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شرکت ملي گاز ايران

مديريت پژوهش و فنآوري

امورتدوين استانداردها

IGS

مشخصات فنی خرید

لوله های فولادی بدون درز / درزجوش گرید B ، اندازه های ۱/۲ تا ۴ اینچ

SMLS/HFW Carbon Steel Pipes, Grade B, Sizes : 1/2 to 4 inch.

دفترمدیرعامل

شرکت ملی گازایران

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ابلاغ مصوبه هیأت مدیره

مدیر محترم پژوهش و فناوری

باسلام،

به استحضار می‌رساند در جلسه ۱۷۵۵ مورخ ۱۳۹۶/۸/۲۱ هیات مدیره ، نامه شماره گ۹/۰۰۰/۱۰۳۹۶۲ مورخ ۹۶/۸/۸ مدیر پژوهش و فناوری درمورد تصویب نهایی استانداردها به شرح زیر مطرح و مورد تصویب قرار گرفت :

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۲. مشخصات فنی شیرهای سماوری جوشی/ فلنجی ، اندازه‌های ۲ تا ۲۴ اینچ کلاس‌های ۱۵۰ ، ۳۰۰ و ۶۰۰ IGS-M-PL-002-1(4)

۳. دستورالعمل کدگذاری رنگ سیلندرهای گاز IGS-C-SF-011(1)

۴. مشخصات فنی لوله‌های فولادی بدون درز / درزجوش گرید B ، اندازه‌های ۱/۲ تا ۴ اینچ IGS-M-PL-001-1(1)

۵. دستورالعمل بازرسی دوره‌ای بالابر زنجیری دستی و اهرمی IGS-I-GN-006(0)

۶. دستورالعمل بازرسی دوره‌ای جرثقیل‌های متحرک IGS-I-GN-005(0)

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الهام ملکی
دبیر هیات مدیره

رونوشت : مدیرعامل محترم شرکت ملی گاز ایران و رییس هیات مدیره
: اعضای محترم هیات مدیره
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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, knowledge, backgrounds and experiences in natural gas industry at national and international levels. 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 DEFINITION:

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

aspects of 1- "STANDARDIZATION DIV." is organized to deal with all 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 NIGC whether as the prime producer or manufacturer or a trading firm.

4- "SHALL ": is used where a provision is mandatory.

5- "SHOULD": is used where a provision is advised only.

6- "MAY": is used where a provision is completely discretionary.

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1. Scope:

This specification describes minimum requirements of NIGC for the purchase of carbon steel pipe grade B (L245) ,PSL1 , pipe sizes 1/2 ≤ 4 inch for use in non-sour natural gas service .This specification is based on API 5L 45 edition 2012.

Note: This specification supersedes IGS-M-PL-001-1(0):2012, "SMLS/HFW Carbon Steel Pipes, Grade B, NPS1/2 ≤ 4.

2. **References:**

Throughout this standard specification the following codes and standards are referred to:

API 5L 45: 2012 "Specification for Line Pipe"

ASME B.36.10: 2004 "welded and seamless wrought steel pipe"

IPS –M-PI-190(3):2014 "material and equipment standard for line pipe"

The applicability of changes in codes and standards that occur after the date of this standard shall be mutually agreed upon by the purchaser and manufacturer and/or supplier

3. Symbols & abbreviated terms:

NIGC: National Iranian Gas Company
NPS: (Nominal Pipe Size) is a dimensionless designator that has been substituted in the customary units section for the previous term Inch Nominal Size
IGS: Iranian gas specification

4. Technical requirements

The steel shall be made by basic oxygen process, electric furnace or open hearth process only in combination with a ladle refining process with fine grain.
Manufacturing, Testing, Dimensions, Tolerances and Marking shall be in according to PSL1 pipe of API 5 L: 2012 with the following amendments /additional requirements which stated in this specification**:**

4.1 Yield strength shall be Max. 57000 psi

4.2 Ratio of body yield strength to ultimate tensile strength shall not exceed 0.88 .

4.3 Sulfur content shall be maximum 0.007% mass fraction .

4.4 Carbon equivalent (CE_{IIW}) shall be max. 0.39 determined using the following equation:

$$CE_{\Pi W} = C + \frac{Mn}{6} + \frac{(Cr + Mo + V)}{5} + \frac{(Ni + Cu)}{15}$$

4.5 For HFW pipes:
4.5.1 Hardness on HAZ and weld center line shall not exceed 170HV10.
4.5.2 Average hardness (body, HAZ, weld) shall not be more than 160HV10.
Hardness shall be measured in three points at five locations as per fig1

4.6 For SMLS pipes, average hardness shall not be more than 150HV10. Hardness shall be measured at four locations as per fig 2.

4.7 HFW pipes shall be manufactured from hot – rolled coil. The entire weld plus HAZ shall be normalized or the pipe shall be processed in such a manner that all martensite tempered.

4.8 All SMLS pipes shall be normalized.

4.9 Repairs by welding (on pipe body & weld seam) are not acceptable.

4.10 Strip end weld and Jointer pipe is not acceptable.

4.11 All pipes shall withstand a minimum hydrostatic test pressure as per Table1, without leakage through the weld seam and pipe body for at least 10 seconds.

Table 1-Minimum Hydrostatic Test Pressure

Dimensions			**Hydrostatic Test**
NPS	**Outside dia.**	**Wall-thickness***	**Pressure**
	(in) mm	**(in) mm**	**psi**
1/2	(0.840) 21.3	(0.109) 2.8	850
3/4	(1.050) 26.7	(0.113) 2.9	850
1	(1.315) 33.4	(0.113) 2.9	850
1 1/2	(1.900) 48.3	(0.145) 3.7	1600
2	(2.375) 60.3	(0.154) 3.9	2000
3	(3.5)88.9	(0.216) 5.5	2500
4	(4.500) 114.3	(0.172) 4.4	2000
4	(4.500) 114.3	(0.237) 6.0	2500

4.12 Acceptance criteria for flattening test of HFW pipes shall be as follow :

No opening and no cracks or breaks shall occur in either weld or parent metal during flattening of the test specimen to 50% of its original OD. The specimen shall be further flattened to 33% of original OD (total 83%) without cracks or breaks other than in the weld. For all pipes, continue flattening until opposite walls of pipe meet, no evidence of lamination or burnt metal shall develop during the entire test.

5. Non-destructive Inspection

5.1. Non-destructive inspections shall be done after Hydrostatic test

5.2 The weld seam of HFW pipes shall be Non-destructive inspected, full length (100%) for entire thickness by an automated ultrasonic or eddy current method. (Tables E1 of API 5L)

5.3 The Non-destructive equipments shall be checked by the reference standard at the start and every two hours of production shift. Reference standard shall be made on a full length pipe with notches (inside & outside) and drilled hole according to table E7 of API 5L.

The reference standards shall have the same diameter, thickness, material, heat treatment as the product to be inspected. The checking shall be carried out at the speed and all conditions that used in production. In case of equipment failed to detect notches and holes, all tested pipes since previous checking (after the last calibration) shall be re-tested.

Capability of equipment to detect reference standard notches and holes shall be verified by end user representative.

5.4 Ultrasonic lamination testing

5.4.1 For HFW pipes, each strip shall be ultrasonically tested for laminations before or after forming using an oscillating scanning pattern with minimum of 12.5% of width or parallel scanning pattern with coverage of at least 25% of strip width. In addition, the scanning shall be executed 100% along the edges with the coverage of at least 25 mm wide from the both trimmed edge.

Alternatively, for wall thickness 6 mm or less, the pipe body may be eddy currently tested with coverage of 100 %.

5.4.2 The whole body & ends of each SMLS pipe shall be non-destructive tested as per table E.2 of API 5L.

5.4.3 The ends weld seam of HFW pipes for at least 100mm (untested area) shall be inspected by manual or semi-automatic ultrasonic angle beam method or cut off .

5.4.4 After beveling, the complete circumference of both ends of pipes shall be tested for laminations covering a band of at least 25 mm wide include the entire bevel by UT or MT.

6. First day production tests

Two of the completely finished pipes which produced during the first days production shall be selected at random for testing to verify that the submitted manufacturing procedure are fully acceptable .

If more than one heat is used in the first day production, at least two heats shall be represented by the tested pipes.

For orders less than 50 tons, first day production tests are not required.

7. Transportation (pipe loading)

Transportation shall be according to manufacturer procedure. If specified in purchaser order, strong plastic cap or bevel protector shall be used at both pipe ends.

8. Documentations:

The manufacturer shall supply the end user/client following documents:

8.1 Weld ability data and MPS, WPS, QCP & PQR shall be sent for NIGC approval, at least two week before start of production.

8.2 Mill test certificate which issued by manufacturer QC/QA department.

The following data shall be included to mill certificate:

8.2.1 Specified manufacturing standard, outside diameter, wall thickness, length, weight, grade, type of pipe, process of manufacturing, type of heat treatment, coil number, pipe identification number**.**

8.2.2 Chemical analysis and carbon equivalent.

8.2.3 Tests data for all mechanical tests required by this specification including: Hardness, yield strength, ultimate tensile strength and elongation (Type and size of specimen shall be specified) , flattening test (at 0^0 and 90^0)

8.2. 4 Minimum hydrostatic test pressure and duration.

8.2.5 Method of Non-destructive inspection employed and results.

8.3 Handling, storage and transportation procedure.

9. Dimensions & **Tolerances:**

9.1 Diameter and wall thickness

Nominal outside diameter and nominal wall thickness shall be as per Table 1.

9.1.1 Tolerances for Wall thickness:

The tolerances for wall thickness 7 mm or less shall be: - 0.35mm / + 10 percent of the wall thickness.

9.1.2 Tolerances for Outside Diameter:

Shall be:

For NPS<2: -0.8mm, + 0.4mm

For 2≤NPS≤ 4: ± 0.0075 OD

9.2 Length

For pipes with NPS ≥ 2: beveled ends, random length of 12 meters and

For pipes with NPS<2: square end, random length of 6 meter.

9.2.1 Tolerances for Lengths:

9.2.1.1 Random length of 12m:

The length of pipes in one order shall be:

- At least 95% between 11 up to 12.2 m.
- Maximum 5% between 5 up to 11 m.

Note: The average length of pipes in one order shall be not less than 11.7m.

9.2.1.2 Random length of 6m:

The length of pipes in one order shall be as follows:

- At least 95% between 5 up to 6.1 m.
- Maximum 5% between 3 up to 5 m.

Note: The average length of pipes in one order shall be not less than 5.8 m.

9.3 Straightness

Deviation from a straight line shall not exceed 0.15 percent of the length**.**

10 Marking

Pipes shall be marked by manufacturer as per API 5L.

Appendix 1

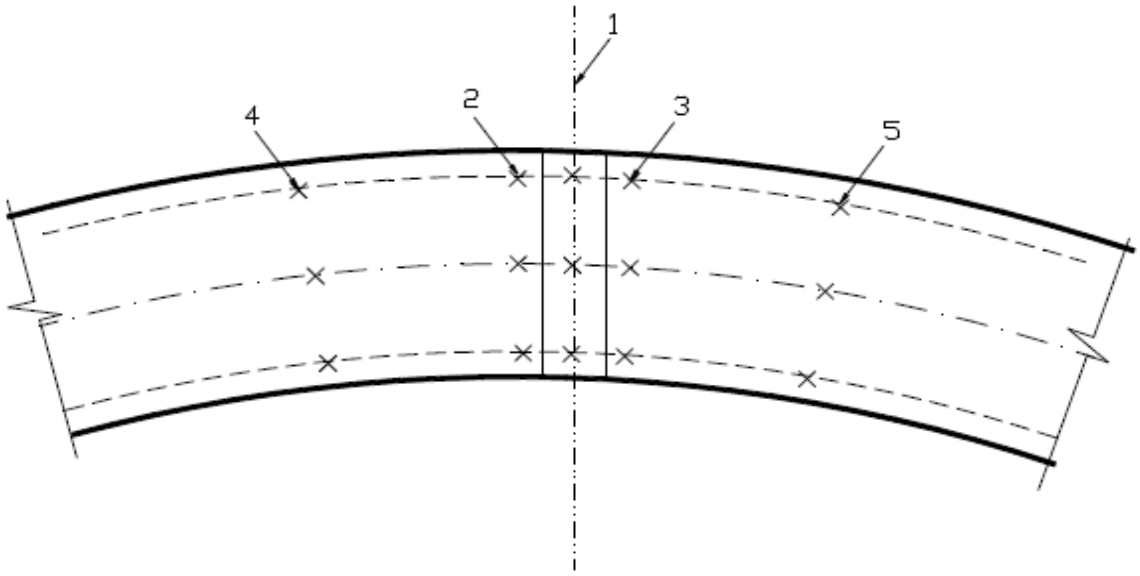
Summary of Testing and Inspection Requirements						
Item	**Type of test / Inspection**	**Type of pipe**	**First day of production**		**During of production**	
			Frequency	**Remarks**	**Frequency**	**Remark**
Chemical analysis						
1	Heat Analysis	SMLS HFW	-	-	Once per heat	As per Mill test certificate
2	Product Analysis		selected pipes	-	Two per heat	Taken from separate products
Mechanical Tests						
3	Tensile Test	Pipe Body: SMLS HFW	One sample of selected pipe	-----	once per test unit [a]	----
4	Flattening Test	HFW	selected pipes	At **0º** and **90º**	As per fig. 6 API	In case of production stop, one sample before and after stop mill shall be tested at**90˚** position
5	Hardness & Micro	SMLS HFW	selected pipes	---	Once Per test unit [a] or Shift	----
6	Hydrostatic Test	SMLS HFW	All Pipes	As per 4.10	All pipes	Min 10 sec.
Visual Inspection and Dimensions						
7	Surface defects	SMLS HFW	All pipes	---	All pipes	---
8	Pipe Diameter	SMLS	Selected Pipes	---	Once per 10 pipes	---
		HFW			Once per coil	

9	Out of Roundness	Body Pipe End	SMLS HFW	Selected Pipes	---	Once per 10 pipes	---
10	Pipe End	Squareness Beveling	SMLS HFW	Selected Pipes	----	At least Once per 4 h Once per10 pipes	----
11	Wall Thickness		SMLS HFW	All pipes	---	All pipes	---
12	Bevel End & Protector		SMLS HFW	All pipes	---	All pipes	----
13	Straightness		SMLS HFW	Selected Pipes	---	Once per 10 pipes	---
14	Length		SMLS HFW	All pipes	---	All pipe	---
Non-destructive Inspection							
15	Pipe Body		SMLS HFW	All pipes	Automatic Ultrasonic or Eddy Current	All Pipe	Automatic Ultrasonic or Eddy Current
16	Weld Seam		HFW	All pipes	Automatic Ultrasonic or Eddy Current	All Pipe	Automatic Ultrasonic or Eddy Current
17	End Weld Seam (100mm)		HFW	All pipes	Manual/Semi-auto UT	All Pipe	Manual/Semi-auto UT
18	Pipe Ends (25mm)		SMLS HFW	All pipes	Manual/Semi-auto UT or MT	All pipes	Manual/Semi-auto UT or MT

a) The test unit shall not be more than 400 lengths.

Appendix 2

Figures



NOTE :

1. WELD CENTRE LINE
2. 3 HAZ
4. 5 BODY

FIG 1 – LOCATION OF HARHNESS TESTS FOR HFW PIPE

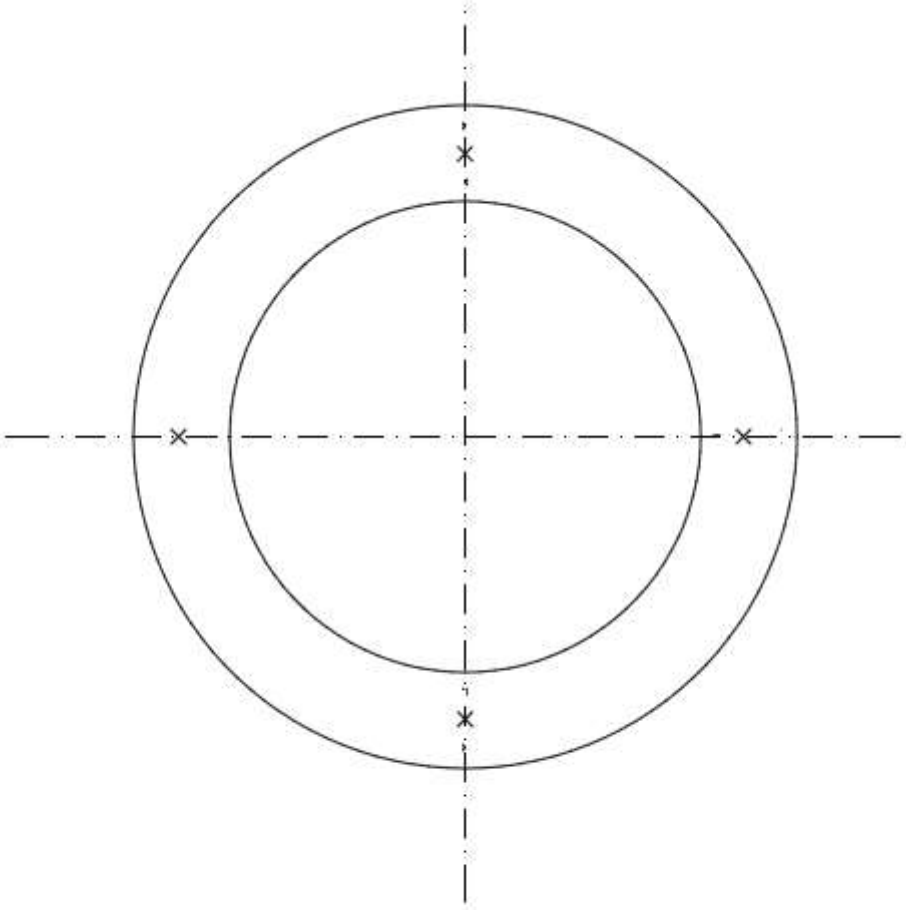


FIG 2 – HARDNESS TEST OF SMLS PIPE