



Soundproof Drainage Piping System

User should check the validity of the Certificate by contacting Member Secretary, BMBA at BMTPC or the Holder of this Certificate.

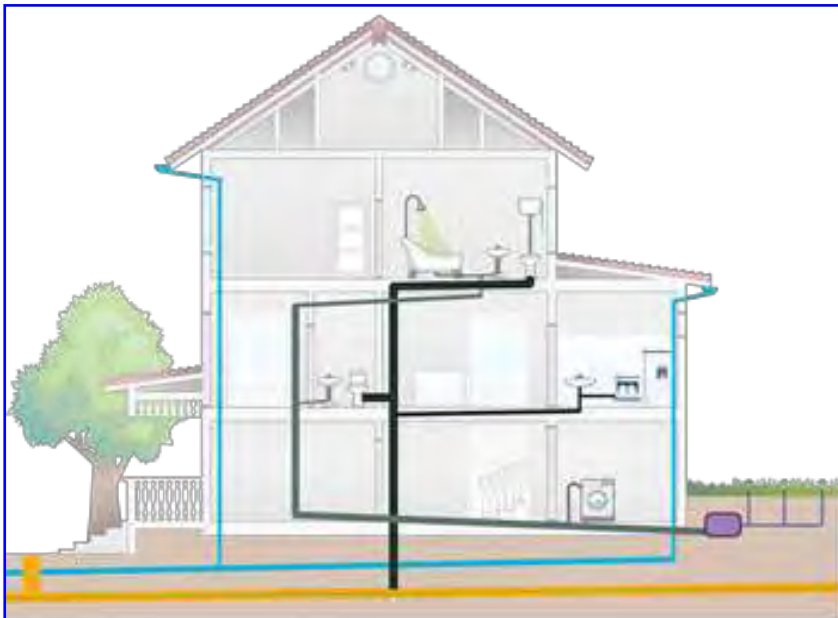
Name and Address of Certificate Holder:
**M/s Huliot Pipes & Fittings
Ltd. 401, Siddharth Complex,
R C Dutt Road, Alkapuri, Next
to Hotel Express
Vadodra – 390007 (Gujarat)**

Performance Appraisal
Certificate No.

PAC No **1024-P/2015**

Issue No. **01**

Date of Issue: **19.11.2015**



bmtpc

Building Materials & Technology Promotion Council
Ministry of Housing & Urban Poverty Alleviation
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PERFORMANCE APPRAISAL CERTIFICATE

FOR

Soundproof Drainage Piping System

ISSUED TO

M/s Huliot Pipes & Fittings Pvt. Ltd.

STATUS OF PAC 1024-P/2015

S. No	Issue No.	Date of Issue	Date of renewal	Amendment		Valid up to (Date)	Remarks	Signature of authorized signatory
				No.	Date			
1.	2.	3.	4.	5.	6.	7.	8.	9.
1	01	19-11-15	19-11-16	--	--	18-11-2016		

PAC No. 1024-P/2015

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1.1 Certificate Holder M/s Huliot Pipes & Fittings Ltd.
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Vadodra -- 390007
Tel: 0265-2330671/73
Email: prasannas@huliot.com

Agency Huliot A. C. S. Ltd.
Kibbutz Sde-Nechemia, Upper-Galilee
1214500, Israel
Tel: 0972-4-6946011
Email: info@huliot.com

1.2 Description of System

1.2.1 *Name of the System* – Soundproof Drainage Piping System

1.2.2 *Brand Name* – Huliot Ultra Silent

1.2.3 *Brief Description* –The top and bottom layers of these soundproof pipes are made of Polypropylene and middle layer made of mineral filled polypropylene compounds (PP-MD). These pipes are suitable for drainage, soil and waste water discharge and low & high temperature. These pipes are having triple layers– external layer of black colour, middle layer of PP-MD compound colour and internal layer of white colour as shown in Fig. 1. The piping system consists of pipes and fittings.

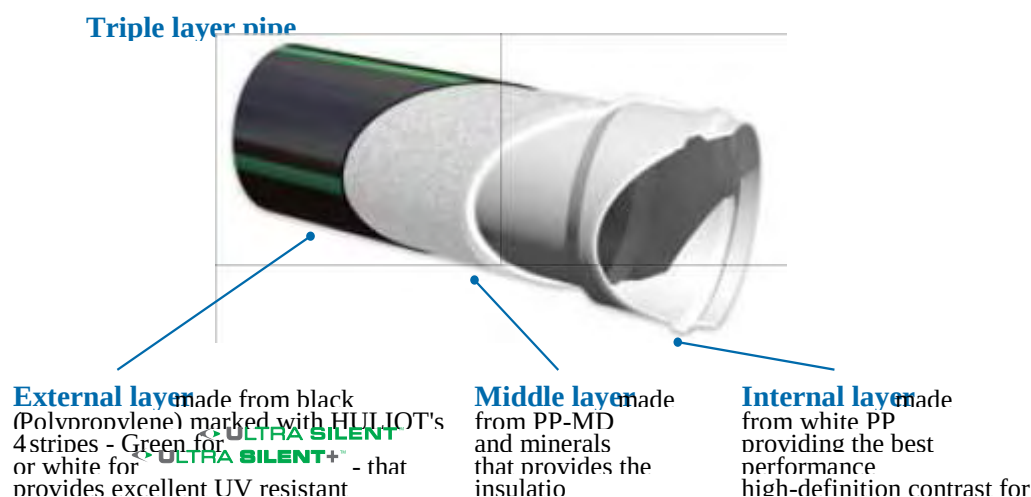


Fig. 1

1.2. Waste water, drainage and sewerage applications

- 1.2.1.  Grey waste water - Collecting water from bathroom sinks, baths and showers and from washing machines. Applicable systems: < ULTRA SILENT™, HT System and < THREADLOCK™.
- 1.2.2.  Waste water - Collecting waste water from toilets and kitchen sinks. Applicable systems: < ULTRA SILENT™ and HT System.
- 1.2.3.  Rain water drainage - Collecting rain water from roofs, gutters, balconies and outdoor surfaces. Applicable systems: < ULTRA SILENT™ and HT System.
- 1.2.4.  Sewerage - Collecting water from building waste water discharge systems to the municipal infrastructure. Applicable systems: < ULTRA SWG™ and KG System.
- 1.2.5.  Grey water recycling system - For garden irrigation systems and for toilet flushing systems. Applicable systems: < CLEARGREY™ and < GREYFLOW™.

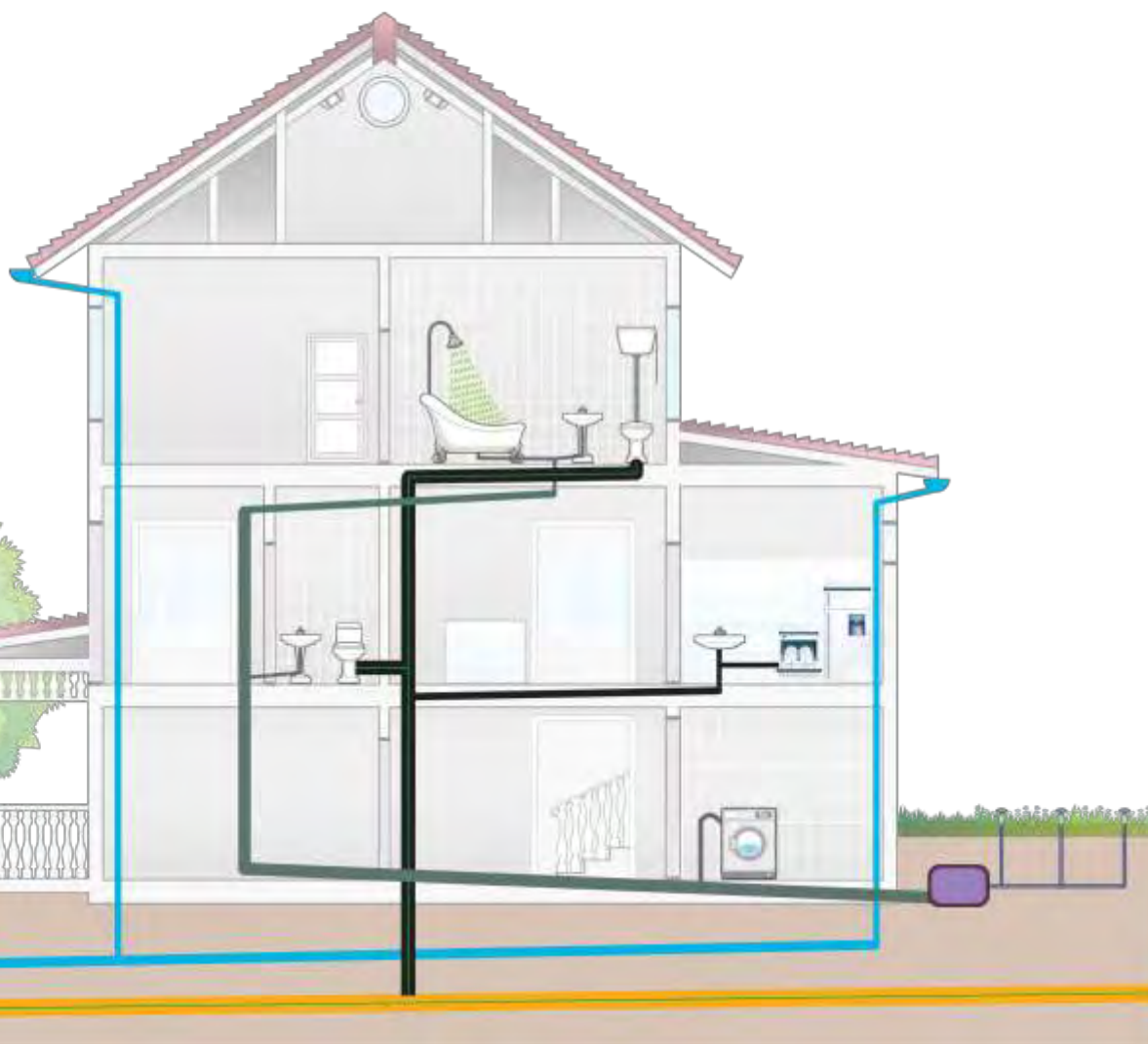


Fig. 2

1.3 Composition of Pipes and Fittings

1.3.1 Materials:

All materials shall comply with RoHS (Restriction of Hazardous Substances) directive and shall be Halogen and Cadmium free. The composition of triple layer pipe is as follows:

1.3.1.1 *External layer* shall be made from black PP (Polypropylene) marked with manufacturer's trade mark and colour stripes – that provides the UV resistant performance.

1.3.1.2 *Middle layer* shall be made from PP-MD (Polypropylene and mineral filled compound) that provides the acoustic insulation.

1.3.1.3 *Internal layer* shall be made from white PP (Polypropylene) that provides the high performance in flow and contrast for visual monitoring.

1.3.2 *Method of Connection:*

All pipes shall be connected by means of push-fit insertion, with single lip high quality seals made of SBR-NR, for guaranteed sealing and leak-proof performance.

1.4 Types and Dimensions of Pipes and Fittings

1.4.1 *Pipes*

These pipes shall be made with one socket and two sockets as shown in the Fig 3 below.



Single and Double Socket Pipes

Fig. 3

Outer diameter DN:

75 mm, 110 mm, 125 mm & 160 mm

Length L:

150 mm, 250 mm, 500 mm, 750 mm, 1000 mm, 1500 mm, 2000 mm & 3000 mm and as per requirement

Socket diameter D:

90 mm, 130 mm, 149 mm & 186 mm

Wall thickness *s*:
 2.2 mm, 3.4 mm, 3.9 mm & 4.9 mm
 Length of socket *t*:
 49 mm, 65 mm, 72 mm & 75 mm.

The detailed dimensions of these pipes are given in Table 1

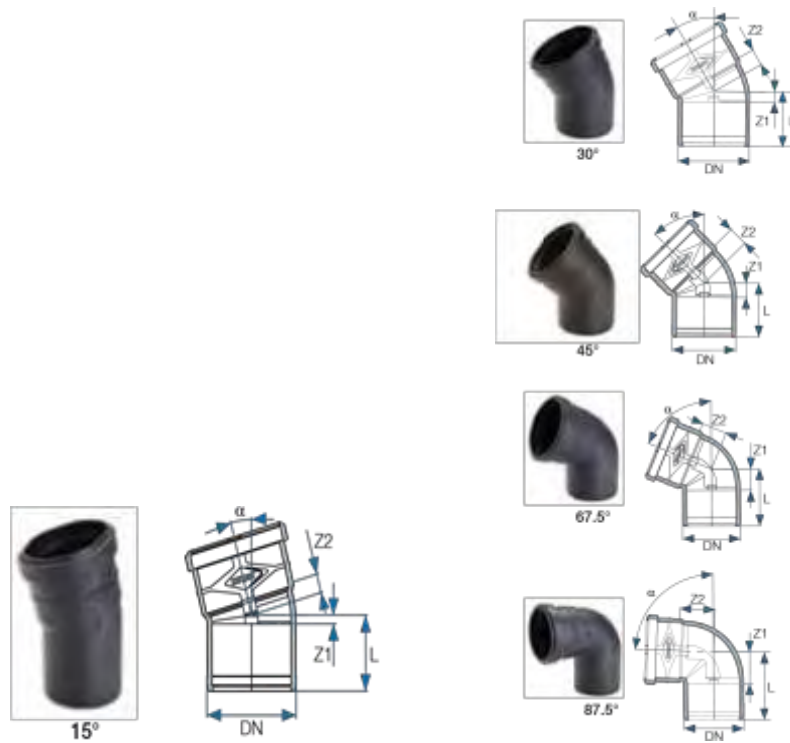
Table 1 (in mm)				
DN	L	D	s	t
75	150	90	2.2	49
75	250	90	2.2	49
75	500	90	2.2	49
75	750	90	2.2	49
75	1000	90	2.2	49
75	1500	90	2.2	49
75	2000	90	2.2	49
75	3000	90	2.2	49
110	150	130	3.4	65
110	250	130	3.4	65
110	500	130	3.4	65
110	750	130	3.4	65
110	1000	130	3.4	65
110	1500	130	3.4	65
110	2000	130	3.4	65
110	3000	130	3.4	65
125	150	149	3.9	72
125	250	149	3.9	72
125	500	149	3.9	72
125	1000	149	3.9	72
125	1500	149	3.9	72
125	2000	149	3.9	72
125	3000	149	3.9	72
160	150	186	4.9	75
160	250	186	4.9	75
160	500	186	4.9	75
160	1000	186	4.9	75
160	1500	186	4.9	75
160	2000	186	4.9	75
160	3000	186	4.9	75

1.4.2 Fittings

All fittings such as bends, branches, sockets, reducers etc. required for laying of these pipes are not manufactured in India at present and are imported from parent company in Israel. Details of these fittings are as under:

1.4.2.1 Bends

i) *Normal bend*: The fixed nominal angle α may be 15°, 30°, 45°, 67.5° & 87.5°. These type of bends are shown in Figs. 4 below. The detailed dimensions of these bends are given in Table 2.



Bends Fig. 4

Table 2

(in mm)

α	$\varnothing/DN$	L	Z1	Z2
15°	90.0	68.0	8.0	16.0
	110.0	78.0	6.0	19.0
	125.0	87.0	12.0	21.9
	160.0	99.0	8.0	22.0
30°	90.0	74.0	14.0	20.5
	110.0	85.0	16.0	25.5
	125.0	104.0	29.0	30.0
	160.0	105.0	27.0	29.0
45°	90.0	81.0	21.0	27.5
	110.0	94.0	25.0	33.5
	125.0	104.0	29.0	38.0
	160.0	116.0	36.0	44.0
67.5°	90.0	94.0	34.0	40.0
	110.0	110.0	44.0	48.0
	125.0	118.0	48.0	52.0
87.5°	90.0	110.0	50.0	56.0
	110.0	129.0	60.0	66.0
	125.0	142.0	67.0	73.0
	160.0	162.0	79.5	81.0

iii) *WC/Double Bend*: The detailed dimensions of WC bend are given in Table 3. This type of bend is shown in Fig. 5 below.

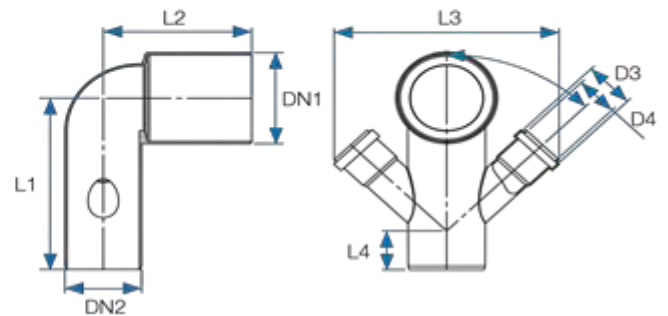
Table 3

(in mm)

Item	DN1	DN2	L1	L2	Z	L3	L4	D3	D4
Ø 110+ Double Ø40/45°	90.0	40.0	225.0	185.0	60.0	250.9	50.9	50.1	41.1
Ø 110+ Double Ø50/45°	110.0	50.0	225.0	185.0	60.0	264.0	50.9	60.1	51.1



ULTRA SILENT™ Double Bend



Double Bend Fig. 5

iv) *Long WC Bend*: The detailed dimensions of long WC bend are given in Table 4. This type of bend is shown in Fig. 6 below.

Table 4 (in mm)				
DN1	DN2	L1	L2	Z
90.0	40.0	225.0	175.0	60.0
110.0	50.0	225.0	185.0	60.0



Long WC Bend

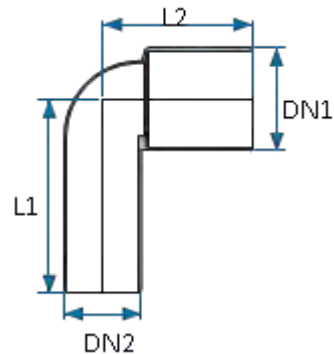
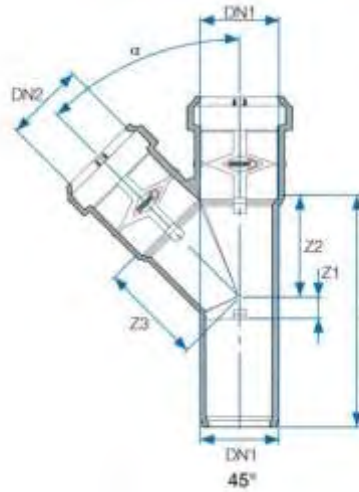


Fig. 6

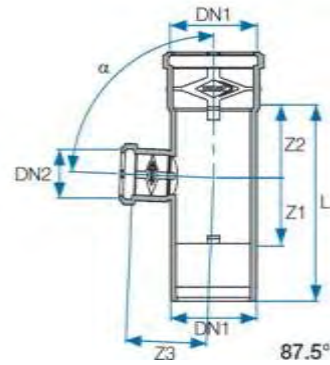
1.4.2.2 Branches

i) *USEA branch*: The fixed nominal angle α may be 45° & 87.5° . The detailed dimensions of these branches are given in Tables 5 & 6. These type of branches are shown in Figs. 7 & 8 below.



Branch 45°

Fig. 7



Branch 87.5°

Fig. 8

Table 5

(in mm)

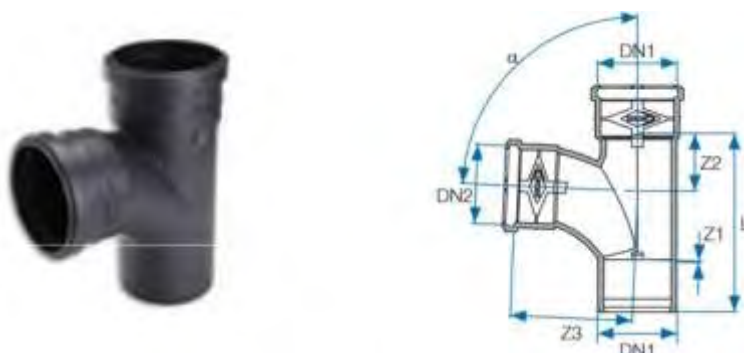
α	DN1	DN2	Z1	Z2	Z3	L
87.5°	90.0	75.0	18.0	95.0	95.0	170.0
	90.0	40.0	33.0	113.0	89.0	206.0
	90.0	50.0	33.0	113.0	89.0	206.0
	90.0	90.0	33.0	113.0	112.5	206.0
	110.0	40.0	25.0	137.0	103.0	231.0
	110.0	50.0	25.0	137.0	103.0	231.0
	110.0	75.0	25.0	137.0	116.0	231.0
	110.0	90.0	25.0	137.0	137.0	231.0
	110.0	110.0	25.0	137.0	137.0	231.0
	125.0	110.0	18.0	145.0	149.0	238.0
	125.0	125.0	31.0	152.0	152.0	258.0
	160.0	110.0	39.0	159.0	169.0	284.0
	160.0	160.0	39.0	194.0	194.0	319.0

Table 6

(in mm)

α	DN1	DN2	Z1	Z2	Z3	L
87.5	90.0	50.0	69.0	76.0	50.0	205.0
	110.0	50.0	77.0	85.0	60.0	231.0
	160.0	160.0	39.0	194.0	279.5	319.0

ii) *Swept branch*: The fixed nominal angle α may be 87.5°. The detailed dimensions of this branch are given in Table 7. This type of branch is shown in Fig. 9 below:

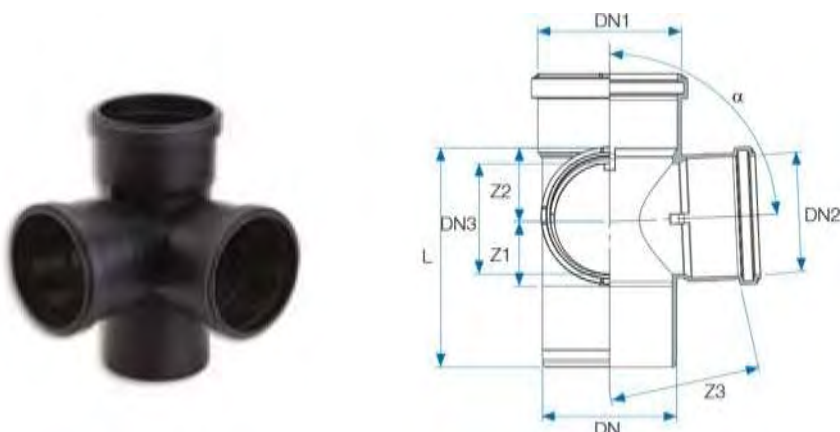


Swept Branch Fig. 9

Table 7 (in mm)

α	DN1	DN2	Z1	Z2	Z3	L
87.5°	90.0	90.0	79.0	66.0	97.0	205.0
	110.0	75.0	82.0	60.0	97.0	211.0
	110.0	90.0	82.0	60.0	97.0	211.0
	110.0	110.0	82.0	60.0	97.0	211.0
	125.0	110.0	100.0	65.0	117.0	240.0
	160.0	110.0	96.0	84.0	117.0	266.0

iii) *Corner branch*: The fixed nominal angle α may be 87.5°. The detailed dimensions of this branch are given in Table 8. This type of branch is shown in Fig. 10 below:

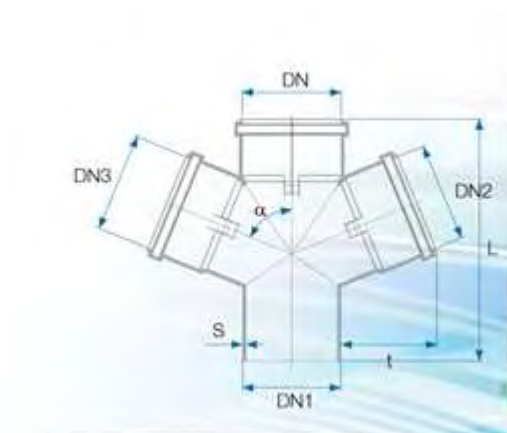


Corner Branch Fig. 10

Table 8 (in mm)

α	DN1	DN2	DN3	Z1	Z2	Z3	L
87.5°	110.0	110.0	110.0	62.0	70.0	69.0	198.0
	125.0	110.0	110.0	62.0	64.0	69.0	202.0

iv) *Double branch*: The fixed nominal angle α may be 67.5° . The detailed dimensions of this branch are given in Table 9. This type of branch is shown in Fig. 11 below:



ULTRA SILENT



Double branch

Fig. 11

Table 9 (in mm)

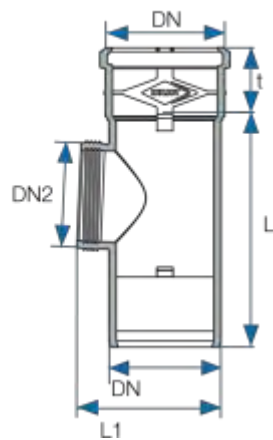
α	DN	DN1	DN2	DN3	t	S	L
67.5°	110.0	110.0	50.0	50.0	68.24	3.6	140.0
	111.0	110.0	110.0	110.0	107.95	3.6	205.0

1.4.2.3 *Inspection pipe*: The detailed dimensions of this pipe are given in Table 10. This type of pipe is shown in Fig. 12 below:

Table 10 (in mm)

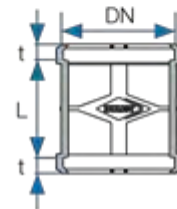
$\emptyset$ /DN	$\emptyset$ /DN2	t	L	L1
90.0	45.0	60.5	202.0	118.0
110.0	97.0	64.0	231.0	142.0
125.0	97.0	73.0	222.0	158.0
160.0	97.0	84.0	236.0	192.0

■ <> **ULTRA SILENT™**



Inspection Pipe Fig. 12

■ <> **ULTRA SILENT™ Sleeve**



Sleeve Fig. 13

1.4.2.4 *Sleeve:* The detailed dimensions of sleeve are given in Table 11. The sleeve is shown in Fig. 13.

Table 11 (in mm)

Ø/DN	t	L
90.0	14.0	85.0
110.0	17.0	97.0
125.0	16.8	118.6
160.0	17.0	131.0

1.4.2.5 *Double Socket:*

i) The detailed dimensions of double socket are given in Table 12. This type of socket is shown in Fig. 14 below:

Table 12 (in mm)

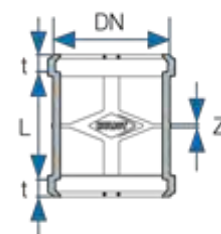
Ø/DN	t	L	Z
90.0	14.0	85.0	1.4
110.0	17.0	97.0	3.3
125.0	16.8	118.6	4.1
160.0	17.0	131.0	4.5



Long Socket Fig. 15



■ < **ULTRA SILENT**



Double Socket Fig. 14

ii) *Long socket*: The detailed dimensions of long socket are given in Table 13. This type of socket is shown in Fig. 15.

Table 13 (in mm)

Ø/DN	t1	t2	L	Z
90.0	13.1	131.0	76.0	13.0
110.0	16.0	141.0	87.0	14.0
125.0	19.1	189.0	91.0	16.0
160.0	23.1	107.0	160.0	20.5

1.4.2.6 Reducer: The detailed dimensions of reducer are given in Table 14. The reducer is shown in Fig. 16 below:

Table 14 (in mm)

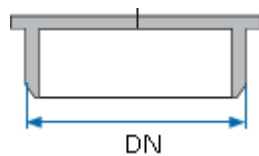
DN1	DN2	L	t	Z
40.0	32.0	48.0	42.0	14.0
50.0	32.0	65.0	42.0	15.0
50.0	40.0	64.0	42.0	15.0
90.0	40.0	93.0	47.0	35.0
75.0	50.0	85.0	47.0	26.0
90.0	50.0	97.0	47.0	34.0
110.0	50.0	118.0	47.0	46.0
110.0	63.0	107.0	52.0	39.0
110.0	75.0	106.0	52.0	34.0
110.0	90.0	101.0	55.0	29.0
125.0	110.0	106.0	64.0	29.0
160.0	110.0	137.0	64.0	84.0
160.0	125.0	140.0	55.0	74.0



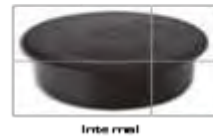
Reducer

Fig. 16

1.4.2.7 End cap: The detailed dimensions of end cap are given in Table 15. This End cap is shown in Fig. 17 below:



◀ **ULTRA SILENT** End Cap



End Cap

Fig. 17

Table 15 (in mm)

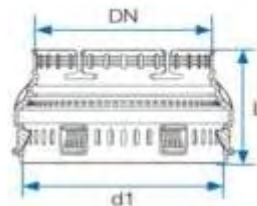
Ø/DN	L
40.0	40.0
50.0	44.0
75.0	51.0
90.0	60.0
110.0	62.0
125.0	75.0
160.0	86.0

1.4.2.8 Seal:

i) *Lockseal:* The detailed dimensions of lockseal are given in Table 16. The lockseal is shown in Fig. 18 below:

Table 16 (in mm)

Ø/DN	d1	L
110.0	130.0	85.0
125.0	147.0	97.0
160.0	179.0	120.0



Lockseal Fig. 18

ii) *Ultraseal*: The detailed dimensions of ultraseal are given in Table 17.

Table 17 (in mm)

Ø	DN1	DN2	L	A	S	L1
110.0	220.0	102.0	340.0	340.0	3	52.0
125.0	239.0	121.0	500.0	500.0	3	52.0
160.0	266.0	149.0	500.0	500.0	3	52.0

1.5 Manufacturing Process and Machinery

1.5.1 Manufacturing Process

The following are the stages of manufacturing process:

Raw material stage: Polypropylene in granular form, mineral filled polypropylene compound, master batch shall be stored in a storage tank. This material shall then be loaded in the hopper.

Extruder stage:

- Extruder --The material from the hopper to the barrel and die hard with proper homogeneous compression at set temperature shall be mixed in the specified ratio
- Size -- The pipe of required size shall be manufactured by changing size of die, bush, mandrel and sizing plates
- Processing -- Processing shall be completed by setting the correct temperature, speed, vacuum and parameter etc.
- Cooling & vacuum tank -- Pipe profile shall be gradually cooled for proper size in water tank
- Traction -- Traction shall be synchronized to the machine extruder so that variations in the dimensions are minimized
- Cutter – Pipes shall be cut to the desired length and at right angle with chamfering
- Socketing – Sockets shall be manufactured on automatic machines as per standard

Quality inspection: Visual inspection and dimensions shall be specifically Checked.

Marking: Marking of batch etc. on the pipes shall be done by proper colour as per specifications laid down

Finished pipes: Pipes shall then be stored on platform and covered by tarpaulin.

Dispatch: Pipes shall be dispatched by truck, as per requirements.

Manufacturing process Flow chart is given in Annex II.

1.5.2 Machinery:

The following machines are used for the manufacture of Soundproof Pipes & fittings:

- i) Single screw Extruder with drive machine having a capacity of 280 kg/hr made by Krauss Maffei, Berstorff
- ii) Traction (Houl off) suitable for 75 mm to 280 mm pipe made by Krauss Maffei, Berstorff
- iii) Cutter suitable for 75 mm to 280 mm pipe made by Krauss Maffei, Berstorff
- iv) Socketing machine with socketing mandrel and heater suitable for 75mm to 160mm pipe made by IPM, Italy
- v) Die bush suitable for pipes of size 75 mm, 110 mm, 125 mm & 160 mm made by Krauss Maffei, Berstorff
- vi) Mandrel (pin) suitable for pipes of size 75 mm, 110 mm, 125 mm & 160 mm made by Krauss Maffei, Berstorff

1.6 Assessments

1.6.1 Scope of Assessment

1.6.1.1 Scope of assessment includes conformance of manufactured pipes to the specified requirements for use as:

- i. Drainage pipes
- ii. Waste water pipes
- iii. Sewerage
- iv. Rain water drainage pipes

1.6.2 Basis of Assessment

Assessment of the suitability of the Soundproof Drainage Piping System is based on:

- i) Inspection of production and testing facilities at site during visit of the IO and taking samples of the product for testing from independent Indian Institute
- ii) Inspection Report of Danish Technological Institute, Denmark for carrying out inspection at the manufacturing site of Huliot, Israel
- iii) Certificate authorizing Huliot A C S Ltd., Israel to use the SKZ – testing and inspection mark for the plastic products – Waste water pipes and fittings, group 1 & 2 Pipes made of polypropylene PP/PP-MD/PP and Fittings made of polypropylene PP-MD within the building structure.
- iv) Specifications for Tests and Inspection of Waste water

Pipes made of PP/PP-MD/PP and fittings Fittings made of polypropylene PP-MD with mineral filling within the building structure by Huliot, Israel by SKZ, Germany

v) Initial type test on a push-fit system “Ultra Silent” pipes made of PP/PP-MD/PP, fittings made of PP-MD, for soil and waste water discharge (low and high temperature) by SKZ, Germany.

vi) Test report for determination of the Acoustic Performance of a Wastewater installation System in the laboratory by M/s Fraunhofer, Germany

vii) Standard EN 1451-1:1998 – Plastics piping systems for soil and waste water discharge (low and high temperature) within the building structure - Polypropylene (PP)

viii) Certificate to comply with the Quality Management System by M/s Huliot for quality control of the system from The Standards Institution of Israel

ix) Certificates to comply with the Occupational Health & Safety Management System and Environmental Management System by M/s Huliot from The Standards Institution of Israel

x) Test report of the tests carried out on a sample of PP Pipe from CIPET, Ahmedabad.

xi) Quality Assurance Scheme followed by the Certificate holder for process control.

1.7 Use of the Soundproof Drainage Piping System

1.7.1 The system shall be used as piping systems for soil and waste water discharge (low and high temperature) within the building structure.

1.7.2 *Scope of Inspection* – Scope of inspection included the verification of production, performance and testing facilities at the factory including competence of technical personnel and status of quality assurance in the factory.

1.7.3 *Manufacturing & test facilities* – Manufacturing and test facilities available in the factory were found to be suitable to manufacture as per the specifications. Testing equipment listed were also verified and found to be in working condition.

1.7.4 *Competence of Technical Personnel* -- Persons involved in training were found to be well conversant with testing procedures required for the quality control of the product.

1.8 Conditions of Certification

1.8.1 *Quality Assurance* – The Certificate Holder shall implement & maintain a quality assurance system in accordance with Scheme of Quality Assurance (SQA) given in the Annex I attached with this Certificate.

1.8.2 *Handling of User Complaints*

1.8.2.1 The Certificate holder shall provide quick redressal to consumer/user complaints proved reasonable & genuine and within the conditions of warranty provided by it to customer/purchaser.

1.8.2.2 The Certificate holder shall implement the procedure included in the SQA. As part of PACS Certification he shall maintain data on such complaints with a view to assess the complaint satisfaction and suitable preventive measures taken.

1.9 **Certification**

1.9.1 On the basis of assessment given in Part III of this Certificate & subject to the conditions of certification, use & limitations set out in this Certificate and if selected, installed & maintained as set out in Part 1 & 2 of this Certificate, the system covered by this Certificate is fit for use as set out in the Scope of Assessment.

PART 2 **CERTIFICATE HOLDER'S TECHNICAL SPECIFICATIONS**

2.1 **General**

2.1.1 The PAC holder shall manufacture the PP pipes and fittings in accordance with the requirements specified in the Catalog and Technical Manual of Soundproof Drainage Piping Systems.

2.2 **Specifications for the System**

2.2.1 *Specification* – Specification for the raw materials and finished product shall be as per performance criteria when tested in accordance with the company standard & relevant Standards listed in this Certificate.

2.2.2 *Raw Materials used for manufacturing PP/PP-MD/PP Pipe and fittings:*
i. PP Copolymer - Shall be as per the manufacturer's specifications
ii PP Compound - Shall be as per the manufacturer's specifications
iii.Desiccant Master Batch -Shall be as per the manufacturer's specifications
iv.PE Master Batch - Shall be as per the manufacturer's specifications

2.2.3 *Density:*
Average density of the base material shall not be less than 0.9 g/cm³ and mineral filled PP compound shall not be less than 1.2 g/cm³

2.2.4 *Melt Mass-flow Rate (MFR):*
The MFR of the base material when tested in accordance with ISO 1133:1997, at test temperature 230°C and loading mass of 2.16 kg shall be less than 3.0 gm/10 min.

2.2.5 *Thermal Stability*
When tested in accordance with EN 728 using a test

temperature of 200°C, the oxidation induction time (OIT) of the material used for pipes and fittings intended for butt fusion shall not be less than 8 min.

2.2.6 *Appearance:*

The internal and external surfaces of pipes and fittings shall be smooth, clean and free from grooving, blistering, impurities and pores and any other surface irregularity.

2.2.7 *Colour:*

The pipes and fittings shall be uniformly coloured throughout the entire thickness. The colours of pipes and fittings shall be preferably grey, black or white.

2.2.8 *Temperature Performance*

2.2.8.1 *Hot water resistance* shall be as follows:

95°C for long term (3000 hours/50 years = 10 min/day)

98°C for short term (2000 hours/50 years = 40 sec/day)

60°C for permanent load (90,000 hours/50 years = 5 hours/day)

2.2.8.2 *Low temperature impact strength* shall be as follows:

-25°C for permanent load assembly

For impact resistance in -20°C conditions for transportation, assembly and short-term storage according to Standard DIN EN ISO 291:2008-08

2.2.9 *Chemical Resistance*

PP piping system are resistant to corrosion by water with a wide range of pH values (pH 2 to pH 12) such as soil and waste water, rain water, surface water and ground water.

2.2.10 *Fire Resistance*

The piping system shall be tested according to Standard EN 13501-1:2009

The piping system shall meet the requirements of Standard EN 4102-2 with fire qualification B2, smoke development category Q1 (low smoke development) and drip formation category TR1 (no drip formation).

2.2.11 *Ring Stiffness*

Ring stiffness of pipes when tested according to ISO 9969:1994 shall be at least 6.0 kN/m².

2.2.12 *Modulus of Elasticity*

Elastic Modulus when tested according to ISO 178:2010 shall be in the range of 2300-3000 MPa.

2.2.13 *Elongation*

Coefficient of elongation when tested shall be 0.09 mm/°K.

For other characteristics of pipes and fittings as applicable, reference may be made of Standard EN 1451-1:1998.

2.3 Transportation and storage

2.3.1 *Loading, Storage and Unloading*

- i) The pipes and fittings in their original sales packaging should be handled carefully to protect them from damage during loading and transportation.
- ii) The pipes shall be loaded and transported in straight and horizontal position with the full length supported (sockets are unencumbered all around) and avoid extreme pressure on the pipes (straps and other heavy materials).
- iii) The pipes shall be unloaded and handled carefully and should be laid in a straight and horizontal position (pay attention to positioning of sockets), on a smooth surface.
- iv) Short pipes (150/250mm) and fittings should be packed in carton boxes. These should be protected from rain & moisture and should be stored in a dry place.

2.3.2 *Storage and Protection*

- i) The pipes and fittings in their original sales packaging should be stored carefully to protect them from damage.
- ii) These pipes are UV protected and can be stored outdoors for up to 3 years. The gasket material can withstand outdoor storage for up to 3 years and must be replaced before installing.
- iii) When using mechanical tools and machines, extra care should be taken to prevent damage to the products.

2.3.3 *Cutting to length and Assembly Preparations*

- i) Pipes are sold in various lengths with one or two sockets and gaskets and with plain ends pre-beveled. If cutting to length is needed, proper cutting tools for plastic pipes only should be used and works according to all safety rules, using proper protective equipment.
- ii) The cut pipe end should be beveled for easier installation (angle of approx. 15° with bevel length of 5mm). Chips, shavings and sawdust should be removed before installing.

2.3.4 *Push-fit connection method*

- i) The position and integrity of the lip seal in the gasket slot should be checked. The seal and the gasket should be cleaned.
- ii) The plain pipe end should be cleaned from saw dust and scraps by applying a thin layer of lubricant around the plain pipe end.
- iii) The plain end should be pushed into the socket while slightly turning until the end of the socket sleeve and then pull the pipe back approx. 10mm. (Figure 19)

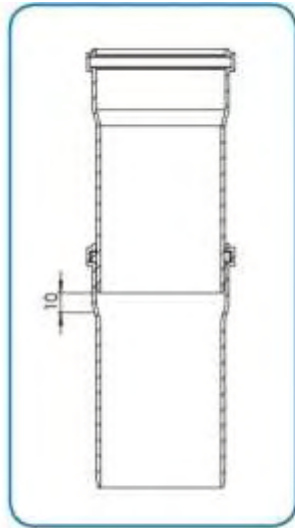


Fig. 19

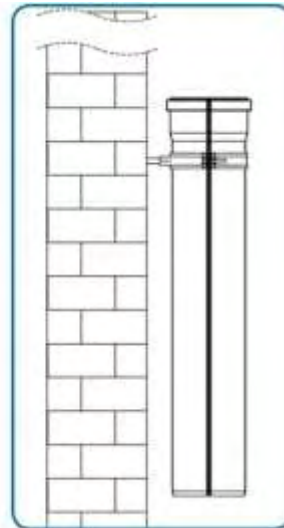


Fig. 20

2.3.5 Mounting with Clamps

- i) For mounting the drainage piping system, steel brackets should be used with rubber inserts approved for acoustic insulation systems.
- ii) Where pipes are installed vertically, every pipe should be fastened with brackets directly under the socket to prevent pipe movement. (Figure 20)
- iii) Maximum distances between the brackets for horizontal and vertical installation should be as given below in Table 18 and Figure 21.

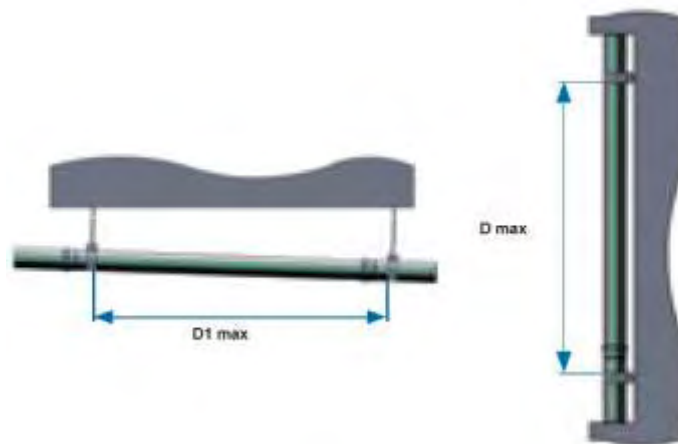


Fig. 21

Table 18

Pipe Ø (mm)	Max. bracket distance for horizontal installation (m)	Max. bracket distance for vertical installation (m)
50	0.80	1.50
75	1.10	2.00
90	1.40	2.00
110	2.00	2.00
125	2.00	2.00
160	2.40	2.00

2.4

Installation

2.4.1

Vertical Installation

- i) For vertical wall mounting, 2 brackets shall be assembled on every floor, taking into account the specified maximum distance between brackets as given in Table 18.
- ii) *Fixed bracket*: The first of the two brackets on each floor should be installed in the lower third of the floor height, just below the pipe or fitting socket, and shall be tightened according to the instructions given in 2.4.1 (iv) below.
- iii) *Sliding bracket*: The second of the two brackets should be mounted in the upper third of the floor height, with the bracket rubber only lightly touching the pipe.

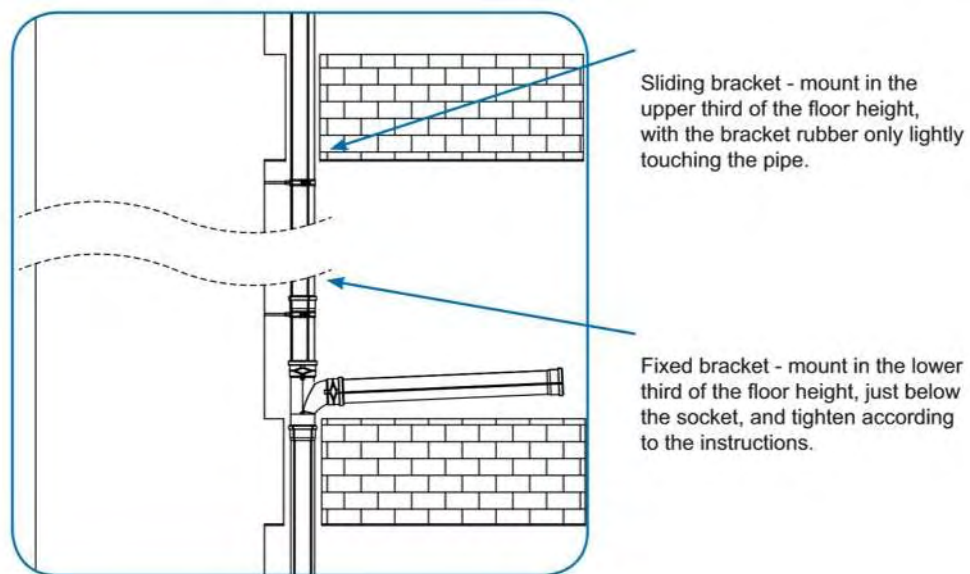


Fig. 22

iv) Bracket tightening: In order to prevent structure-borne noise transmission, only recommended brackets with proper dimensions shall be used and a space of 5 mm shall be left in the bracket aperture when screwing closed as shown in Figs. 23 & 24



Fig. 23

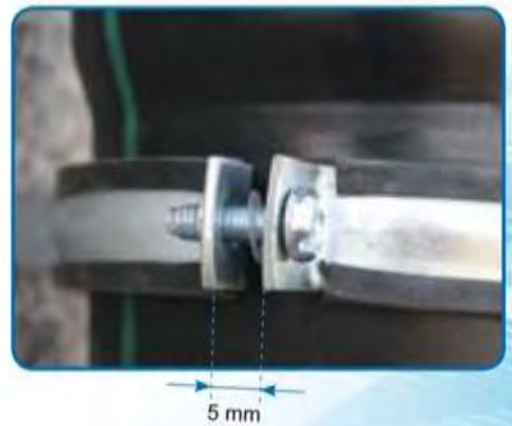


Fig. 24

2.4.2 *Installation of the System through ceilings, floors and walls*

- i) The contact between system components and rigid elements such as walls, ceilings, floors etc. should be avoided in order to prevent structure-borne noise transmission.
- ii) For pipes traversing walls and ceilings, a space of at least 30 mm should be maintained between the pipe and any rigid material.
- iii) If the spaces around the pipes traversing walls and floors are to be filled, only soft construction materials such as foam or glass shall be used as shown in Fig. 25.

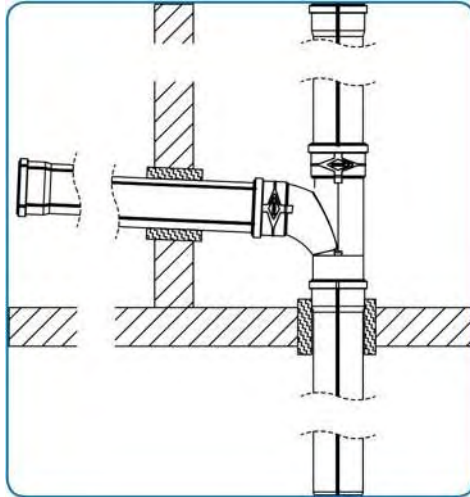


Fig. 25

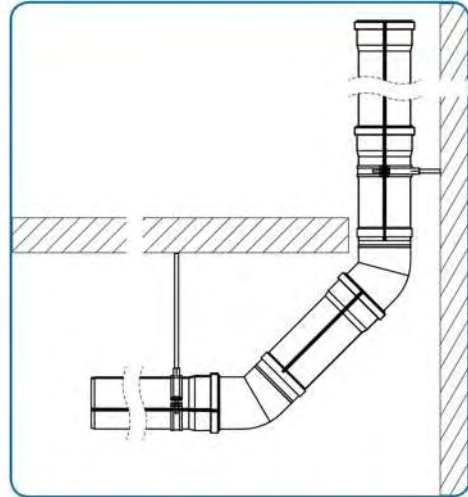


Fig. 26

- iv) For improved hydraulic flow and reduced noise, 87° bends shall not be used for changing flow direction from vertical to horizontal. Instead, two 45° bends with 250 mm minimum length of connecting pipe between them shall be used as shown in Fig. 26.

- v) When installing pipes in open spaces (basements, parking garages etc.), above suspended ceilings or behind screen walls, any contact of other material (suspended ceiling, electrical, water, ventilation and air conditioning systems etc.) with the pipes shall be prevented as shown in Fig. 27.

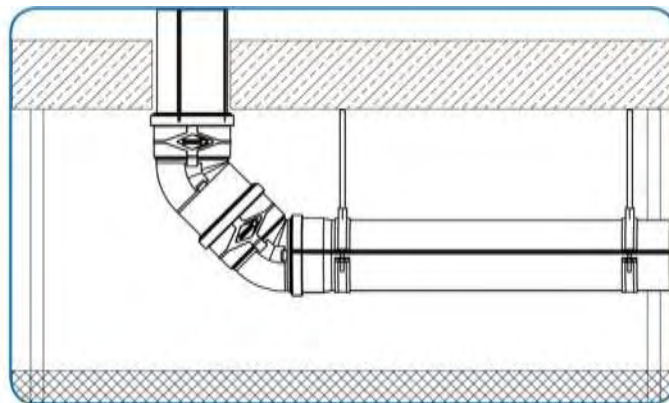


Fig. 27

2.4.3 Repairs and irregular installation

i) To add a branch to an existing pipe with long socket and sleeve, the long socket plain end shall be inserted into the branch socket and equivalent of the socket length from the existing pipe piece shall be cut. The long socket shall be inserted into the upper pipe all the way. The sleeve shall be fixed on the lower pipe and the branch slid and long socket down into the sleeve as shown in Fig. 28. An alternative possibility is to use two sleeves and plain pipe (the minimum plain pipe length must be more than double of the external pipe diameter as shown in Fig. 29).

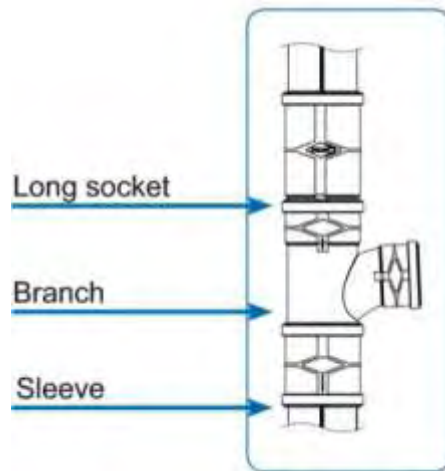


Fig. 28

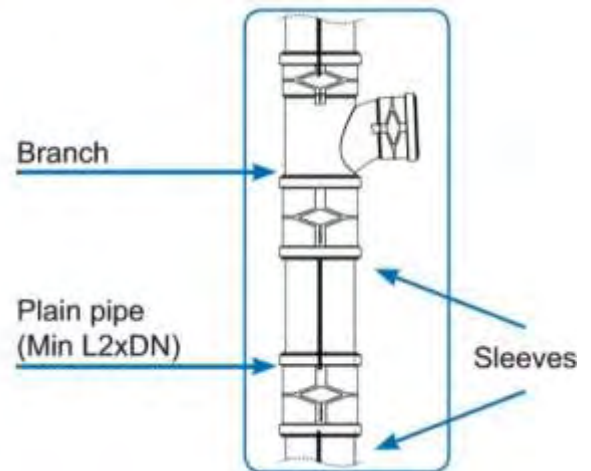


Fig. 29

ii) To fix punctured pipe, same methods shall be applied with one socket pipe instead of the branch and for adding inspection pipe or double branch.

iii) Installing technical bends/siphon, connectors can facilitate connection to various types of siphons or drainage outlets (air conditioning condensation water, washing machine etc.) by replacing only the external gasket as shown in Fig. 30.

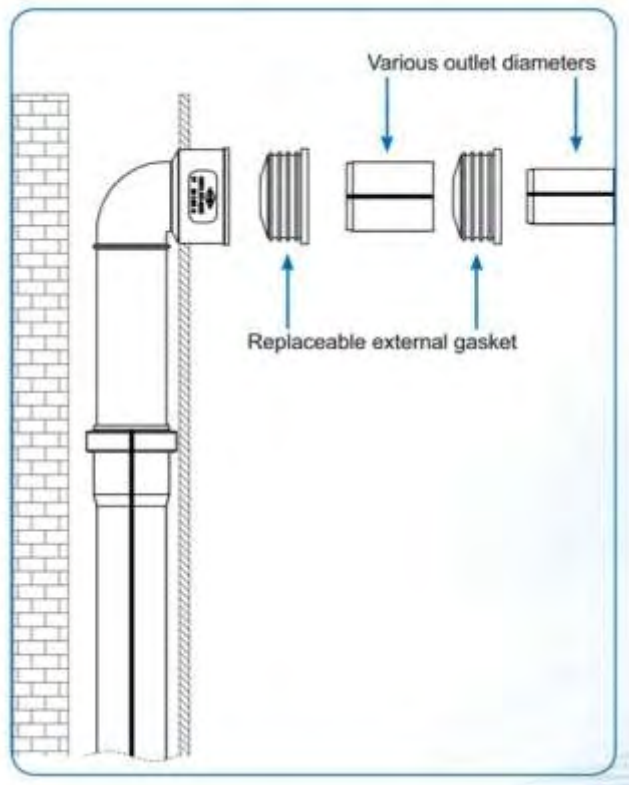


Fig. 30

2.4.4 *Installation of the System in concrete*

The piping system shall be installed in concrete walls, columns and floors, when carried out strictly in accordance with the installation instructions. The entire system inclusive of all components shall be insulated with suitable noise reduction materials in order to prevent any direct contact between rigid construction elements and the piping system.

2.4.5 *Lockseal*

2.4.5.1 *Applications*

- i) Installation of pipes in concrete (Locking): Use of lockseal prevents the concrete lift force and vibrations from separating the pipes.
- ii) Installation of pipes in concrete (Sealing): Use of lockseal prevents the concrete slurry from infiltrating to the gasket and negatively sealing.
- iii) Installing pipes with long-span suspension: Use of lockseal creates a firmer connection between the pipes providing additional safety for the system, especially for horizontal configuration in open spaces with vehicle traffic (parking garages, warehouses, plants, airports etc.). (Figure 31)



Fig. 31

2.4.5.2 *Assembly*

- i) Wide opening of the lockseal shall be pushed onto the fitting or pipe socket and shall be pushed lightly but firmly until the locking grips pass the socket and a 'click' sound is heard.
- ii) The plain end of the fitting or pipe shall be inserted into the socket through the narrow part of the lockseal (normal push-fit connection method) and the metal clamp shall be tightened by turning the key all the way until it stops.
- iii) For disassembling – the clamp shall be opened and the pipe pulled, while simultaneously pulling the lockseal from the socket with flat end tool (screwdriver). The grips shall be released one at a time, until dismantled. (Figure 32)



Fig. 32

2.5 Marking

2.5.1 Pipe markings

On each pipe, the following details shall be clearly printed on every meter, with incredible ink:

- i. Name of Manufacturer and/or trade mark
- ii. Pipe type
- iii. Dimensions
- iv. Materials
- v. Stiffness level
- vi. No. of the applicable standard
- vii. Date of manufacture
- viii. Standards Institute symbols

2.5.2 Fittings markings

Every fitting shall be marked with the following details:

- i. Name of Manufacturer and/or trade mark
- ii. Fitting type
- iii. Dimensions including angle, if applicable
- iv. Material
- v. Stiffness level
- vi. No. of the applicable standard
- vii. Date of manufacture
- viii. Standards Institute symbols

2.6 Selection & Installation

2.6.1 The user/installer is responsible for proper selection and installation of the piping system as per manufacturer's instructions.

2.6.2 *Choosing type, size and thickness*—Appropriate size and thickness of the pipes and fittings shall be chosen to suit the requirements of the user.

2.7 Guarantees/Warrantees Provided by the PAC Holder

PAC holder shall warrant that its products will be free from defects in materials and workmanship under normal use and service (liability for damages resulting from manufacturing errors, material defects, deficiencies caused by incorrect storage, laying and installation instructions), for a period of 10 years from the date of manufacture in accordance with the terms of this warranty. Further, the manufacturer shall repair or supply an equivalent replacement product in the event that the product is determined by it to be defective within the guarantee period. A brochure giving relevant details of warrantee shall be made available to the client.

2.8 Services Provided by the PAC Holder to the Customer

PAC holder shall provide availability of spare parts, replacements and repair kit etc. to the customers for any after sales services, if required.

2.9 Manuals

PAC holder shall provide Catalog and Technical Manual and other Manuals and Certificates to the customers, if required.

PART 3 BASIS OF ASSESSMENT AND BRIEF DESCRIPTION OF ASSESSMENT PROCEDURE

3.1 Basis of Assessment

3.1.1 *Factory Inspection*

The factory was inspected by the technical representative of the Council. During inspection the entire manufacturing process along with the manufacturing and testing equipment were inspected. The manufacturing process was found to conform to the process description given in the Annex. The in-process inspection and the inspection of the finished product were in accordance with the SQA approved as a part of the requirements for grant of this PAC.

3.2 *Laboratory Tests Done for Assessment*

3.2.1 *Testing of samples* -- The performance tests for Soundproof Drainage Piping system specified in Standard EN 1451-1:1999-03 pertaining to "Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure-Polypropylene (PP) – Specifications for pipes, fittings and the systems" namely Appearance, Wall structure, Impact resistance, Water tightness, Air tightness and

Resistance to internal pressure listed below have been carried out by Central Institute of Plastics Engineering & Technology, Ahmedabad on a sample of the Multi-layer PP pipe of 110 mm dia. collected by the IO during inspection of the plant. The samples conform to the tests as per the performance characteristics and specifications given by the manufacturer.

Tests performed by Central Institute of Plastics Engineering & Technology, Ahmedabad

S. No.	Property	Test Method	Result
1.	Appearance	EN 1451-1	Outside black with four green strips & inside white
2.	Wall structure	--do--	2.1 <i>Dimension of pipe</i> i. Mean outer dia. = 110.20 mm, 110.30 mm ii. Effective length=1.5 m iii. Chamfering = 15° iv. Wall thickness = 3.75 mm, 3.80 mm 2.2 <i>Dimension of socket</i> i. Wall thickness E2= 3.75 mm, E3 = 3.36 mm ii. Mean inside dia. D1= 110.20 mm iii. Length of bending & neck A = 40 mm iv. Neck B = 6 mm v. Length beyond C = 20 mm
3.	Impact resistance 0°C/1hr conditioning, 1kg load	--do--	Passed
4.	Resistance to internal pressure	--do--	i. At 80°C, 140 hour (4.2 MPa) -- No failure ii. At 95°C, 1000 hour (2.5 Mpa) - No failure
5.	Water tightness at a pressure of 0.5 & test period set value of ≥ 15 min	--do--	No leakage observed
6.	Air tightness at a pressure of 0.1 & test period set value of ≥ 5 min	--do--	No leakage observed

Test results satisfy the performance requirements as per EN 1451-1.

3.3 Supply of the Piping System

Details of the Piping system supplied by the manufacturer in India and Israel are given below:

S.No.	Customer	Description of Item	Period of supply
I. India			
1.	M/s Aasha Enterprise, Ahmedabad	Ultra Silent Pipe - 510 m Ultra Silent fittings- 1425	April to June 2015
2.	M/s Darshanam Life Space Pvt. Ltd., Vadodra	Ultra Silent Pipe - 736 m Ultra Silent fittings- 1245	Jan to June 2015

3.	Mr. Jinofer Bhujwala, Ahmedabad	Ultra Silent Pipe - 150 m Ultra Silent fittings- 334	Feb to June 2015
4.	M/s Tirupathi Stainless Steel Traders, Gurgaon	Ultra Silent Pipe - 987 m Ultra Silent fittings- 2867	March to June 2015
5.	M/s Piyush Palace Pvt. Ltd., Kheda, Gujarat	Ultra Silent Pipe - 788 m Ultra Silent fittings- 2642	March to June 2015
6.	ASK & SUBB Associates, Mumbai	Ultra Silent Pipe - 236 m Ultra Silent fittings- 1055	June 2015
7.	Siddhi Trading Co., Vadodra, Gujarat	Ultra Silent Pipe - 215 m Ultra Silent fittings- 1105	June 2015
II. Israel			
8.	M/s Aviv Technology Supply, Komba 1, Hadera	Ultra Silent Pipe - 4405 m Ultra Silent fittings- 3201	Jan to June 2015
9.	M/s Aviam Installation & building, Beersheba	Ultra Silent Pipe – 2358 m Ultra Silent fittings- 1560	Jan to June 2015
10.	M/s Alonim M M S Ltd., Hod HaSharon	Ultra Silent Pipe - 5826 m Ultra Silent fittings- 6474	Jan to June 2015
11.	M/s ESHED R B Ltd., Tel Aviv	Ultra Silent Pipe – 6582 m Ultra Silent fittings- 4156	Jan to June 2015
12.	HAMESHAVEK Trading & Engineers, Rishon LeTsiyo	Ultra Silent Pipe - 5467 m Ultra Silent fittings- 5415	Jan to June 2015
13.	M/s H B Keramica, Jerusalem	Ultra Silent Pipe - 2813 m Ultra Silent fittings- 2660	Jan to June 2015
14.	M/s Mendelson – S Bar Ltd., Kiryat Atta	Ultra Silent Pipe -34080 m Ultra Silent fittings- 28181	Jan to June 2015
15.	M/s QONDUS Trading Ltd., Kfar Ilut	Ultra Silent Pipe - 6210 m Ultra Silent fittings- 6733	Jan to June 2015
16.	M/s S Al Technical Equipment Ltd., Holon	Ultra Silent Pipe -42725 m Ultra Silent fittings- 38075	Jan to June 2015
17.	M/s S Al North Ltd., Haifa	Ultra Silent Pipe - 7761 m Ultra Silent fittings- 6144	Jan to June 2015

PART 4 STANDARD CONDITIONS

This certificate holder shall satisfy the following conditions:

- 4.1** The certificate holder shall continue to have the product reviewed by BMBA.
- 4.2** The product shall be continued to be manufactured according to and in compliance with the manufacturing specifications and quality assurance measures which applied at the time of issue or revalidation of this certificate. The Scheme of Quality Assurance separately approved shall be followed.
- 4.3** The quality of the product shall be maintained by the certificate holder. Complete testing facilities shall be installed for in-process control.
- 4.4** The product user should install, use and maintain the product in accordance with the provisions in this Certificate.
- 4.5** This certificate does not cover uses of the product outside the scope of this appraisal.
- 4.6** The product is appraised against performance provisions contained in the standards listed in Part-V. Provisions of any subsequent revisions or provisions introduced after the date of the certificate do not apply.
- 4.7** Where reference is made in this Certificate to any Act of Parliament of India, Rules and Regulations made there under, statutes, specifications, codes of practice, standards etc. of the Bureau of Indian Standards or any other national standards body and the International Organization for Standardization (ISO), manufacturer's company standards, instruction/manual etc., it shall be construed as reference to such publications in the form in which they were in force on the date of grant of this Certificate (and indicated in Part V to this Certificate)
- 4.8** The certificate holder agrees to inform BMBA of their clients with details of construction on six monthly basis.
- 4.9** The certificate holder agrees to provide to BMBA feedback on the complaints received, the redressal provided, and the time taken to provide redressal on complaint to complaint basis as soon as redressal is provided. BMBA agrees to provide the certificate holder the user feedback received by it, if any.
- 4.10** If at any time during the validity period, PACH is unable to fulfill the conditions in his PAC, he should on his own initiative suspend using the PAC and notify Chairman, PAC the date from which he has suspended its use, the reason for suspension and the period by which he will be able to resume. He shall not resume without the prior permission of BMBA. He shall also inform, simultaneously, his agents, licensees, distributors, institutional, government, public sector buyers, other buyers and all those whom he has informed about his holding the PAC. He shall also inform all those who buy his product(s) during the period of suspension. He shall provide to BMBA at the earliest the list of who have been so informed by him.
- 4.11** In granting this Certificate, BMBA takes no position as to:
 - (a) The presence or absence of patent or similar rights relating to the product;

- (b) The legal right of the Certificate holder to market, install or maintain the product;
- (c) The nature of individual installations of the product, including methods of workmanship.

4.12 BMTPC and the Board of Agreement of BMTPC (BMBA) take no position relating to the holder of the Performance Appraisal Certificate (PACH) and the users of the Performance Appraisal Certificate (PAC) respecting the patent rights / copy rights asserted relating to the product / system / design / method of installation etc. covered by this PAC. Considerations relating to patent / copy rights are beyond the scope of the Performance Appraisal Certification Scheme (PACS) under which this PAC has been issued. PACH and users of this PAC are expressly advised that determination of the Claim / validity of any such patent rights / copy rights and the risk of infringement of such rights are entirely the responsibility of PACH on the one hand and that of the users on the other.

4.13 It should be noted that any recommendations relating to the safe use of the product which are contained or referred to in this Certificate are the minimum standards required to be met with when the product is installed, used and maintained. They do not purport in any way to restate or cover all the requirements of related Acts such as the Factory Act, or of any other statutory or Common Law duties of care, or of any duty of care which exist at the date of this Certificate or in the future, nor is conformity with the provisions of this Certificate to be taken as satisfying the requirements of related Acts.

4.14 In granting this Certificate, BMTPC and BMBA does not accept responsibility to any person or body for any loss or damage, including personal injury, arising as a direct or indirect result of the use of this product.

4.15 The certificate holder indemnifies BMBA, its officers and officials involved in this assessment against any consequences of actions taken in good faith including contents of this certificate. The responsibility fully rests with the certificate holder and user of the product.

4.16 The responsibility for conformity to conditions specified in this PAC lies with the manufacturer who is granted this PAC. The Board (BMBA) will only consider requests for modification or withdrawal of the PAC.

4.17 The PAC holder shall not use this certificate for legal defense in cases against him or for legal claims he may make from others.



Dr. Shailesh Kr. Agarwal
Chairman, TAC

& Member Secretary, BMBA

Building Materials and Technology Promotion Council
Ministry of Housing & Urban Poverty Alleviation, (Govt. of India)
Core 5A, 1st Floor, Bhabha Bhawan, Lodhi Road,
New Delhi 110 003

Place: New Delhi

Date of issue 19.11.15

Member Secretary, BMBA

for and on behalf of

PART 5 LIST OF STANDARDS & CODES USED IN ASSESSMENT

5.1 Standards - These Standards are referred for carrying out particular tests only and do not specify the requirement for the whole product as such.

5.1.1 IS 2530:1963 – Method of tests for polyethylene moulding materials and polyethylene compounds

5.1.2 IS 7328:1992 – High density polyethylene materials for moulding and extrusion

5.1.3 DIN 8078:2008 – Type 1, 2 & 3 polypropylene pipes (PP) pipes – general quality requirements and testing

5.1.4 DIN 19560-10 – Pipes and fittings made of polypropylene (PP) for hot water resistant waste and soil discharge systems inside buildings – Part 10 - Fire behavior

5.1.5 EN 681-1 – Elastomeric seals. Material requirement for pipe joint seals in water & drainage applications –Part 1- vulcanized rubber

5.1.6 EN 728:1997 – Plastics piping and ducting systems – Determination of oxidation induction time

5.1.7 EN 744:1995 -- Plastics piping and ducting systems – Test method for resistance to external blows by round-the-clock method

5.1.8 EN 1053:1996 – Thermoplastic piping systems for non-pressure applications – Test method for water tightness of joints

5.1.9 EN 1054:1995 – Thermoplastic piping systems for soil & waste water discharge - Test method for air tightness of joints

5.1.10 EN ISO 2505 – Thermoplastic pipes – Longitudinal reversion –Test methods and parameters

5.1.11 EN 1451-1:1998 – Plastics piping systems for soil & waste discharge (low & high temperature) within the building structure – Polypropylene (PP)-Part 1- Specifications for pipes, fittings and the systems

5.1.12 EN 1451-7:2008 – Plastics piping systems for soil & waste discharge (low & high temperature) within the building structure – Polypropylene (PP)-Part 7- Assessment of conformity

5.1.13 EN 12061:1999 -- Plastics piping systems-Thermoplastic fittings – Test method for impact strength

5.1.14 EN 13501-1:2007 – Classification for reaction to fire behaviour of building products

5.1.15 DIN EN ISO 291:2008 – Plastics-Standard atmosphere for conditioning and testing

5.1.16 DIN EN ISO 1133:2011 – Plastics-Determination of Melt mass-flow rate (MFR)

5.1.17 DIN EN ISO 1167-1:2006 -- Thermoplastic pipes & fittings and assemblies for the conveyance of fluids-Determination of resistance to internal pressure

5.1.18 DIN EN ISO 1183:2012 -- Plastics-Determination of density of non-cellular plastics- Immersion method

5.1.19 DIN EN ISO 3126:2005 -- Plastics piping systems – Determination of dimensions

5.1.20 DIN EN 1411 -- Thermoplastic pipes-Determination of resistance to external blows by the staircase method

5.1.21 DIN EN 10204 – Metallic products Type of inspection documents

5.1.22 ISO 178:2010 – Plastics-Determination of flexural properties

5.2 Company Standards of the PAC holder – The branded design & specifications of the raw materials and finished product are as submitted by the manufacturer. The PAC holder has to make available the company standards to the consumers according to which testing have been done.

CERTIFICATION

In the opinion of Building Materials & Technology Promotion Council's Board of Agreement (BMBA), **Soundproof Drainage Piping System** bearing the mark manufactured by M/s Huliot Pipes and Fittings Pvt. Ltd. is satisfactory if used as set out above in the text of the Certificate. This Certificate **PAC No. 1024-P/2015** is awarded to **M/s Huliot Pipes and Fittings Pvt. Ltd, Vadodra.**

The period of validity of this Certificate is as shown on Page 1 of this PAC. This Certificate consists of pages 1 to 39.


Dr. Shailesh Kr. Agarwal
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& Member Secretary, BMBA
Building Materials and Technology Promotion Council
Ministry of Housing & Urban Poverty Alleviation, (Govt. of India)
Core 5A, 1st Floor, India Habitat Centre, Lodhi Road.



On behalf of BMTPC Board of Agreement Chairman, Technical Assessment Committee (TAC) of BMBA & Member Secretary, BMTPC Board of Agreement (BMBA) Under Ministry of Housing and Urban Poverty Alleviation, Government of India, New Delhi, India.

Place: **New Delhi**
Date: **19-11-15**

PART 6 ABBREVIATIONS

Abbreviations

BMBA	Board of Agreement of BMTPC
BMTPC	Building Materials and Technology Promotion Council
CPWD	Central Public Works Department
ED	Executive Director of BMTPC
IO	Inspecting Officer
MS	Member Secretary of BBA
PAC	Performance Appraisal Certificate
PACH	PAC Holder
PACS	Performance Appraisal Certification Scheme
SQA	Scheme of Quality Assurance
TAC	Technical Assessment Committee (of BMBA)

Performance Appraisal Certification Scheme - A Brief

Building Materials & Technology Promotion Council (BMTPC) was set up by the Government of India as a body under the Ministry of Housing & Urban Poverty Alleviation to serve as an apex body to provide inter-disciplinary platform to promote development and use of innovative building materials and technologies laying special emphasis on sustainable growth, environmental friendliness and protection, use of industrial, agricultural, mining and mineral wastes, cost saving, energy saving etc. without diminishing needs of safety, durability and comfort to the occupants of buildings using newly developed materials and technologies.

During the years, government, public and private sector organizations independently or under the aegis of BMTPC have developed several new materials and technologies. With liberalization of the economy several such materials and technologies are being imported.

However, benefits of such developments have not been realized in full measure as understandably the ultimate users are reluctant to put them to full use for want of information and data to enable them to make informed choice.

In order to help the user in this regard and derive the envisaged social and economic benefits the Ministry of Housing & Urban Poverty Alleviation has instituted a scheme called Performance Appraisal Certification Scheme (PACS) under which a Performance Appraisal Certificate (PAC) is issued covering new materials and technologies. PAC provides after due investigation, tests and assessments, amongst other things information to the user to make informed choice.

To make the PACS transparent and authentic it is administered through a Technical Assessment Committee (TAC) and the BMTPC Board of Agreement (BMBA) in which scientific, technological, academic, professional organizations and industry interests are represented.

The Government of India has vested the authority for the operation of the Scheme with BMTPC through Gazette Notification No. 1-16011/5/99 H-II in the Gazette of India No. 49 dated 4th December, 1999.

Builders and construction agencies in the Government, public and private sectors can help serve the economic, development and environmental causes for which the people and Government stand committed by giving preference to materials and technologies which have earned Performance Appraisal Certificates.

Further information on PACS can be obtained from the website: www.bmtpc.org

ANNEX I
(Clause 1.8.1)

QUALITY ASSURANCE PLAN FOR SOUNDPROOF DRAINAGE PIPING SYSTEM

S. No.	Performance Characteristics	Test Method	Requirement	Frequency of Testing
I. Raw Materials				
1.	PP base material	DIN EN 10204	Shall be as per DIN EN 1451-1:1999-03	Each consignment
2.	Density	DIN EN ISO 1183	Shall be as per company standards	Each consignment
3.	Melt Mass-flow Rate (MFR)	DIN EN ISO 1133	Shall be as per company standards	Each consignment
4.	Fire behaviour	As per national requirements	Shall be as per DIN EN 1451-1:1999-03	As per national requirements
II. Pipes				
1.	Appearance	Visual inspection	Shall be as per DIN EN 1451-1:1999-03	Continuous observation
2.	Colour	Shall be uniformly coloured	Shall be as per DIN EN 1451-1:1999-03	Continuous observation
3.	Dimensions	DIN EN ISO 3126	Shall be as per company standards	Continuous measurement
4.	Wall structure (layer thickness)	DIN EN ISO 3126	Shall be as per company standards	Continuous measurement
5.	Impact resistance	EN 744	Shall be as per DIN EN 1451-1:1999-03	Each control unit
6.	Longitudinal reversion	EN ISO 2505	Shall be as per DIN EN 1451-1:1999-03	Each control unit
7.	Ring stiffness	DIN EN ISO 9969	Shall be as per DIN EN 1451-1:1999-03	
8.	Resistance to internal pressure	DIN EN ISO 1167-1	For A, stress shall be 4.2 N/mm ² at 80°C for ≥140 hrs For B, stress shall be 2.5 N/mm ² at 95°C for ≥ 1000 hrs	Each control unit and type test also
III. Fittings				
1.	Appearance	Visual inspection	Shall be as per DIN EN 1451-1:1999-03	Continuous observation
2.	Colour	Shall be uniformly coloured	Shall be as per DIN EN 1451-1:1999-03	Continuous observation
3.	Dimensions	DIN EN ISO 3126	Shall be as per company standards	Continuous measurement
4.	Impact resistance (falling weight test)	EN 12061 at 0°C	No damage	Each control unit
5.	Effects of heating	EN ISO 2505	Shall be as per DIN EN 1451-1:1999-03	Each control unit
6.	Fitness for purpose			Each control unit

6.1	characteristics of the joints	Shall be as per DIN EN 1451-1:1999-03	Shall be as per DIN EN 1451-1:1999-03	
6.2	Water tightness			
6.3	Air tightness			
6.4	Elevated temperature cycling Tightness of elastomeric ring seal joints			
7.	Sealing rings	DIN EN 10204	EN 681-1	Each consignment

Annex II
(Clause 1.5.1)

MANUFACTURING PROCESS FLOW CHART

