



# **BHAGYANAGAR GAS LIMITED**

(A JOINT VENTURE OF HPCL & GAIL)

**CITY GAS DISTRIBUTION PROJECT AT  
HYDERABAD, VIJAYAWADA & KAKINADA**

## **BID DOCUMENT FOR**

**Supply of MDPE Pipes**

**UNDER DOMESTIC  
COMPETITIVE BIDDING**

***Bid Document No.: MEC/23R8/01/51/S2/PE/00/0011***

**VOLUME - II OF II**



**PREPARED AND ISSUED BY  
MECON LIMITED**

(A Govt. of India Undertaking)

Bengaluru, India

**July, 2016**



Bhagyanagar Gas Ltd.

BHAGYANAGAR  
GAS LIMITED

## **Bhagyanagar Gas Limited**

CITY GAS DISTRIBUTION PROJECT AT HYDERABAD, VIJAYAWADA & KAKINADA

### **Supply of MDPE Pipelines for CGD network**

(VOLUME - II)

**Bid Document No.: MEC/23R8/01/51/S2/PE/00/0011**



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## **VOLUME - II OF II**

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- Section-I : Material Requisition
- Section-II : Technical Specification



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## **SECTION - I**

# **MATERIAL REQUISITION**



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**Material Requisition**

Project : Procurement of PE Pipes for City Gas Distribution project at Hyderabad, Vijayawada and Kakinada  
Client : M/s Bhagyanagar Gas Limited  
Items : PE PIPES  
Tender No. : **MEC/23R8/01/51/S2/PE/00/0011**

**PE Pipes**

S. No	Description	Quantity in Meter		
		HYDERABAD	VIJAYAWADA	KAKINADA
1	125mm OD x SDR 11 PE 100 PLYETHYLENE PIPES	12000	-	-
2	90 mm OD x SDR 11 PE 100 PLYETHYLENE PIPES	3700	3000	3200
3	63 mm OD x SDR 11 PE 100 PLYETHYLENE PIPES	7500	7000	6500
4	32 mm OD x SDR 11 PE 100 PLYETHYLENE PIPES	25000	16000	16000
5	20 mm OD x SDR 11 PE 100 PLYETHYLENE PIPES	-	3500	3500



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# **SECTION - II**

## **TECHNICAL SPECIFICATION**

### **CONTENTS:**

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- Part - B : Polyethylene Pipes Technical Data Sheet**
- Part - C : Quality Control of Pipes**
- Part - D : Supplementary Procedure for MDPE Pipes**



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## Part - A : General Requirements

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## 1.0 SCOPE

This specification defines the requirements which must be met by polyethylene (PE) pipes used to construct underground networks for natural gas distribution.

Testing of the pipes is carried out in accordance with the procedures described in document Part - C: **“Polyethylene pipes for underground networks for natural gas distribution - Quality control of pipes”**.

## 2.0 Reference Standards & Specifications:

<b>ISO 760: 1978</b>	Determination of water - Karl Fisher method (General method) Buried polyethylene (PE) pipes for the supply of gaseous fuels- Metric series-Specifications.
<b>ISO6259-3: 1997</b>	Plastic pipes- Measurement of dimensions.
<b>EN728:1997</b>	Plastics piping and ducting systems - Plastics pipes and fillings - Method for exposure to direct (natural) weathering.
<b>prEN 1555-1: 2001</b>	Plastics piping systems for the supply of gaseous fuels- Polyethylene (PE)-Part 1: General.
<b>prEN 1555-2: 2001</b>	Plastics piping systems for the supply of gaseous fuels - Polyethylene (PE) - Part 2: Pipes.
<b>ISO 4440-1: 1994</b>	Thermoplastics pipes and fittings - Determination of melt mass-flow rate - Part 1: Test method.
<b>ISO 4437 -1997</b>	Buried Polyethylene (PE) Pipes for supply of gaseous fuels specifications.
<b>IS 14885</b>	Specifications for Polyethylene Pipes for Supply of Gaseous Fuels.
<b>Part - D</b>	Acceptance procedure for MDPE Pipes

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### 3.0 DEFINITIONS:

#### 3.1 BATCH OF COMPOUND

By batch of compound is meant a homogeneous quantity of PE compound of the same origin and of a particular brand.

The batch must be registered under a single identification number (batch number) which leaves no doubt as to the origin, identity and date of manufacture of the compound.

#### 3.2 BATCH OF PIPES

By batch of pipes is meant a homogenous lot of pipes with identical dimensions, made in a continuous process by the same extrusion machine and from the same batch of compound.

#### 3.3. MINIMUM REQUIRED STRENGTH (MRS 10)

Standardized class of compounds for which the Lower Confidence Limit (LCL) is equal to 10.

#### 3.4 Nominal out Side Diameter (dn) –

The Specified nominal outside diameter of Pipe.

#### 3.5 Mean Outside Diameter (do) –

Average Value corresponding to the circumference of any pipe divided by ( $\pi = 3.1416$ ) for the number of measurements rounded up to the next greater 0.1mm.



#### 3.6 Out of Rounded (Ovality) –

The Roundness is the difference between the measured maximum outside diameter and measured minimum diameter in the same cross- section of pipe.

#### 3.7 Nominal wall thickness (en) –

The numerical designated wall thickness of the pipe which is convenient round number approximately equal to the manufacturing dimension in mm.



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### 3.8 Minimum walls Thickness (emin) –

The minimum value of the mean wall thickness as specified for a given nominal wall thickness.

### 3.9 Mean Wall thickness (em) -

The arithmetic mean of a number of measurements regularly spaced around the circumference of the pipe in the same cross section of pipe, including the absolute measured minimum and measured maximum value of the wall thickness.

### 3.10 PE 100

Standard designation for PE compounds 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°C, a period of 50 years and a reliability of 97.5 % — must be at least 10 MPa.

### 3.11 Lower Confidence Limit (LCL)

A quantity with the dimensions of stress, in Megapascal, which can be considered as a property of the material under consideration and represents the 97.5% lower confidence limit of the predicted long-term hydrostatic strength at a temperature of 20°C for 50 years with internal water pressure.

### 3.12 Standard Dimensions Ratio (SDR)

SDR is the quotient of the nominal outside diameter and the nominal wall thickness (expressed rounded to one decimal).



$$\text{SDR} = \text{de/en}$$

de = nominal diameter of pipe

en= nominal thickness of pipe in mm

### 3.13 Overall Service (Design) 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.

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### 3.14 Maximum Allowable Operating Pressure (MAOP)

The highest effective pressure of the gas in the pipeline system expressed in bar, which is allowed in Continuous use. It takes into account the physical and the mechanical characteristics of the components of the piping system.'

It is given by the equation: **MAOP = (20 X MRS) / (C X (SDR – 1))**

## 4.0 MATERIAL SPECIFICATION

The PE compounds that are acceptable shall conform to the requirements for PE 100 described in prEN1555-1.

The polyethylene compound used in the manufacturing of pipes shall be cadmium free pigmented compound. It shall be free from visible water compound.

In order to be approved, materials shall conform with the MECON technical specification Part - D: "Polyethylene compounds for manufacture of pipes and fittings for underground networks for natural gas distribution - Acceptance procedure."

Approved materials are listed in Appendix 1. Characteristics of PE Compound are given in Appendix 2. Following are forbidden:

- a. use of recycled materials;
- b. mixture of different materials;
- c. addition of complementary materials by the pipe manufacturer.

## 5.0 CHARACTERISTICS

### 5.1. RAW MATERIAL

All the characteristics of the PE Compound are in accordance with the provisions of prEN 1555-1 or IS 14855 for PE 100 materials and for the limit values listed in the table in Appendix 2.

### 5.2. PIPES

#### 5.2.1. Physical characteristics



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**5.2.1.1. Appearance of pipes**

The pipes must be square cut with smooth trimmed ends.

The internal and external surfaces of the pipes, examined visually without magnification, are uniform and smooth.

The pipes are free of scratches, pits, voids, blisters, occlusions or cracks.

**5.2.1.2. Colour**

The pipes shall be yellow.

**5.2.1.3. Density**

Density is measured in Kg/m<sup>3</sup> as per ISO -1183. The measured value must correspond to the data listed in the table in Appendix 2, allowing for possible differences caused by measuring on the pipe instead of granulate.

**5.2.1.4. Melt mass-flow rate (MFR)**

The melt mass-flow rate MFR (190°C - 5 kg), measured on a sample taken from the pipe in accordance with ISO 4440-1 or IS 14885., is within the limits stated in the table in Appendix 2: characteristics of PE Compound.

In addition, the discrepancy in absolute value between the MFR measured on a pipe sample and that measured on a sample of raw material may not exceed 20% of the latter.

**5.2.1.5. Volatile content**

The volatile content, measured on a pipe sample in accordance with ISO 4437 or IS 14885., may not exceed 350 mg/kg.

**5.2.1.6. Water content**

The water content may be estimated by measuring the volatile content.

If the volatile content, measured in accordance with ISO 4437., is more than 250 mg/kg, the water content must be ascertained.

The water content, measured in accordance with ISO -760., must be 250 mg/kg or less.



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**5.2.1.7. Thermal stability (OIT)**

Thermal stability is measured in accordance with D of IS 14885 on samples taken from the wall at random.

The minimum oxidation induction time at 210°C is 20 minutes. The maximum admissible decrease in the oxidation induction time measured on a pipe sample compared to that measured on the raw material, may not exceed 20% of the latter.

**5.2.1.8. Resistance to atmospheric influence**

Resistance to atmospheric influence is tested in accordance with EN 1056.

The exposure dose corresponds to a total energy of at least 3.5 GJ/m<sup>2</sup>.

**5.2.2. Mechanical characteristics -**

**5.2.2.1. Internal stresses**

Internal stresses are measured in accordance with ISO 2505. The variation in length between the reference points must be 3% or less. The test temp. is 110°C.

**5.2.2.2. Resistance to internal hydraulic pressure**

The tests are carried out in accordance with IS 1167. The test specimens taken from a batch of pipes show no leakage in the conditions of temperature, wall stress and test length stated in the tables in Appendix 2: resistance to internal hydraulic pressure.

If, for a given material, during the test at 80°C - 165 hrs with the highest wall stress  $\sigma$ , fracture occurs before the specified time and is ductile in nature, the tests are repeated with a minimum time of 1,000 hrs and the corresponding wall stress level as specified in Appendix 2.

The test pressure is calculated using the following formula based on the nominal diameter and thickness.

$$P = 10 \cdot \frac{2 \cdot \sigma \cdot t}{d - 2t}$$



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Where,

- = Pipe Wall stress in MPa.
- de= nominal diameter of pipe.
- en= nominal thickness of pipe.
- P= test pressure in bar.

The test must be repeated if the pressure and /or temperature fall below the lower limit.

**5.2.2.3. Resistance to slow cracking (Notch test)**

The test is carried out on pipes with a nominal diameter  $\geq 90$  using the test method stated in EN ISO 13479. No fracture will occur on the samples for test periods of less than 500 hrs at  $80^{\circ}\text{C}$  on a notched pipe with wall stress at 4.6MPa.

**5.2.2.4. Resistance to growth of cleavage fractures**

Pipes with a diameter  $\geq 90$  are tested in accordance with the test described at ISO 13477. The critical pressure at  $0^{\circ}\text{C}$  is at least 3 bar and knife speed will be 20m/s.



**5.2.2.5. Stress at yield point and elongation to fracture**

The test is carried out in accordance with ISO 6529-3 for thickness of less than 12mm, the test specimen shall be cut using a hollow punch. The traction speed should not be more than 100mm/min.

The minimum stress at the yield point is defined in the table “Characteristics of PE Compound” (Appendix 2).

**5.2.3 Dimensional characteristics**

All dimensions except for length are measured at  $23^{\circ}\text{C}$  using method stated In ISO 3126.

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### 5.2.3.1. Series

The pipes belong to the series of SDR 11 in the table as below:

Nominal Diameter (de)	Thickness en (mm)
	SDR 11
20	3.0
32	3.0
63	5.8
90	8.2
125	11.4

### 5.2.3.2. Length

The length of the pipes is specified in the order. The preferred lengths are defined in Part - B.

The tolerances for straight pipes are: - 0 / + 0.05 m

The tolerances for rolled pipes are: - 0 / + 0.50 m

### 5.2.3.3. Mean external diameter Dm

The extreme mean external diameters are stated in ISO 4437.

### 5.2.3.4. External diameter D - ovalisation

The maximum deviation permitted in relation to nominal diameter de is given ISO 4437.

In the event of dispute regarding the dimensions of rolled pipes, the dimensions shall be reviewed 24 hours after the pipe has been unrolled.

### 5.2.3.5. Thickness

The thicknesses are given in table A and have been taken from ISO 4437.

### 5.2.4 Reversion Test

When tested as stated in IS 14885, the value of longitudinal reversion shall not be greater than 3%.



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#### 5.2.5 Tensile Test

When tested in accordance with IS 14885 at  $23\pm 1^{\circ}\text{C}$  at a speed of 100 mm/min  $\pm 10\%$  for specimen thickness below 5 mm and at a speed of 25 mm/min for thickness above 5mm, the value obtained shall be as follows:

Tensile yield strength 15 MPa, Min  
Elongation at Break 350 %, Min

#### 5.2.6 Squeeze off

On all sizes of pipe up to and including 400 mm diameter, strength after squeeze-off and subsequent re rounding, must be demonstrated by testing as per IS 14885.

#### 5.2.7 Pigment Dispersion

### 6.0 MARKING

The marking is repeated at least once per metre. This marking is done on two diametrically opposite generating lines. The empty space between two technical data is filled by alternate repetition of the word "GAS". Marking must be indelible and visible in colour.

The stamping must not affect the quality of the pipe.

The minimum height of the characters must be:

- 3 mm for nominal diameters  $\leq 63$
- 5 mm for nominal diameters  $\geq 110$ .

The depth of the marking must be  $\leq 0.1$  mm in the case of pipes with a nominal diameter  $\leq 110$  and  $\leq 0.2$  mm in the case of pipes with larger diameters.

Marking of the pipes shall include, in the following order, on each generating line:

- The word "GAS";
- Nominal diameter and the thickness of the wall;
- SDR series;
- Date of manufacture (year, month, day);



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- Manufacturer's identity;
- The words BHAGYANAGAR GAS LIMITED;
- The alphanumeric coding PE 100
- The name or style of the manufacturer.

Any other marking, either in terms of the application technique or the data specified, must be submitted to the Company for approval in advance.

## 7.0 PACKAGING AND STORAGE

### 7.1. GENERAL

The manufacturer shall take all necessary action to prevent the pipes from deteriorating during storage, loading and transport.

The pipes may be supplied in straight lengths or in rolls. Straight lengths are normally placed in crates.

The pipes are fitted with sealing devices at both ends, of a model approved by the Company.

### 7.2. LENGTHS

The preferred pipe lengths are given in table C below.

**TABLE C**

Nominal diameter de	Preferred Length in meters		
	Reels		Straight pipes
20	100		-
32	100		-
63	100		-
90	50		
125	50		

The lengths to be supplied are specified in the order.

#### 7.3.1. Packaging of straight pipes

The wooden framework is banded using galvanized steel hoops. The tension of the hoops is such that the pieces of wood forming the framework are in





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contact with one another and the overlap of the crosspieces on the uprights is 2/3 the thickness of the latter.

### **7.3.2 Packaging of rolled pipes**

Each roll includes an adequate number of hoops made from cords or bands of synthetic material, evenly distributed around the whole circumference of the bundle. In each case there must be a hoop less than 0.3 m from each end of the pipes.

The packaging must on no account adulterate the pipe.

### **7.4 HANDLING AND STORAGE**

Immediately after production, pipes shall be handled with great care from the production line to the storage place, in order to avoid any damage such as scratches, notches, superficial wear and tear, holes, dented walls or similar.

If handled by fork lift or similar equipment, the metallic forks shall be covered with a soft material in order to avoid any damage to the pipes.

The extremities of the pipes shall not be in contact with the floor while handling.

Indoor storage is preferred.

Outdoor storage is permitted at the following conditions:

- Storage periods are not exceeding one month
- Pipes are protected from direct sunlight by a suitable shelter
- Pipes are stored on a hard storage surface clean from excessive dust,
- Pipes are not in contact with the soil, but are supported by soft material such a wood etc.

### **7.5 SEALS:**

Prior to execution of the order, the manufacturer must submit to the Company the seals which it intends to use for all the types of pipes ordered.

The seals shall preferably be made of PE or a material which does not adulterate polyethylene. Metal and PVC seals are not permitted. The seals must be able to withstand storage times as guaranteed in § 8.6. of this specification, and also to withstand handling during installation.



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They must not be brittle or sharp and the materials, shapes and dimensions thereof must be such that they cannot fully penetrate inside the pipes.

They are of the internal plug type for all pipes supplied in straight lengths, and for pipes rolled in coils or on reels, the seals may be caps.

All seals are fitted with a valve to prevent pressurization or depressurizations of the pipes, depending on climatologically temperature cycles.

In theory, they are placed on the pipes immediately after completion of the manufacturing tests, but before storage of the pipes. In the event of acceptance, the pipe plugs are removed and replaced by the supplier.

The seals cannot be recycled after the pipes have been installed. Their removal on site should not require the use of special tools.

#### 7.6 STORAGE WARRANTY

It must be possible to store the pipes in the open air, protected from direct sunlight, without taking any other special precautions for at least two years from the date of manufacture stated on the pipe.

The storage warranty covers continued conformity of the dimensions, characteristics and performances laid down in this specification.



#### 8.0 PRODUCT TYPE-APPROVAL

For the purpose of type-approval of the product, the manufacturer is obliged to supply a technical file as defined in MECON procedure PART - D.

Type-approval of the products is carried out in accordance with the aforementioned procedure

Any change to the type-approved product, process or manufacturing equipment must be notified to the Company in writing.

Any failure in this respect shall incur withdrawal of type-approval until termination of the contract.

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## ANNEXURE - 1

### Approved materials

As per the MECON standard PART-A the following will be the basic requirement of PE basic material.

1. The base material from which the pipe is produced shall be medium density polyethylene and shall be made by adding only antioxidants, UV stabilisers and pigments which are necessary for the manufacture of pipes and to the end user of pipes.
2. The polyethylene should be mixed with ultraviolet stabiliser and suitable antioxidants to protect the pipe from photo degradations.
3. 100% virgin raw material shall be used for pipe production.
4. The raw material used for pipe manufacturing shall comply the requirement as stated in Annexure 2.
5. The raw material when classified in accordance with ISO 4437-1997 shall be PE 100 with MRS(Minimum Required Strength) of 10MPa.
6. The technical details of the pipe manufacturing and Raw material shall be made available in advance and subsequently get approved by MECON.



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**ANNEXURE – 2**

**Characteristics of MDPE material**

<b>Sr No</b>	<b>Characteristics</b>	<b>Units</b>	<b>Requirement</b>	<b>Test Parameters</b>	<b>Test Method</b>
1	Conventional Density	Kg/m <sup>3</sup>	>930	23°c	IS 7328
2	Melt Flow rate	g/10min	0.68 – 1.0	190°c	IS 2530
3	Volatile Content	Mg/Kg	<350	105°c	IS 4437
4	Thermal Stability	Minute	>20	200°c	IS 14885
5	Water Content	Mg/kg	<300	105°c	
6	Resistant to Gas Constituents	H	>=20	80°c	



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CITY GAS DISTRIBUTION PROJECT AT HYDERABAD, VIJAYAWADA & KAKINADA

### **Supply of MDPE Pipelines for CGD network**

(VOLUME - II)

**Bid Document No.: MEC/23R8/01/51/S2/PE/00/0011**



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## **Part - B: Polyethylene Pipes Technical Data Sheet**

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## 1.0 REFERENCE

- PART - A** : Polyethylene pipes for underground networks for Natural Gas Distribution - General requirements.
- PART - C** : Polyethylene pipes for underground networks for natural gas distribution -Quality control of pipes.
- PART - D** : Supplementary procedure for type-approval of polyethylene pipes for underground networks for natural gas distribution.
- IS 14885** : Polyethylene Pipes for the Supply of Gaseous Fuels-Specification

## 2.0 Working Condition

- a. Maximum Operating Pressure : 7 bar
- b. Working Medium : Dry Natural gas
- c. Maximum Working temperature : 47°C

## 3.0 Weldability:

- 3.1 The pipes are used for assembly by electro fusion fitting or butt welding and so should possess good weldiability.
- 3.2 The manufacturer has to prove weldiability of the pipes to MECON's representative and indicate specific electro fusion conditions to be complied with for such components.
- 3.3 Fusion of two network components having been made from different compounds may lead to difficulties and hence the manufacturer has to ensure that the properties of each batch of raw material are identical.

## 4.0 Production of pipe:

- 4.1 Entire production of pipe shall be carried out in presence of BGL / MECON representative.
- 4.2 The bags of raw material should be certified/approved by BGL / MECON representative.



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- 4.3 The tolerance of length of coil shall be +/-100mm.  
4.4 The pipes shall be supplied in coils/straight length as per the table:

Sr No	Outside Diameter in mm	Length of pipe in Coil in meters	Length of pipe in Straight length in mtrs	Minimum inner diameter of coil
1	20	100	-----	0.5
2	32	100	-----	0.8
3	63	100	-----	1.6
4	90	50	-----	2.3
5	125	50	-----	2.7



**5.0 Sampling**

- 5.1 All the in a single consignment , of the same size , same length and manufactured essentially from same batch of raw material and under similar condition of manufacture shall be considered as a lot.  
5.2 The scale of sampling for raw material shall be as per table,

Characteristics	No of sample from lot
Conventional Density	1
Melt flow rate	1
Thermal stability	1
Volatile / Moisture Content	2

- 5.3 Scale of sampling for finished pipe is as per table,

Characteristics	No of sample from lot
L.T.H.S.Test	2 to5
I.B.T.Test	2 to 5
Squeeze Test	1 to 3
Notch test	1 to 3
Tensile Test	1 to 3
Weldiability	1 to 3
Conventional Density	1 to 3
Melt Flow rate	1 to 3



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The quantity of sampling may vary at the time of inspection, depending up on the quantity and duration of product.

## 6.0 Inspection and Testing:

- 6.1 Inspection shall be carried out by BGL / MECON representative or Third Party inspection agency nominated by BGL.
- 6.2 Manufacturer shall submit the copies of test report of following test along with lot.
  - a. All test report for Raw material and Finished Product.
  - b. Certificate from raw material producer, for each batch of raw material procured for manufacture of Pipes.
- 6.3 BGL / MECON's representative shall have right of free entry, at all the times at manufactures workshop/factory.



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## PART -C: Quality Control of Pipes

### 1.0 GENERAL PRINCIPLES

#### 1.1 MANUFACTURER'S RESPONSIBILITY

The manufacturer is totally responsible for the quality of the pipes which he manufactures. Acceptance Test procedures do not absolve him from this responsibility.

In order to ensure that the pipes comply with the specification in every case, tie pipes are tested by the factory control department, which is separate from its production department.

The pipes supplied are guaranteed for one year after commissioning or three years maximum after the date of manufacture.

#### 1.2 QUALITY ASSURANCE

The manufacturer must have a quality assurance system in place as described in standard EN 29001 or EN 29002. The quality manual must be supplied to the Owner/ owner representative Quality Control Department.



The quality assurance system shall be certified by an accredited body.

### 2.0 SPECIMEN SAMPLE OF GRANULATE

The manufacturer shall supply the Owner/ owner representative Quality Control Department with a kilo of granulate from each batch of material used to manufacture the pipes.

The specimen sample is taken in the presence of the Owner/ owner representative Quality Control Department official if testing takes place during manufacture. A suitable container shall be supplied to the manufacturer by Owner.

All necessary precautions shall be taken to prevent contamination and deterioration of the granulate during sampling and during subsequent handling of the sample.

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### 3.0 TESTS

#### 3.1. TESTS CARRIED OUT BY THE MANUFACTURER

##### 3.1.1. General

It is essential to comply with the provisions in the following sections to ensure that the pipes conform to the specification in every case.

All the pipes are individually numbered. This marking is done using an inert product which will not adulterate the quality of the pipes (e.g. lithographic chalk). The pipe number consists of a maximum of three digits. In the case of pipes with a diameter of 90 mm or more, the number is marked on the inside. For rolled pipes and pipes on drums, it is applied on an adjoining label and the marking must not be subject to deterioration. All the test carried out by the manufacturer are as per the MECON standards.

##### 3.1.2. Dimensions

The thickness and average diameter, measured in the conditions defined in the specification, are entered in an inspection document which includes the dates of manufacture and the production team, extruder number, code of the material used, pipe number and, if a pipe is declared invalid, the reason for the rejection.

When the manufacturer carries out continuous measurement of the thickness, the record of the values measured shall include all the details necessary for marking of the pipes.

The, inspection documents and any records shall be supplied to the Owner/owner representative official.

### 3.2 FACTORY ACCEPTANCE

#### 3.2.1. General

Acceptance tests are carried out in the presence of an official from the Owner/owner representative Quality Control Department. All checks and tests are carried out in the conditions laid down in technical specification PART -A.

The results must be in accordance with the provisions specified therein and with the individual specifications of the order. Whenever so requested by the Owner/Owner's representative, the manufacturer must be able to provide him with recent test and calibration reports for the measuring instruments and test installations.



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### **3.3 ACCEPTANCE AND REJECTION**

#### **3.3.1. Appearance, dimensions and marking**

Any failure means that the batch is rejected. It may however be presented again after sorting, with the agreement of the Owner.

#### **3.3.2 Checking of characteristics**

Any result which is not in accordance with the provisions of the specification and the individual specifications of the order shall give rise to a repeat test on at least double the number of samples. If the unfavorable result is confirmed, the batch is definitively rejected. If the unfavorable result is invalidated, the batch is accepted. By way of additional investigation, other analyses or examinations may be carried out by mutual agreement, at the manufacturer's expense.

### **3.4 DISPATCH PREPARATION**

**3.4.1** The Pipe ends shall be cleanly cut, square with axis of pipe and protected against shocks and ingress of foreign bodies by welding appropriate end caps.

**3.4.2** Each coil shall be properly secured with PVC strap/Self Adhesive Tape at regular intervals to avoid unwinding of the coil during transport or storage.



**3.4.3** Each coil shall be wrapped properly first wrap of white PE sheet having thickness more than 30 microns and outer wrap of good quality Hessian cloth so as to prevent the pipe from exposure to sunlight.

**3.4.4** The pipes shall be transported in trucks, the coils being covered properly so as to avoid damage to pipes.

### **4.0 DOCUMENTS**

The Bidder shall submit all the Test Certificates of the Raw material, Factory Approval certificate approved by reputed Inspection agency for MECON approval.

The Bidder shall submit the Quality Assurance Plan approved by Inspection agency along with the test certificates for manufacture of MDPE pipes.

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Following completion of the type approval tests, the Supplier shall compile a data folder which shall include details of all test results and all critical information, i.e., dimensions, materials, source of materials, manufacturing site and manufacturing techniques.

All test results shall be signed by the Supplier and countersigned by Bhagyanagar Gas Ltd / MECON representative.

## 5.0 DESIGN CHANGES

Any proposed changes in design, materials, and source of materials, manufacturing site or manufacturing techniques to approved pipes shall be proposed by the supplier for consideration as variant by Bhagyanagar Gas Ltd / MECON.

The Supplier shall submit details of the changes with a copy of the original signed data and a copy of the new data appropriately signed. Bhagyanagar Gas Ltd / MECON shall require the relevant approval tests to be repeated if performance is considered to be affected. On approval of the variant, the new data shall be countersigned and returned to the Supplier to replace the superseded data in the data folder



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**PART -D: Supplementary Procedure for MDPE Pipes**

**1 PREAMBLE**

The internal and external surfaces of the tubes are examined visually with the naked eye, without magnification and under adequate lighting.

**2. DESCRIPTION OF MAIN APPEARANCE DEFECTS**

**2.1. DEFECTS CAUSED BY HANDLING OR STORAGE**

2.1.1. Incrustation with foreign matter: Pebbles, sand, glass, filings, wood splinters, etc.

2.1.2 Scratches Narrow continuous lesions.

2.1.3 Notches Incisions made by a sharp instrument.

2.1.4 Superficial wear and tear Surface deterioration resulting from friction against foreign matter.

2.1.5 Holes: Holes in the wall caused by forceful insertion of a generally pointed object (e.g.: nails, probes, screws, etc.).

2.1.6 Dented walls Permanent distortion of the wall accidentally caused during handling.

**2.2 MANUFACTURING DEFECTS**



2.2.1. Continuous longitudinal internal lines

Longitudinal marks evenly distributed around the inner circumference of the pipe, caused by fusion of material faces on exit from the extrusion tool. These marks are caused by an incorrect choice of transformation parameters.

2.2.2. Continuous longitudinal lines inside and outside these do not exceed 0.2 mm in depth

- They may be caused by the defective condition of the calibrators or the sealing device for the calibration system, in which case they are isolated instances.

- They may be caused by friction of residual deposits attached to parts of the extrusion tool, the calibrators or the sealing plug of the calibration system. In this case, they are generally randomly. These deposits may consist of waxes, oxidised

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polyethylene or other products which are released during transformation of the material in the extruder or which are present in the cooling water.

### 2.2.3. Incrustation with residual matter generated during extrusion

The deposits defined in 2.2.2. work loose and are crushed in the external wall of the pipes while passing into the calibrator, or adhere to the internal wall of the pipes.

### 2.2.4. Presence of foreign matter in the polyethylene resulting from contamination of the raw material.

This contamination may be caused by all sorts of liquid or solid products (oil, paper, cardboard, plastics, glass, sand, dust, etc.).

### 2.2.5. Excessive water and volatile contents

#### 2.2.5.1 Porosity

Defects generally caused by volatile matter which occur specifically when the water and volatile contents are too high.

The term extrusion defect covers all defects resulting from the complete pipe manufacturing process.

#### 2.2.5.2 Craters (surface spalling)



Shallow or deep conical cavities the cause of which is difficult to establish, generally the result of water and volatile contents being too high.

### 2.2.6 Pitting

Defects in the shape of aligned dots, either in clusters or dispersed, which are often connected with carbon black anomalies.

### 2.2.7 Unfused parts

Molecular polyethylene elements which are totally or partially unfused and located both on the surface and right inside the thickness of the pipe wall.

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### 2.2.8 Cavities

Superficial denting of the external wall, sometimes replicated on the internal wall.

This is the result of distortion caused by a drop of water between the pipe and the calibrator at the intake. The water comes from the calibrator cooling system and is a common phenomenon if the pressure of the calibrator cooling water is too high.

### 2.3. DEFECTS CAUSED BY MARKING

#### 2.3.1 Marking too deep

This is caused by incorrect setting of the stamps or the stamp design.

#### 2.3.2 Dentations caused by the tool holding the marking stamps. These are the result of incorrect settings or wear and tear.

### 3. ASSESSMENT CRITERIA

#### 3.1. CRITICAL DEFECTS

The following defects are critical:

- Continuous longitudinal internal lines
- Presence of foreign matter in the polyethylene resulting from contamination of the raw material
- Porosity

#### 3.2 OTHER DEFECTS

##### 3.2.1 Defects caused by handling or storage

Pipes presenting one of the following defects are classified as defective:

- Incrustation with foreign matter
- Scratches the depth of which is more than 10% of the thickness, with a limit of 0.5 mm.
- Superficial wear and tear where the depth of the marks is more than 10% of the thickness, with a limit of 0.5 mm.
- Notches the depth of which is more than 10% of the thickness, with a limit of 0.50 mm.
- Holes, the depth of which is more than 10% of the thickness, with a limit of 0.50 mm
- Dents in the pipe wall



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**3.2.2 Manufacturing defects**

3.2.2.1 Incrustation with residual matter generated during extrusion, craters, pits, unfused elements sample may present several of the above defects.

- Let p be the depth of the defect and e the nominal thickness of the pipe.
- Case 1 :  $p > 0.1.e$
- Any pipe which includes one of the above defects where the depth is more than 10% of the nominal thickness of the pipe is always considered to be defective.
- Case 2 :  $p \leq 0.1.e$
- For a pipe which contains isolated defects<sup>2</sup>, the depth of which is 10% of the nominal thickness or less, each defect is allocated a grade g depending on its largest dimension a, excluding the depth. The value of g in terms of a is defined in Table 1.

**Table I**

<b>Largest</b>	<b>Grade</b>
Dimension of defects in mm	
$1.0 \leq a < 2.0$	5
$2.0 \leq a < 3.0$	10
$3.0 \leq a < 4.0$	25
$4.0 \leq a < 5.0$	50
$5.0 \leq a < 6.0$	51

Defects, the largest dimension of which is less than 1mm are not taken into account.

A pipe is considered to be defective when it presents a defect, the largest dimension of which is 6.0 mm or more.

A pipe is considered to be defective when the sum of the products of the grades g multiplied by the number of defects n detected along a length of 100 cm exceeds the value L defined in table 2 in terms of the diameter of the pipe.





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**Table 2**

<b>Nominal diameter de</b>	<b><math>L=\sum(n.g)</math></b>
20	20
32	20
62	40
125	40
180	60

3.2.2.2 Continuous longitudinal marks inside and outside, cavities, marking too deep and indentations caused by marking tool.

Pipes presenting the following defects are classified as defective:

- Continuous longitudinal marks on the inside and outside which are 0.20 mm deep or more
- Cavities
- Marking too deep where the depth is more than 0.20 mm.
- Indentations caused by the marking tool where the depth is more than 0.20 mm.