



## SCOPE OF SUPPLY AND TECHNICAL SPECIFICATION

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1. Vadodara Gas Limited (VGL) plans to augment the PE Network. It supplies natural gas to domestic & commercial consumers in the city of Vadodara
2. The present document covers the technical specifications for the procurement of “**Medium Density Polyethylene Pipes**” The Polyethylene Pipes shall be manufactured, supplied in accordance with Pr EN: 1555-1 Plastic Piping System for the Supply of Gaseous Fuels, IS 14885:2001 Polyethylene Pipes for Supply of Gaseous Fuels and ISO-4437 Buried Polyethylene (MDPE) for the supply of gaseous fuels metric series specifications

### **3. COMPLIANCE WITH SPECIFICATION**

The vendor shall be completely responsible for the design, materials, manufacture, supply, testing, inspection, preparation for shipment, loading at your works, unloading at owner's store of the above item strictly in accordance with Technical Specification, Material Requisition and all other applicable codes.

### **4. VENDOR'S SCOPE**

Vendor's scope of work includes the design, materials, manufacture, supply, testing, inspection, loading/unloading according to present specification and applicable codes and standards and all other works necessary for completion of works.

### **5. TERMINOLOGY**

- Maximum Allowable Operating Pressure (MAOP): The maximum effective pressure of gas in a piping system, expressed in bars, which is allowed in continuous use. It takes in account physical & mechanical characteristics of the components of piping system. The equation for  $MAOP = (20 \times MRS) / [C \times (SDR - 1)]$
- Minimum Required Strength (MRS): The value of lower confidence limit rounded down to next value as defined in ISO 3:1973 MRS is expressed as a hoop stress in mega-Pascal. Standardized class of component for which the Lower Confidence Limit (LCL) is equal to 10.
- PE 100: Standard designation for PE compound in class MRS 10. For such PE compounds, the long term hydrostatic strength- calculated and classified according to the standardized method (ISO 9080 and ISO 12162) for a temperature of 20 degree centigrade, a period of 50 years and a reliability of 97.5% - must be at least 10 Mpa.
- Co-efficient (C): C is an overall co-efficient with a value greater than 1 which takes into consideration service condition as well as properties of the components of a piping system other than those represented in the lower confidence limit. For this specification the minimum of C is 2.0
- Nominal outside Diameter (dn): A convenient round number (in millimeters) for reference purposes which is common to all components in.
- Out of roundness (Ovality): The absolute out of roundness is the difference between the measured maximum outside diameter and the measured minimum outside diameter in the cross – section of pipe



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- Nominal Wall Thickness (en): The wall thickness in millimeters corresponding to minimum wall thickness at any point around circumference of the pipe.
- Resin: A material (solid or semi-solid) which has a high molecular weight and is a product of polymerization.
- Metal Flow Rate (MFR): is a value relating to the viscosity of the molten material at a specified temperature and a rate of shear.
- Standard Dimension Ratio (SDR). The ratio of nominal outside diameter of a pipe to its nominal thickness.
- $SDR = dn/en$  for any other terminology, IS-14885-2001 (latest) and / or other applicable National & International codes /Standards can be referred.

### **6. DESIGN CODES/ STANDARDS/REFERENCES**

The following National & International codes / standards / references (Latest edition) shall be applicable for PE-100 material as well as Polyethylene pipe.

Pr EN 1555 -1	Plastic Piping System for the Supply of Gaseous Fuels.
Pr EN 1555-2	Standard PE Pipes and Fitting, Suitable for Gas Transportation System Solutions
IS-14885	Polyethylene pipes for supply of Gaseous Fuels.
ISO-4437	Buried Polyethylene pipe for supply of gaseous fuels – metric series – specification
IS-2530	Methods of test for PE moulding materials and PE compound
ISO-1183:1987	Plastic: Methods for determining the density of non-cellular plastics.
ISO-1872- 2B	Plastic: polyethylene (PE) moulding and extrusion material.
ISO- 527	Plastics: Determination of tensile properties.
EN 728	Plastic Piping and Ducting System – Determination of oxidation Induction time.
EN 12099	Polyethylene piping system - Determination of Volatile Content
ISO 13949:1997	Method of assessment of the degree of pigment dispersion in polyolefin pipes, fittings and compounds
EN 12118	Plastic Piping systems – Determination of moisture content in thermoplastic by coulometer



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ISO-1133                      Plastics – determination of the melt-mass flow rate (MFR) and melt volume flow rate (MVR) of thermoplastic.

EN 1555-7                    Gaseous fuels supply polyethylene (PE)

### **7. I) APPROVED MANUFACTURER FOR RAW MATERIAL**

- a) INEOS
- b) BOROUGE (part of BOREALIS & ADNOC group)
- c) TOTAL PETROCHEMICALS
- d) DOW
- e) BASELL / LYONDELLBASELL

### **II) APPROVED RAW MATERIAL**

- a) SOLWAY
- b) BOREALIS
- c) FINATHENE
- d) DOW BG
- e) ELENAC (HOSTALEN CRP 100)

### **8. RAW MATERIAL GRADE AND PROPERTIES**

- Raw material grade / classification shall conform to Cl.4.2 of IS-14885: 2001. i.e. PE 100
- The raw material of polyethylene pipes shall be PE 100. The properties of PE-100 compound shall conform to the table 2 of IS-14885: 2001.
- Other materials / additives such as anti-oxidant, UV stabilizer, pigment dispersion etc. shall conform to IS- 14885: 2001.
- Raw material of polyethylene pipes shall be virgin quality. PE compound shall be Cadmium free pigment compound.
- Anti-oxidant & UV stabilized used in PE resin shall not exceed 0.3 and 0.5 % by mass of finished resin respectively.
- Raw material supplier to submit the certificate for percentage use of U.V. stabilizer in the raw materials (PE compound)

#### **8.1 Characteristic of PE – 100 Compound**

<b>Sr. No.</b>	<b>Characteristic</b>	<b>Unit</b>	<b>Requirement</b>	<b>Test Method</b>
1	Conventional Density	Kg/m <sup>3</sup>	> 928.4 at 23°C (Base Polymer) > 930 at 27°C (Base Polymer)	IS-14885 / ISO IS 7328



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2	Tensile Yield Point	MPa	Min. 15 MPa	IS-14885 : 2001
3	Elongation at break	%	Min 350	IS-14885 : 2001
4	Melt-mass Flow Rate	g/10 min.	+ 20% of value nominated by compound producer @ 190°C / 5.0 kg. (load)	IS-14885/ IS 2530
5	Thermal stability (Oxidation Induction time)	Minute	>20 @ 200°C	Annex. D of IS-14885 : 2001
6	Volatile Matter Content	(mg/kg)	<350	IS-14885 : 2001/ EN 12099
7	Pigment Dispersion		<3	Annex. E of IS-14885 : 2001
8	Resistance to gas constituents	H	>20 @ 100°C	Clause 5.5 of IS-14885 : 2001
9	Resistance to Slow crack growth	H	165h at 80°C, 0.92 MPa	ISO 13479

The above requirements are also same for the final product

## **9. PIPE SIZE/ DIMENSION AND LENGHT**

### **• Wall Thickness and Length of Pipes**

Sr. No.	Nominal diameter (mm)	Minimum wall thickness (e) (mm)	SDR	OVALITY as per	Packing length in Mtrs / Coil
1	160 mm	9.1	17.6	IS-14885 : 2001	12 Straight Length
2	180 mm	10.3	17.6	IS-14885 : 2001	12 Straight Length
3	200 mm	11.4	17.6	IS-14885 : 2001	12 Straight Length
4	225mm	12.8	17.6	IS-14885 : 2001	12 Straight Length

## **10. METHOD OF MEASUREMENT**

The method of measurement of outside diameter, wall thickness, length, ovality etc. of pipe shall conform to IS 14885:2001 or equivalent code/standards.

## **11. TOLERANCE**

### **11.1. Tolerances for Random Length of Pipes Tolerances for Random Length of Pipes**

- Tolerances for each rolled pipes – 0 / +0.5m
- Tolerances for each straight pipes – 0 / +0.5m

### **11.2. Tolerances on Nominal wall thickness at any points of pipe shall be in accordance with IS 144885:2001 or equivalent codes/ standards**



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12. The Pipe shall be of ORANGE color, when the pipe shall be manufactured from PE-100 grade of raw material.

### **13. MARKING**

13.1. The pipes shall be supplied with “VGL” mark

- All pipes shall be permanently and legibly marked along their length with a legend, which shall be impressed to a depth of not more than 0.15 mm.
- Marking details shall be formed in such a way that marking does not initiate cracks or other type of failure and in such a way that with normal storage weathering and processing and permissible method of installation use legibility shall be maintained for the pipe.

13.2. The embossing for orange pipe shall have black base. Height of character shall be uniform and at least as given below:

- 3mm for pipe not greater than 90mm nominal size.
- 5mm for pipe greater than 90mm nominal size.

13.3. Legend shall be repeated at intervals of 1 m and shall consist of following Information:

“Vadodara Gas Ltd. Manufacturer’s Name PE 100 DN-X-(W.T.) MM- SDR-GAS  
IS:14885:2001 ISI CM/L- Batch or Coil no.-Sequential Meter Marking “

Legend:

DN - Nominal Diameter

W.T. - Wall Thickness

SDR - Standard Dimensions Ratio

### **14. INSPECTION AND TEST PROCEDURE**

The entire production lot will have to be tested by third party agency suggested by contractor with prior permission of VGL, at the bidder’s cost and risk. The testing certificate shall have to be obtained by the supplier & sent along with every consignment without fail. The supplier shall have to provide all testing facilities to the inspecting agency at free of cost. If such testing facility is not available in that case inspecting agency will send it to other laboratory for testing and the charge of the same shall be borne by supplier.

### **15. FINISH / DEFECT LIABILITY**

The internal and external surfaces of the pipes shall generally be smooth, clean and free from cavities and other surface defects, which may affect pipe performance. The pipe ends shall be cut cleanly and square to the axis of the pipe and shall be within the tolerances of ends. Defect liability period shall be 24 months from last date of delivery of pipes at site.



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### **16. SUPPLY, PACKAGING, HANDLING TRANSPORTATION AND STORAGE OF PE-100 PIPES**

Packaging shall be done in Hessian cloth (Jute) with polyethylene sheet wrapped around the pipe of 100 micron to avoid direct sunlight and facilitate out-door storage and both ends of pipe shall be protected with proper end caps. Packing size to be mentioned to ensure uniformity in delivery conditions of the pipe being procured. Bidder shall submit the packaging details during offer and also complied with at the time of delivery. Manufacturer shall make an arrangement for unloading of pipes at VGL Gajrawadi Store.