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Saddles



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# Polyethylene electrofusion saddle fittings

## 1. Scope:

This standard specification provides NIGC's requirements for polyethylene electrofusion tapping saddle with integral heating element, manufacturing, testing, inspection, dimension, tolerances, marking, packing, handling, storage etc. in accordance with BS-EN 1555, part 3 , except otherwise have been specified in this standard , within an operating temperature range of -20 to 45<sup>0</sup>C and max operating pressure of 4 bar. They are intended for use with polyethylene pipes conforming to IGS-M-PL-14-1.(2)

## 2. References:

Through out this standard specification the following standard and codes are referred to, the edition of these standards and codes that are in effect at the time of issues of this standard specification.

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

### 2.1. Normative references

EN 1555-1:2008, Plastics piping systems for the supply of gaseous fuels-  
Polyethylene (PE) - Part 1: General

EN 1555-2:2008, Plastics piping systems for the supply of gaseous fuels-  
Polyethylene (PE) - Part 2: pipes

EN 1555-3:2008, Plastics piping systems for the supply of gaseous fuels-  
Polyethylene (PE) - Part 3: fitting.

EN 1555-5:2008, Plastics piping systems for the supply of gaseous fuels-  
Polyethylene (PE) - Part 5: Fitness for purpose of the system

- EN 12117, Plastics piping systems – fittings, valves and ancillaries – determination of gaseous flow rate / pressure drop relationships.
- EN 1716 Plastics piping systems – polyethylene (PE) tapping tees – test method for impact resistance of an assembled tapping tee.
- EN ISO 1133:2005, Plastics – determination of the melt mass – flow rate (MFR) and the melt volume – flow rate (MVR) of thermoplastics) .
- EN ISO 1167-1:2006, Thermoplastics pipes, fittings and assemblies for the conveyance of fluids – determination of the resistance to internal pressure– Part1: general method .
- EN ISO 1167-2:2006, Thermoplastics pipes, fittings and assemblies for the conveyance of fluids – determination of the resistance to internal pressure – Part 2: preparation of pipe test pieces .
- EN ISO 1167-3:2007, Thermoplastics pipes, fittings and assemblies for the conveyance of fluids – determination of the resistance to internal pressure – Part 3: preparation of components .
- EN ISO 1167-4:2007, Thermoplastics pipes, fittings and assemblies for the conveyance of fluids – determination of the resistance to internal pressure – Part 4: preparation of assemblies .
- GIS/PL2-4: 2008, Polyethylene pipes and fittings for natural gas and suitable manufactured gas part 4: fusion fitting with integral heating element (s)
- ISO 13955, Plastics pipes and fittings – crushing decohesion test for polyethylene (PE) electrofusion assemblies.
- ISO/ CD 13956: 2008, Plastics pipes and fittings – determination of cohesive strength – tear test for polyethylene (PE) assemblies.
- ISO /FDIS 11357 – 6:2008, Plastics – differential scanning calorimetry(DSC) – part6:determination of oxidation induction time(isothermal OIT) and oxidation induction temperature (dynamic OIT)

## **2.2. Informative references**

EN ISO 3126:2005, plastics piping systems—plastics piping components – measurement and determination of dimensions.

ISO 228-1, Pipe threads where pressure – tight joints are not made on the threads – part 1: dimensions, tolerance and designation .

ISO 18553, Method for the assessment of the degree of pigment or carbon black dispersion in polyolefin pipes, fittings and compounds

## **3. Terms and definitions**

### **3.1. Batch release test (BRT)**

Test performed by the manufacturer on a batch of material or components which has to be satisfactorily completed before the batch can be released.

### **3.2. Electrofusion saddle fitting**

Polyethylene (PE) fitting which contains one or more integral heating elements, that are capable of transforming electrical energy into heat to realize a fusion joint onto a pipe

### **3.3. Melt – mass flow rate (MFR)**

Value relating to the viscosity of the molten material at a specified temperature and load, expressed in grams per 10 min (g/10 min)

### **3.4. Spigot end fitting**

Polyethylene (PE) fitting where the outside diameter of the spigot end is equal to the nominal outside diameter, (dn), of the corresponding pipe

### **3.5. Standard dimension ratio (SDR)**

Numerical designation of a pipe series, which is a convenient round number, approximately equal to the dimension ratio of the nominal outside diameter, dn, and the nominal wall thickness

### **3.6. Tapping tee**

Electrofusion saddle fitting which contains an integral cutter, to cut through the wall of the main pipe. The cutter remains in the body of the saddle after installation

### **3.7. Type testing (TT)**

Testing performed to prove that the material, component, assembly is capable of conforming to the requirements given in the relevant standard. (Such as CEN 1555 part 7)

In addition, relevant type tests shall be carried out and relevant certificate shall be submitted when ever there is a change in design, and /or in the production method other than routine in–process adjustment and any change in raw material such as brand , production designation , production location etc. In case of no changes in mentioned above items every five years the type tests certificate shall be renewed.

### **3.8. Virgin material**

Material in form of granules that has not been subjected to use or processing other than that required for its manufacturer and to which no reprocess able or recyclable materials have been added.

## **4. Technical specification for PE electrofusion tapping saddle**

Electrofusion PE gas fittings, black, minimum density at least  $945 \text{ kg/m}^3$ , SDR 11-13.6 , PE 100 suitable for operating pressure of 4 bar. The employed PE material shall be compound (in the form of granules), virgin and relevant certificate shall be submitted to purchaser. Processed PE material not allowed. material , manufacturing , testing , inspection , dimension , tolerances , marking , packing , handling , storage ,transportation etc. In accordance with CEN specification 1555 part 1,3,5,7 : 2008 edition and this standard .

Manufacturer shall design and produce its products so that guarantee on the requirements of this standard.

## **5. Saddle fitting aspect, geometry and dimension**

### **5.1. General**

Tapping tee shall be designed for connection by saddle fusion, to pressurized, main pipes and by electrofusion to outlet service pipe.

Tapping tees shall provide a means of cutting through the pressurized main pipe and allowing gas to flow into the outlet pipe. Uncontrolled leakage of gas to atmosphere shall not occur.

The pipe fixation device shall be an integral part of the body for all saddles (belt or under clamp).

An upper stop at the neck of the saddle shall be provided to prevent the cutter removing after tapping.

All saddles shall be equipped at least with a lower stop to prevent the cutter falling in to the pipe.

### **5.2. Indicator**

Each tapping saddle shall have two indicators and to be operated simultaneously but for outlet sizes of 63 and 32 mm mentioned two indicators are preferable.

Indicators shall not operate if any wire becomes open circuit during the first 50% of the fusion cycle.

The fusion indicators shall be designed so as to prevent the escape of fusion melt.

### **5.3. Fusion zone area**

Fusion zone area shall not be less than 3750 mm<sup>2</sup> for 25 mm outlet.

### **5.4. out let**

Outlet length shall not be less than 70 mm for 25 mm outlet.

**5.5. Cutter**

The cutter design shall be so that to hold the coupon and not produce swarf .

The integral cutter diameter shall not be less than 16 mm for saddle with 25 mm outlet and it shall be operated with 10 or 12 mm AF hexagonal key and the depth of hexagonal shall not be less than 16 mm. A stop shall be provided to prevent the key penetrating through the cutter.

**5.6. Cutter torque**

The cutter operating torque shall not exceed 30 N.m (applied at 5 rpm) for 25 mm outlet.

**5.7. Metallic part**

Perforator set shall be corrosion resistant. The corrosion resistance of perforator set shall be assessed by immersing the fitting for minimum of 170 hrs in an aqueous sodium chloride solution (30 g/l) at  $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ .

On completion of the test period there shall be no evidence of rust spots and corrosion of exposed metal.

**5.8. Tapping tee cap**

The tapping tee cap shall be capable of passing all tests required of the fitting without additional fastenings or constraints to the cap.

Where an "O" ring is used as a seal, it shall remain in position in the cap when the cap is removed.

## 6. Electro fusion fitting for gas distribution network

**Table 1**

TAPPING SADDLE
63×25
63×32
90×25
90×32
110×25
110×32
125×25
125×32
125×63
160×25
160×32
160×63
200×63
225×63

## 7. Required characteristics

Table 2

characteristics	Requirements	Test parameters		Test method	Type of test
		Parameter	Value		
Hydrostatic Strength (20°C , 100 h ) *	No failure during test periods of any test piece	End caps Orientation Conditioning time  Number of test pieces <sup>a</sup> Type of Test Circumferential(hoop) stress In pipe for : PE 80 PE 100  Test period Test temperature	Type a ) of EN ISO 1167-1:2006 Free Shall conform to EN ISO 1167-1:2006 3 Water – in –water  10,0 MPa 12.4 MPa b  100 h 20°C	EN ISO 1167-1 and EN ISO 1167-2, EN ISO 1167-3, or EN ISO 1167-4, as applicable	TT
Hydrostatic strength (80°C , 165 h ) *	No failure during test period of any test piece <sup>b</sup>	End caps Orientation Conditioning time  Number of test pieces <sup>a</sup> Type of test Circumferential (hoop) stress In pipe for : PE80 PE100  Test period Test temperature	Type a ) of EN ISO 1167-1:2006 Free Shall conform to EN ISO 1167-1:2006 3 Water – in –water  4,5 MPa 5,4 MPa  165 h 80°C	EN ISO 1167-1 and EN ISO 1167-2, EN ISO 1167-3, or EN ISO 1167-4, as applicable	BRT TT
Hydrostatic Strength (80°C , 1000 h ) *	No failure during test period of any test piece	End caps Orientation Conditioning time  Number of test pieces <sup>a</sup> Type of test Circumferential (hoop) stress in pipe for : PE80 PE100  Test period Test temperature	Type a ) of EN ISO 1167-1:2006 Free Shall conform to EN ISO 1167-1:2006 3 Water – in –water  4,0 MPa 5,0 MPa 1000 h 80°C	EN ISO 1167-1 and EN ISO 1167-2, EN ISO 1167-3, or EN ISO 1167-4, as applicable	TT
Decohesive resistance (B)	Surface of rupture $\leq$ (total fusion area)/7 in brittle failure	Test temperature number of test pieces <sup>a</sup>	23°C Shall conform to ISO 13955	ISO 13955	BRT TT
Decohesive resistance (B) (Strip bend test )	Surface of rupture $\leq$ (total fusion area)/7 in brittle failure	Test temperature number of test pieces <sup>a</sup>	23°C Shall conform to ISO-TC 1381/SC 5/WG12 2007	ISO-TC 1381/SC 5/WG12 2007	BRT
Cohesive strength (B)	Surface of rupture $\leq$ 15% (brittle failure )	Test temperature Number of test pieces <sup>a</sup>	23°C Shall conform to ISO 13956	ISO 13956	BRT TT
Impact resistance (B)	No failure,no leakage	Test temperature Falling height Mass of the striker Number of test pieces <sup>a</sup>	0°C 2 m 2,5 Kg 1	EN 1716	BRT TT

## Continue

Pressure drop (B)	Air flow rate (value indicated by the manufacturer )	Test medium Test pressure Pressure drop: For $d_n \leq 63$ mm For $d_n > 63$ mm Number of test piece <sup>a</sup>	Air source 25 mbar  0,5 mbar 0,1 mbar 1	EN 12117	TT
Oxidation induction time (thermal stability )	$\geq 25$ (T= 210 <sup>0</sup> C) $\geq 50$ (T=200 <sup>0</sup> C)	Test temperature Number of test piece <sup>a</sup>	200 <sup>0</sup> C <sup>c</sup> 3	ISO/FDIS 11357-6	TT BRT
Conventional density conforming to EN ISO 1872 -1	$\geq 945$ kg /m <sup>3</sup> (base polymer)	Test temperature Number of test pieces <sup>a</sup>	23 <sup>0</sup> C Shall conform to ISO 1183	EN 1183-1/2	TT BRT
Melt mass – flow Rate (MFR)	$0.2 \leq MFR \leq 0.7$ g/10min After processing maximum deviation of $\pm 10\%$ of the value measured on the batch used to manufacture the fitting	Loading mass Test temperature Time Number of test piece <sup>a</sup>	5kg 190 <sup>0</sup> C 10 min Shall conform to EN ISO 1133:2005	EN ISO 1133:2005	TT BRT
Carbon black content <sup>1</sup>	(2 to 2.5 )% ( by mass)	Shall conform to ISO 6964		ISO 6964	TT BRT
Carbon black dispersion	Grade $\leq 3$	Preparation of test pieces Number of test pieces <sup>a</sup>	Free shall conform to ISO 18553	ISO18553	TT BRT

a – The number of test pieces given indicate the numbers required to establish a value for the characteristic described in the table. The numbers of test pieces required for factory production control and process control should be listed in the manufacturer's quality plan. For guidance see pr EN 1555-7

b- Only brittle failures shall be taken into account. If a ductile failure occurs before 165 h, the test may be repeated at a lower stress. The stress and the associated minimum test period shall be selected from table 3 from a line based on the stress / time points given in table 3.

c- Test may be carried out at 210<sup>0</sup>C providing that there is a clear correlation to the results at 200<sup>0</sup>C, in case of dispute reference temperature shall be 200<sup>0</sup>C.

(B) electrofusion saddle fitting

\* All hydrostatic strength tests shall be carried out before cutting the main pipe by perforator, pressurizing process shall be performed via tapping saddle outlet. The same number of tests pieces is required.

## 8. Circumferential (hoop) stress at 80°C and associated minimum test period

Table 3

PE 80		PE 100	
Stress Mpa	Minimum test period h	Stress Mpa	Minimum test period h
4,5	165	5,4	165
4,4	233	5,3	256
4,3	331	5,2	399
4,2	474	5,1	629
4,1	658	5,0	1000
4,0	1000	--	--

## 9. Marking

The marking elements shall be printed or formed directly on the fitting on such a way that after storage, handling and installation legibility is maintained during the use of the fitting.

Marking shall not initiate cracks or other types of defects which adversely influence the performance of the fitting.

### 9.1. Minimum required marking

All saddle shall be marked with the data of table 4

**Table 4**

<b>Aspects</b>	<b>Mark symbol</b>
Number of the system standard	EN 1555
manufacturer's name and / or trademark	Name or symbol
nominal outside diameter (s)of pipe ; d	e.g. 110
material and designation	e.g. PE 100
design application series	e.g. SDR 11
Applicable SDR fusion range of pipe	e.g. SDR 11-13.6
manufacturer's information	
internal fluid	Gas
Production date *	Year / month / day
Fusion voltage *	Volt
Fusion time *	Second
Cooling time *	Minute
NIGC symbol *	NIGC

\* These requirements may be appear on a label firmly fixed to the fitting .

### 10. Delivery conditions

The fitting shall be packaged in bulk or individually protected where necessary in order to prevent deterioration. Whenever possible, they shall be placed in individual bags, in cardboard boxes or cartons.

The cartons and/or individual bags shall bear at least one label with the manufacture's name, type and dimensions of the part, number of units in the box, and any special storage conditions and storage time limits.

Each carton or protective package shall clearly indicate its content.

## 11. Documentation

The technical bid shall include the following items.

- 1) Original technical catalogue showing materials , dimensions etc
- 2) Material specification for PE 100 issued by granules manufacturer
- 3) Approval test report required by this standard shall be issued by certification body which is accepted by NIGC. By the way these mentioned reports shall include fallowing items :
  - a) hydrostatic strength (80<sup>0</sup>C,1000h)
  - b) cohesive strength
  - c) impact resistance
  - d) pressure drop
  - e) conventional density
  - f) oxidation induction time
  - g) melt mass – flow rate

**ANNEX A (Normative) – Data Sheet for Polyethylene electrofusion saddle**

P.O. NO / Contract No.	
Manufacturer's name and address	
Product	
Product designation	
Granule manufacturer & designation	

**Raw Material**

Item	Property	Unit	Test method	Requirement	Manufacturer's remark
1	Density	g/cm <sup>3</sup>	ISO 1183	> 0.945	
2	Oxidation induction time	Min	ISO 11357-6	≥ 25 (T= 210 <sup>0</sup> C) ≥ 50 (T=200 <sup>0</sup> C)	
3	Melt mass flow rate ( MFR)	g/10 min	ISO 1133	0.2 ≤ MFR ≤ 0.7	
4	Carbon black content	% (by mass)	ISO 6964	2 to 2.5	
5	Carbon black dispersion		18553	Grade ≤ 3	
6	Designation			PE 100	

**Finished product**

Item	Property	Unit	Test method	Requirement	Manufacturer's remark
1	SDR	-		11	
2	All type of hydrostatic test	-	According to IGS-M-PL-014-4(0)	Conformity mentioned on test method and accepted results	
3	Minimum area of fusion zone for 25 mm outlet	mm <sup>2</sup>		3750	
4	Minimum outlet length	mm		70	
5	Melt mass flow rate ( MFR)	g/10 min		After processing, maximum deviation of ±10% of the value measured on the raw material used to manufacture the fitting	

**Notes:**

- 1- This data sheet shall be filled, signed, and stamped by manufacturer / supplier.
- 2- Any deviation from this standard specification shall be clearly specified by manufacturer / supplier.
- 3- Any change in raw material shall be requalified
- 4- Requirements for material, manufacturing, testing, inspection, packing, etc are in accordance with EN 1555 : 2008 & IGS-M-PL-014-4
- 5- Processed PE material (recycled ) are not allowed