IGS-M-PL-001-2(1)	Jun. 2016
Approved	مصوب

شرکت ملی گازایران

مدیریت پژوهش و فنآوری

امورتدوین استانداردها

IGS

مشخصات فنی خرید

لوله های فولادی بدون درز/درزجوش گریدهای B تا X۸۰ , اندازه های ۶ تا ۵۶ اینچ

SMLS/HFW/SAWL/SAWH Carbon Steel Pipes, Grades B to X80, Sizes : 6 to 56 inch.

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دفترمدیرعامل

شرکت ملی گازایران

تاریخ : ۱۳۹۵/۵/۱۳
شماره : گ ۰/دب ۰/۱۳۴- ۱۷۷۰۲

ابلاغ مصوبه هیأت مدیره

مدیر محترم پژوهش و فناوری

باسلام،

به استحضار می‌رساند در جلسه ۱۶۹۱ مورخ ۱۳۹۵/٤/۲۷ هیات مدیره ، نامه شماره گ۹/۰۰۰/ ٥٤۳۸۹ مورخ ۹٥/٤/۲۳ مدیر پژوهش و فناوری درمورد تصویب نهایی استانداردهای زیر مطرح و مورد تصویب قرارگرفت .

۱ ـ مشخصات فنی خرید اتصالات چدنی مالیبل/داکتیل IGS-M-PL-037(0)

۲ ـ مشخصات فنی خرید لوله‌های فولادی بدون درز/درز جوش گریدهای B تا X80 اندازه‌های ٦ تا ٥٦ اینچ IGS-M-PL-001-2(1)

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

ناصر آبگون
دبیر هیات مدیره

رونوشت : مدیرعامل محترم شرکت ملی گاز ایران و نایب رییس هیات مدیره
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FOREWORD

This standard intends to be mainly used by NIGC and its contractors, and has been prepared based on interpretation of recognized standards and, technical document as well as employment of existing, knowledge, background and experience in natural gas industry at national and international level.
Iranian Gas Standards (IGS) are prepared, reviewed and amended by technical standard committees within NIGC Standardization Division and submitted to 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 cannot 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 feedback about this standard, and may revise the document accordingly based on the received feedback.

GENERAL DEFINITIONS:

The following definitions, should be implied throughout this standard:
1- "STANDARDIZATION DIV." is responsible to deal with all aspects of 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

(Sub.)

This specification is based on API 5L. 45th edition is written in the form of amendments and supplements of this standard, intended to be used for Non-sour service natural gas transmission and distribution pipeline applicable to grade B (L245) to ≤ X80(L555), from 6 to ≤ 56 inch sizes.

Note**:** *This specification supersedes* IGS-M-PL-001-2(0):2013.

1.1. Guidance for use of this specification:

The amendments/ supplements to API Spec. 5L. 45th edition given in this specification are directly equivalent sections or clauses in API 5L. All other paragraphs which are not amended by this supplementary shall remain valid as written. The following annotations, as specified hereunder, have been used at the beginning of each paragraph to indicate the type of change made to that paragraph of API 5L .

Sub. (Substitution) "The paragraph in API Spec. 5L shall be deleted and replaced

by the new paragraph in this supplementary "

Del. (Deletion) "The paragraph in API Spec. 5L shall be deleted without any

replacement"

Add. (Addition) "The new paragraph with the new number shall be added to

The relevant section of API Spec. 5L"

Mod. (Modification) "Part of the clause or paragraph in API Spec. 5L shall be modified and/or the new description and/or statement shall be added to that clause or paragraph as given in this supplementary.

2. Conformity

2.3 Compliance to this standard

(Sub.)

The manufacturer shall establish and maintain a quality assurance system in accordance with the latest edition of ISO 9001 or an alternative standard approved by NIGC. Purchasers nominated inspector(s) or representative(s) shall have the right to undertake such audits as he/she deems necessary to assess the effectiveness of the manufacturer's quality assurance system.

3. Normative references **(Del.)**

ISO 13678, API 5B, API RP5A3, NACE TM0177 & NACE TM0284

(Add) The following standards:

ISO 9001: Quality systems-Model for quality assurance in design, development, production, installation and servicing.

ISO 9956-3: Specification and approval of welding procedures for metallic material part 3- welding procedure tests for the arc welding of steels.

ANSI/ASME B31.8: Gas Transmission and Distribution Piping Systems

API 1104: Welding of Pipelines and Related Facilities.

EN 876: Destructive Tests on weld in metallic materials Longitudinal Tensile Test on weld Metal in Fusion Welded joint

ANSI B 36.10 Welded and Seamless Wrought Steel Pipe.

ASTM E 112: Standard Test Methods for Determining Average Grain Size.

Shell DEP 31.40.20.37-Gen Line Pipe for Critical Service.

Saudi Aram Co 01-SAMSS-035 API Line Pipe.

IPS-M-PI-190(3) Material and Equipment Standard for Line Pipe.

4. Terms and definitions

(Del.) 4.8,4.9,4.10,4.11,4.12, 4.13, 4.20 ,4.30 ,4.33 ,4.34 ,4.35 ,4.52 .

4.23 HFW pipe

(Mod.)

EW pipe produced with a welding current frequency equal to or greater than 100 kHz.

4.53 SAWH pipe

(Mod.)

Tubular product having one Helical / Spiral seam produced by double submerged-arc welding

4.54 SAWL pipe

(Mod.)

Tubular product having one longitudinal / straight seam produced by double submerged-arc welding

4.57 Service condition

(Mod.)

The service condition is non-sour natural gas .Offshore and sour service is not included**.**

4.60 Tack weld

(Mod)

Continuous seam weld used to maintain the alignment of the abutting edges until the final Seam weld is produced.

Tack weld shall be made by continuous single pass to complete the forming process.

4.67 welded pipe

(Mod.)

HFW, SAWH and SAWL pipe

5.Symbols and abbreviated terms

5.2 Abbreviated terms

(Add.)

AUT Automatic Ultrasonic Testing
IGS Iranian Gas Standard
NIGC National Iranian Gas Company
NPS: Nominal pipe size (inch)

6. Pipe grade, steel grade and delivery condition

6.1 pipe grade and steel grade

6.1.1(Sub.)

PSL1 shall not be supplied

6.1.2 (Add.)

Grades covered by this specification are B, X42, X46, X52, X56, X60, X65, X70 and X80.

Note2 (Del.)

Note 3(Del.)

6.2 Delivery condition

6.2.1 (Mod.)

Delivery condition for PSL 2 pipes are given in table 1 with additional information in table 3.

Table 1: (Add.)

Note: 1) PSL1 shall not be supplied

2) For welded pipes PSL2, only thermo mechanical rolled or hot rolled starting material shall be accepted.

7. Information to be supplied by the purchaser

7.1 General information

(Add.)

i) Minimum design temperature for CVN test.

j) Items which weld ability tests shall be carried out on.

k) Special color code for wall thickness.

l) Suitable bevel preparation for pipe line automatic field welding systems.

m) The requiring or not requiring bevel protectors.

7.2 Additional information

(Del.) :a (9).b(3,5,8,13,14,15).c(2,4,5,6,7,13,14,18,19,25,31,44,50,55,56,57)

8 Manufacturing

8.1 Process of manufacture

Table 2

Notes **(sub)**

a Only PSL2 are acceptable

b Only HFW/SAWL/SAWH/SMLS pipes are acceptable

c Pipe's grades are limited from B(L245) ≤ X80(L555)

d HFW pipe's sizes are limited to NPS ≤ 20 (508).

e SAWH pipes are limited to NPS ≥ 20(508).

f SMLS pipes are limited from grade B(L245) to ≤ X60(L415).

8.3 Starting material

8.3.1

NOTE (Sub.) Raw material shall be procured from purchasers approved mill and shall have original certificate and third party inspection.

8.3.3 **(Sub.)**

For plate or coil, the steel shall be fully killed and fine grain with a grain size of 8 or finer, as defined in ASTM E-112.

8.3.7 (Add.)

The abutting edges of strip or plate to be welded shall be profiled by milling or machining**.**

8.4 Tack weld

8.4.2(Add.)

d) As defined in paragraph 4.60.

8.5(Del.) 9

8.7 (Sub.)

Double –seam pipe shall not be supplied.

8.8. Treatment of weld seam

8.8.1(Del.)

8.10 Coil / plate end welds

8.10.2(Mod.)

Finished helical seam pipe shall not contain any strip/plate end welds (skelp end weld).

8.10.3 & 8.10.4 (Del.)

8.11 jointers

8.11.1(Sub.)

Jointers shall not be supplied

8.11.2 & 8.11.3 & 8.11.4 (Del.)

8.13 Traceability

8.13.1 (Sub.)

PSL1 pipe shall not be supplied

9. Acceptance criteria

9.2 Chemical composition

9.2.1(Del.)

9.2.3 ((Mod.)

For the pipes with t > 25.0 mm (0.984 in), the chemical composition shall be agreed, according to the requirements of Tables 5 and plate specification being amended as appropriate.

9.2.4 (Mod.)

For pipe with a product analysis carbon mass fraction equal to or less than 0, 12 %, the Carbon equivalent, CE_{PCM}, ≤ 0.21, shall be determined using Equation (2)**.**

9.2.5(Mod.)

For pipe with a product analysis carbon mass fraction greater than 0, 12 %, the carbon Equivalent, CE_{IIW} ≤ 0.39**,** shall be determined using Equation (3)**.**

9.2.6 (Add.)

For HFW pipes, sulfur content shall not exceed 0.007%.

Table 4 (Del.)

Table 5 — Chemical composition for PSL 2 pipe with *t* ≤ 25, 0 mm (0.984 in) (Mod)

Table 5 shall be modified accordant to paragraph: 9.2.4, 9.2.5 & 9.2.6.

9.3 Tensile properties

9.3.1 & Table 6 (Del.)

Table 6 (Del.)

Table 7 — Requirements for the results of tensile tests for PSL 2 pipe

9.3.2.1 (Mod)

a- The ratio of body yield strength to body ultimate tensile strength shall not exceed:
0.88, for grade B.
0.90, for grades X42 to ≤ X70.
0.93, for grade X80.

b- Max. Yield strength shall not exceed the min. values by more than 150 MPa.

9.4 Hydrostatic test

9.4.2 (Del.)

9.6 Flattening test (Sub.)

Acceptance criteria for flattening test of HFW pipe (all grades and all sizes) shall be as follows:

1) There shall be no opening of the weld before the distance between the plates is less than 50% of the original outside diameter.

2) There shall be no cracks or breaks other than in the weld before the distance between the plates is less than 33% of original outside diameter.

3) For all pipes, continue flatting until opposite walls of the pipe meet; no evidence of lamination or burnt metal shall develop during the entire test.

9.8 CVN impact test for PSL2 pipe

9.8.1.1 (Mod.) If sub size test pieces and orientations are used, the required minimum absorbed energy values shall be multiplied by the following corresponding factors**:**

Table par 9.8.1.1 (Add.)

SIZE (mm)	ORIENTATION	FACTOR
10 × 10	Longitudinal	1.5
10 × 7.5	Transverse	0.75
10 × 7.5	Longitudinal	1.125
10 × 5	Transverse	0.5
10 × 5	Longitudinal	0.75

9.8.1.2 (Mod.)

Individual test values for any test piece are given in table 8.

9.8.2.1(Mod.)

The minimum absorbed energy for pipe body, full size (10mm×10mm) specimen taken transverse to the pipe axis, is given in table 8. The test temperature shall be lower than or equal to that specified in the table below:

Table par. 9.8.2.1 (Add.)

Nominal Wall Thickness ,t mm(in)	Test Temperature (^{0}C)
W.t ≤ 16 (0.630)	T_{min}
16(0.630) < w.t < 25 (0.984)	T_{min}-10
≥ 25(0.984)	T_{min}-20
Note: T_{min} is the minimum design temperature which shall be specified in the purchase order. If no minimum design temperature is specified, it shall be taken -10^{0}C.	

9.8.2.2 (Del)

9.8.2.3 (Mod.) The shear fracture area on the CVN specimen shall be estimated and reported for information purposes for all grades and sizes of pipe that have been CVN tested.

Table8 (Sub.)

Table 8- CVN absorbed energy requirement for pipe body

Grade	Full –size CVN absorbed energy minimum	
	AV a set (J)	individual (J)
B(L245) ≤ X56(L390)	40	32
X60(L415)	42	34
X65(L450) to ≤ X70(L485)	54	44
X80(L555)	68	55

9.8.3 Weld and HAZ tests

(Sub.)

The minimum absorbed energy for each pipe weld and HAZ test shall be the 80% of those stated in Table 8.

If any individual specimen displays a value less than minimum in table 8, three further specimens shall be taken in the same area.

All three specimens shall comply with the minimum value.

9.9. DWT test for PSL2 welded pipe

9.9.1 (Sub.) For each test (a set of two test pieces) of NPS ≥ 16, the average shear fracture area shall be ≥ 85 %.

The test temperature shall be carried out at minimum design temperature specified in the purchase order. If no minimum design temperature is specified, it shall be taken -10^0C**.**

9.10 Surface conditions, imperfections and defects

9.10.5.1 (Add) Flat spots and peaks at pipe ends that exceed 1,5 mm in depth, measured as the gap between the extreme point of the deviation, shall be considered defects.

9.10.5.2 a -(Sub.)

Any cold formed dents with sharp bottom gouge deeper than 1mm shall be considered as defect. Dents on weld &HAZ are not acceptable

9.10.6 Hard Spots (Mod.)

Any hard spot larger than 50mm in any direction with hardness greater than 280 HV10 shall be classified as defect.

9.10.7 Other surface imperfections

d) (Add)

The minimum permissible wall thickness shall be classified by table 11 of API 5L (45th edition) standard.

9.11 Dimensions, mass and tolerances

Table 10(Mod.)

Table 10 – Tolerances for diameter and out of roundness

Specified outside diameter mm(in)	diameter tolerances [d] mm(in)				Out of roundness tolerances mm(in)[b]	
	Pipe except the end [a]		Pipe end [a, b]		Pipe except the end [a]	Pipe end [a , c]
	SMLS	Welded	SMLS	Welded		
168.3(6.625) to≤610(24)	± 0.0075 D	± 0,007 5 D, but maximum of± 3,2 (0.125)	± 0,005 D, but maximum of ±1,6 (0.063)		0.020 D	0.015 D but maximum 5.0(0.197) for any D/t
›610(24) to≤1422(56)	±3.0 (0.118)	± 0,005 D, but maximum of ± 4,0 (0.160)	±2.0 (0.078)	±1.6 (0.063)	0.010 D but maximum of 13 (0.500) for any D/t	0.005 D for D/t ≤ 75 & 0.006 D for D/t >75

a) The pipe end includes a length of 100 mm (4.0 in) at each of the pipe extremities
b) Included in the diameter tolerance.
c) For out of roundness: The pipe ends with NPS≤20 shall be checked for out of roundness by external ring gauges & for NPS ≥24 by internal ring gauges.
d) For determining compliance to diameter tolerances, the pipe diameter is defined as the circumference. of the pipe in any circumferential plane divided by Pi.

9.11.3.2 Tolerances for wall thickness shall be as given in table

11. **Table 11 (Sub.)**

Table 11- Tolerances for Wall Thickness

Wall thickness, t mm (in)	Minus tolerance mm(in)	Plus tolerance mm(in)
Welded pipe		
t < 7.0(0.276)	0. 5(0.020)	0.5(0.020)
7.0(0.276) < t <10.0(0.394)	5%t	10%t
t ≥10.0(0.394)	0.5(0.020)	10%t but max. 1.5 mm
SMLS pipe		
All sizes, all grades,	10%t	12.5%t

9.11.3.3 and Table 12

(Sub.)

The average length of pipes in one order shall not be less than 11.6m with a minimum of 95 % of pipes between 11m to12.2 m in length. No pipe shall be less than 5m for NPS≤20 and 8m for NPS≥24 in length. No pipe shall be more than 12.5m.

9.11.3.4(Mod.)

a) The total Deviation from a straight line, over the entire pipe length, shall be less than 0.15 percent of pipe length.

9.12 Finish of pipe ends

9.12.1.1 (Del.)

9.12.2 Threaded ends (PSL1 only) (Del.)

9.12.3 Belled ends (PSL1 only) (Del.)

9.12. 4 End preparation for special coupling (PSL1 only) (Del.)

9.12.5 Plain end

9.12.5.2(Mod.)

The end face of each pipe with wall thickness 0.125(in) ≤ 0.875(in), shall be beveled for welding the angle of the bevel, measured from a line drawn perpendicular to the axis of the pipe shall be 30 degrees with tolerance of + 5, - 0 and the width of the root face Of the bevel shall be 1.6mm, with a tolerance of ± 0.8mm.

9.12.5.3 (Mod)

For wall thickness greater than 0.875(in), the ends shall be beveled as shown in Fig.1of Appendex2

For field mechanized / automatic girth welding, other end preparation may be specified

in the purchase order.

Table 13 (Del.)

9.13 Tolerances for the weld seam

9.13.2.2 e (Mod.)

For a distance of at least 150mm (6.0 in) from each pipe ends, the outside weld bead shall be removed by grinding

9.13.2.2 f) (Add.)

The height of outside weld beads shall not exceed 3 mm.

9.15 Weld ability of PSL2 pipe

(Sub.)

If specified in purchase order, weld ability trials shall be carried out to approve the WPS of girth welding which agreed between NIGC and manufacturer. The test pieces shall be inspected and tested as per API 1104(CVN test is required).

9.16 Macro residual stress test

(Add.)

Spiral welded pipe (SAWH) shall meet the testing and minimum acceptance criterion as per 9.16.3 The residual stress test shall be done after the hydrostatic test.

9.16.1Test Frequency

For first day production, one specimen shall be tested for each grade, size and wall thickness. For during Production once per test unit

9.16.2 Test Specimen

The specimen consists of a 150 mm wide ring cut from the end of a pipe (see the figure 7 of Appendix 2). The specimen may be either flame cut or sawed from the parent pipe. The specimen ring shall be cut, by flame or sawing, parallel to the longitudinal axis. The cut shall be 180 degrees from the spiral weld. Prior to cutting the ring, fiducially marks shall be placed on either side of the proposed cut location.

9.16.3 Computation of Macro Residual Stress

The change in circumference after cutting shall be measured using the fiducially marks established on the specimen prior to severing. The assumed residual stress shall be computed using the following formula:

$$S = \frac{ETC}{12.566\ R^2}$$

Where:

S residual stress in MPa (psi)

C ± change in circumference, mm (in)

t nominal thickness, mm (in)

E 200,000 MPa (2.9×10^7 psi)

R = nominal pipe radius mm (in)

9.16.4 Acceptance Criterion

The computed macro residual stress shall not exceed ±10% of the specified minimum yield strength of the material.

9.16.5 Reporting

All residual stress results shall be recorded as part of the mill report.

10. Inspection

10.1.2 (Del.)

10.1.3 inspection documents for PSL2 pipe

10.1.3.1

(sub)

The manufacturer shall issue an Inspection Certificate type 3.1.B in accordance with ISO 10474:1991 or an Inspection type 3.1 in accordance with EN 10204:2004.

10.2 Specific inspection

10.2.1 Inspection frequency

10.2.1.1 (Del.)

10.2.1.2. (Mod.) For PSL 2 pipe, the inspection frequency shall be as given in Table 18(Sub.) as following:

Table 18: Inspection frequency for PSL2 pipe (Sub.)

NO.	TYPE OF INSPECTION	TYPE OF PIPE	FIRST-DAY PRODUCTION[a,b]		DURING PRODUCTION[c,d]	
			FREQUENCY	REMARKS	FREQUENCY	REMARKS
1	Heat analysis	HFW SAWH SAWL SMLS	1 sample from each selected pipe	As per approved mill test certificate	Once per heat of steel	As per approved mill test certificate
2	Product analysis	HFW SAWH SAWL SMLS	1 sample from each selected pipe	---	Two analyses per heat of steel (taken from separate product)	One of them as per approved mill test certificate
3	Tensile testing of pipe body	HFW SAWH SAWL SMLS	Two from selected pipes	both longitudinal and transverse specimens (for NPS=6 only longitudinal)	Once per test unit of not more than 100 pipes with the same cold expansion ratio	transverse specimens (for NPS= 6 only longitudinal)
4	Tensile testing of weld seam	HFW SAWH SAWL	Two from selected pipes	---	Once per test unit of not more than100 pipes with the same cold expansion ratio a	Transverse test piece See note b
5	All weld tensile test	SAWH SAWL	One from selected pipe	As per B.5.1.2	---	---

NO.	TYPE OF INSPECTION		TYPE OF PIPE	FIRST-DAY PRODUCTION[a,b]		DURING PRODUCTION[c,d	
				FREQUENCY	REMARKS	FREQUENCY	REMARKS
6	C.V.N.	Body	HFW SAWL SAWH SMLS	Two from selected pipes	One Set	Once per test unit of pipes with the same cold expansion ratio a	See table 22
7		Weld&HAZ	SAWL SAWH HFW	Two from selected pipes	As per B.5.1.3	Once per test unit of pipes with the same cold expansionratio	Two set(weld center line & HAZ)
8		Transition curve	HFW SAWH SAWL SMLS	One set of selected pipe	all locations, -40C to room Temperature with 10C increment	---	---
9	D.W.T.T.	For body	HFW SAWH SAWL For NPS ≥ 16 and	Two from selected pipes	Minimum design temperature	Once per test unit of pipes with the same cold expansion ratio	Minimum design temperatur
10		Transition curve of body		One set of selected pipe	-40C to room temperature with 10C increment	---	---
11	Guided –bend test (for weld)		SAWH SAWL	Two from selected pipes (root & face)	As per 9.7 &10.2.4.6	Once per test unit but not more than 50 length (root &face)	As per 9.7 &10.2.4.6

NO.	TYPE OF INSPECTION		TYPE OF PIPE	FIRST-DAY PRODUCTION[a,b]		DURING PRODUCTION[c,d]	
				FREQUENCY	REMARKS	FREQUENCY	REMARKS
12	Flattening Test		HWF	each selected pipes	Test method as per 9.6	As shown in fig 6 API & after weld stop	Test method as per 9.6
13	Macro Residual Stress Test		SAWH	Two from selected pipes	As per B.5.1.7	One Per Test Unit	As per 9.16
14	Hardness Test	Body	HFW SAWH SAWL SMLS	Two from selected pipes	As per 10.2.4.8	One Per Test Unit	As per 10.2.4.8
		weld seam & HAZ	HFW SAWH SAWL	Two from selected pipes	As per 10.2.4.8	One Per Test Unit	As per 10.2.4.8
15		Hard Spot	HFW SAWH SAWL SMLS	Each Pipe Contain Hard Spot	As per 9.10.6	Each Pipe Contain Hard Spot	As per 9.10.6
16	Hydrostatic Test		HFW SAWH SAWL SMLS	Each Pipe	As per 9.4.1 & 10.2.6.1	Each Pipe	As per 9.4.1 & 10.2.6.1
17	Macrographic testing of the longitudinal or helical weld seam		SAWH SAWL	Two from selected pipes	proper fusion & good weld alignment	At least once per test unit or per operating shift (whichever is sooner)	proper fusion & good weld alignment

NO.	TYPE OF INSPECTION		TYPE OF PIPE	FIRST-DAY PRODUCTION[a,b]		DURING PRODUCTION[c,d]	
				FREQUENCY	REMARKS	FREQUENCY	REMARKS
18	Metallographic testing of the longitudinal weld seam of HFW pipe		HFW	Two from selected pipes	proper fusion & seam-Heat treated (no untempered martensite remains)	At least once per test unit or per operation shift (whichever is sooner)	proper fusion & seam Heat treated (no untempered martensite remains)
19	Visual inspection and marking		HFW SAWH SAWL SMLS	Each Pipe	---	Each Pipe	
20	Dimensions and Workmanship	Outside diameter	HFW SAWH SAWL SMLS	Each Pipe	---	One pipe per every 20 pipe but not less than once per 4 hour operating shift	
21	Dimensions and Workmanship	out of roundness (pipe ends)	HFW SAWH SAWL SMLS	Each Pipe	Table 10 NPS<20: by external ring NPS>24: by internal ring gauges	Each pipe end	Table 10 NPS≤20: by external ring NPS≥24: by internal ring gauges
	Dimensions and Workmanship	Pipe Body				Every 20 pipes	By suitable tools
22	Dimensions and Workmanship	Wall thickness measurement	HFW SAWH SAWL SMLS	All selected Pipes	---	Each Pipe	Table 11

NO.	TYPE OF INSPECTION		TYPE OF PIPE	FIRST-DAY PRODUCTION[a,b]		DURING PRODUCTION[c,d]	
				FREQUENCY	REMARKS	FREQUENCY	REMARKS
23	Dimensional and Workmanship	Out-of-squareness	HFW SAWH SAWL SMLS	First 10 Pipes	As per 9.12.1.4	At the start of shift and once per 4 hour operating shift	As per 9.12.1.4
24		Identifying number	HFW SAWH SAWL SMLS	First 10 Pipes	As per 11.2.3	Each pipe	As per 11.2.3
25		Straightness	HFW SAWH SAWL SMLS	First 10 Pipes	As per 9.11.3.4	One pipe per every 20 pipe	As per 9.11.3.4
26		Length	HFW SAWH SAWL SMLS	Each pipe	As per 9.11.3.3	Each pipe	As per 9.11.3.3
27		Weighing	HFW SAWH SAWL SMLS	Each Pipe	---	Each pipe	---
28	Ultrasonic examination (ANNEX E)	Body	SMLS	Each Pipe	As Per Table E2	Each pipe	As Per Table E2
		strip/coil body	HFW SAWH	Each strip/coil/ pipe		Each strip/coil/ pipe	---
29		Strip/coil edges	HFW SAWH	Each plate/strip/pipe	100% of edges for 25mm wide	Each plate/strip/pipe	100% of edges for 25mm wide

NO.	TYPE OF INSPECTION		TYPE OF PIPE	FIRST-DAY PRODUCTION[a,b]		DURING PRODUCTION[c,d]	
				FREQUENCY	REMARKS	FREQUENCY	REMARKS
30	Ultrasonic examination (ANNEX E)	Plate Body	SAWL	Each Plate	As per manufacturer NDE certificate	Each Plate	As per manufacturer NDE certificate
		Plate Edges			100% of edges for 25mm wide		100% of edges, for 25mm wide
31		Pipe Ends	HFW SAWH SAWL SMLS	Each Pipe	25mm of circumference pipe ends	Each Pipe	25mm of circumference pipe ends
32		Weld seam	HFW SAWH SAWL	Each Pipe	AUT 100% of weld seam	Each Pipe	AUT 100% of weld seam
33		End weld seam	HFW SAWL	Each Pipe	Untested area and 150mm end weld	Each Pipe	Untested area and 150mm end weld
			SAWH	Each Pipe	Untested area and 400 mm end weld	Each Pipe	Untested area and 400 mm end weld
34	Radiography (ANNEX E)	weld seam	SAWH SAWL	100% weld seam of each selected pipes	---	Each Pipe	200mm of each end weld
						retesting of suspect area indicated by UT	As per E.4
						Each Weld repaired area	---

NO.	TYPE OF INSPECTION		TYPE OF PIPE	FIRST-DAY PRODUCTION[a,b]		DURING PRODUCTION[c,d]	
				FREQUENCY	REMARKS	FREQUENCY	REMARKS
35	Magnetic particle(ANNEX E)	weld seam	HFW SAWH SAWL	Each selected pipe (100% weld seam)	For NPS>30 from inside& outside For NPS< 30 only outside	Each pipes of SAWH/SAWL	ground end weld & Weld repaired area
36		bevel face	SAWH SAWL SMLS	Each selected pipes	NPS≥24	Each pipes of SAWH/SAWL SMLS	NPS≥24
37	Weld ability		HFW SAWHSAWL SMLS	One joint if specified in purchase order	As per API 1104 + impact test	All pipe	Certified by manufacture

a) First day production tests as defined in ANNEX B.
b) Mechanical tests of first day production, sampling shall be carried out at least on two heats.
c) Pipe produced by each welding machine shall be mechanical tested at least once per week.
d) “Test unit” is as defined in 4.62.

Table 19 (Del.)

Table 20 (Mod.)

Table 20-Number, orientation and location of test pieces per sample for mechanical tests of PSL2 pipe

Type of pipe	*Sample location*	*Type of test*	*Number, orientation and location of test pieces per sample* (a)		
			Specified outside diameter *D* / in		
			< 8	*8 to < 16*	*≥ 16*
SMLS	*Pipe body*	*Tensile*	*1L*	*1T*(b)	*1T* (b)
		CVN	*3T*	*3T*	*3T*
HFW	*Pipe body*	*Tensile*	*1L90*	*1T180* (b)	*1T180*(b)
		CVN	*3T90*	*3T90*	*3T90*
		DWT	*--*	*----*	*2T90*
	weld Seam	*Tensile*	*---*	*1W*	*1W*
		CVN	*3W*	*3W*	*3W*
	Pipe body and weld	*Hardness*	*1w*	*1w*	*1w*
		Flattening	*As shown in fig 6*		
SAWL	*Pipe body*	*Tensile*	*----*	*----*	*1T180*(b)
		CVN	*----*	*----*	*3T90*
		DWT	*---*	*----*	*2T90*
	weld seam	*Tensile*	*---*	*----*	*1W*
		CVN	*----*	*----*	*3W and 3HAZ*
		Hardness	*----*	*----*	*1w*
		Guided bend	*---*	*----*	*2W* (c)
SAWH	*Pipe body*	*Tensile*	*---*	*----*	*1T* (c)
		CVN	*----*	*----*	*3T*
		DWT	*---*	*----*	*2T*
	weld seam	*Tensile*	*----*	*----*	*1W*
		CVN	*---*	*----*	*3W and 3HAZ*
		Hardness	*---*	*----*	*1w*
		Guided bend	*----*	*----*	*2W* (c)

Notes:
a) See figure 5 for an explanation of the symbols used to designate orientation and location
b) if agreed, annular test pieces may be used for the determination of transverse yield strength by hydraulic ring expansion test in accordance with ASTM A370
c) For pipe with t › 19.0mm, the test pieces may be machined to provide a rectangular cross-section having a thickness of 18.0mm.

10.2.4.8 Hardness test

(Add.)

10.2.4.8.1

Hardness survey (Vickers) shall be carried out in accordance with ISO 6507.

a) For SAWL/SAWH pipes, hardness testing shall be performed on macro graphic and metallographic samples as per fig.3& fig 4 of Appendix 2.

b) For HFW pipes, hardness shall be measured in three points at five locations showing in fig.5 of Appendix 2.

c)For seamless pipes, hardness shall be measured in three points at four locations showing in fig.6 of Appendix 2

10.2.4.8.2

a) For welded pipe, grade B:

1) The average hardness (body, HAZ & weld) shall not be more than 160HV10.

2) The Max hardness on HAZ and weld center line shall be 170HV10.

b) For welded pipe, grades X42 to ≤ X60:

The average results of hardness measurements on weld metal and HAZ shall not exceed the hardness of the parent metal by more than 45HV10.

c) For welded pipe, grades X65 to ≤ X80:

The average results of hardness measurements on weld metal and HAZ shall not exceed the hardness of the parent metal by more than 75 HV10.

In any case the hardness shall not exceed 280 HV10.

d) For SMLS pipe the average hardness shall not be more than:

1-160 HV10 for grade B.

2- 200 HV10 for grade X42.

3- 240 HV10 for grade X52.

4- 260 HV10 for grade X60.

10.2.5 Micrographics and metallographic tests

10.2.5.2 (Del.)

10.2.5 Hydrostatic test

10.2.6.1 (Mod.)

Test duration (all sizes and all grades) shall be at least 10 seconds. The minimum test pressure for:

Grade B, shall be alternative pressure as per table 26.

Grade ≥ X42, shall be 95% of SMYS.

10.2.6.3(Del.)

10.2.6.4 (Del.)

Table 24 (Del.)

Table 25(Del.)

10.2.6.7 (Del.)

10.2. 7 Visual inspection

10.2.7.1 (Sub.)

Each pipe after finishing shall be visually inspected full body, internally and externally, for any surface and weld defects such as: lamination, gouge, scratch, pitting, dents, hard spots, weld profile, weld crack, bead height, bead off-set and other imperfections.

10.2.8 Dimensional testing

10.2.8.1 (Sub.) But hold under paragraph note

The diameter of all selected pipe for first day shall be measured.

Thereafter the diameter shall be measured every 20 pipe but not less than once per 4 hour operating shift**.**

10.2.8.2 (Sub.)

The out-of-roundness for all pipe ends shall be measured in accordance with table 10. For NPS≤20: by external ring & NPS ≥24: by internal ring gauges. Also for pipe body every 20 pipes but not less than once per 4 hour operating shift by suitable tools**.**

10.2.8.3 (Sub)

For welded expanded pipe, the internal diameter of one end of the pipe shall not differ by more than 2 mm from that of other end.

11 Marking

11.2 pipe markings

11.2.1(Add.)

i) Order No

j) Purchaser name

k) Length (meter with two decimal)

l) Hydro test pressure (bar)

m) Actual weight (SI unit)

n) Each pipe shall be uniquely identified with a number that permits the correlation of the product or delivery unit with the related inspection documents.

o) API monogram certificate Number& Date

11.2.2 (Add.) c

1) For NPS>12, the marking shall be on the inside surface of the pipe, starting at a point at least 150mm from one pipe ends**.**

2) The required pipe marking shall be Paint-stenciled by heat resistance color (approximate 230 C) executed in white block capitals in such a way legibility is maintained.

11.2.3 (Sub.)

a) For grade < X 60 pipes, identification number shall be marked by low stress vibro - etched or dot peen marking on the pipe surface (see fig.8 A for welded pipes and 8 B for

seamless pipes of Appendix 2), by following limitations:

1) For welded pipes, at least 25mm from the weld and 50 mm from pipe ends.

2) For SMLS pipes, at least 50 mm from the ends.

3) The maximum depth shall be less than 10% of specified wall thickness or 2 mm, whichever is less and blunt bottom.

4) As a minimum requirement, the pipe identification number shall include: manufacturer's name, order or project number and pipe number.

5) The specification of marking shall be approved by the client.

b) For grade ≥ X 60 pipes, identification number shall be marked by low stress vibro –die – stamping or vibro - etched on the pipe bevel face at 150 mm from weld.

11.2.7 (Mod.)

The manufacturer shall apply a daub of paint, approximately 50mm (2 in) in diameter, on the inside surface of each length of pipes. The paint color shall be as given in table 27.

Table 27(Mod.)

Table 27 -Paint color code

Pipe grade	Paint color
B(L245)	White-red
X42(L290)	Silver
X46(L320)	Blue-blue
X52(L360)	Green
X56(L390)	Blue
X60(L415)	Red
X65(L450)	White
X70(L485)	Purple
X80(L555)	Gray

Note: Special color code for wall thickness may be identified by end user.

11.3 Coupling markings (Del.)

12 Coatings and thread protectors

12.2 Thread protector (Del.)

13. Retention of records

(Mod.)

Records of the following inspection shall be retained by the manufacturer and shall be

made available to the purchaser for a period of ten years after the date of purchase from the manufacturer.

Add the following

m) WPS &WPQT/PQR

n) Manufacturing procedure specification (MPS)

o) Quality control plan (QCP).

p) Packing list

q) Pipe history system

r)NDT procedures

s) DT & NDT results

t) An up to date API monogram certificate.

u) Data sheet of appendix 1

14. Pipe loading

(Add.)

If specified in purchase order, the manufacturer shall supply removable strong plastic cap or bevel protector used at both ends of the each pipe up to NPS12 (before or after coating) to protect the bevels from damage during normal handling and transportation. The design shall be submitted to the end user and shall be conducive for using crane hook for lifting.

Handling, storage and transportation shall be as per manufacturer's submitted procedure (after NIGC approval)

Note: For locally coated pipes IGS-C-PL-035 may be used.

ANNEX A Specification for welded jointers (Del.)

ANNEX B manufacturing procedure qualification for PSL2 pipe

B.1 Introduction (B.1.1, B1.2, B1.3) (Sub.)

Manufacturer procedure qualification shall be required for all pipe .Qualification shall be carried out on each combination of grade, diameter and wall thickness group. The QCP shall be approved by end user/NIGC. The QCP shall be support by MPS, WPS, PQR and all NDT & DT procedure.

Any deviations from the qualified manufacturing procedure are not permitted without approval by end user/ NIGC.

B.2 Additional Information to be supplied by the purchaser

B.2.a & b (Del.)

B.3 Characteristics of the manufacturing Procedure specification

a)(Add.)

9) Quality control plan detailing all inspection points and tests.

B.5 manufacturing procedure qualification tests.

B.5.1 (Mod.)

For the Qualification of the manufacturing procedure, the mandatory first-day tests, specified in table 18 of this specification, shall be carried out at the beginning of production. The following additional test requirements shall apply:
Note: For orders less than 100 tons or 100 length (whichever is greater), first day production tests are not required.

B.5.1.1 Tensile tests

Parent material and weld metal tensile test at ambient temperature shall be conducted so as to record the full stress / strain curve up to maximum load. Weld tensile specimens shall be taken from the same part of the pipe used for parent metal tensile specimens. Test results shall meet the minimum specified requirements of tensile strength with regard to the pipe body

B.5.1.2 All weld tensile tests (SAW only)

All weld tensile test shall be carried out on the first day production. The test method shall be in accordance with EN876. Test results shall meet the minimum specified requirements of the pipe body and achieve a minimum elongation value of 18%.

B.5.1.3 Impact tests

For first day production HAZ test of SAW pipe, the axis of notch shall be located at fusion line, fusion line +2mm and fusion line +5mm.(see the figure2 of Appendix 2).

For each of first day production selected pipes, a full impact transition curve at temperature range between room temperature to - 40C (with 10C increment) shall be determined for all location specified in 10.2.3.3

B.5.1.4 Drop weight Tear tests

For one of selected pipe, in addition to the normal DWTT, a full transition curve shall be established for the parent material at temperature range between room temperature to

- 40 C (with10C increment).

B.5.1.5 Radiography

The weld seam of all SAW selected pipes for first day production shall be radiographically examined throughout their full length in accordance with.E.4

B.5.1.6 MT

The weld seam of all selected pipes (HFW/SAWL/SAWH) shall be subjected to magnetic particle testing from outside for all sizes and additionally from inside for D ≥ 30", in order to check for surface and sub -surface defects in the weld and adjacent HAZ.

B.5.1.7 Macro residual stress for SAWH

Helical welded pipe shall meet the testing and minimum acceptance criterion as per 9.16.

B.5.2 (Sub.)

The manufacturing procedure shall be qualified by first-day production tests. This shall be achieved by selecting at random three of the completely finished pipes of the first day's production for testing to verify that the submitted manufacturing procedure results are fully acceptable pipe. If more than one heat is used, at least two heats shall be represented by the tests pipes. In addition, the SAWH pipe which has been made from the end of each coil shall be tested as above.

The first day production tests shall be repeated after any change in:

-Pipe outside diameter

Wall thickness group as:
1) Specified pipe wall thickness: ≤ 12.7 mm (0.500 in).
2) Specified pipe wall thickness: > 12.7 mm (0.500 in) ≤ 25.4 mm (1.00 in).
3) Specified pipe wall thickness :> 25.4 mm (1.00 in).

- Raw material (Supplier, Chemical & Mechanical properties)

- Manufacturing production specification.

- Welding procedure specification (current, voltage, speed, flux, wire, edge preparation and other essential variables of welding procedure)

- Any interruption to the production over 6 month.

ANNEX C Treatment of surface imperfections and defects C4.1(mod)

For PSL1 pipe shall not be supplied.

C 4.2 (Sub.)

Repair by welding shall be confined to the weld of SAW pipes.

Also repair of welds containing cracks is not permitted and if found, cracked area shall be cut-off and the pipe end re-tested as per table 18. Back to back repair is not permitted.

Repairs to welds shall be performed prior to cold expansion and hydrostatic testing

((No more than one repair at same area.))

C 4.3(Sub.)

Weld repair is limited to three zones per each length. Repair of weld seam within 200 mm of the bevel ends shall not permitted. The total length of repaired weld zones on each pipe shall not exceed 5% of the total length of weld.

C 4.6 (Sub.)

After weld repair and dressing, the entire pipe shall be hydrostatically tested. Also the repaired area shall be verified by local visual inspection and by RT,UT and MT in accordance with Annex E, and that the remaining wall thickness is within the specified tolerances**.**

Annex E Non-destructive inspection for other than sour service or offshore service

E. 1.4 Add

All ND Test procedures shall be performed in accordance with written procedures by manufacturer.

E 3 Methods of inspection

Table E.1 (Sub.) - Pipe-weld seam non-destructive inspection

Weld seam type	Wall-thickness t (mm)	Non-destructive inspection method [a]		
		Electromagnetic[c]	Ultrasonic	Radiographic
HFW	t ≤ 6	one method or a combined of methods is required		not applicable
HFW	t > 6	not applicable	Required	not applicable
SAW	all	not applicable	Required	See note (b)
Note: a) The weld seam at the pipe end require additional inspection (see E.3.2). b) For SAW pipes, The weld seam of all selected pipes in first day production test shall be R.T & M.T examined throughout their full length (see table 18). c) For HFW pipes, The weld seam of all selected pipes in first day production test shall be M.T examined throughout their full length (see table 18).				

E.3.1.2 (Sub.) All SMLS pipe shall be non-destructively inspected full length (100 %), as given in Table E.2.

.**Table E.2 (Sub.)— SMLS pipe body non-destructive inspection**

Item	Wall-thickness	Non-destructive inspection method [a]		
		Electromagnetic[c]	Ultrasonic	Magnetic particle (circular field)
any grade	t ≤ 5	one method or a combined of methods is required		not applicable
	t > 5	not applicable	Required	not applicable

E.3.1. 3 (Sub.)

The location of equipment:

a) For welded pipes shall take place after cold expansion and hydrostatic test.

b) For SMLS pipes shall take place after all heat treating; cold-expansion operations; end sizing and hydrostatic test.

E.3.2 pipe end inspection – welded pipe

E.3.2.3(Sub.)

Ultrasonic inspection in accordance with the method described in ASTM A578 and ASTM A 435, or ISO 10893-8 shall be used to verify that the 25 mm (1.0 in) wide zone at each pipe end is free of laminar imperfections > 6, 4 mm (0.25 in) in the circumferential direction.

In addition, for NPS ≥ 24 the bevel of each pipe ends shall be inspected for the detection of laminar imperfections in accordance with ISO 13664 by magnetic particle.
Any lamination or inclusion extending in to the surface or bevel of pipe shall be considered as a defect.

E.3.3 Pipe end inspection — SMLS pipe

E.3.3.2 (Sub.)

For pipe with $t \geq 5{,}0$ mm (0.197 in), ultrasonic inspection in accordance with ISO 10893-8 or ASTM A578 and ASTM A435 shall be used to verify that the 25 mm (1.0 in) wide zone at each pipe end is free of laminar imperfections > 6, 4 mm (0.25 in) in the circumferential direction.

E.5 Ultrasonic and electromagnetic inspection

E.5.1 Equipment

E.5.1.1(Add.)

Automatic ultrasonic and electromagnetic equipment shall be used for weld seam and pipe body inspection for detection of flaws.

The equipment shall have automatic facilities with the following characteristics:

a) Recording of indications on paper and/or on a retrievable medium shall be carried out without any intervention of the ultrasonic operator.

b) A device which monitors the effectiveness of the coupling -

When the sensitivity (echo height) decreases by more than 10 dB relative to the static calibration loss of coupling could have happened. It shall be recorded and clear automatic acoustic warnings and automatic paint spray shall be activated.

c) An automated weld tracing system for correct positioning of the probes with respect to the weld centerline shall be used.

d) All systems shall be equipped with ruggedized (firm and stable) scanning systems

The automated ultrasonic system is considered to be acceptable when the fluctuation of reference signal between the eight tests run is less than 3-4 dB (+/-25% of the average value)

Manual ultrasonic inspection may be used to verify the indications rejected by automated ultrasonic and confirm rejection or acceptance**.**

E.5.2 Ultrasonic and electromagnetic inspection reference standard

E.5.2.2(Sub.)

Reference standards shall be full length

E.5.2.6(Add.)

The AUT equipment shall be checked by reference standard:

a) At the beginning of each inspection shift

b) At least once per every 4 hours of continuous operation.

c) After any power interruption

d) Prior to resuming operation after repair or change to a system component that would affect system performance.

Note: The checking shall be carried out at the same speed and all other production conditions.

Table E.7 (Sub.)–Reference indicators

Item	Reference indicators for SMLS & weld seam							
	Notch location		Notch orientation		Notch dimension			Diameter (a) of radially drilled hole mm
	OD	ID	Longitudinal	Transverse	Depth (b) %	Length (c) (max) mm	Width (max) mm	
SMLS	required	required	required	not required	10	50	1.0	3.2
HFW	required	required	required	not required	5.0	50	1.0	1.6
SAWL SAWH	required	required	required	required	5.0	50	1.0	1.6
Note1 Notches are rectangular or U-shaped Note 2 The reference standard shall contain OD notches, ID notches and radial drilled hole.								
a) Drilled hole diameters are based upon standard drill-bit sizes. b) Depth is expressed as a percentage of the specified wall thickness. It is not necessary for the depth to be less than 0.3 mm. The depth tolerance is ±15% of the specified notch depth or ± 0.05 mm whichever is greater. c) Length at full depth.								

E.8 Laminar imperfection in the pipe body of HFW, SAW pipes (Sub.)

E.8.1 & E.8.2 (mod)

For welded pipes, ultrasonic inspection shall be used to verify that the strip/plate or pipe body is free of laminar imperfections greater than those permitted by table E 9.

Inspection method shall be in accordance with ISO 10893-9, if such inspection is done prior to pipe forming; or ISO 10893-8, if such inspection is done after seam welding.

The coverage of inspection shall be at least 25% by maximum gap 150 mm of total strip/plate or pipe body.

Table E 9 (Add.) Acceptance criteria for laminar imperfection of Pipe body or strip/plate

Maximum individual imperfection area (mm^2)	Minimum imperfection size considered			Maximum population density
	Area (mm^2)	Length (mm)	Width (mm)	
1000	300	35	8	10 per square meter

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

E.9 Laminar imperfections along the strip/plate edges or pipe weld seam of HFW and SAW pipe.

(Sub.)

For HFW and SAW pipes, ultrasonic inspection shall be used to verify that the 25mm wide zone along each of the strip/plate edges or along each side of the pipe weld seam is free of laminar imperfections >6, 4 mm (0.25 in) in any direction.

E .11 (Add.)

For pipes subjected to 100% rotary ultrasonic inspection after forming, pipe body and edges testing are not required.

Annex F Requirements for coupling (PSL 1 only) (Del.)

Annex G PSL2 pipe with resistance to ductile fracture propagation (Del.)

Annex H PSL2 pipe ordered for sour service (Del.)

Annex I Pipe ordered as "Through the flow line" (TFL) pipe (Del.)

Annex J PSL2 pipe ordered for offshore service (Del.)

Annex K Non-destructive inspection for pipe ordered for sour service and/or offshore service (Del.)

Annex L Steel designations (Del.)

Annex M Correspondence of terminology between ISO 3183 and its source documents (Del.)

Annex N Identification /explanation of deviations (Del.)

Appendix 1 Data sheet (Add.)

After receiving enquiry, following data sheet shall be filled, signed & sealed by manufacturer's authorized person and sent to NIGC for primary evaluation. If there is any clarification /deviations not mentioned in following data sheet, please specify and submit us as remarks or supplementary clarification.

General	
Manufacture name and address : Tel & fax :	Order No.:
Nominal outside diameter (inch) :	Item No.:
Wall thickness (inch) :	Quantity (meter) :
☐ HFW ☐ SAWL ☐ SAWH ☐ SMLS	☐ PSL2
minimum design temp : ^{0}C	☐ API monogram
Flow media :	☐ MPS
☐ Weld ability report	☐ PQR
☐ WPS	☐ QCP

Raw material					
Plate / coil/billet manufacturer name and address / country :			☐ plate ☐ billet ☐ coil		
Item	Properties	Requirements	Ref. to clauses	Deviation	Manufacturer remarks
1	Raw material	Basic oxygen / electric furnace or fully killed with fine grain size 8 or finer	8.3.2		
2	Chemical composition and C.E	Heat analysis	9.2 & table 5		
3	Mechanical testing	tensile ,CVN ,DWTT & bend	9.3 & 9.8 & 9.9		
4	UT inspection of plate & coil or pipe body	min 25% body +100% edges	E.8 & E.9 Table E.9		

Pipe inspection & testing					
5	Chemical composition	Product analysis	9.2		
6	Base metal tensile test	Yield, tensile strength & elongation ref. to table 7	9.3		
7	Weld tensile test	Tensile strength shall be meet minimum requirements	Table 7		
8	All weld test (for SAW)	Tensile strength shall be meet minimum requirements of body	B.5.1.2		
9	Flattening test (for HFW)	No opening at 50% & no crack at 33%of OD (distance between the plate) at 0 ° & 90°	9.6		
10	Guided bend test (for SAW)	root & face	9.7 &10.2.4.6		
11	Charpy impact test &Transition curve	Body, weld center line& HAZ	9.8& B.5.1.3		
12	DWTT Test & Transition curve	NPS>16	9.9 & B.5.1.3		
13	Macro Residual Stress Test	SAWH	9.16		
14	Hardness test weld & body	Once per test unit	10.2.4.8		
15	metallographic	HFW & SAW	10.2.5		

16	Hydrostatic test	Each pipe , Test duration: 10sec Test pressure: a) Grade B: alternative pressure b) Grade> X42: 95%SMYS	9.4 & 10.2.5 & C.4.6		
17	AUT	100% weld	E. 5 & table E.1		
18	Calibration of AUT	Every 4hour	E.5.2.6		
19	Manual UT	end weld& ends(25mm) & suspected area	E.3.2.3		
20	RT	ends weld, suspected/ repaired area	B.5.1.5 & E.3.2.2 & C.4		
21	MT	pipe end, bevel face, end weld suspected/ repaired area,	E.3.2.2 & B.5.1.6 & E.6		
Dimension & workmanship					
22	Outside diameter	One pipe per every 20 pipe but not less than once per 4 hour operating shift	9.11 & table10		
	Out of roundness	each pipe ends	9.11 & table10		
23	Wall thickness tolerance	Each pipe	9.11 & table11		
24	Height of inside and outside weld bead (for SAW)	max 3mm	9.13		
25	Removal of weld bead (for SAW)	Each pipe ends , 150mm of outside and 100mm inside weld bead	9.13.2.2		

26	Length	Each pipe 95%between11 12.2m average 11.6 m No one less than 8M for NPS>24pipe &5M for NPS<20 and more than 12.5 m for all pipe	9.11.3.3		
27	Straightness	max 0.15 % of pipe length	9.11.3.4		
28	End preparation	For wall thickness of 0.875(in) and less: as per API-5L For wall thickness greater: as per fig1	9.12.5..12.5.3		
29	Lamination	Any lamination or inclusion extending in to the surface or bevel of the pipe shall be considered as defect	E8 & table E9		
30	Dents	cold dent on body with sharp gauge deeper than 1mm and any dent on weld or HAZ not acceptable	9.10.5.2		
31	Strip end weld & Jointers	are not permitted	8.10.2 & 8.11.1		
32	Hard spots	larger than 50mm in any direction with hardness greater than 280 HV10 considered as defect	9.10.6		
33	Marking	pipe marking & identification number	11.2		

Notes:

Sampling and testing frequency shall be done in accordance with this IGS requirement.

APPENDIX 2 Figures (Add.)

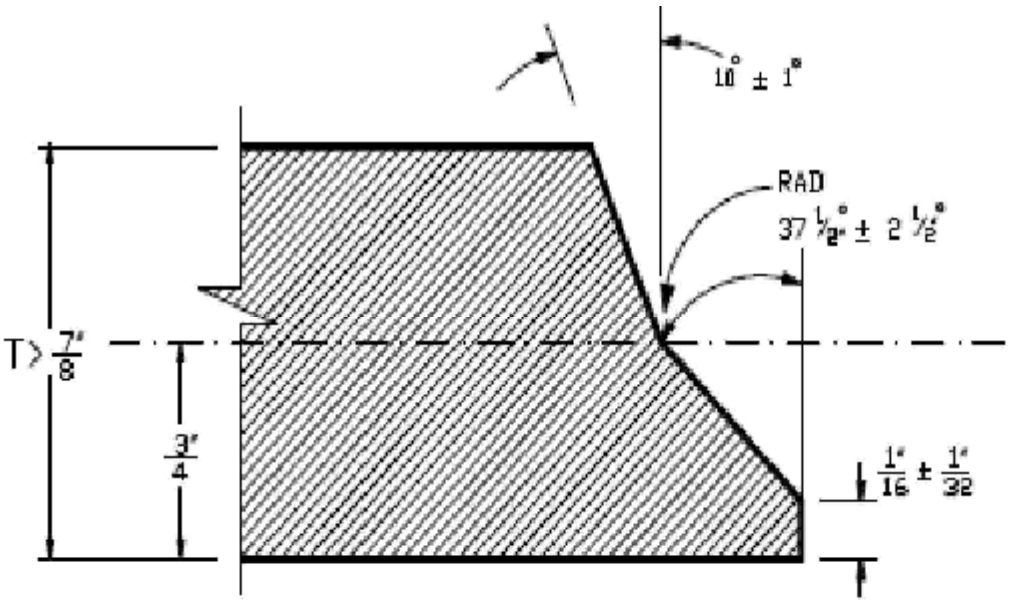


FIG 1 – END PREPATION FOR PIPE OVER THAN 22 mm (7/8") THICHNESS

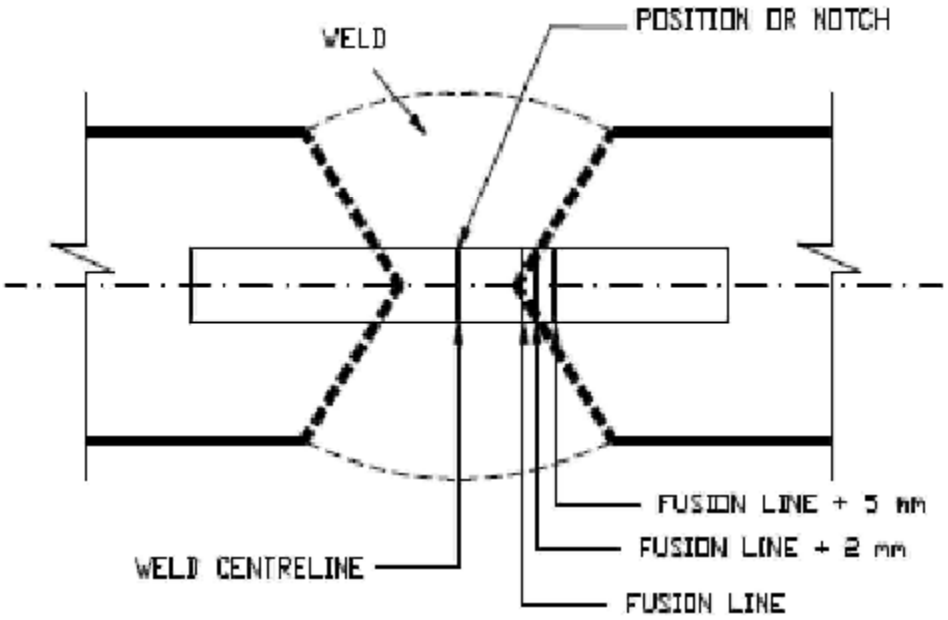


FIG 2 – LOCATION OF CHARPY V-NOTCH SPECIMENS IN SAW PIPE WELDS

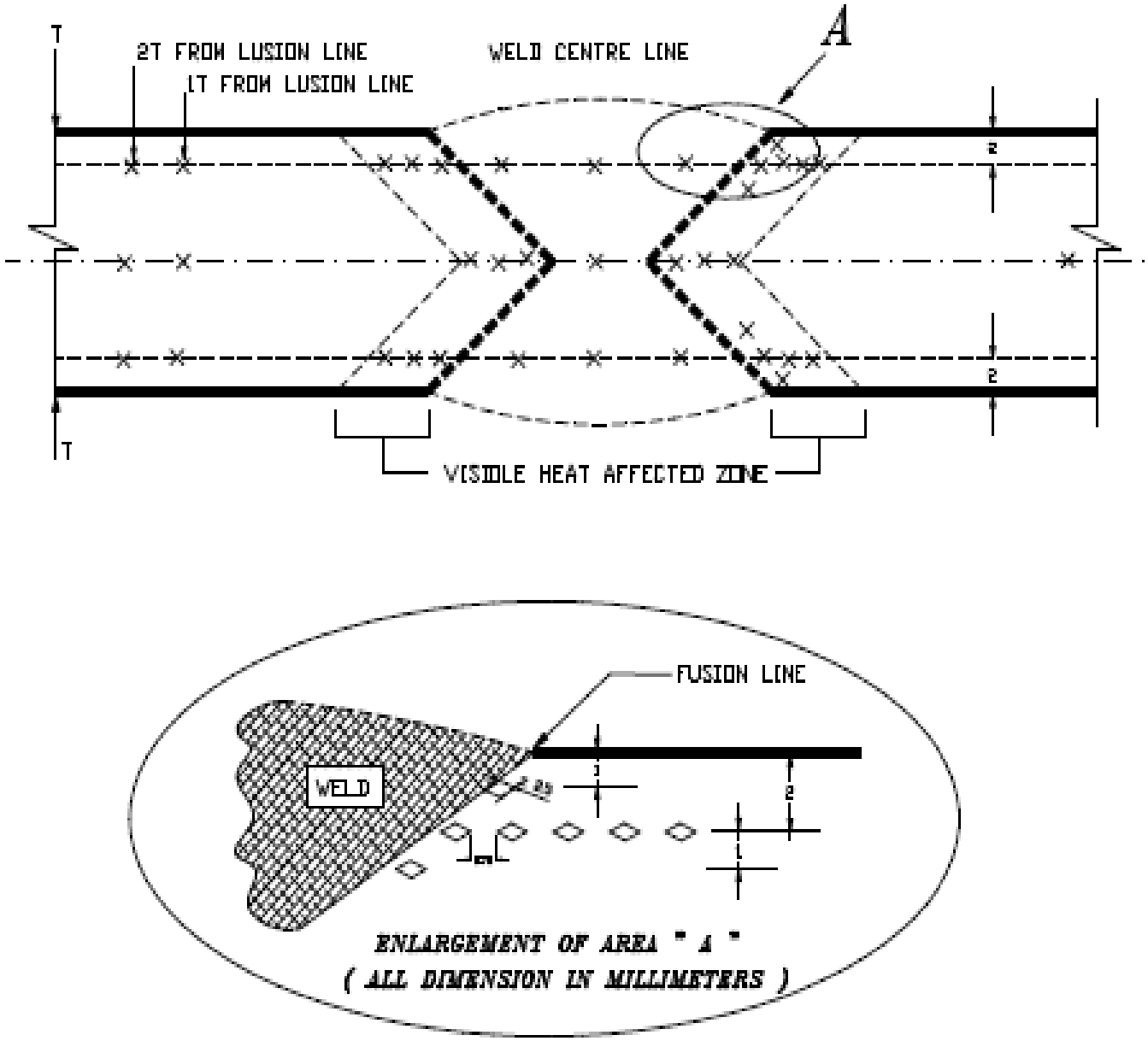


FIG 3 - LOCATION OF HARDNESS FOR SAW PIPE (FIRST DAY PRODUCTION)

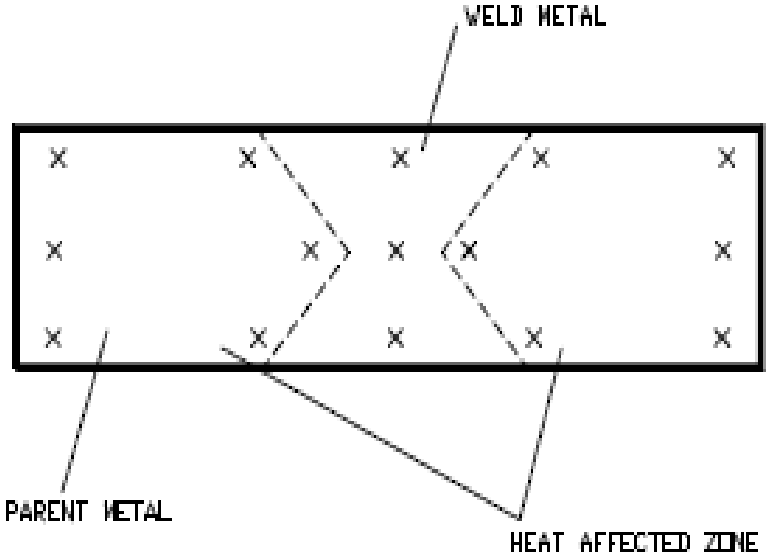
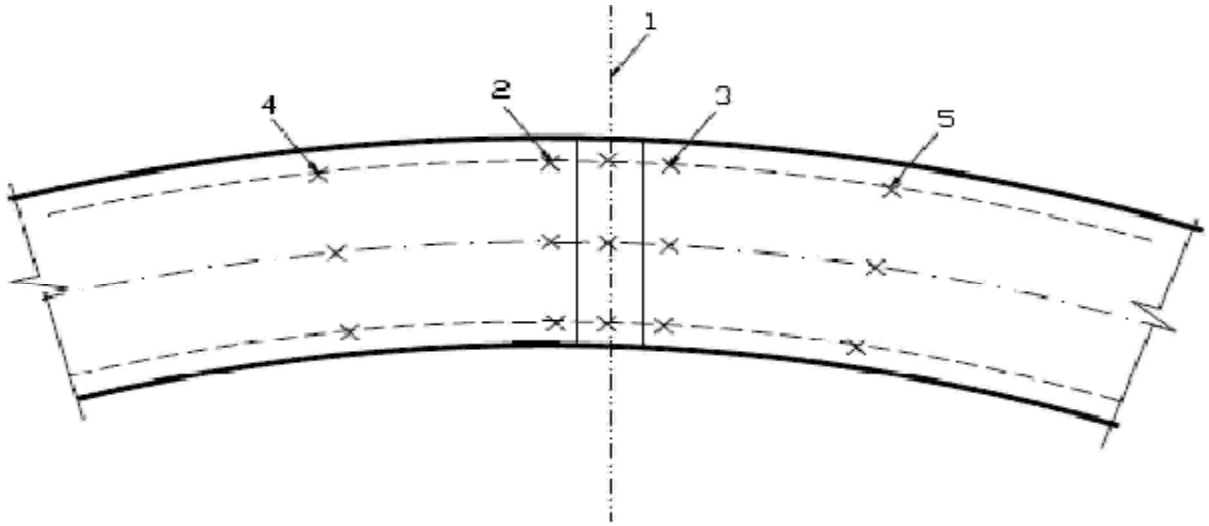


FIG 4 - LOCATION OF HARDNESS FOR SAW PIPE (ROUTINE TEST)



NOTE :

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

FIG 5 – LOCATION OF HARDNESS TEST FOR HFW PIPE

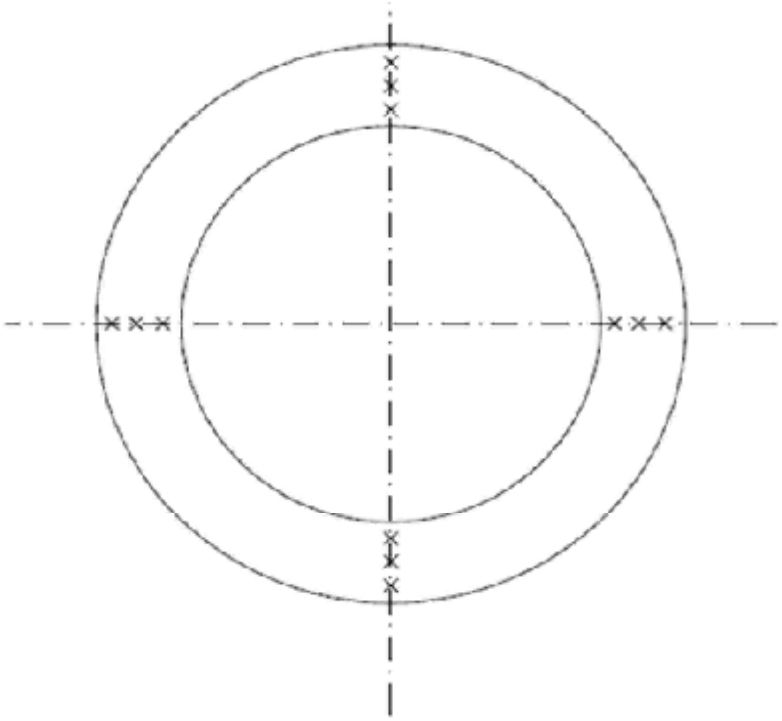


FIG 6 – LOCATION OF HARDNESS TEST FOR SMLS PIPE

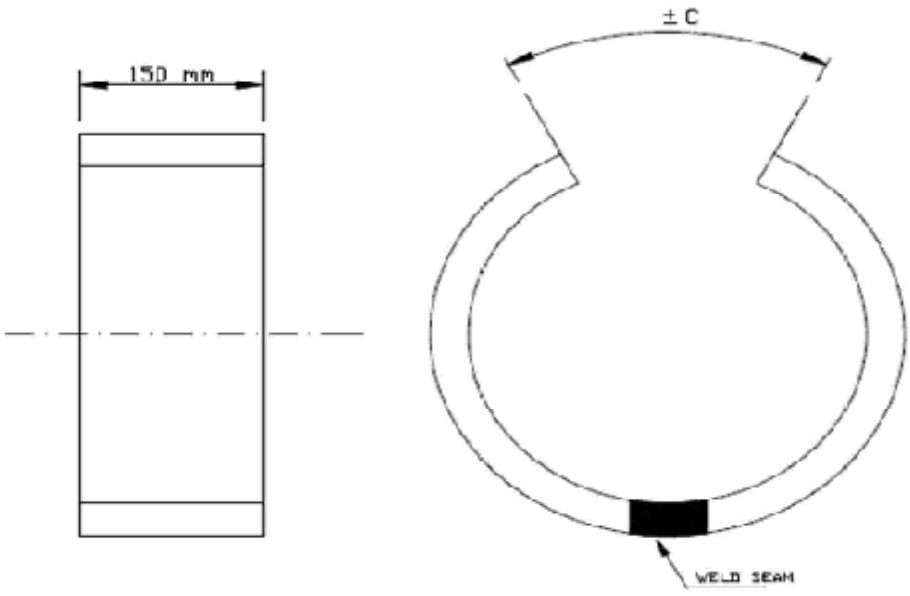
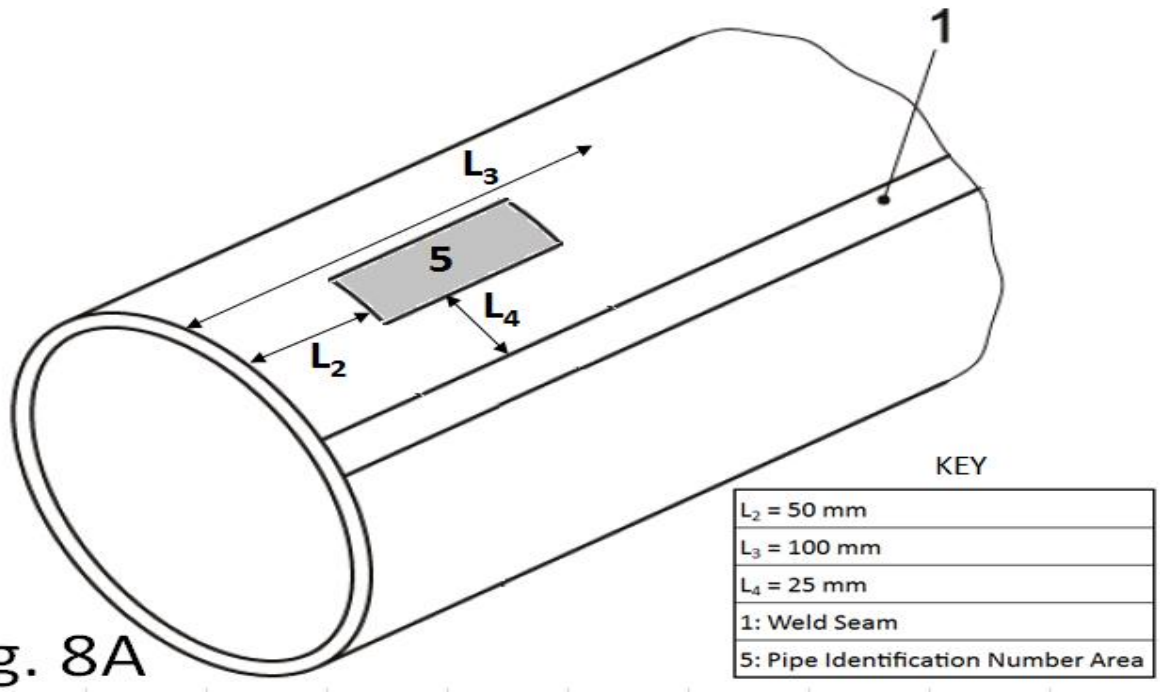
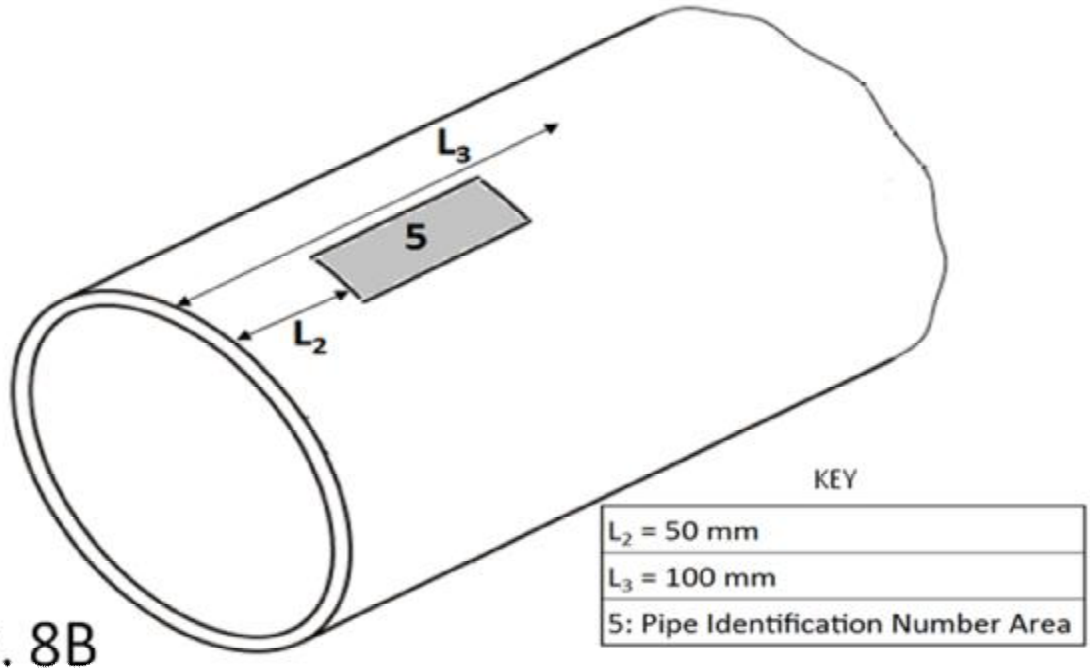


FIG 7 – MICRO RESIDUAL STRESS SPLIT RING FOR SAWH PIPE



KEY
L_2 = 50 mm
L_3 = 100 mm
L_4 = 25 mm
1: Weld Seam
5: Pipe Identification Number Area

Fig. 8A



KEY
L_2 = 50 mm
L_3 = 100 mm
5: Pipe Identification Number Area

Fig. 8B

FIG 8- LOCATION OF PIPE IDENTIFICATION NUMBER FOR GRAED LESS THAN X60