINGS AND TECHNICAL DOCUMENTS

7.1 At Quotation Stage

Documents to be submitted by manufacturer/supplier shall give the following as complete:


b) Drawings and documents which define the technical data of required commodity (ies).

c) List of tests which may be made on his work.

d) Complaint and compensation policies.

e) Declaration of any certificate from any impartial laboratory "if any".

7.2 At Ordering Stage

a) A copy of test certificate.

b) Quality assurance certificate.

7.3 At Delivery Stage

Manufacturer certificate to verify that the cylinders are made in accordance with purchase order and relevant specification.
8. CONFLICTING REQUIREMENTS

In case of conflict between documents relating to the inquiry or purchase order the following priority of documents shall apply:

- **First Priority**: Purchaser order (including attachments) and variations thereon.

- **Second Priority**: Data sheets and drawing.

- **Third Priority**: This standard.

All conflicting requirements shall be referred to the Purchaser in writing, the purchaser will issue confirmation document if needed for clarification.

9. GUARANTEE AND WARRANTY

Unless exception is recorded by the Vendor in his proposal, it shall be understood that the Vendor shall, with all possible speed and without cost to the Purchaser, replace or repair the cylinder or any part thereof found to be defective due to faulty martial, workmanship or to any act or omission of the Vendor, in particular the Vendor shall reimburse any transportation and other charges incurred by the Purchaser in effecting such replacement or repair.

10. PACKING

10.1 Cylinders must be carefully packed to provide necessary protection during transit to destination.

10.2 Special attention must be given to protection against corrosion damages or defects which may occur during handling, shipment and sea/road transportation.

10.3 The supplier shall provide methods of handling to prevent damage and/or deterioration during transit.

11. LANGUAGES

11.1 All correspondence, drawings, documents, certificates, including testing, operation, maintenance and repairs manuals, etc. shall be in English / Farsi.

11.2 Offers in other languages will not be considered.
HYDROSTATIC PRESSURE TEST

A.1 General

This Appendix describes an example of a method for carrying out the hydrostatic pressure test.

Containers if tested in batches shall be of the same test pressure, established as described in BS EN 1964-2:2001 which shall not be exceeded by 3% or 1 MPa (10 Bar), whichever is the lower.

A.2 Equipment

A.2.1 All rigid pipe work, flexible tubing, valves, fittings and components forming the pressure test equipment should be capable of withstanding a pressure 1.5 times the maximum test pressure of any container that may be tested. Flexible tubing should have sufficient wall thickness to prevent kinking.

A.2.2 Pressure gages should comply with the requirements of the industrial class of BS EN 837-1:1998 and have a scale range appropriate to the container test pressure. They should be tested and recalibrated as necessary, at regular intervals and in any case not less frequently than once per year against a dead weight tester.

A.2.3 A device should be fitted to the test equipment to ensure that no container is subjected to a pressure in excess of its test pressure by more than the tolerances in A.1.

A.2.4 All joints shall be leak tight.

A.2.5 The design and installation of the equipment and of the containers connected to it should be such as to avoid trapping air in the system.

Note:

An example of the equipment required is shown in Fig. 1.
A.3 Procedure

Carry out the following procedures:

a) Completely fill all container(s) with water.

b) Connect the container(s) to the test equipment as shown in Fig. 1, leaving all valves open.

c) Fill the pump and pipe work system with water and close the air bleed valve when water appears. Close the bypass valve.

d) Remove any excess water from the outside of the container(s).

e) Operate the pump until the test pressure is reached. Stop the pump and close the hydrostatic line valve.

f) Check that the test pressure remains constant for a minimum period of 1 min.

g) Inspect the container(s) visually. The presence of water is an indication of either:

1) A leaking connection to a container, or

2) A leak in a test container.

In case (1): The system is depressurized, the connection made good and the test repeated on the batch.

In case (2): The faulty container(s) is isolated and the test continued on the remainder of the batch.

h) If at the end of the test period the pressure in the system has fallen, this may indicate that one or more of the containers has failed under pressure.

In this event the whole test batch is retested, individually if necessary, to identify the faulty container(s).
APPENDIX B

HYDROSTATIC EXPANSION TEST

B.1 General

This Appendix gives details of the water jacket method for determining the expansion of welded steel gas containers. The water jacket expansion test may be carried out using equipment with a leveling burette or with a fixed burette.

B.2 Equipment

B.2.1 Hydrostatic test pressure pipelines should be capable of withstanding a pressure twice the maximum test pressure of any container that may be tested.

B.2.2 Glass burettes should be of sufficient length to receive water equivalent to the full volumetric expansion of the container and capable of being read to an accuracy of 1 ml.

B.2.3 Pressure gages should comply with the requirements of the Industrial Class of BS EN 837-1:1998. They should be tested at regular intervals and in any case not less frequently than once per month.

B.2.4 A device should be fitted to ensure that no container is subjected to a pressure in excess of its test pressure.

B.2.5 Pipe work should use long bends in preference to elbow fittings, and pressure pipes should be as short as possible.

Flexible tubing should be capable of withstanding twice the maximum test pressure in the equipment and have sufficient wall thickness to prevent kinking.

B.2.6 All joints should be leak tight.

B.2.7 The installation of the equipment should be such as to avoid trapping air in the system.

Note:

B.2.1 to B.2.7 are general to both methods of test.
Fig. 1- EXAMPLE OF HYDROSTATIC PROOF PRESSURE TEST EQUIPMENT

شکل 1- نمونه تجهیزات آزمون فشار ایستایی (هیدرواستاتیک)
B.3 Water Jacket Expansion Test

B.3.1 Principle

This method of test necessitates enclosing the water-filled container in a jacket also filled with water. The total volumetric expansion of the container is measured by the amount of water displaced from the jacket when the container has been pressurized. The permanent volumetric expansion of the container is measured by the amount of water which continues to be displaced from the jacket when the pressure has been released.

B.3.2 Additional equipment

The water jacket should be fitted with a safety device capable of releasing the energy from any container that may burst at the test pressure. An air bleed valve should be fitted to the highest point of the jacket.

B.3.3 Procedure

B.3.3.1 General

Two methods of performing this test are described in B.3.3.2 and B.3.3.3. Other methods are acceptable provided that they are capable of measuring the total and, if any, the permanent volumetric expansions of the container.

B.3.3.2 Water jacket expansion test

Leveling burette method: An example of the equipment required is shown in Fig. 2 but other types of installation may be acceptable.

Carry out the following procedures:

a) Fill the container with water and attach the water jacket cover to it.

b) Seal the container in the jacket and attach the pressure line to the container.

c) Fill the jacket with water, allowing air to bleed off through the air bleed valve. Close the air bleed valve when water issues freely from it.

d) Adjust the zero level on the burette to the datum mark on the burette support stand.
Adjust the height of the water to the burette zero level by manipulation of the jacket filling valve and the drain valve.

e) Raise the pressure in the container to two-thirds of the test pressure. Close the hydraulic line valve and check that the burette reading remains constant.

**Note:**

A rising water level indicates a leaking joint between the container and the jacket. A falling water level indicates a leaking joint between the water jacket and the atmosphere.

**Fig. 2- WATER JACKET VOLUMETRIC EXPANSION TEST (LEVELLING BURETTE)**

شکل 2- نمونه تجهیزات آزمون انبساط سنجش حجمی در مخزن آب سر بسته (با استفاده از بورت تراز کننده)
f) Open the hydraulic line valve and continue the pressurization of the container until the test pressure is reached. Close the hydraulic line valve.

(g) Lower the burette until the water level is at the datum mark on the burette support stand. Take the reading of the water level in the burette. Record this reading, the total expansion, on the test certificate.

(h) Open the hydraulic line drain valve to release pressure from the container. Raise the burette until the water level is again at the datum line on the burette support stand. Check that the pressure is at zero and that the water level is constant.

(i) Check that the permanent expansion does not exceed 10% of the total expansion as determined by the following equations:

\[
\text{Permanent expansion} \times 100 \quad = \quad \% \quad \text{Total expansion}
\]

B.3.3.3 Water jacket volumetric expansion test

Fixed burette method: An example of the equipment required is shown in Fig. 3 but other types of installation may be acceptable.
Fig. 3- WATER JACKET VOLUMETRIC EXPANSION TEST (FIXED BURETTE)

carry out the following procedures:

a) Fill the container with water and attach the water jacket cover to it.

b) Seal the container in the jacket and attach the pressure line to the container.

c) Fill the jacket with water, allowing air to bleed off through the air bleed valve. Close the air bleed valve when water issues freely from it.

d) Adjust the water level to the zero mark on the burette by manipulation of the jacket filling valve and the drain valve.
e) Raise the pressure in the container to two-thirds of the test pressure. Close the hydraulic line valve and check that the burette reading remains constant.

Note:
A rising water level indicates a leaking joint between the container and the jacket. A falling water level indicates a leaking joint between the water jacket and the atmosphere.

f) Open the hydraulic line valve and continue the pressurization of the container until the test pressure is reached. Close the hydraulic line valve.

g) Read the level of the water in the burette. Record this reading, the total expansion, on the test certificate.

h) Open the hydraulic line drain valve to release pressure from the container. Check that the pressure is at zero and that the water level is constant.

i) Read the level of the water in the burette. Record this reading, the permanent expansion, if any, on the test certificate.

j) Check that the permanent expansion does not exceed 10% of the total expansion as determined by the following equation:

\[
\frac{\text{Permanent expansion} \times 100}{\text{Total expansion}} = \% 
\]
APPENDIX C
CONTAINER MARKING AND COLOURS
(For gases in general use having traditional ground colours)

<table>
<thead>
<tr>
<th>Name of gas</th>
<th>Chemical formula or symbol</th>
<th>Nominal</th>
<th>Colour No. to BS 381C</th>
<th>Colour No. to BS 381C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetylene</td>
<td>C₂H₂</td>
<td>Maroon</td>
<td>541</td>
<td>None</td>
</tr>
<tr>
<td>Air</td>
<td>*</td>
<td>French grey</td>
<td>630</td>
<td>None</td>
</tr>
<tr>
<td>Ammonia</td>
<td>NH₃</td>
<td>Black</td>
<td>-</td>
<td>Signal red and golden yellow**</td>
</tr>
<tr>
<td>Argon</td>
<td>Ar</td>
<td>Peacock blue</td>
<td>103</td>
<td>None</td>
</tr>
<tr>
<td>Ethyl chloride</td>
<td>C₂H₅Cl</td>
<td>French grey</td>
<td>630</td>
<td>Signal red</td>
</tr>
<tr>
<td>Ethylene</td>
<td>C₃H₄</td>
<td>Dark violet</td>
<td>796</td>
<td>Signal red</td>
</tr>
<tr>
<td>Helium</td>
<td>He</td>
<td>Middle brown</td>
<td>411</td>
<td>None</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>H₂</td>
<td>Signal red</td>
<td>537</td>
<td>None</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>N₂</td>
<td>French grey</td>
<td>630</td>
<td>Black</td>
</tr>
<tr>
<td>Oxygen</td>
<td>O₂</td>
<td>Black</td>
<td>-</td>
<td>None</td>
</tr>
</tbody>
</table>

* No formula to be added.

** The red or blue band should be placed adjacent to the valve fitting and the yellow band between that and the ground colour of the container.

* هیچ فرمولی اضافه نشود.

** توصیه میشود نوار قرمز یا آبی در کنار محل اتصال شیر به سیلندر و نوار زرد بین آن و رنگ زمینه سیلندر استفاده شود.
<table>
<thead>
<tr>
<th>a) General</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project:                      Location:</td>
</tr>
<tr>
<td>Order No.:                    Manufacturer:</td>
</tr>
<tr>
<td>Site Hazard Class:            Mountings:</td>
</tr>
<tr>
<td>Enclosed space: Open space:</td>
</tr>
<tr>
<td>Space Application: Commercial: Residential: Industrial:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>b) Specified Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Gas:                Capacity (Net):</td>
</tr>
<tr>
<td>m³                         liters</td>
</tr>
<tr>
<td>Design pressure:            Working pressure: MPa</td>
</tr>
<tr>
<td>Hydrostatic test pressure:  MPa</td>
</tr>
<tr>
<td>Air test:                  MPa</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>c) Test Certificates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material test:              Analysis:</td>
</tr>
<tr>
<td>Welding test:               Structural test:</td>
</tr>
<tr>
<td>Rupture test:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>d) Physical Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight: kg. net: gross:       Dimension: Ht.: mm, Dia: mm, Thickness: mm</td>
</tr>
</tbody>
</table>

### APPENDIX D
DATA SHEET FOR GAS CYLINDERS

بالعربية

**د) القيم الفيزيائية**

<table>
<thead>
<tr>
<th>وزن (كيلوغرام)</th>
<th>قطر (مم)</th>
<th>ضخامة (مم)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>