GUJARAT GAS

TECHNICAL SPECIFICATION FOR PROCUREMENT OF ELECTROFUSION FITTINGS (PE-100)

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1.0 INTRODUCTION AND SCOPE

Gujarat Gas Ltd., is a Group Company of Gujarat State Petroleum Corporation Ltd., (State Government undertaking) is supplying natural gas to automobile, industrial, commercial and domestic consumers including CNG stations in various Geographical Areas as per authorisation from PNGRB.

The intent of this specification is to establish minimum requirements to manufacture, testing and supply of Polyethylene (PE) Electrofusion Fittings for the supply of Natural gas.

The scope of the tender will include manufacture, supply, inspection, testing, marking, packaging, handling and despatch of Polyethylene (PE) Electrofusion Fittings as per EN 1555-3 : 2002 / ISO 8085-3 with latest amendments.

All codes and standards for manufacture, testing, inspection etc shall be of latest edition.

Owner reserves the right to delete or order additional quantities during execution of order, based on unit rates and other terms & conditions in the original order.

Following PE Electro-fusion fittings shall be supplied under this specifications.

- Electro-fusion Coupler/Elbow/Eq. Tee/End Cap/Reducer fitting
- Electro-fusion saddle / Tapping Tee fitting

2.0 REFERENCE CODES AND STANDARDS:

12.1 Governing Standards

PNGRB T4S	Technical Standards and Specifications including Safety Standards for City or Local Natural Gas Distribution Networks.
EN 1555-3	Plastic piping systems for the supply of gaseous fuels - Polyethylene (PE) Part-3 Fittings

12.2 Reference Standards

IS 14885	Polyethylene pipes for the supply of Gaseous Fuels -- Specifications
EN 1555-1	Plastic piping systems for the supply of gaseous fuels - Polyethylene (PE) Part-1 : General
EN 1555-1	Plastic piping systems for the supply of gaseous fuels - Polyethylene (PE) Part-2 : Pipes
EN 1555-5	Plastic piping systems for the supply of gaseous fuels - Polyethylene (PE) Part-5 : Fitness for the purpose of the system
EN 1555-7	Plastic piping systems for the supply of gaseous fuels - Polyethylene (PE) Part-7 : Guidance for assessment of conformity
EN 682	Elastomeric seals – Material requirements for seals used in pipes and fittings carrying gas and hydrocarbon fluids
EN 728	Plastic piping and ducting systems – Polyolefin pipes and fittings – Determination of oxidation induction time.
EN 921	Plastic piping systems – Thermoplastic pipes – Determination of resistance to internal pressure at constant temperature.

EN 1716	Plastic piping systems – Polyethylene (PE) tapping tees – test method for impact resistance of an assembled tapping tee.
EN 12117	Plastic piping systems – Fittings, valves and ancillaries – determination of gaseous flow rate/pressure drop relationship
EN 12099	Plastic Piping Systems — Polyethylene piping materials and components — Determination of volatile content
EN ISO 1133	Plastics- Determination of melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics
ISO 1183	Plastics — Methods for determining the density of non cellular plastics
ISO 13954	Plastics pipes and fittings -- Peel decohesion test for polyethylene (PE) electrofusion assemblies of nominal outside diameter greater than or equal to 90 mm
ISO 13955	Plastics pipes and fittings -- Crushing decohesion test for polyethylene (PE) electrofusion assemblies
ISO 13956	Plastics pipes and fittings -- Decohesion test of polyethylene (PE) saddle fusion joints -- Evaluation of ductility of fusion joint interface by tear test
ISO 13953	Polyethylene (PE) pipes and fittings -- Determination of the tensile strength and failure mode of test pieces from a butt-fused joint

3.0 DEFINITIONS

OWNER / CLIENT	Gujarat Gas Ltd., (GGL)
PNG	Natural Gas produced from Gas wells, Gas condensate wells or Oil wells and the residue Gas remaining after conditioning being metered, regulated / controlled, odorized & distributed through pipelines for various applications, i.e. for industrial, commercial and domestic.
Manufacturer	Manufacturer of PE Electro-fusion Fittings
Vendor	The person(s), firm, company, organization from whom Client/Contractor procures materials.
TPA	Third Party Inspection Agency
EIC	Engineer In Charge
PNGRB	Petroleum and Natural Gas Regulatory Board
T4S	Technical Standard and Specification including Safety Standards,

4.0 MATERIAL

Compound

The compound of PE 100 grade from which the fittings are made shall conform to EN 1555-1 (latest edition).

Material for non-polyethylene parts

PE pipes conforming to EN 1555-2:2002 and the requirements for the level of material performance of non-polyethylene parts shall be at least as stringent as that of the compound for the piping system

Elastomers

Elastomeric seals shall conform to EN 682 and other sealing materials are permitted if suitable for gas service.

Other Materials

Greases or lubricants shall not enter into fusion areas, and shall not affect the long-term performance of fitting materials

Other materials may be used provided that it is proven that the fittings conform to this standard.

5.0 MECHANICAL PROPERTIES / TESTING

- Fittings shall be tested using pipes, which conform to EN 1555-2.
- Jointed pipe and fitting test pieces shall be assembled in accordance with the technical instructions of the manufacturer and take into account the limit conditions of utilisation described in EN 1555-5.
- The sample test assemblies shall take account of manufacturing and assembly tolerances.
- In the event of modification of the jointing parameters, the manufacturer shall ensure that the joint conforms to the requirements given in clause 7.2 of as per EN 1555-3.
- Unless otherwise specified by the applicable test method, the test pieces shall be conditioned at (23 ± 2) °C before testing in accordance with Table 4 of as per EN 1555-3.
- When tested in accordance with the test methods as specified in Table 4 of EN 1555-3 using the indicated parameters, the fittings shall have mechanical characteristics conforming to the requirements given in Table 4, as applicable to the following types of fitting :
  - Electro-fusion socket fitting;
  - Electro-fusion saddle/Tapping fitting;

6.0 PHYSICAL CHARACTERISITICS

The physical characteristics of electro-fusion fittings shall conform to the requirements of Table 6 of clause 8 .2 as per EN 1555-3.

7.0 PERFORMANCE REQUIREMENT

When electro-fusion fittings conforming to this standard are assembled to each other or to components conforming to other parts of EN 1555, the joints shall conform to EN 1555-5.

8.0 HYDROSTATIC PRESSURE TEST

Electro-fusion fittings shall confirm to the requirements of Table 4 of clause 7.2 as per EN 1555-3.

9.0 PNEUMATIC PRESSURE TEST

Electro-fusion fittings shall be leak tightness tested and confirm to the requirements of Table 4 of clause 7.2 as per EN 1555-3.

10.0 DIMENSIONAL TOLERANCES

Dimensions tolerances of various types of Electro-fusion fitting shall be as per EN 1555-3.

Measurement of dimensions

Dimensions shall be measured at 23 ± 2 °C, after being conditioned for at least 4 h. The measurement shall not be made less than 24 h after manufacture of fittings.

Diameters and lengths

The electro-fusion socket diameter and lengths shall conform to Table 1 and clause 6.2 of as per EN 1555-3.

Outlets from tapping tees and branch saddles shall conform to clause of 6.4 of as per EN 1555-3.

The dimensions of spigot end fittings shall conform to Table 3 and clause of 6.4 of as per EN1555-3.

Mechanical fittings with polyethylene spigot ends (Polyethylene spigot ends) shall conform to 6.4.

Mechanical fittings with polyethylene electro-fusion sockets shall conform to 6.2.

Wall Thickness

The minimum wall thickness of a fitting shall be SDR 11 in accordance as per Clause of 6.2.2 and Table 2 of as per EN 1555-3.

Wall thickness of the fusion end

The wall thickness of the fusion end shall be at least equal to the minimum wall thickness of the pipe, except between the plane of the entrance face and a plane parallel to it, located at a distance not greater than (0.01 De + 1 mm), where a thickness reduction for e.g. a chamfered edge is permissible.

Wall thickness of the fitting body

The wall thickness of the fittings are as per SDR 11.

The permissible tolerance of the wall thickness at any point shall conform to those of the nominal wall thicknesses given in EN 1555-2.

Any changes in wall thickness of the fitting body shall be gradual in order to prevent stress concentrations.

Out-of-roundness of the bore of a fitting (at any point)

When a fitting leaves the site of the manufacturer, the out-of-roundness of the bore of a fitting at any point shall not exceed 0,015dn.

11.0 COLOUR

The colour of the PE parts of fittings shall be black.

12.0 QUALITY ASSURANCE (QA)

The Contractor/Manufacture /Vendor shall manufacture, supply, inspection, testing, marking, packaging, handling and dispatch of Polyethylene (PE) Electrofusion Fittings as per EN 1555-3: 2002 with latest amendments and GGL QAP.

Quality Assurance of Company Procured Material

The Contractor/Manufacturer /Vendor shall submit QAP after getting firm order from Owner for their review and approval. Prior dispatching of materials, vendor shall offer material lot to TPA/Owner for inspection as per approved QAP at their premise following for review of TPA / EIC at the time of final inspection at vendor premise prior to dispatch of materials.

Quality Assurance of Contractor Procured Material

The Contractor/Manufacturer /Vendor after getting firm order from Contractor shall manufacture, supply, inspection, testing, marking, packaging, handling and dispatch Polyethylene (PE) Electrofusion Fittings as per EN 1555-3: 2002 / ISO 8085-3 with latest amendments and GGL QAP.

13.0 INSPECTION / DOCUMENTS

Inspection shall be carried out as per design codes/standards, OWNER Technical Specification and approved QAP.

Inspection of Company Procured Material

i. Inspection of Company Procured MaterialTPA /GGL Representative shall carry out final inspection at vendor premise prior to dispatching of materials.

ii. TPA / GGL Representative shall carry out inspection during manufacturing/ final inspection as per approved QAP.

iii. Contractor / manufacturer / Supplier / Vendor shall furnish all the material test certificates, proof of approval/ license from specified authority as per specified standard, if relevant, internal test/ inspection reports as per OWNER Technical Specification, at the time of final inspection of each supply lot of material.

iv. Even after third party inspection, OWNER reserves the right to select a sample of items randomly from each manufacturing batch/ lot and have these independently tested. If the results of these tests fall outside the limits specified in OWNER Technical specification, then OWNER reserves the rights to reject all production supplied from the batch.

v. Deputation of TPA is in the scope of the Vendor.

For any control test or examination required under the supervision of TPA/ GGL Representative, latter shall be informed in writing one (1) week in advance by vender about inspection date & place along with production schedule.

Inspection of Contractor Procured Material

i. Vendor Representative shall carry out final inspection at his premise prior to dispatching of materials as per GGL QAP provided with the tender document.

ii. For inspection at contractor premises by TPA/ GGL Representative, latter shall be informed in writing one (1) week in advance by contractor about inspection date & place along with inspection schedule.

iii. Contractor shall furnish all the material test certificates, type test reports, internal test/ inspection reports as per OWNER Technical Specification and QAP, at the time of final inspection of each supply lot of material.

iv. OWNER reserves the right to select a sample of items randomly from each batch/ lot and have these independently tested. If the results of these tests fall outside the limits specified in OWNER Technical specification, then OWNER reserves the rights to reject all production supplied from the batch.

v. Inspection of the material shall be carried out as per GGL IMS procedure " Quality Assurance for Contractor procured material".

14.0 MARKING

Electro-fusion fittings marking shall confirm to the requirements of clause 10 as per EN 1555-3.

The minimum required marking shall conform to Table 7 of EN 1555-3.

Each packing containing fittings shall carry the following stamped or written in indelible ink.

a) Number of the System Standard- EN 1555
b) Manufacturer's name and/or trademark
c) Bar code
d) Nominal outside diameter(s) of pipe, dn (i.e. 20, 32, 63mm etc.)
e) Material and designation (PE 100)
f) Design application series
g) SDR fusion range (SDR 11)
h) Manufacturer's information
i) Internal fluid (i.e. Gas)
j) Month and year of manufacturing

15.0 PACKAGING

Packing size to be mentioned to ensure uniformity in delivery conditions of the material being procured.

Manufacturer / Supplier / Vendor shall submit the packaging details and also complied with at the time of delivery.

16.0 DOCUMENTS OF PRECEDENCE

In case of conflict between the requirements of this specification and the Reference Codes & Standards, the requirements of the specification, having stringent requirement, shall govern. Vendor shall obtain prior permission from GGL in such cases.

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17.0 QUALITY ASSURANCE PLAN

S.No.	Description	Quantum of check	Reference Document GGL Technical Specification	Acceptance Criteria	Inspection Methodology	Format of Record	INSPECTION		Remarks
							Manuf. / Supplier	TPA/ GGL	
1	**Raw Material Inspection**								
1.1	Density		As per EN 1555-Part 1 & EN ISO 1183	≥930 Kg / M^3 at 23°C			P	R	
1.2	Oxidation induction time (Thermal stability)		As per EN 1555-Part 1 & EN 728	>20 min at 200°C			P	R	
1.3	Melt mass flow rate (MFR)		As per EN 1555-Part 1 & EN ISO 1133	Min. 0.2 to 1.40 at 190°C & 5Kg. Load in gm/10 Min.			P	R	
1.4	Volatile Content		As per EN 1555-Part 1 & EN 12099	≤ 350 mg/kg			P	R	Not applicable if water content test reports are availbale.
1.5	Water Content (Moisture Content)		As per EN 1555-Part 1 & ISO 15512	< 300 mg/kg (Equivalent to < 0.03% by mass)			P	R	Only applicable, if the measured volatile content is not in conformity to its specified requirement. In case of dispute the requirement of water content shall be used. As an alternative method, ISO 760:1978 may apply
1.6	Carbon Black Content		As per EN 1555-Part 1 & ISO 6964	2 to 2.5% by mass			P	R	
1.7	Carbon Black Dispersion		As per EN 1555-Part 1 & ISO 18553	Grade ≤3			P	R	
1.8	Antioxidant and UV Stabilzer	-	PNGRB T4S- G.S.R. 612(E).	The Antioxidant used is not more than 0.3% and U V Stabilizer used are not more than 0.5% by mass of finished resin	Declaration from Raw Material Supplier and Fitting Manufacturer	Declaration from Raw Material Supplier and Fitting Manufacturer	P	R	
1.9	Cadmium Free Pigmented compound material			Material shall be cadmium free pigmented compund					
1.10	Polyethylene -Virgin Material			Polyethylene resin used for manufacture of thermoplastic fittings shall be virgin,					
2	**Performance requirements**								
2.1	Appearance	As per EN 1555-Part 7	Free from scoring, cavities and other surface defects and Cut cleanly and square to the axis. Smooth & clean Should be free grooves, scoring etc.	EN 1555-3/GGL Technical Spec.	Visual	Inspection Report	P	Rv	
2.2	Colour		GGL Technical Spec. / EN 1555-3	Black	Visual	Inspection Report	P	V	
2.3	Geometrical Characteris		GGL Technical Spec. / EN 1555-3	EN 1555-3/GGL Technical Spec.	Vernier Calliper	Inspection Report	P	V	
2.4	Hydrostatic Strength (80º C, 165 h)	As per EN 1555-Part 7	EN 1555-Part 3 Clause No. 7.2 Table-4 & EN 921	EF fitting joint shall withstand the hydrostatic pressure throughout the test period. No leakages are allowed through fusion area.	Hydrostatic Pressure Test.	Inspection Report	P	R	
2.5	Oxidation induction time (Thermal stability)		EN 1555-Part 3 Clause No. 8.2 , EN 12117 & EN 728	>20 min at 200°C		Inspection Report	P	R	
2.6	Melt mass-flow rate (MFR)		EN 1555-Part 3 Clause No. 8.2 , EN 12117 & EN ISO 1133	After processing maximum deviation of ± 20 % of the value measured on the batch used to manufacture the fitting at 190°C & 5Kg. Load in gm/10 Min. Test Parameters as per Table 6 of EN 1555-3	Melt Flow Tester	Inspection Report	P	R	
2.7	Electric Resistance		EN 1555-Part 3 Clause No. 5.5	Resistance of the fitting at 23°C shall be as specified by the fitting manufacturer.	Resistance measurement .		P	R	
2.8	Marking	As per EN 1555-Part 7	EN 1555-Part 3 Clause No. 10.2 & 10.3	a) Number of the System Standard- EN 1555 b) Manufacturer's name and/or trademark c) Barcode d) Nominal size of Fitting e) Material and designation f) Design application series (i.e SDR - 11) g) Applicable SDR fusion range of pipe (i.e SDR 11 to SDR 26) h) Manufacturer's information i) Intgernal Fluid (i.e. Gas) j) Month and year of manufacturing.(A code may be provided e.g batch No -- 16/02)	Visual	Inspection Report	P	Rv	
2.9	Packing		EN 1555-Part 3	EN 1555-Part 3	Visual	Inspection Report	P	V	
2.10	Documentation		EN 1555-Part 3	As per the term & conditions of GGL Technical Specification	Visual	Compliance Certificate	P	R	

LEGENDS: Rv- Random Verification, V- Verification, W - Witness, R - Review of Documents / test certificates, H - Hold, P - Perform, TPA - Third Party Agency

Notes: -

1 **In additional to above tests, Vendor shall submit Type Test report as per Table-4 of EN 1555-7**

2 The Above Testing and acceptance criteria are minimum requirements, however, Vendor shall ensure that the execution of works shall also comply to the additional requirements as per GGL Technical specifications(TS) & EN 1555-1, EN-1555-3 & EN 1555-7