KiTEC

A New and Unique Pipe

Multi-layer Composite Pipes

Product Manual

Rewriting the Standards

IAPMO India Pvt. Ltd.
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KiTEC QC & R&D Test Laboratory, 8 - Madhuban Industrial Area, Madhuban Dam Road, Rakholi, Silvassa, UT of D&NH

Is accepted for recognition by IAPMO India as a Manufacturer's In-House Testing Laboratory. IAPMO India agrees to accept test reports prepared by this Laboratory in accordance with the policies and procedures agreed upon by the laboratory in the Laboratory Listing Agreement. The Laboratory has satisfactorily demonstrated its compliance to ISO/IEC 17025-2017 and has been verified as capable of performing tests to the following standards:

- **IAPMO IGC-India 306-2016, *Brass Compression Fittings for Multilayer Piping Systems***
- **IAPMO IGC-India 308-2014, *Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pipes***
- **IAPMO IGC-India 309-2014, *Polyethylene/Aluminum/Crosslinked Polyethylene (PE-AL-PEX) Composite Pipes***
- **ASTM F1281-2017, *Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe***
- **ASTM F876-22a, *Crosslinked Polyethylene (PEX) Tubing.***

IAPMO India will accept from this Laboratory only reports of testing conducted under the direct control and supervision of employees of this Laboratory.

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IAPMO INDIA PRODUCT CERTIFICATION

Tom Palkon
Executive Vice President and
Chief Technical Services Officer
The IAPMO Group.

PRODUCT MANUAL
KiTEC COMPOSITE PIPING SYSTEM (CPS)

1 Company Profile

The Company:

KiTEC Industries (India) Private Limited a joint venture promoted to manufacture revolutionary piping system popularly known as "KiTEC Composite Pipes". The company commenced its manufacturing operation in technical and financial collaboration with KiTECHNOLOGY BV, Netherlands at its Silvassa (India) plant in October, 1996.

The past six decades account for accelerating the trend towards the use of alternative materials, particularly plastics and ceramics based, as replacement for metals including steel and non-ferrous materials (Copper, aluminium and brass).

In India, GI pipes are being extensively used for domestic water distribution system. However, this trend is changing and use of alternative materials such as copper is being already thought of. High cost of copper piping is a major factor which is keeping the use of this pipe to very low levels.

KiTEC composite pipes offer an economic alternative to copper piping with a potential to replace GI pipes.

Quality Policy :

We are committed to meet the requirements of customers - Internal and External with respect to Quality of our products and services.

We shall concentrate on preventive methods and adopt an innovative approach to make Total Quality a way of life with an objective to “Do It Right, the first time”. We shall focus on continual improvements in all areas of our business.

We shall create an environment in the organisation that will encourage the employees and suppliers to eliminate the non- conformances to generate error free output and to improve Quality of our products and services.

We are committed to comply with the requirements of ISO 9001:2008 standards, including the statutory and regulatory requirements

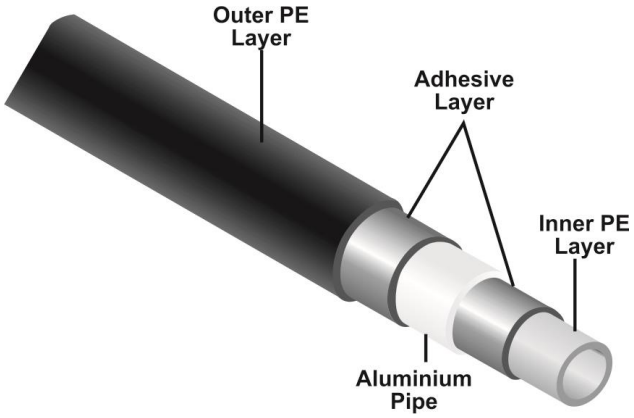
Mission:

KiTEC Industries (India) Private Limited will remain the market leader in alternative to the conventional piping systems in India by providing innovative engineering solutions to the market.

2. Concept of KiTEC Pipe :

KiTEC is a Multi Layer composite pipe having an aluminium tube bonded in between two layers of Polyethylene.

Functional properties of various layers are as follows :



PLASTIC (PE) LAYERS : PE layers of composite pipe provide all the advantages of plastic pipes such as,

- corrosion resistance
- chemically inert
- smooth surface for better flow properties.

TIE LAYERS : The tie layers (adhesive layers) have the following functions :

- to perfectly bond the metal and plastic.
- to absorb eventual shifting movements between the plastic and the metal, likely to occur in opposite directions.
- to give the Composite pipe the advantages of a single component pipe.

ALUMINIUM (METAL) LAYER : In addition to all the inherent advantages of plastic pipes the inclusion of the metallic pipe gives Composite pipe the qualities of metal, namely :

- absolute tightness.
- mechanical resistance to deformation.
- dilation within reasonable limits.

3. Standards & Approvals:

COUNTRY	Standard/Approval
AUSTRALIA	Standard specifications for PE-AL-PE pressure pipes.
CANADA	For plumbing products and materials.
FRANCE	Central heating systems & hot/cold drinking water application.
GERMANY	Central heating systems & hot/cold drinking water application.
INDIA	IS 15450:204 - Specification for PE-AL-PE pressure pipe for hot and cold water supplies.
	IAPMO IGC-India 308-2014 - Specification for PE-AL-PE pipe for residential and commercial water supply/ residential heating systems
	IAPMO IGC-India 309-2014 - Specification for PE-AL-PEX pipe for residential and commercial water supply /residential heating, compressed air systems and transportation of chemicals.
ISRAEL	For hot and cold water supply.
RUSSIA	For use in construction - cold/hot water supply systems.
SOUTH AFRICA	Approval for use in water installations.
SWITZERLAND	Central heating systems & hot/cold drinking water application.
TAIWAN	For use as hot & cold water works in building industry.
UNITED KINGDOM	Approval for water fittings & materials.
USA	Standard specifications for PE-AL-PE pressure pipes.

In India, KiTEC pipes and fittings are approved by following organisations:

- Indian Register of Shipping
- Central Public Works Department
- E-n-C's Branch, Army headquarters
- Southern Central Railway
- Reasearch Designs & Standards Organisation, Lucknow
- Quality Assurance Department - DGS&D
- Tirupati Devasthan Trust
- Dept. of Atomic Energy - Govt. of India
- Brihanmumbai Mahanagarpalika
- Central Industrial Development Corporation
- MECON Ltd.
- Public Works Department - Govt. of Jammu & Kashmir
- Public Works Department - Govt. of Rajasthan
- Public Works Department - Govt. of Assam

4. Pipe Size Range:

4.1 KiTEC Composite Pipe

KiTEC Composite Pipes are manufactured as per IS 15450:2004 standards.

Description	Pipe Size						
	1014	1216	1620	2025	2532	3240	4050
Minimum Outside Diameter (mm)	14	16	20	25	32	40	50
Minimum Wall Thickness (mm)	1.70	1.75	2.00	2.45	2.80	3.40	4.00
Maximum Coil/Pipe Length (meters)	300	300	250	200	150	150	100
Minimum Aluminium Thickness (mm)	0.20	0.20	0.25	0.25	0.30	0.30	0.30
Minimum Outside PE Layer Thickness (mm)	0.40	0.40	0.40	0.40	0.40	0.40	0.40
Maximum Weight Kg/Metre	0.090	0.106	0.151	0.220	0.337	0.487	0.695
Equivalant NB size in inch	⅜"	½"	¾"	1"	1¼"	1½"	2"

The pipes are black in colour on outer layer and natural colour in inner layer , are UV resistant and can be safely used for outdoor as well as concealed installations.

4.2 KiTEC Composite PL Pipe

KiTEC Composite PL Pipes are manufactured as per IAPMO IGC-India 308-2014. Composite pipes covered by this Standard are intended for use in residential and commercial water supply systems, residential heating systems and compressed air systems.

KiTEC Composite PL Pipes have a pressure rating of 12 Kg/cm^2 at 23°C temperature, 6 Kg/cm^2 at 65°C. Design life span for KiTEC Composite PL Pipes is in excess of 50 years

KiTEC Composite PL (Plumbing) Pipe

Description	Pipe Size									
	1216	1620	2025	2532	3240	4050	5063	6375	7590	90110
Minimum Outside Diameter mm	16	20	25	32	40	50	63	75	90	110
Minimum Wall Thickness mm	1.70	1.90	2.30	2.90	3.40	3.90	4.80	5.80	6.80	7.00
Maximum Coil/Straight Length meters	300	250	200	150	150	100	100	50	12	12
Minimum Aluminium Thickness mm	0.17	0.17	0.19	0.23	0.23	0.23	0.50	0.60	0.70	0.80
Minimum Outside Layer Thickness mm	0.40	0.40	0.40	0.40	0.40	0.40	0.80	0.80	1.00	1.00
Maximum Weight Kg/Meter	0.107	0.145	0.218	0.348	0.491	0.688	1.113	1.572	2.185	2.876
Equivalent NB size inch	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	3½"	4"

4.3 KiTEC Composite PE-AL-PEX Pipes

KiTEC introduced a new range of composite pipes having cross linked polyethylene (PEX) layer inside. Cross-linked polyethylene, commonly abbreviated PEX or XLPE, is a form of polyethylene with cross-links. PEX is made from high density polyethylene (HDPE) and improves property at elevated temperature, KiTEC Composite PE-AL-PEX pipes have a pressure rating of 12 Kg/cm^2 at 23°C temperature, 8 Kg/cm^2 at 80°C temperature and 5.0 Kg/cm^2 at 95°C temperature. Design life span for KiTEC Composite PE-AL-PEX pipes is in excess of 50 years.

KiTEC Composite PE-AL-PEX Pipe

Description	Pipe Size									
	1216	1620	2025	2532	3240	4050	5063	6375	7590	90110
Minimum Outside Diameter mm	16	20	25	32	40	50	63	75	90	110
Minimum Wall Thickness mm	1.70	1.90	2.30	2.90	3.40	3.90	4.80	5.80	6.80	7.00
Maximum Coil/Straight Length meters	300	250	200	150	150	100	100	50	12	12
Minimum Aluminium Thickness mm	0.17	0.17	0.19	0.23	0.23	0.23	0.50	0.60	0.70	0.80
Minimum Outside Layer Thickness mm	0.40	0.40	0.40	0.40	0.40	0.40	0.80	0.80	1.00	1.00
Maximum Weight Kg/Meter	0.107	0.145	0.218	0.348	0.491	0.688	1.113	1.572	2.185	2.876
Equivalent NB size inch	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	3½"	4"

KiTEC Composite PE-AL-PEX Pipes are manufactured as per IAPMO IGC-India 309-2014. Composite pipes covered by this Standard are intended for use in residential and commercial water supply systems, residential heating systems, compressed air systems and transportation of chemicals. The manufacturing range is from 1216 to 90110. The pipes, black in color on outer layer and orange color in the inner layer with a continuous red line, are UV-resistant and can be safely used for outdoor as well as concealed installations.

Applications: KiTEC Composite PE-AL-PEX Pipes can be used for all the applications of PR Pipes. In addition to this, these pipes are suitable for other applications such as solar panel piping, where the operating temperature can be up to 95°C.

4.4 KiTEC Composite PEX-AL-PEX Pipes:

KiTEC Composite PEX-AL-PEX pipes are having inner and outer layer of cross linked polyethylene. Cross-linked polyethylene, commonly abbreviated PEX or XLPE, is a form of polyethylene with cross-links. KiTEC Composite PEX-AL-PEX pipes are approved by IAPMO Research and Testing, INC. California, USA.

KiTEC Composite PEX-AL-PEX Pipes are having pressure rating of 13.8 Kg/cm^2 at 23°C, 11.0 Kg/cm^2 at 60°C. KiTEC Composite PEX-AL-PEX pipes can safely be used for 8.6 Kg/cm2 pressure at 83°C operating temperature. Design life span for KiTEC Composite PEX-AL-PEX pipes is in excess of 50 years. KiTEC Composite PEX-AL-PEX pipes are manufactured as per ASTM F 1281-11.

KiTEC Composite PEX/AL/PEX Pipe

Description	Pipe Size							
	1216	1620	2025	2532	3240	4050	5063	6375
Minimum Outside Diameter mm	16	20	25	32	40	50	63	75
Minimum Wall Thickness mm	1.65	1.90	2.25	2.90	3.40	4.00	4.60	7.20
Maximum Coil/Straight Length meters	300	250	200	150	150	100	100	50
Minimum Aluminium Thickness mm	0.18	0.23	0.23	0.28	0.33	0.47	0.57	0.67
Minimum Outside Layer Thickness mm	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
Maximum Weight Kg/Meter	0.106	0.154	0.223	0.361	0.529	0.765	1.107	1.876
Equivalent NB size inch	½”	¾”	1”	1¼”	1½”	2”	2½”	3”

5. Range of Fittings:

Description	Size	Unit	Composite crimp Fittings - Internal Sealing	Composite compression Fittings - Internal Sealing	Brass Compression Fittings - Internal Sealing	Brass Crimp fittings - Internal sealing
Equal Tee 	1014	Nos.	N/A	N/A	✓	N/A
	1216	Nos.	✓	✓	✓	✓
	1620	Nos.	✓	✓	✓	✓
	2025	Nos.	✓	✓	✓	✓
	2532	Nos.	N/A	✓	✓	N/A
	3240	Nos.	N/A	✓	✓	N/A
	4050	Nos.	N/A	✓	✓	N/A
	5063	Nos.	N/A	✓	✓	N/A
	6375	Nos.	N/A	✓	✓	N/A
	7590	Nos.	N/A	✓	N/A	N/A
	90110	Nos.	N/A	✓	N/A	N/A
Reducing Tee 	1216x1216x1014	Nos.	N/A	N/A	✓	N/A
	1620x1216x1216	Nos.	✓	✓	✓	✓
	1620x1216x1620	Nos.	✓	✓	✓	✓
	1620x1216x2025	Nos.	N/A	✓	N/A	N/A
	1620x1620x1014	Nos.	N/A	N/A	✓	N/A
	1620x1620x1216	Nos.	✓	✓	✓	✓
	1620x1620x2025	Nos.	✓	N/A	✓	N/A
	2025x1216x1216	Nos.	✓	N/A	N/A	N/A
	2025x1216x1620	Nos.	N/A	N/A	N/A	✓
	2025x1216x2025	Nos.	✓	✓	✓	✓
	2025x1620x1216	Nos.	✓	✓	✓	✓
	2025x1620x1620	Nos.	✓	✓	✓	✓
	2025x1620x2025	Nos.	✓	✓	✓	✓
	2025x2025x1216	Nos.	✓	✓	✓	✓
	2025x2025x1620	Nos.	✓	✓	✓	✓
	2025x2025x2532	Nos.	N/A	✓	N/A	N/A
	2532x1216x1216	Nos.	N/A	✓	N/A	N/A
	2532x1216x2025	Nos.	N/A	✓	N/A	N/A
	2532x1216x2532	Nos.	N/A	✓	N/A	N/A
	2532x1620x1216	Nos.	N/A	✓	N/A	N/A
	2532x1620x1620	Nos.	N/A	✓	✓	N/A
	2532x1620x2025	Nos.	N/A	✓	N/A	N/A
	2532x1620x2532	Nos.	N/A	✓	N/A	N/A
	2532x2025x1216	Nos.	N/A	✓	✓	N/A
	2532x2025x1620	Nos.	N/A	✓	✓	N/A
	2532x2025x2025	Nos.	N/A	✓	✓	N/A
	2532x2025x2532	Nos.	N/A	✓	N/A	N/A
	2532x2532x1216	Nos.	N/A	✓	✓	N/A
	2532x2532x1620	Nos.	N/A	✓	✓	N/A
	2532x2532x2025	Nos.	N/A	✓	✓	N/A
	3240x1216x1216	Nos.	N/A	✓	N/A	N/A
	3240x1216x2025	Nos.	N/A	✓	N/A	N/A
	3240x1216x2532	Nos.	N/A	✓	N/A	N/A
	3240x1216x3240	Nos.	N/A	✓	N/A	N/A
	3240x1620x1216	Nos.	N/A	✓	N/A	N/A
	3240x1620x1620	Nos.	N/A	✓	✓	N/A
	3240x1620x2025	Nos.	N/A	✓	N/A	N/A
	3240x1620x2532	Nos.	N/A	✓	N/A	N/A
	3240x1620x3240	Nos.	N/A	✓	N/A	N/A
	3240x2025x1216	Nos.	N/A	✓	N/A	N/A
	3240x2025x1620	Nos.	N/A	✓	N/A	N/A
	3240x2025x2025	Nos.	N/A	✓	✓	N/A
	3240x2025x2532	Nos.	N/A	✓	N/A	N/A
	3240x2025x3240	Nos.	N/A	✓	N/A	N/A
	3240x2532x1216	Nos.	N/A	✓	N/A	N/A
	3240x2532x1620	Nos.	N/A	✓	✓	N/A
	3240x2532x2025	Nos.	N/A	✓	✓	N/A
	3240x2532x2532	Nos.	N/A	✓	✓	N/A
	3240x2532x3240	Nos.	N/A	✓	N/A	N/A
	3240x3240x1216	Nos.	N/A	✓	✓	N/A
	3240x3240x1620	Nos.	N/A	✓	✓	N/A
	3240x3240x2025	Nos.	N/A	✓	✓	N/A
	3240x3240x2532	Nos.	N/A	✓	✓	N/A

Description	Size	Unit	Composite crimp Fittings - Internal Sealing	Composite compression Fittings - Internal Sealing	Brass Compression Fittings - Internal Sealing	Brass Crimp fittings - Internal sealing
Reducing Tee 	4050x3240x3240	Nos.	N/A	✓	N/A	N/A
	4050x4050x1216	Nos.	N/A	✓	✓	N/A
	4050x4050x1620	Nos.	N/A	✓	✓	N/A
	4050x4050x2025	Nos.	N/A	✓	✓	N/A
	4050x4050x2532	Nos.	N/A	✓	✓	N/A
	4050x4050x3240	Nos.	N/A	✓	✓	N/A
	4050x1620x1620	Nos.	N/A	✓	N/A	N/A
	4050x1620x4050	Nos.	N/A	✓	N/A	N/A
	4050x2025x2025	Nos.	N/A	✓	N/A	N/A
	4050x2025x4050	Nos.	N/A	✓	N/A	N/A
	4050x2532x2025	Nos.	N/A	✓	N/A	N/A
	4050x2532x2532	Nos.	N/A	✓	N/A	N/A
	4050x2532x3240	Nos.	N/A	✓	N/A	N/A
	4050x2532x4050	Nos.	N/A	✓	N/A	N/A
	4050x3240x1216	Nos.	N/A	✓	N/A	N/A
	4050x3240x1620	Nos.	N/A	✓	✓	N/A
	4050x3240x2025	Nos.	N/A	✓	N/A	N/A
	4050x3240x2532	Nos.	N/A	✓	N/A	N/A
	4050x3240x3240	Nos.	N/A	✓	✓	N/A
	4050x3240x4050	Nos.	N/A	✓	N/A	N/A
	5063x2025x5063	Nos.	N/A	✓	N/A	N/A
	5063x2532x2025	Nos.	N/A	✓	N/A	N/A
	5063x2532x2532	Nos.	N/A	✓	N/A	N/A
	5063x2532x5063	Nos.	N/A	✓	N/A	N/A
	5063x3240x5063	Nos.	N/A	✓	N/A	N/A
	5063x4050x1620	Nos.	N/A	✓	✓	N/A
	5063x4050x2025	Nos.	N/A	✓	✓	N/A
	5063x4050x2532	Nos.	N/A	✓	✓	N/A
	5063X4050X3240	Nos.	N/A	✓	✓	N/A
	5063x4050x4050	Nos.	N/A	✓	✓	N/A
	5063x4050x5063	Nos.	N/A	✓	N/A	N/A
	5063x5063x1216	Nos.	N/A	✓	N/A	N/A
	5063x5063x1620	Nos.	N/A	✓	✓	N/A
	5063x5063x2025	Nos.	N/A	✓	✓	N/A
	5063x5063x2532	Nos.	N/A	✓	✓	N/A
	5063x5063x3240	Nos.	N/A	✓	✓	N/A
	5063x5063x4050	Nos.	N/A	✓	✓	N/A
	5063x5063x6375	Nos.	N/A	✓	N/A	N/A
	6375x4050x4050	Nos.	N/A	✓	N/A	N/A
	6375x4050x6375	Nos.	N/A	✓	N/A	N/A
	6375x6375x1216	Nos.	N/A	✓	N/A	N/A
	6375x6375x1620	Nos.	N/A	✓	N/A	N/A
	6375x6375x2025	Nos.	N/A	✓	N/A	N/A
	6375x6375x2532	Nos.	N/A	✓	N/A	N/A
	6375x6375x3240	Nos.	N/A	✓	N/A	N/A
	6375x6375x4050	Nos.	N/A	✓	N/A	N/A
	6375x6375x5063	Nos.	N/A	✓	✓	N/A
	7590x7590x1620	Nos.	N/A	✓	N/A	N/A
	7590x7590x2532	Nos.	N/A	✓	N/A	N/A
	7590x7590x3240	Nos.	N/A	✓	N/A	N/A
	7590x7590x4050	Nos.	N/A	✓	N/A	N/A
	7590x7590x5063	Nos.	N/A	✓	N/A	N/A
	7590x7590x6375	Nos.	N/A	✓	N/A	N/A
	90110X90110X2025	Nos.	N/A	✓	N/A	N/A
	90110X90110X2532	Nos.	N/A	✓	N/A	N/A
	90110X90110X3240	Nos.	N/A	✓	N/A	N/A
	90110X90110X4050	Nos.	N/A	✓	N/A	N/A
	90110X90110X5063	Nos.	N/A	✓	N/A	N/A
	90110X90110X6375	Nos.	N/A	✓	N/A	N/A
	90110X90110X7590	Nos.	N/A	✓	N/A	N/A

Description	Size	Unit	Composite crimp Fittings - Internal Sealing	Composite compression Fittings - Internal Sealing	Brass Compression Fittings - Internal Sealing	Brass Crimp fittings - Internal sealing
Female Tee 	1014x1014x1/2”	Nos.	N/A	N/A	✓	N/A
	1014x1014x1/4”	Nos.	N/A	N/A	✓	N/A
	1216x1216x1/2”	Nos.	✓	✓	✓	✓
	1620x1620x1/2”	Nos.	✓	✓	✓	✓
	2025x2025x1/2”	Nos.	✓	✓	✓	✓
	2025x2025x1”	Nos.	✓	✓	✓	✓
	2025x2025x3/4”	Nos.	N/A	N/A	✓	✓
	2532x2532x1/2”	Nos.	N/A	✓	✓	N/A
	2532x2532x1”	Nos.	N/A	✓	N/A	N/A
	2532x2532x1.25”	Nos.	N/A	✓	N/A	N/A
	3240x3240x1/2”	Nos.	N/A	✓	N/A	N/A
	3240x3240x1.25”	Nos.	N/A	✓	N/A	N/A
	4050X4050X1/2”	Nos.	N/A	N/A	✓	N/A
	4050X4050X1”	Nos.	N/A	N/A	✓	N/A
	4050X4050X1.5”	Nos.	N/A	✓	N/A	N/A
	4050X4050X2"	Nos.	N/A	✓	N/A	N/A
	5063x1/2"	Nos.	N/A	✓	N/A	N/A
	5063X2"	Nos.	N/A	✓	N/A	N/A
	5063X2.5"	Nos.	N/A	✓	N/A	N/A
	6375X1/2"	Nos.	N/A	✓	N/A	N/A
	6375X2"	Nos.	N/A	✓	N/A	N/A
	6375X1.5"	Nos.	N/A	✓	N/A	N/A
	7590X1.5"	Nos.	N/A	✓	N/A	N/A
	90110X1"	Nos.	N/A	✓	N/A	N/A
	90110X2"	Nos.	N/A	✓	N/A	N/A
Equal Elbow 	1216	Nos.	N/A	N/A	✓	✓
	1620	Nos.	✓	✓	✓	✓
	2025	Nos.	✓	✓	✓	✓
	2532	Nos.	N/A	✓	✓	N/A
	3240	Nos.	N/A	✓	✓	N/A
	4050	Nos.	N/A	✓	✓	N/A
	5063	Nos.	N/A	✓	✓	N/A
	6375	Nos.	N/A	✓	✓	N/A
	7590	Nos.	N/A	✓	N/A	N/A
	90110	Nos.	N/A	✓	N/A	N/A
Reduced Elbow 	2025x1216	Nos.	✓	✓	✓	✓
	2025x1620	Nos.	✓	✓	✓	✓
	2532x1216	Nos.	N/A	✓	N/A	N/A
	2532x1620	Nos.	N/A	✓	✓	N/A
	2532x2025	Nos.	N/A	✓	✓	N/A
	3240x1216	Nos.	N/A	✓	N/A	N/A
	3240x1620	Nos.	N/A	✓	N/A	N/A
	3240x2025	Nos.	N/A	✓	✓	N/A
	3240x2532	Nos.	N/A	✓	✓	N/A
	4050x1216	Nos.	N/A	✓	N/A	N/A
	4050x1620	Nos.	N/A	✓	✓	N/A
	4050x2025	Nos.	N/A	✓	N/A	N/A
	4050x2532	Nos.	N/A	✓	✓	N/A
	4050x3240	Nos.	N/A	✓	✓	N/A
	5063x2025	Nos.	N/A	✓	N/A	N/A
	5063x2532	Nos.	N/A	✓	✓	N/A
	5063x3240	Nos.	N/A	✓	N/A	N/A
	5063x4050	Nos.	N/A	✓	✓	N/A
	6375x1620	Nos.	N/A	✓	N/A	N/A
	6375x2025	Nos.	N/A	✓	N/A	N/A
	6375x3240	Nos.	N/A	✓	N/A	N/A
	6375x4050	Nos.	N/A	✓	N/A	N/A
	6375x5063	Nos.	N/A	✓	N/A	N/A
	7590x3240	Nos.	N/A	✓	N/A	N/A
	7590x4050	Nos.	N/A	✓	N/A	N/A
	7590x5063	Nos.	N/A	✓	N/A	N/A
	7590x6375	Nos.	N/A	✓	N/A	N/A
	90110x2025	Nos.	N/A	✓	N/A	N/A
	90110x4050	Nos.	N/A	✓	N/A	N/A
	90110x5063	Nos.	N/A	✓	N/A	N/A
	90110x6375	Nos.	N/A	✓	N/A	N/A
	90110x7590	Nos.	N/A	✓	N/A	N/A

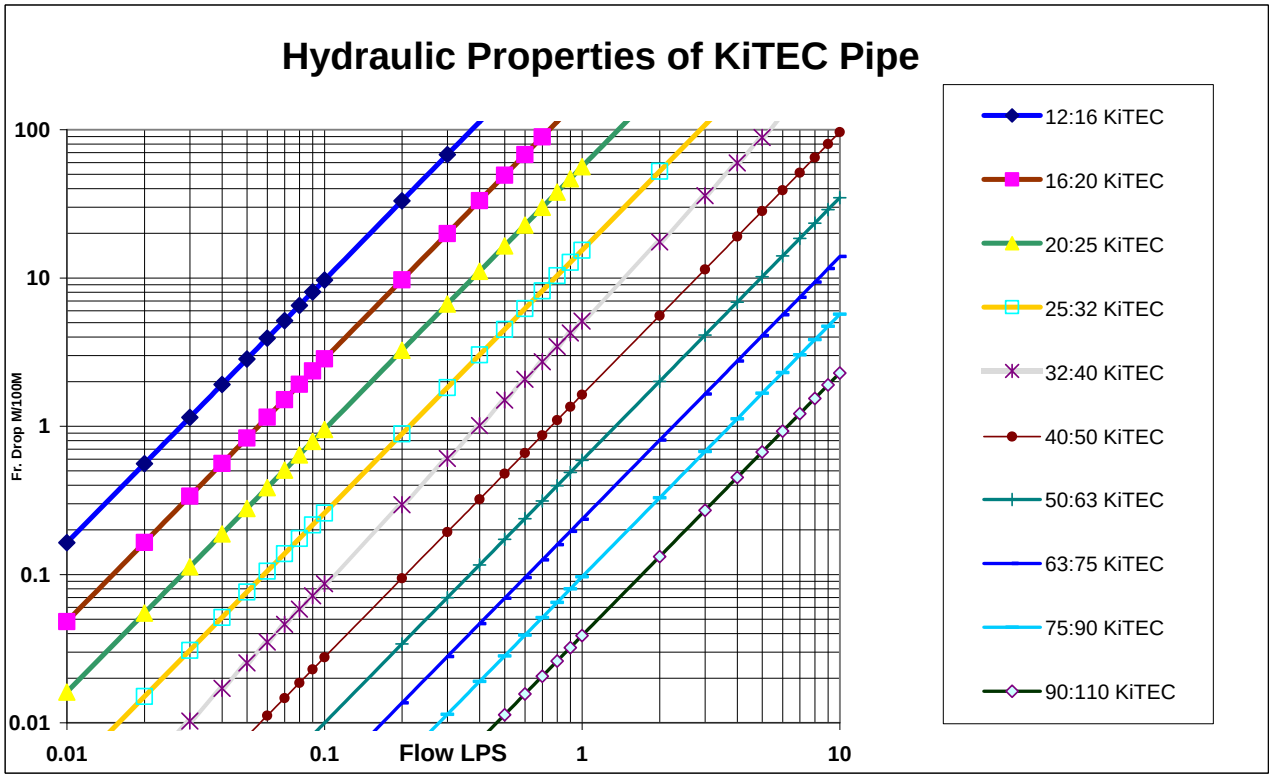
Description	Size	Unit	Composite crimp Fittings - Internal Sealing	Composite compression Fittings - Internal Sealing	Brass Compression Fittings - Internal Sealing	Brass Crimp fittings - Internal sealing
Female Elbow	1014x1/2”	Nos.	N/A	N/A	✓	N/A
	1014x1/4”		N/A	N/A	✓	N/A
	1216x1/2”	Nos.	✓	✓	✓	✓
	1216x1/2” (S)	Nos.	N/A	N/A	✓	✓
	1620x1/2”	Nos.	✓	✓	✓	✓
	1620x1/2” (S)	Nos.	N/A	N/A	✓	N/A
	1620x3/4”	Nos.	✓	✓	✓	✓
	1620x3/4” (S)	Nos.	N/A	N/A	✓	✓
	2025x1/2”	Nos.	✓	✓	✓	✓
	2025x1/2” (S)	Nos.	N/A	N/A	✓	N/A
	2025x1”	Nos.	✓	✓	✓	✓
	2025x1” (S)	Nos.	N/A	N/A	✓	N/A
	2025x3/4”	Nos.	N/A	✓	✓	✓
	2532x1”	Nos.	N/A	✓	✓	N/A
	2532x1.25”	Nos.	N/A	✓	✓	N/A
	3240x1.25”	Nos.	N/A	✓	✓	N/A
	3240x1.5”	Nos.	N/A	✓	✓	N/A
	4050X1.5”	Nos.	N/A	✓	N/A	N/A
	4050X2"	Nos.	N/A	✓	N/A	N/A
	5063X2"	Nos.	N/A	✓	N/A	N/A
	5063X2.5"	Nos.	N/A	✓	N/A	N/A
	6375X2.5"	Nos.	N/A	✓	N/A	N/A
	90110X2"	Nos.	N/A	✓	N/A	N/A
	90110X3"	Nos.	N/A	✓	N/A	N/A
Male Thread Connector	1014x1/2”	Nos.	N/A	N/A	✓	N/A
	1014x1/4”	Nos.	N/A	N/A	✓	N/A
	1014x3/8”	Nos.	N/A	N/A	✓	N/A
	1216x1/2”	Nos.	✓	✓	✓	✓
	1620x1/2”	Nos.	✓	✓	✓	✓
	1620x3/4”	Nos.	✓	✓	✓	✓
	2025x1/2”	Nos.	N/A	N/A	✓	✓
	2025x3/4”	Nos.	✓	✓	✓	✓
	2025x1”	Nos.	✓	✓	✓	✓
	2025x1.25”	Nos.	N/A	✓	N/A	N/A
	2532x1/2"	Nos.	N/A	N/A	✓	N/A
	2532x1"	Nos.	N/A	✓	✓	N/A
	2532x1.25"	Nos.	N/A	✓	✓	N/A
	2532x1.5"	Nos.	N/A	✓	N/A	N/A
	3240x1.25"	Nos.	N/A	✓	✓	N/A
	3240x1.5”	Nos.	N/A	✓	✓	N/A
	4050x1.5”	Nos.	N/A	✓	✓	N/A
	4050X2"	Nos.	N/A	✓	✓	N/A
	5063X2"	Nos.	N/A	✓	✓	N/A
	5063X2.5"	Nos.	N/A	✓	✓	N/A
	6375X2.5"	Nos.	N/A	✓	N/A	N/A
	6375X3"	Nos.	N/A	✓	✓	N/A
	7590X2.5"	Nos.	N/A	✓	N/A	N/A
	7590X3"	Nos.	N/A	✓	✓	N/A
	90110X3"	Nos.	N/A	✓	N/A	N/A
	90110X4"	Nos.	N/A	✓	✓	N/A
Female Thread Connector	1014x1/2”	Nos.	N/A	N/A	✓	N/A
	1216x1/2”	Nos.	✓	✓	✓	✓
	1620x1/2”	Nos.	✓	✓	✓	✓
	1620x3/4”	Nos.	N/A	N/A	✓	✓
	2025x1/2”	Nos.	N/A	N/A	N/A	✓
	2025x3/4”	Nos.	N/A	N/A	✓	✓
	2025x1”	Nos.	N/A	N/A	✓	✓
	2532x1”	Nos.	N/A	N/A	✓	N/A
	2532x1.25”	Nos.	N/A	N/A	✓	N/A
	2532x1.5”	Nos.	N/A	N/A	✓	N/A
	3240x1.25"	Nos.	N/A	N/A	✓	N/A
	3240x1.5”	Nos.	N/A	✓	✓	N/A
	4050X1.5”	Nos.	N/A	✓	N/A	N/A
	4050X2"	Nos.	N/A	✓	✓	N/A
	5063X2"	Nos.	N/A	✓	✓	N/A
	5063X2.5"	Nos.	N/A	N/A	✓	N/A
	6375X3"	Nos.	N/A	N/A	✓	N/A

Description	Size	Unit	Composite crimp Fittings - Internal Sealing	Composite compression Fittings - Internal Sealing	Brass Compression Fittings - Internal Sealing	Brass Crimp fittings - Internal sealing
Reducer 	1216x1014	Nos.	N/A	N/A	✓	N/A
	1620x1216	Nos.	✓	✓	✓	N/A
	2025x1216	Nos.	✓	✓	✓	✓
	2025x1620	Nos.	✓	✓	✓	✓
	2532x1216	Nos.	N/A	✓	✓	N/A
	2532x1620	Nos.	N/A	✓	✓	N/A
	2532x2025	Nos.	N/A	✓	✓	N/A
	3240x1216	Nos.	N/A	✓	✓	N/A
	3240x1620	Nos.	N/A	✓	✓	N/A
	3240x2025	Nos.	N/A	✓	✓	N/A
	3240x2532	Nos.	N/A	✓	✓	N/A
	4050x1216	Nos.	N/A	✓	N/A	N/A
	4050x1620	Nos.	N/A	✓	✓	N/A
	4050x2025	Nos.	N/A	✓	✓	N/A
	4050x2532	Nos.	N/A	✓	✓	N/A
	4050x3240	Nos.	N/A	✓	✓	N/A
	5063x1620	Nos.	N/A	✓	N/A	N/A
	5063x2025	Nos.	N/A	✓	N/A	N/A
	5063x2532	Nos.	N/A	✓	N/A	✓
	5063x3240	Nos.	N/A	✓	N/A	N/A
	5063x4050	Nos.	N/A	✓	N/A	N/A
	6375X2532	Nos.	N/A	✓	N/A	N/A
	6375x3240	Nos.	N/A	✓	N/A	N/A
	6375x4050	Nos.	N/A	✓	N/A	N/A
	6375x5063	Nos.	N/A	✓	N/A	N/A
	7590x3240	Nos.	N/A	✓	N/A	N/A
	7590x4050	Nos.	N/A	✓	N/A	N/A
	7590x5063	Nos.	N/A	✓	N/A	N/A
	7590x6375	Nos.	N/A	✓	N/A	N/A
	90110X6375	Nos.	N/A	✓	N/A	N/A
	90110x7590	Nos.	N/A	✓	N/A	N/A
Straight Coupler  	1014	Nos.	N/A	N/A	✓	N/A
	1216	Nos.	✓	✓	✓	✓
	1620	Nos.	✓	✓	✓	✓
	2025	Nos.	✓	✓	✓	✓
	2532	Nos.	N/A	✓	✓	N/A
	3240	Nos.	N/A	✓	✓	N/A
	4050	Nos.	N/A	✓	✓	N/A
	5063	Nos.	N/A	✓	✓	N/A
	6375	Nos.	N/A	✓	✓	N/A
	7590	Nos.	N/A	✓	✓	N/A
	90110	Nos.	N/A	✓	✓	N/A
Saddle 	4050X1/2"	Nos.	N/A	✓	N/A	N/A
	4050X3/4"	Nos.	N/A	✓	N/A	N/A
	4050X1"	Nos.	N/A	✓	N/A	N/A
	5063X1/2"	Nos.	N/A	✓	N/A	N/A
	5063X3/4"	Nos.	N/A	✓	✓	N/A
	6375X3/4"	Nos.	N/A	✓	N/A	N/A
	6375X1"	Nos.	N/A	✓	✓	N/A
	7590X3/4"	Nos.	N/A	✓	N/A	N/A
	7590X1"	Nos.	N/A	✓	✓	N/A
	90110x1"	Nos.	N/A	✓	✓	N/A
Pipe Plug 	1216	Nos.	N/A	✓	N/A	N/A
	1620	Nos.	N/A	✓	N/A	N/A
	2025	Nos.	N/A	✓	N/A	N/A
	3240	Nos.	N/A	N/A	✓	N/A
	4050	Nos.	N/A	N/A	✓	N/A
	5063	Nos.	N/A	✓	N/A	N/A
	6375	Nos.	N/A	✓	N/A	N/A
	7590	Nos.	N/A	✓	N/A	N/A
	90110	Nos.	N/A	✓	N/A	N/A

6. Salient features:

a. **Long Life :** KiTEC pipes are designed to withstand 60 degree C. temperature at 11 bar pressure for a life span of 50 years.

b. **Higher flow :** Because of smooth inside surface KiTEC pipe is furr & scale free and gives higher and consistent flow throughout the service life. Friction drop properties for KiTEC pipes are represented by following graph.



This graph is based on following formula (used for smooth pipes only):

Q = 0.552 x F 0.5645 x D 0.6925

Where,

Q =	Water Flow Rate	Litres per Hour
F =	Friction drop	Meter per meter
D =	Inside Diameter of Pipe	mm

In case of KiTEC fittings, the equivalent length for various fittings is as given in the following table. For calculating the friction drop, add the eqivalent length for highest size of fitting to the length of the pipe. Find out the friction drop from graph.

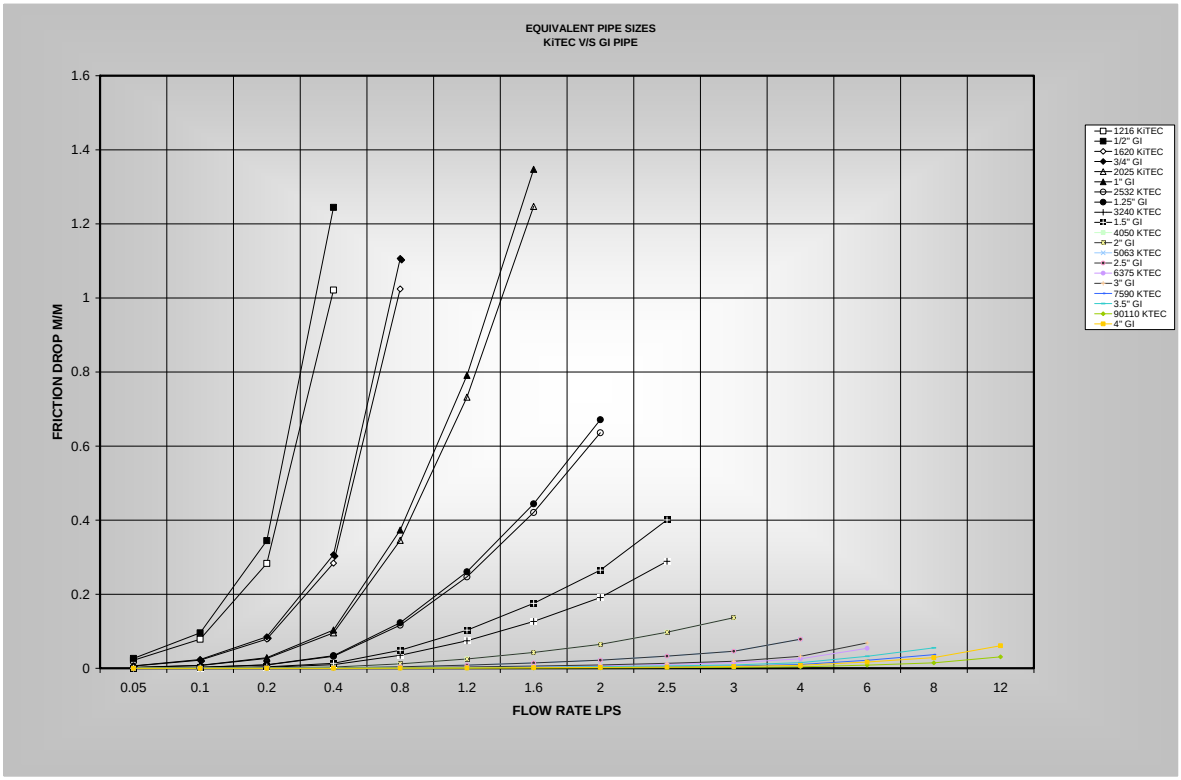
Type of fitting	Equivalent length meters									
	1216	1620	2025	2532	3240	4050	5063	6375	7590	90110
Female Branch Tee / Female Thread Elbow	1.30	1.50	1.70	1.90	2.10	2.40	2.80	3.40	3.80	4.40
Male/Female Thread Connector	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Equal/Reducing Tee	2.40	3.00	3.20	3.30	3.50	3.70	3.90	4.20	4.30	4.50
Equal/Reducing Elbow	2.40	3.00	3.20	3.30	3.50	3.7	3.90	4.20	4.30	4.50
Straight/Reducing Connector	1.30	1.50	1.70	1.90	2.10	2.40	2.80	3.40	3.80	4.40

Example:

Pipe size :3240
Length :10 meters
Flow : 1 lps
Fittings :Eq. Elbow

Eq. Length for elbow (from table)	3.5 meters
Cumulative length	13.5 meters
Friction drop (from graph)	4.5 meter/100 meter
friction drop for pipeline	4.5*13.5/100=0.61 meters

c. **Equivalent Pipe Sizes:** Equivalent pipe size calculations are based on following graph. Flow rate v/s friction drop curves for KiTEC and equivalent GI pipe are shown in Graph. For same friction drop, flow is marginally higher in case of KiTEC pipe as compared to equivalent GI pipe. Thus, flow carrying capacity of KiTEC pipe is higher than the equivalent GI pipe.



The graph is based on Hazen William's Flow Equation. The formula is as follows :

$Q = F^{0.54} \times 1002 \times C \times D^{2.63}$

Where,

Q =	Water Flow Rate	Cubic Meter per Hour
F =	Friction Drop	Meter per meter
C =	Surface Factor	For KiTEC C = 150 For GI C = 100
D =	Inside Diameter of Pipe	mm

d. **High Chemical Resistance :** KiTEC pipes, due to inner and outer PE layers, are totally inert to most of the chemicals. In addition to all the chemicals to which PE pipes are totally resistant, KiTEC offer better chemical resistance than PE pipes for the chemicals, such as fuel oils, where PE pipes fail because of swelling. The chemicals are broadly categorised as follows:

KiTEC is totally resistant to following chemicals at temperatures upto 60 degree C. :
Acids, Alcohol, Aldehyde, Ethylene Glycol, Bleach, Corrosion inhibitors, Detergents, Foodstuff, Petrol/diesel/fuel oils, Veg/Mineral oils.
For following chemicals, the KiTEC is resistant at ambient temperature. The performance is not yet ascertained at elevated temperature:
Beverages, Insecticides, Ketones, Oxidation agents, Paints, Salts, Surfactants/soaps
KiTEC should not be used for chlorinated solvents.

e. **No Corrosion :** KiTEC does not have any corrosion due to inner and outer PE layers.

f. **Completely Impermeable :** Because of aluminium tube, KiTEC is totally impermeable unlike other plastic pipes.

g. **Fur and Scale Free :** Because of smooth inside surface of PE layer, the problem of scaling is minimised.

h. **Light and Strong:** KiTEC pipes are light as compared to conventional metal pipes. The aluminium tube provides necessary strength to withstand the design pressure.

i. **Easy Detection:** Concealed KiTEC pipe can be easily detected by using meal detectors.

j. **Malleable** : KiTEC pipe can be formed by hand leading to :

- Fewer fittings
- Fewer joints
- Faster installation
- Less wastage

Small diameter KiTEC is easily formed into curves, sets by hand and only requires a bending springs when forming tight bends down to radius equivalent to 5 times the diameter of pipe.

Unlike plastic plumbing pipes, KiTEC permanently holds whatever shape it is formed into and does not need additional clips or brackets to retain the shape of bends or curves.

k. **No effect of UV Radiation:** Due to addition of carbon black, KiTEC pipes do not have any deteriorating effect of UV rays.

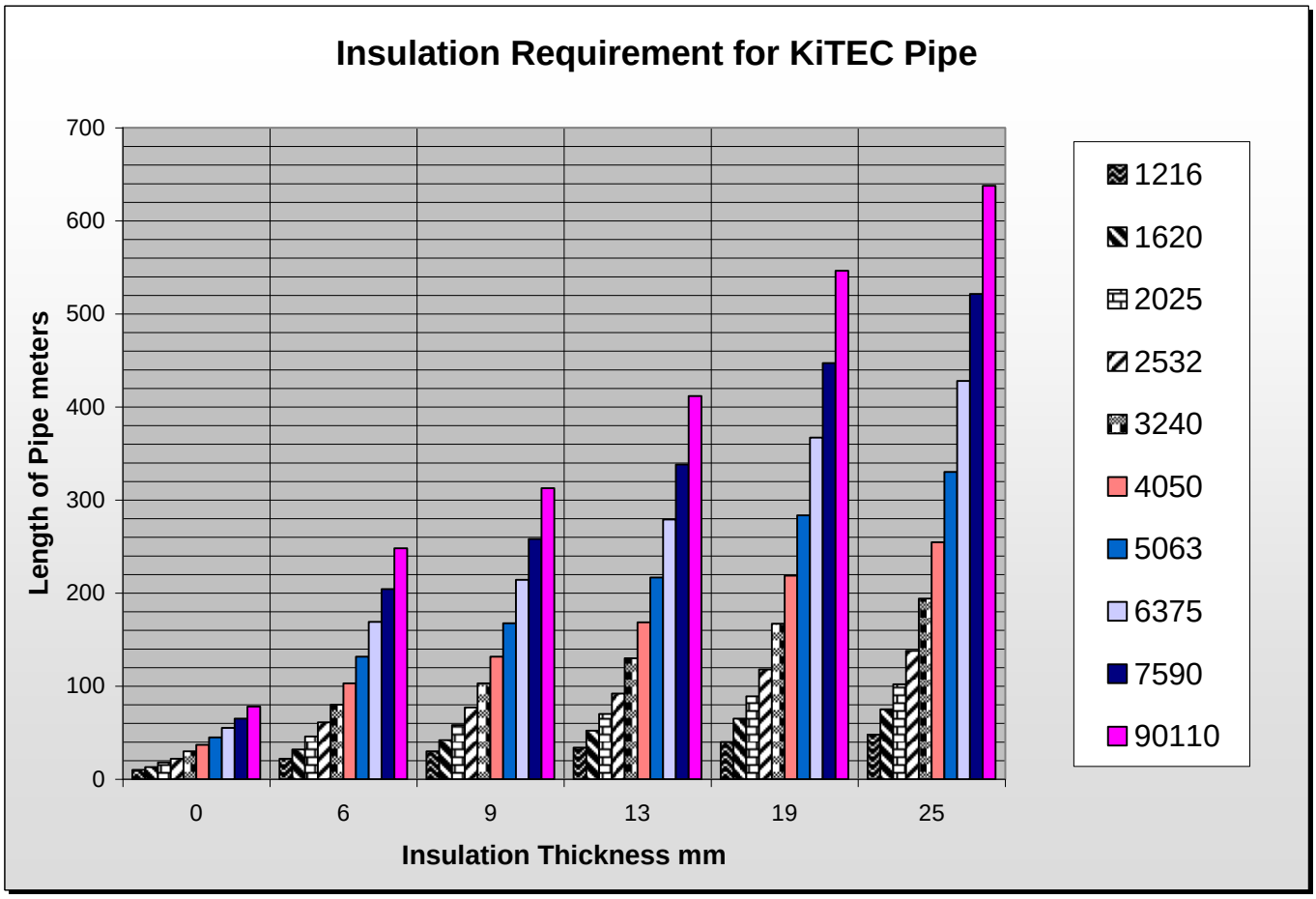
l. **Thermal Strength: KiTEC Composite PR Pipe** having pressure rating of 13.8 Kg/Cm^2 at 23^{0}C. and 11.0 Kg/Cm^2 at 60^{0}C. KiTEC piping system can safely be used for 6 Kg/Cm^2 pressure at 80^{0}C. working temperature. Short term excursions to 95^{0}C. will not affect the overall performance. Design life span for KiTEC Piping System is in excess of 50 years.

KiTEC Composite PE-AL-PEX Pipes are suitable for applications having continuous operting temperature of 95^{o}C. Rated pressure at 82^{o}C is 5.0 Kg/Cm^2. Short term excursions to 110^{0}C will not affect the overall performance.

KiTEC Composite PL Pipes having pressure rating of 12.0 Kg/Cm^2 at 23^{0}C. and 6.0 Kg/Cm^2 at 65^{0}C. Short term excursions to 95^{0}C will not affect the overall performance.

m. **Thermal Expansion:** By combining the two materials along with adhesive layers, KiTEC pipe avoids the unaccepted thermal expansion and deformation of plastic pipe. At the same time it retains the flexibility, frost resistance and ease of use associated with plastic. Low expansion coefficient is due to tie layer which eliminates the differential expansion of plastic and metal. The coefficient of thermal expansion for KiTEC pipe is 23 x 10^{-6} / ^{o} K (approx. same as that of copper pipe).

n. **Conductivity:** KiTEC is bad conductor of heat. Thermal conductivity is 0.43 Watt/[m deg K.] Because of this the insulation requirement is less as compared to GI pipes. Following graph is given as guideline for selection of insulation thickness calculations.



The graph is given for guideline purpose only.
This graph is based on following assumptions.

I. Conductivity of Insulation material : 0.035 W/(m deg. K.)
II. The calculations are based on allowable heat loss with one degree centigrade temperature drop and velocity of flow as 1 meter/second.

Heat loss calculations are based on no wind, ambient conditions at 10 deg. C. temperature. If the conditions are more severe, suitable safety factor should be incorporated.

o. **Flame/Smoke Rating** : KiTEC pipe has a Flame Spread of 5 and a Smoke Development of 5 as per ULC-S102.2. The ratings meet most building code requirements allowing for the use of KiTEC in high-rise construction as well as in return air plenums and vertical shafts. Flamability test of KiTEC Composite Pipes was conducted by Central Power Research Institute and the same has been classified as HB.

p. **Permeation:** KiTEC's aluminium core acts as a permeation barrier against entry of contaminants, and limits oxygen permeation to virtually zero. Permeation is the molecular transport of chemicals, from the soil surrounding the pipe, through the pipe wall and into the fluid being carried within. Permeation may have adverse effects on the piping system, the conveyed fluid or both. KiTEC is widely used for the transmission and distribution of potable water providing a second line of defence for the plumbing system.

7. Comparison with other piping materials :

CRITERIA	GI PIPE	COPPER PIPE	CPVC PIPE	PVC PIPE	KITEC PIPE
EFFECT OF HARD WATER	High scale Formation	Scale formation is prohibited due to smooth bore	Scale formation is prohibited due to smooth bore	Scale formation is prohibited due to smooth bore	**Scale formation prohibited due to smooth bore**
EFFECT OF SOFT WATER	Gets corroded.	Gets corroded due to acidic nature of water	No effect.	No effect.	**No effect.**
HEALTH CRITERION	Low. Due to lead content and corrosion.	Good with ferrule but lead content in solder- bad for health.	Very good.	Very good.	**Very good.**
JOINTING TECHNIQUES	Threaded.	Soldered /ferrule	Solvent cement/ Threaded.	Solvent cement.	**Compression fittings.**
CORROSION RESISTANCE	Very low.	Low.	No effect.	No effect.	**No effect.**
THERMAL STRENGTH PROPERTY AT 60°C TEMPERATURE	Very good.	Very good.	Very good for plain pipes. For threaded pipes the de-rating factor is high(0.25)	Not recommended	**Very good.**
AVAILABILITY OF FITTINGS	Very good.	Average.	Very good.	Good.	**Very good.**
THERMAL EXPANSION	Low. Good for concealed piping.	Low. Good for concealed piping.	Very high. Requires specials as being rigid pipe may fail.	High. Special care is required for use in concealed piping.	**Low. Good for use in concealed piping.**
EFFECT OF SUB-ZERO TEMPERATURE	Up to 0°C.	Up to 0°C.	Up to 0°C.	Up to 0°C.	**Up to -40°C.**
U. V. RESISTANCE	Very Good.	Very Good.	Low.	Low.	**Very Good.**
EASE IN INSTALLATION	Low.	Average.	Low. Installation time for solvent cement is very high. Set time is up to 1 hour. and curing time is up to 2 hours.	Good.	**Very Good.**
FLOW PROPERTIES FOR FRICTION	Low.	Very good.	Very good.	Very good.	**Very good.**

8. Applications and selection procedure:

Selection of pipe and fittings: Following factors should be considered for proper selection of KiTEC pipe and type of associated fittings.

Table I

Application	Operating Temp. ° C.	Pressure Kg/Cm^2													
		KiTEC PR pipe			KiTEC PL pipe			KiTEC PE-AL-PEX pipe			KiTEC Brass Compression fittings			KiTEC Composite Compression / Crimp & Brass Crimp fittings		
		Do's	*Can be used*	*Don'ts*	*Do's*	*Can be used*	*Don'ts*	*Do's*	*Can be used*	*Don'ts*	*Do's*	*Can be used*	*Don'ts*	*Do's*	*Can be used*	*Don'ts*
Cold water	<27	<=13.8	>13.8 <17.00	>17.00	<=12.0	>12.0 <14.00	>14.00	<=12.0	>12.0 <14.00	>14.00	<=13.8	>13.8 <17.00	>17.00	<=13.8	>13.8 <17.00	>17.00
Hot Water	>27<=65	<=11	>11 <13.80	>13.8	<=6	>6 <8	>8	<=7	>7 <9	>9	<=11	>11 <13.80	>13.8	<=11	>11 <13.80	>13.8
	>65<80	<=6	>6<11	>11	<=4	>4<6	>6	<=6	>6<8	>8	<=6	>6<11	>11	-	-	-
	>80	-	-	-	-	-	-	<=5	>5<7	>7	<=6	>6<11	>11	-	-	-
Compressed Air	Ambient	<=13.8	>13.8 <17.00	>17.00	-	-	-	-	-	-	<=13.8	>13.8 <17.00	>17.00	<=13.8	>13.8 <17.00	>17.00
Natural Gas/LPG	Ambient	<=6.00	>6.00 <11.00	>11.00	-	-	-	-	-	-	<=6.00	>6.00 <11.00	>11.00	-	-	-
Diesel/Fuel Oil	Ambient	<=11	>11 <13.80	>13.8	-	-	-	-	-	-	<=11	>11 <13.80	>13.8	<=11	>11 <13.80	>13.8
Other Chemicals*	Ambient	<= (11xm)	>(11xm) <13.80	>13.8xm	-	-	-	-	-	-	<= (11xm)	>(11xm) <13.80	>13.8xm	<=11xm	>11xm <13.8xm	>13.8xm
Other Chemicals*	>27<65	<= (11xm)	>(11xm) <13.80	>13.8xm	-	-	-	-	-	-	<= (11xm)	>(11xm) <13.80	>13.8xm	<=11xm	>11xm <13.8xm	>13.8xm

* Check the following :

1. Select the multiplication factor (m) from following table.
2. Check the chemical resistance of Brass. If chemical is corrosive for brass, do not use brass & composite fittings (Internal) with brass inserts. However, composite fittings with SS inserts can be used.

Multiplication Factor m

Chemicals	Ambient Temperature	65°C .
Acids	0.80	0.80
Aldehyde	0.80	0.40
Beverages	0.80	0.40
Corrosion Inhibitors	0.80	0.80
Foodstuffs	0.80	0.80
Ketones	0.80	0.40
Paints	0.80	0.40
Chlorinated solvents	0.30	0.20
Alcohol	0.80	0.40
Ethylene Glycol	0.80	0.70
Bleach	0.80	0.80
Detergents	0.80	0.70
Insedtides	0.80	0.40
Oxidation Agents	0.80	0.40
Veg/mineral oils	0.80	0.70

KiTEC Fittings for Chemical Handling

Present range of fittings is having following limitations:

1. **Composite Internal Sealing fittings:** Brass inserts are mostly not suitable for the chemicals. However, Fittings of 2532 size and above (being in full plastic) can be used for chemical applications.

2. **Brass fittings:** Mostly not suitable for the chemicals.

   a) Table 1 gives the list of chemicals with recommended maximum operating pressure, for which the fittings are suitable with EPDM O rings.

   b) Table 2 gives the list of chemicals with recommended maximum operating pressure, for which the fittings are suitable with Viton O rings.

   c) Table 3 gives the list of chemicals with recommended maximum operating pressure, for which the fittings are suitable with Nitrile O rings.

   d) EPDM, Viton and Nitrile O rings will be supplied as spares.

Table 1

Chemical	Rated Pressure Kg/Cm²	
	Ambient	<=65 Deg. C.
Acetaldehyde	6.0	4.5
Acetic Acid	10.0	7.5
Acetic Acid, Glacia	6.0	4.5
Acetic Anhydride	10.0	7.5
Acetone	6.0	4.5
Aluminum Chloride, 20%	10.0	7.5
Aluminum Sulfate	10.0	7.5
Ammonia, Anhydrous	10.0	7.5
Ammonia, Liquids	10.0	7.5
Ammonium Carbonate	10.0	7.5
Ammonium Chloride	10.0	7.5
Ammonium Hydroxide	10.0	7.5
Ammonium Nitrate	10.0	7.5
Ammonium Persulfate	10.0	7.5
Ammonium Phosphate, Dibasic	10.0	7.5
Ammonium Phosphate, Monobasic	10.0	7.5
Ammonium Phosphate, Tribasic	10.0	7.5
Ammonium Sulfate	10.0	7.5
Amyl Alcohol	10.0	7.5
Analine	6.0	4.5
Anti-freeze	10.0	7.5
Barium Chloride	10.0	7.5
Barium Hydroxide	10.0	7.5
Barium Sulfate	10.0	7.5
Barium Sulfide	10.0	7.5
Beet Sugar Liquids	10.0	7.5
Borax (Sodium Borate)	10.0	7.5
Boric Acid	10.0	7.5
Butyric Acid	10.0	7.5
Calcium Chloride	10.0	7.5
Calcium Hydroxide	10.0	7.5
Calcium Hypochlorite	10.0	7.5
Carbon Monoxide	10.0	7.5
Carbonated Water	10.0	7.5
Carbonic Acid	10.0	7.5
Chromic Acid, 5%	10.0	7.5
Chromin Acid, 50%	6.0	4.5
Citric Acid	6.0	4.5

Table 1 Contd.

Chemical	Rated Pressure Kg/Cm²	
	Ambient	<=65 Deg. C.
Copper Chloride	10.0	7.5
Copper Cyanide	10.0	7.5
Copper Sulfate	10.0	7.5
Detergents	10.0	7.5
Ethylene Glycol	10.0	7.5
Ferric Chloride	10.0	7.5
Ferric Nitrate	10.0	7.5
Formaldehyde	10.0	7.5
Formic Acid	10.0	7.5
Freon 12 (wet)	10.0	7.5
Freon 22	10.0	7.5
Gelatin	10.0	7.5
Glucose	10.0	7.5
Glycersin	10.0	7.5
Honey	10.0	7.5
Hydrobromic Acid	6.0	4.5
Hydrochloric Acid, 20%	10.0	7.5
Hydrocyanic Acid (gas 10%)	10.0	7.5
Hydrofluoric Acid, 20%	6.0	4.5
Hydrofluosilicic Acid, 20%	10.0	7.5
Hydrogen Sulfide, aqueous solution	10.0	7.5
Lacquer Thinners	6.0	4.5
Lactic Acid	10.0	7.5
Latex	6.0	4.5
Lead Acetate	10.0	7.5
Magnesium Carbonate	10.0	7.5
Magnesium Chloride	10.0	7.5
Mercuric Chloride (dilute solution)	10.0	7.5
Mercury	10.0	7.5
Methyl Cellosolve	10.0	7.5
Methyl Ethyl Ketone	10.0	7.5
Milk	10.0	7.5
Nickel Chloride	10.0	7.5
Nickel Sulfate	10.0	7.5
Nitric Acid (10% solution)	10.0	7.5
Oil, Aniline	10.0	7.5
Oil, Coconut	10.0	7.5
Oil, Cod Liver	10.0	7.5

Table 1 Contd.

Chemical	Rated Pressure Kg/Cm²	
	Ambient	<=65 Deg. C.
Oxalic Acid (cold)	10.0	7.5
Phosphoric Acid (40%-100% solution)	10.0	7.5
Phosphoric Acid (to 40% solution)	10.0	7.5
Potassium Bromide	10.0	7.5
Potassium Cyanide Sloutions	10.0	7.5
Potassium Dichromate	10.0	7.5
Potassium Hydroxide, 50%	10.0	7.5
Potassium Nitrate	10.0	7.5
Potassium Sulfate	10.0	7.5
Pptassium Chloride	10.0	7.5
Pyridyne	6.0	4.5
Sea Water	10.0	7.5
Silicone	10.0	7.5
Sodium Bicarbonate	10.0	7.5
Sodium Carbonate	10.0	7.5
Sodium Chloride	10.0	7.5
Sodium Cyanide	10.0	7.5
Sodium Hydroxide, 20%	10.0	7.5
Sodium Nitrate	10.0	7.5
Sodium Perborate	10.0	7.5
Sodium Silicate	10.0	7.5
Sodium Sulfate	10.0	7.5
Sodium Sulfide	10.0	7.5
Sodium Thiosulphate ("Hypo")	10.0	7.5
Stannic Chloride	10.0	7.5
Sulfurous Acid	10.0	7.5
Tannic Acid	10.0	7.5
Urine	10.0	7.5

Table 2

Chemical	Rated Pressure Kg/Cm²	
	Ambient	<=65 Deg. C.
Vinegar	10.0	7.5
Water, distilled, Lab Grade #7	10.0	7.5
Water, Fresh	10.0	7.5
Water, Salt	10.0	7.5
Whiskey and Wines	10.0	7.5
Zinc Chloride	10.0	7.5
Zinc Sulfate	10.0	7.5
Ammonium Biflouride	10	6
Arsenic Acid	10	6
Asphalt	10	6
Barium Carbonate	10	6
Calcium Bisulfide	10	6
Calcium Bisulfite	10	6
Calcium Carbonate	10	6
Calcium Chlorate	10	6
Calcium Sulfate	10	6
Calgon	10	6
Catsup	10	6
Chocolate Syrup	10	6
Chromic Acid, 10%	10	6
Chromin Acid, 30%	10	6
Cider	7.5	4.5
Citric Oils	10	6
Coffee	10	6
Copper Floborate	7.5	4.5
Copper Nitrate	10	6
Copper Sulfate (5% solution)	10	6
Cream	10	6
Epson Salts (Magnesium Sulfates)	10	6
Ethylene Dichloride	10	6
Fatty Acids	10	6
Ferric Sulfate	10	6
Ferrous Chloride	10	6
Ferrous Sulfate	10	6
Fluoboric	10	6
Fluosilicic Acid	10	6
Fruit Juice	10	6
Fuel Oils	7.5	4.5

Table 2 Contd.

Chemical	Rated Pressure Kg/Cm²	
	Ambient	<=65 Deg. C.
Gallic Acid	10	6
Gasoline	7.5	4.5
Grapejuice	7.5	4.5
Hydrobromic Acid, 20%	10	6
Hydrochloric Acid, 37%	10	6
Hydrocyanic Acid	10	6
Hydrofluoric Acid, 75%	7.5	4.5
Hydrogen Gas	10	6
Hydrogen Peroxide	10	6
Hydrogen Peroxide, 30%	10	6
Ink	7.5	4.5
Iodine (in alcohol)	7.5	4.5
Lard	10	6
Lead Sulfamate	10	6
Lubricants	10	6
Oil, Mineral	7.5	4.5
Oil, Olive	10	6
Oil, Orange	10	6
Oil, Resin	10	6
Oil, Silicone	10	6
Oil, Soybean	10	6
Paraffin	10	6
Phenol (carbolic acid)	7.5	4.5
Photographic (developer)	10	6
Plating Solution, Antimony Plating 130°F	10	6
Plating Solution, Arsenic Plating 110°F	10	6
Plating Solution, Brass High Speed Brass Bath 110°F	10	6
Plating Solution, Brass Regular Brass Bath 100°F	10	6
Plating Solution, Bronze Copper-Cadmium Bronze Bath R	10	6
Plating Solution, Bronze Copper-Tin Bronze Bath 160°F	10	6
Plating Solution, Bronze Copper-Zinc Bronze Bath 100°F	10	6
Plating Solution, Cadmium Cyanide Bath 90°F	10	6
Plating Solution, Cadmium Fluoborate Bath 100°F	10	6
Plating Solution, Copper (Acid) Copper Fluoborate Bath 120°F	10	6
Plating Solution, Copper (Acid) Copper Sulfate Bath R	10	6
Plating Solution, Copper (Cyanide) Copper Strike Bath 120°F	10	6
Plating Solution, Copper (Cyanide) High Speed Bath 180°F	10	6
Plating Solution, Copper (Cyanide) Rochelle Salt Bath 150°F	10	6

Table 2 Contd.

Chemical	Rated Pressure Kg/Cm²	
	Ambient	<=65 Deg. C.
Plating Solution, Copper (MiscCopper (Electroless) 140°F	10	6
Plating Solution, Gold Acid 75°F	10	6
Plating Solution, Gold Cyanide 150°F	10	6
Plating Solution, Gold Neutral 75°F	10	6
Plating Solution, Indium Sulfamate R	10	6
Plating Solution, Iron Sulfate Bath 150°F Ferrous Am	10	6
Plating Solution, Iron Ferrous Chloride Bath 190°F	10	6
Plating Solution, Iron Ferrous Sulfate Bath 150°F	10	6
Plating Solution, Iron Fluoborate Bath 145°F	10	6
Plating Solution, Iron Sulfamate 140°F	10	6
Plating Solution, Iron Sulfate-Chloride Bath 160°F	10	6
Plating Solution, Nickel Electroless 200°F	10	6
Plating Solution, Nickel Fluoborate 100-170°F	10	6
Plating Solution, Nickel High Chloride 130-160°F	10	6
Plating Solution, Nickel Sulfamate 100-140°F	10	6
Plating Solution, Nickel Watts Type 115-160°F	10	6
Plating Solution, Silver 80-120°F	10	6
Plating Solution, Tine-Lead 100°F	10	6
Plating Solution, Tin-Fluoborate 100°F	10	6
Plating Solution, Zinc Acid Chloride 140°F	10	6
Plating Solution, Zinc Acid Fluoborate Bath R	10	6
Plating Solution, Zinc Acid Sulfate Bath 150°F	10	6
Plating Solution, Zinc Alkaline Cyanide Bath R	10	6
Potash	10	6
Potassium Bicarbonate	10	6
Potassium Carbonate	10	6
Potassium Chlorate	10	6
Potassium Permanganate	7.5	4.5
Rum	10	6
Rust Inhibitors	10	6
Salad Dressing	10	6
Silver Nitrate	10	6
Soap Solutions	10	6
Sodium Bisulfate	10	6
Sodium Bisulfite	10	6
Sodium Chlorate	10	6
Sodium Chromate	10	6
Sodium Hydroxide (80% solution)	10	6

Table 2 Contd.

Chemical	Rated Pressure Kg/Cm²	
	Ambient	<=65 Deg. C.
Sodium Hypochlorite	10	6
Sugar (liquids)	10	6
Sulfuric Acid (10% - 75%)	10	6
Sulfuric Acid (to 10%)	10	6
Sulfuric Acid, 75% - 100%	7.5	4.5
Syrup	10	6
Tanning Liquors	10	6
Tartaric Acid	10	6
Terpentine	7.5	4.5
Tetrachlorethane	10	6
Tomato Juice	10	6
Varnish (use vitron for aromatic)	10	6
Water, Acid, Mine	10	6
White Liquor (Pulp Mill)	10	6
White Water (Paper Mill)	10	6

Table 3

Chemical	Rated Pressure Kg/Cm²	
	Ambient	<=65 Deg. C.
Ammonia, Nitrate	10	6
Formaldehyde, 40%	10	6
Hydrogen Peroxide, 10%	10	6
Mercuric Cyanide	10	6
Oil, Clove	7.5	4.5
Rosins	10	6
Shellac (bleached)	10	6
Shellac (orange)	10	6

9. Production Process – In brief:

The process is based on the forming and welding of an aluminium strip into a pipe whilst concurrently extruding, via a sophisticated die-head arrangement, layers of hot melt adhesives and polyethylene resins. In a short space, raw materials are fed into the system and finished pipe emerges requiring only to be cooled down, coiled and cut to length. Control of the extrusion equipment synchronises the speed of the multi-extruders, the haul-off and the welding equipment. The KiTECHNOLOGY process requires electrical power, compressed air and cooling water. The material used in the process are specific grade of aluminium, hot melt adhesive and polyethylene resins. The process does not give rise to pollution, nor have any adverse impact on environment. Waste and scrap materials are disposed of by traditional methods.

9.1 Process Safety :

- **Aluminium Welding:** Air pressure is maintained inside the tube during production. If there is any welding malfunction, bubbling out of air from non-welded pipe section will indicate the welding problem.
- **No aluminium :** Alarm indicates if there is no aluminium.
- **Low material:** In case of adhesive as well as PE, low material alarm will indicate the low level of material.
- **Length counter:** The cutting of the pipe at predetermined intervals is possible as the counter provided with the extruder counts the exact length produced.

10. Quality assurance (on Line) for KiTEC Pipes:

KiTEC has world class quality lab and IAPMO India has recognised the same for in-house testing facilities. The quality assurance plan consists of various tests which are conducted online as well as after completion of the production.

10.1. Aluminium weld Strength : Procedure:

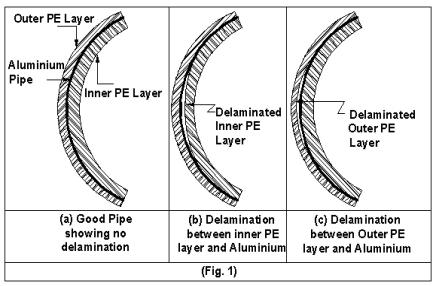
Aluminium ring, after welding and before starting the PE as well as adhesive extruders, is tested for weld strength as follows:

25 mm long sample is tested on tensile tester.

No failure is permitted across the weld line with minimum values as given in company standard.

Nominal Pipe Size mm	Minimum Strength (N)
1014	850
1216	850
1620	850
2025	1050
2532	1050
3240	1050
4050	1250

10.2. Adhesion Test (Only For Pipe Size 1014 – 4050) : There shall be no de-lamination of the PE and AL, either on bore side or the outside. The test is conducted as follows:.



(Fig. 1)

Cutting of the spiral: Mount a sharp but razor like bladewithin a protective housing and angle to cut a 45o spiral in the pipe. Choose a KiTEC pipe at random and insert into the housing and rotate to form the spiral cut. The cut goes through the complete wall on one side of the pipe only. Run the spiral along the pipe for a minimum distance along the pipe axis equal to five times the outside diameter.

Examining for de-lamination: Hold pipe with the spiral cut firm at the uncut end and create a ribbon of pipe material by opening out the spiral cut pipe. Pliers can be used to grip the spiral cut pipe. Examine the wall of the pipe visually side-on for evidence of de-lamination between metal and plastic layers (see figure).

10.3 Layer Separation Test (Only for Pipe Sizes 4050 and Larger)

The layer separation test shall be conducted at 23 ± 2 ºC (73 ± 4ºF) and on pipe sizes 4050 and larger only. The test apparatus for the layer separation test shall consist of a tension testing device with suitable pull-off device (see Figure). The test specimens for the layer separation test shall consist of five sections of PE-AL-PE pipe, each approximately 10 mm long, cut at random intervals from one section of pipe.

Test Procedure: The layer adhesion test shall be conducted as follows:

(a) Mechanically separate, to about 5 mm and on the opposite side to the welding seam, the outside PE layer, together with the aluminium layer, from the inside PE layer of the test specimens, using the pull-off device.

Note: Separating the layers 5 mm allows clamping.

(b) Examine the adhesion of the outside PE layer to the aluminium tube.

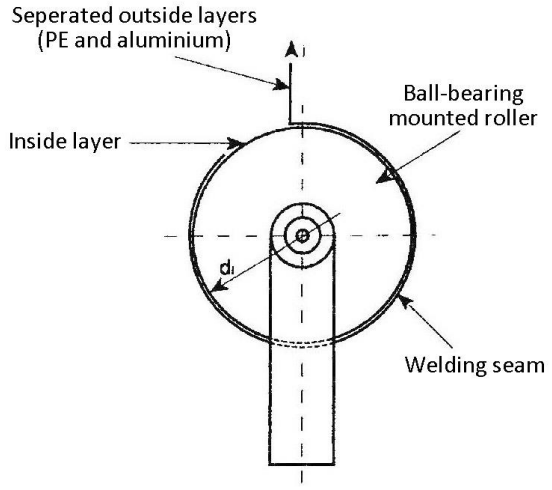
(c) Mount the test specimen and clamp the 5 mm tab in the tension testing device.

(d) Remove the outside layer with a linear speed of 50 mm/min.

(e) Record the force diagram.

Performance Requirements: The minimum adhesive force per each 10 mm pipe strip shall be as specified in Table 7 and there shall be no signs of delamination or separation between the outside PE layer and the aluminium tube.

Nominal Pipe Size	Minimum Adhesive Force per 10 mm Pipe Section, N
4050	50
5063	60
6375	70
7590	70
90110	70



Note: The diameter of the roller shall be 95% of the pipe inside diameter, where di is the pipe inside diameter

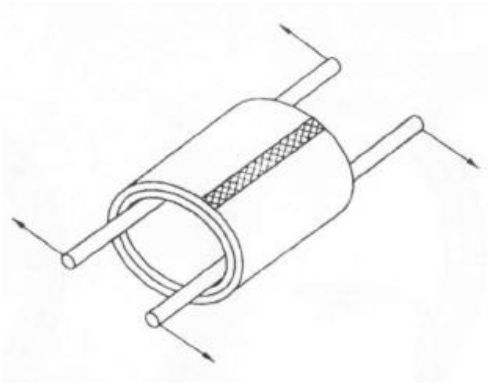
10.4 Minimum Pipe Ring Strengths: Procedure to be demonstrated.

Sample size and shape : Cut the rings of the KiTEC pipe so that two sides are parallel and at 90o to the pipe axis. The length of each ring will be 25 mm. Cut minimum of 15 samples consecutively along the axis of the pipe.

Ring Tests: Test the consecutively cut samples using a tensile testing machine. Arrange the rings so that the aluminium weld is at 90^0 to the tensile axis as shown in figure. The cross head speed shall be at 50 mm/Min. Mount the rings of pipe on two steel rods of minimum diameter of 4 mm. Record the peak force and the same should be equal to or more than the values given in the table.

Minimum Pipe Ring Strengths of KITEC Composite Pipe

Nominal Pipe Size mm	Minimum Pipe Ring Strength (N)
1014	2100
1216	2100
1620	2400
2025	2400
2532	2700
3240	2700
4050	2700



Minimum Pipe Ring Strengths of KITEC Composite PL Pipe & KiTEC PE/AL/PEX Composite Pipe

Nominal Pipe Size mm	Minimum Pipe Ring Strength (N)	Nominal Pipe Size mm	Minimum Pipe Ring Strength (N)
1216	1900	4050	2500
1620	1900	5063	3500
2025	2100	6375	4100
2532	2400	7590	4700
3240	2500	90110	5300

Minimum Pipe Ring Strengths of KITEC PEX/AL/PEX Composite Pipe

Nominal Pipe Size mm	Minimum Pipe Ring Strength (N)	Nominal Pipe Size mm	Minimum Pipe Ring Strength (N)
1216	2300	3240	3500
1620	2500	4050	3700
2025	2500	5063	5500
2532	2500	6375	6000

10.5 Minimum Burst Pressure :

Pipe sample : Select a length of KITEC pipe at random and prepare 5 consecutive lengths of required length (200 mm minimum). Seal samples at the ends with appropriate fittings and test either free or fixed end.

Test temperature : The test should be carried out at ambient temperature inside the laboratory. The temperature should preferably be 23±5°C.

Burst pressure : Increase the pressure inside the pipe in such a way that the time required to reach the burst pressure is between 60 to 70 seconds. Record the burst pressure and it should not be less than the values given in table above.

23 deg. C. Burst Pressure of KITEC Composite Pipe

Nominal Pipe Size mm	Minimum Burst Pressure (MPa)	Nominal Pipe Size mm	Minimum Burst Pressure (MPa)
1014	7.00	2532	4.00
1216	6.00	3240	3.50
1620	5.00	4050	3.50
2025	4.00		

23 deg. C. Burst Pressure of KITEC Composite PL Pipe & KiTEC PE/AL/PEX Composite Pipe

Nominal Pipe Size mm	Minimum Burst Pressure MPa	Nominal Pipe Size mm	Minimum Burst Pressure MPa
1216	5.50	4050	3.00
1620	4.50	5063	3.00
2025	3.50	6375	3.00
2532	3.00	7590	3.00
3240	3.00	90110	3.00

23 deg. C. Burst Pressure of KITEC PEX/AL/PEX Composite Pipe

Nominal Pipe Size mm	Minimum Pipe Ring Strength (N)	Nominal Pipe Size mm	Minimum Pipe Ring Strength (N)
1216	6.00	3240	4.00
1620	5.00	4050	3.80
2025	4.00	5063	3.80
2532	4.00	6375	3.80

11. Quality assurance test for KiTEC Pipes (Product release laboratory):

11.1. Creep test of pipes (to demonstrate sample preparation & ongoing test): When subjected to internal pressure creep rupture test, the pipe under test shall show no sign of localised swelling, leakage or weeping, and shall not burst during the prescribed test duration. The temperatures, duration of test and pressure for the test shall conform to those specified in Table.

Hydraulic Pressure Test conditions and requirements for KITEC Composite Pipe

Nominal Pipe Size mm	Test Temperature °C.	Test Pressure MPa	Minimum test duration hours
1014	20 60	3.00 2.50	1 10
1216	20 60	3.00 2.50	1 10
1620	20 60	2.70 2.50	1 10
2025	20 60	2.60 2.50	1 10
2532	20 60	2.30 2.10	1 10
3240	20 60	2.20 2.00	1 10
4050	20 60	2.10 1.90	1 10

Hydraulic Pressure Test conditions and requirements for KITEC Composite PL Pipe

Nominal Pipe Size mm	Test Temperature °C.	Test Pressure MPa	Minimum test duration hours
1216	20 60	2.70 2.30	1 10
1620	20 60	2.40 2.30	1 10
2025	20 60	2.40 2.30	1 10
2532	20 60	2.00 1.80	1 10
3240	20 60	2.00 1.80	1 10
4050	20 60	2.00 1.80	1 10
5063	20 60	2.00 1.80	1 10
6375	20 60	1.90 1.70	1 10
7590	20 60	1.80 1.60	1 10
90110	20 60	1.70 1.50	1 10

Hydraulic Pressure Test conditions and requirements for KITEC PE/AL/PEX Composite Pipe

Nominal Pipe Size mm	Test Temperature °C.	Test Pressure MPa	Minimum test duration hours
1216	20 80	2.70 2.10	1 10
1620	20 80	2.40 2.10	1 10
2025	20 80	2.40 2.10	1 10
2532	20 80	2.00 1.60	1 10
3240	20 80	2.00 1.60	1 10
4050	20 80	2.00 1.60	1 10
5063	20 80	2.00 1.60	1 10
6375	20 80	1.90 1.50	1 10
7590	20 80	1.80 1.40	1 10
90110	20 80	1.70 1.30	1 10

Hydraulic Pressure Test conditions and requirements for KITEC PEX/AL/PEX Composite Pipe

Nominal Pipe Size mm	Test Temperature °C.	Test Pressure MPa	Minimum test duration hours
1216	82	2.72	10
1620	82	2.72	10
2025	82	2.72	10
2532	82	2.72	10
3240	82	2.00	10
4050	82	2.00	10
5063	82	2.00	10
6375	82	2.00	10

12. Quality assurance test for fittings (Product release laboratory):

12.1. Pull out Test for fittings (To be demonstrated) : Fittings are tested for pull out strength to ensure the strength of the joint when assembled with fittings.

Procedure: A joint formed with suitable pipe is tested on tensile testing machine. The required values are as given in table.

Test temperature: Ambient

Connection Size	Test Load N	Duration Hours
1014	620	1
1216	740	1
1620	1068	1
2025	1640	1
2532	2427	1
3240	3694	1
4050	5463	1
5063	6500	1
6375	8000	1
7590	9000	1
90110	9000	1

12.2. Internal pressure creep test (to demonstrate sample preparation on going test):

To ensure basic strength of the fitting, the fittings are tested for following test.

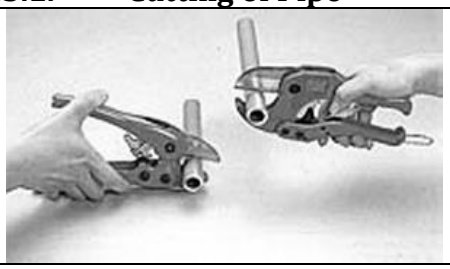
Test temperature: 80 Deg. C.

Pipe Size	Test Pressure Bar	Duration Hours
1014	10	50
1216	12	50
1620	10	50
2025	10	50
2532	09	50
3240	09	50
4050	09	50
5063	08	50
6375	08	50
7590	07	50
90100	07	50

13. End Preparation for Jointing:

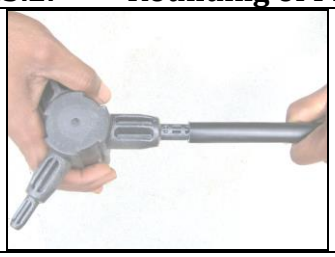
For jointing of KiTEC pipes, the end preparation of pipe is very important. Use KiTEC Tools only for perfect end preparation. the details are as follows:

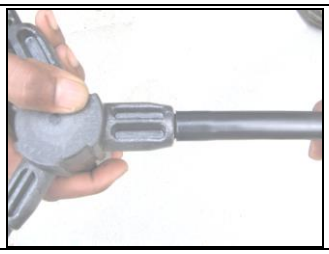
13.1. Cutting of Pipe



Always use KiTEC pipe cutter to ensure burr free cutting. It is necessary that the cut is always at the right angle. Hold the pipe as shown in the figure to ensure right angle cut.

13.2. Rounding of Pipe





Push the pipe over the rounding tool, as shown. **Rounding of the pipe end is essential.**

By using rounding tool, the end of the pipe is

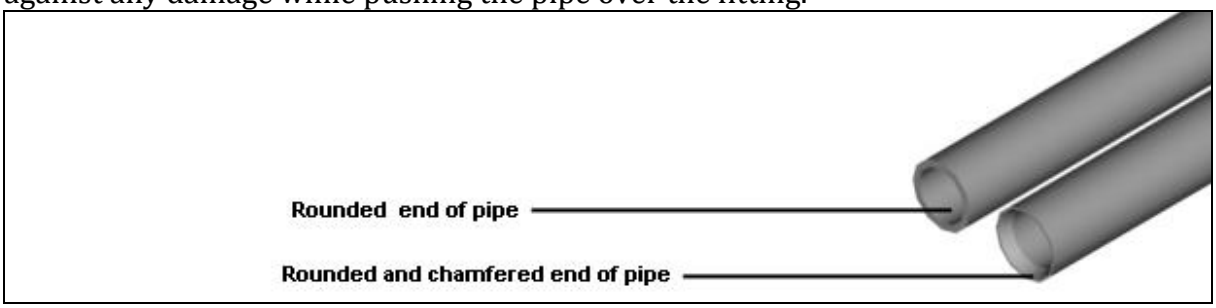
- Properly rounded.
- The dimensions of the end are properly formed so that perfect sealing takes place in case of external as well as internal sealing fittings.

13.3. Chamfering of Pipe

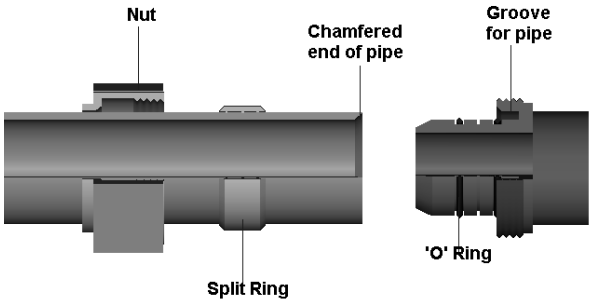
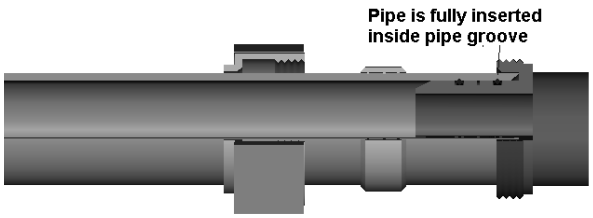
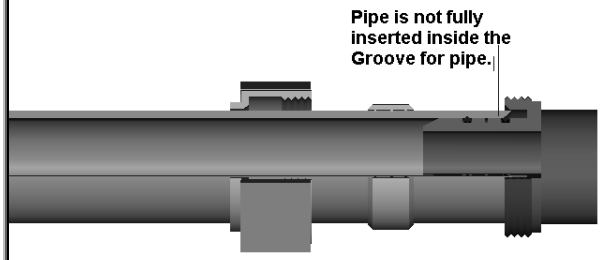
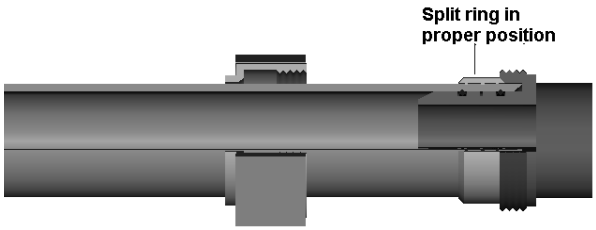
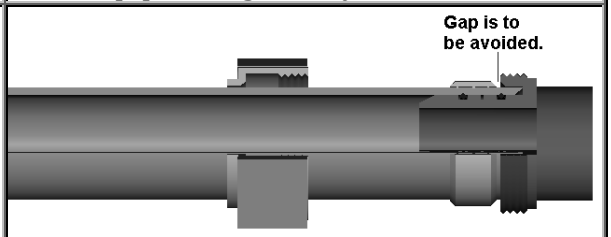
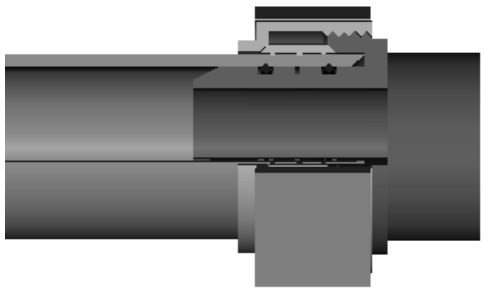
Chamfering Tool

Insert the pipe as shown for chamfering the end.

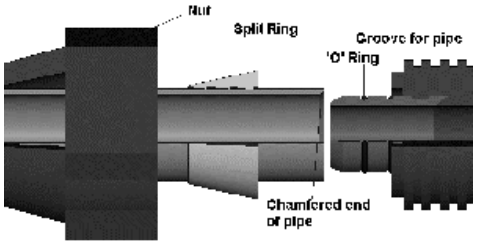
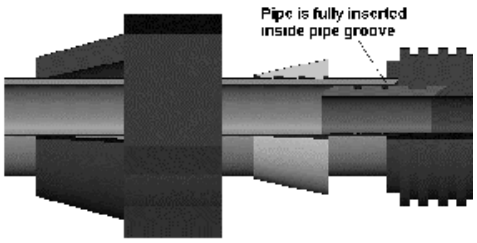
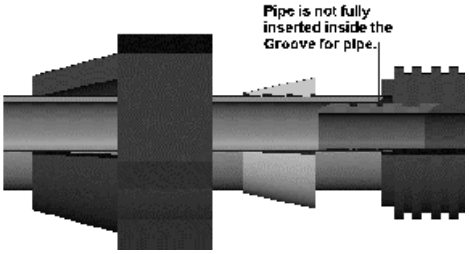
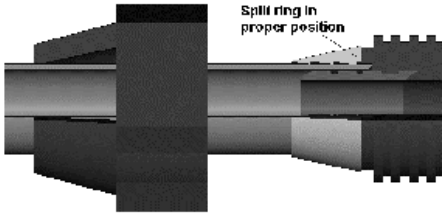
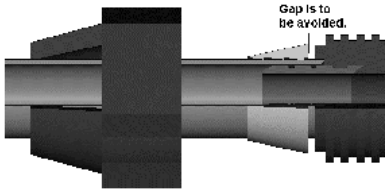
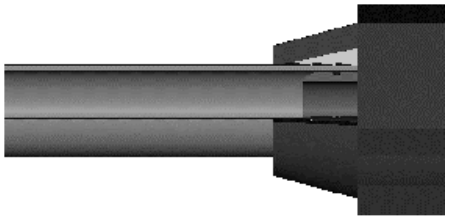
It is always essential to chamfer the end of the pipe when pipe is used with brass as well as composite internal sealing fittings. The chamfering of the pipe protects the 'O' rings against any damage while pushing the pipe over the fitting.



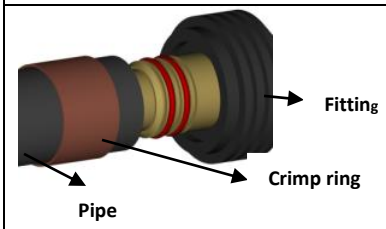
14. Jointing Procedure – Brass Internal Sealing Fittings

Do's	Don'ts
 1. The cut of the pipe must be at right angle. **The end is essentially to be chamfered.** 2. Remove the nut and split ring from fitting. Inspect the 'O' rings. 3. Place the nut and split ring over the pipe.	1. Do not try to put nut and split ring over the pipe after beveling. 2. Do not bend the pipe at the joint after completing the joint. Any bending operation should be completed before jointing. Minimum distance of 150 mm from joint should be maintained if pipe is to be bent after jointing.
 1. Insert the pipe fully inside the groove over the insert. 2. Check that the pipe goes over smoothly without damaging the 'O' rings.	 1. Do not leave any gap when pipe is inserted inside the groove. 2. Don't apply any lubricating medium such as oil or grease to pipe or fitting. With proper beveling and chamfering, the pipe will go easily.
 1. Push the split ring until it sits inside the tapered portion provided in the fitting.	 1. Don't keep the split ring away from the fitting.
 1. Tighten the nut fully using spanner of proper size over the fitting.	1. Don't leave the nut without spanner tightening. Hand tightening is not sufficient for proper joint. 2. Tightening should not be excessive. If spanner starts slipping, stop tightening.

15. Jointing Procedure - Composite Internal Sealing Fittings

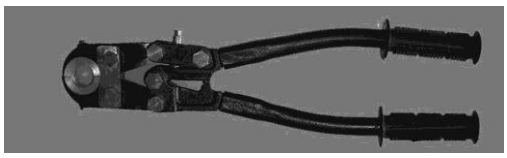
Do's	Don'ts
 1. The cut of the pipe must be at right angle. **The end is essentially to be chamfered.** 2. Remove the nut and split ring from fitting. Inspect the 'O' rings. 3. Place the nut and split ring over the pipe.	1. Don't try to insert the pipe inside the nut and split ring after beveling. 2. Don't bend the pipe at the joint after completing the joint. Any bending operation should be completed before jointing
 1. Insert the pipe fully inside the groove over the insert. 2. Check that the pipe goes over smoothly without damaging the 'O' rings.	 1. Do not leave any gap when pipe is inserted inside the groove. 2. Don't apply any lubricating medium such as oil or grease to pipe or fitting. With proper bevelling and chamfering, the pipe will go easily.
 1. Push the split ring until it touches the fitting.	 1. Don't keep the split ring away from the fitting.
 1. For smaller sizes up to 2025 hand tightening is sufficient. It is not necessary to use spanner for tightening. 2. In case of fittings of 2532 and 3240 size, tighten the nut fully using spanner of proper size over the fitting.	1. In case of 2532 & 3240 fittings, do not leave the fitting with hand tightening. Spanner tightening is essential. 2. Tightening should not be excessive. If spanner starts slipping, stop tightening.

16. KiTEC Crimp Fittings

Concept of Crimp fittings	
	The sealing is with the 'O' rings, seated in 'O' ring grooves which are surrounded by crimp grooves.
	When crimp ring is pressed onto pipe by crimping tools, the 'O' ring gets compressed. At the same time, the crimp ring forces the tubing on the crimp grooves leading to permanent joint which is hel together by crimping ring. All these design aspects contribute to water tight permanent joints.
Size range :	1216 to 2025

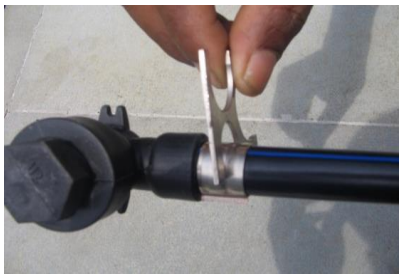
16.1 Jointing Procedure of Crimp fitting

Details of the crimping tool used for making crimp joint are follows

	The toggle type tool consists of **two halves of the replacableof fix die . Handle with a toggle mechanism** is provided to hold the tool as well as crimping the crimp ring over the fitting.

STEP I 	Cut the pipe square. A plastic pipe cutter should be used. Ensure that the stainless steel cutting blade is sharp and in good condition
STEP II 	Push the copper crimp ring onto the pipe

STEP III 	Re-round the inside of the pipe by rotating the rounding tool 360°.
STEP IV 	Chamfering of pipes is essential for fittings. Push the chamfering tool inside the pipe for chamfering; rotate the tool for proper chamfering
STEP V 	The fitting will then slip easily into the pipe without damaging or displacing the O-rings.
STEP VI 	Position the crimp ring on the pipe so that the edge touches the fitting body.
STEP VII 	Center the jaws of the crimping tool around the ring and hold the tool at a right angle to the pipe and fitting

STEP VIII 	Completely close the jaws of the tool around the ring to properly crimp the fitting. Care should be taken not to twist the tool while crimping or disengaging the crimp tool.
Inspection of Joint for proper crimping	
STEP IX 	Check the crimp diameter of each joint with the go-gauge provided. The gauge should slide over the compressed crimp ring which ensures a proper joint.
STEP X 	a. Joints that do not pass the gauge test should be cut out. The crimp tool should be checked before doing the next joint. b.Remake the joint with all the precautions and if still go-gauge does not slide over the crimp ring the tool needs to be changed.

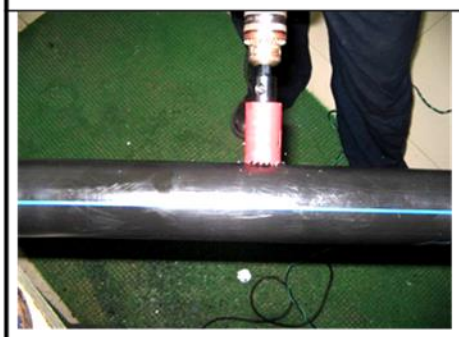
17. Jointing Procedure - For 5063 and above sizes

	Cut the pipe at right angle using KiTEC circular cutter.
	It is always essential to chamfer the end of the pipe using chamfering tool or sharp blade.
	Remove the nuts and bolts to open the fitting and inspect the 'O' rings for free of damages. Insert the pipe fully over the insert without damaging 'O' ring until the step touches the pipe.
	After inserting the inner part of the fitting the both the clamp halves are placed ensuring proper alignment with the steps provided on the inner part of the fitting clamp.
	After placing the clamp halves in place the allen screw is tightened fully. It should be ensured that opposite bolts are tightened to avoid excessive load on the clamp half.
	The sealing is on ID of pipe. When the allen bolts are tightened, the pipe gets compressed by the clamp. This leads to compression of 'O' rings leading to positive sealing. The clamp holds the joint in position.

18. Jointing Procedure – Saddles Connections

Tools required:

- Hole Saw Cutter- 29 mm for 4050 & 5063
  35 mm for 6375 to 90110
- Allen Key
- Knife



- Mark the location from where the connection is to be taken
- Select the required size of Hole Saw Cutter
- Cut the pipe at desired location using hole saw cutter and hand drilling machine
- Ensure cutting at right angle to the pipe

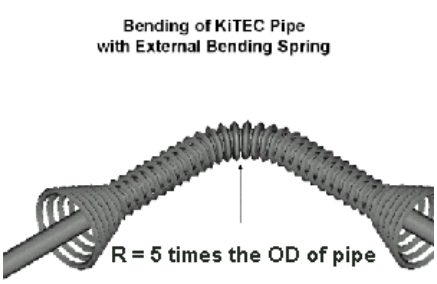
- Drilling/cutting to be done at lower speed
- Do not exert excessive pressure

- Clean the cutting dust/fines from the pipe
- Remove the burrs from the edges of the hole using sharp knife

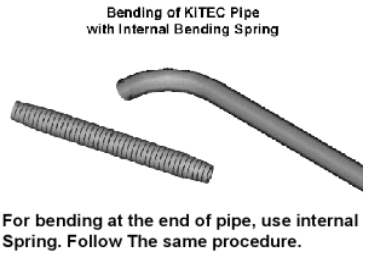
	• Fit the rubber grommet in the hole in right orientation to match the curvature of the pipe
	• Insert the spigot of the top half of the saddle in the grommet

	• Fit both halves of the saddle using allen key
	• The installation of saddle is complete • Suitable fitting/plumbing accessories can be fitted at the threaded end

19. Bending of KiTEC pipe



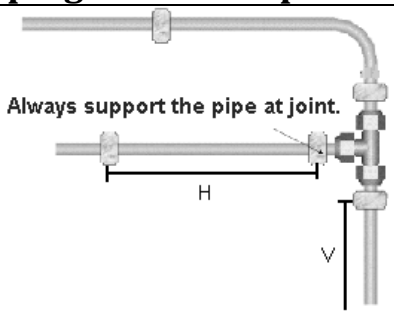
External Bending Spring



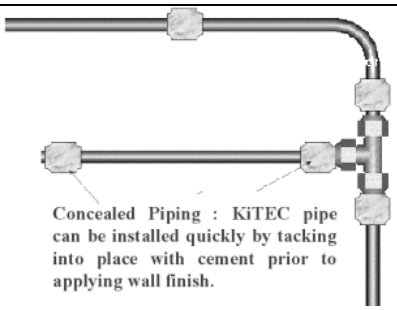
Internal Bending Spring

Do's	Don'ts
1. IF the pipe run is required to be exactly in horizontal and vertical planes, then minimum distance between two bend should be 5 times diameter of pipe. 2. For lower distances, pipe should be allowed to run at lower angles to horizontal plane. 3. Use internal bending spring at bends near the end as shown in figure.	1. Don't bend the pipe at a radius lesser than 5 times the diameter of pipe. 2. Don't bend the pipe without using bending springs of suitable size.

20. Clamping of KiTEC Pipe



External Installation



Internal Installation

Do's

External Installation

1. Maintain the clamping distances as mentioned in the table,
2. Always support the fittings at all the joints.
3. Use proper clamps, preferably KiTEC clamps, for supports.

Pipe Size	H meters	V meters	Pipe Size	H meters	V meters
1014	0.80	1.00	4050	1.4	1.6
1216	0.80	1.00	5063	1.6	1.8
1620	0.80	1.00	6375	1.6	1.8
2025	1.00	1.00	7590	1.8	2.0
2532	1.20	1.20	90110	2.0	2.2
3240	1.20	1.40			

Internal Installation

Cement tacking is the best method to keep the KiTEC pipe in place before concealing. Always tack the pipe at all the joints.

Don'ts

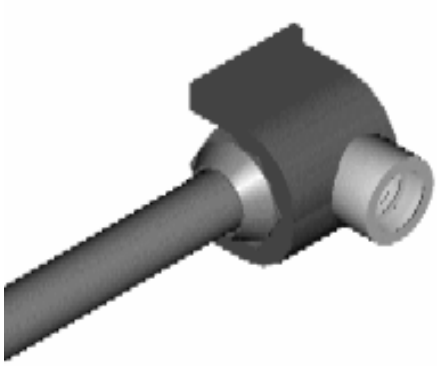
External Installation

1. Don't tighten the clamps too tight to avoid deformation of pipe section.
2. Don't use sharp objects such as nails and steel wires for holding the pipe.

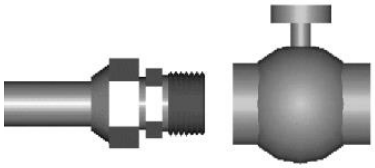
Internal Installation

1. Don't use sharp objects such as nails and steel wires for holding the pipe.

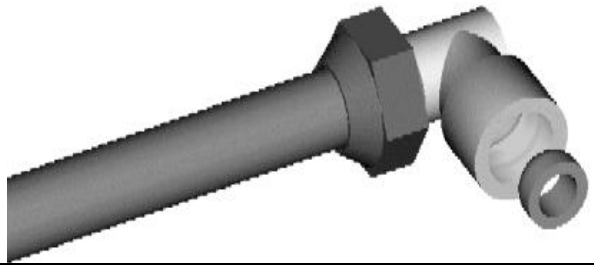
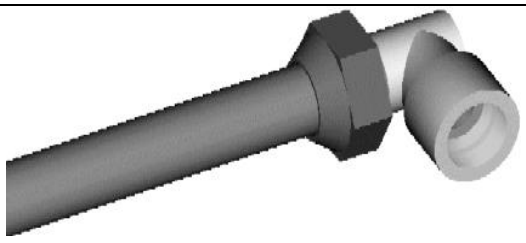
a. Use of Fitting Clamps (For External Installation only)

	Do's	Don'ts
	While connecting plumbing accessories with female threaded KiTEC fittings, use fitting clamp. This will ensure that the fitting will not rotate in perpendicular direction to pipe axis.	Never connect plumbing accessories such as taps without proper clamping. This may lead to loosening of joint and leakage during operation.

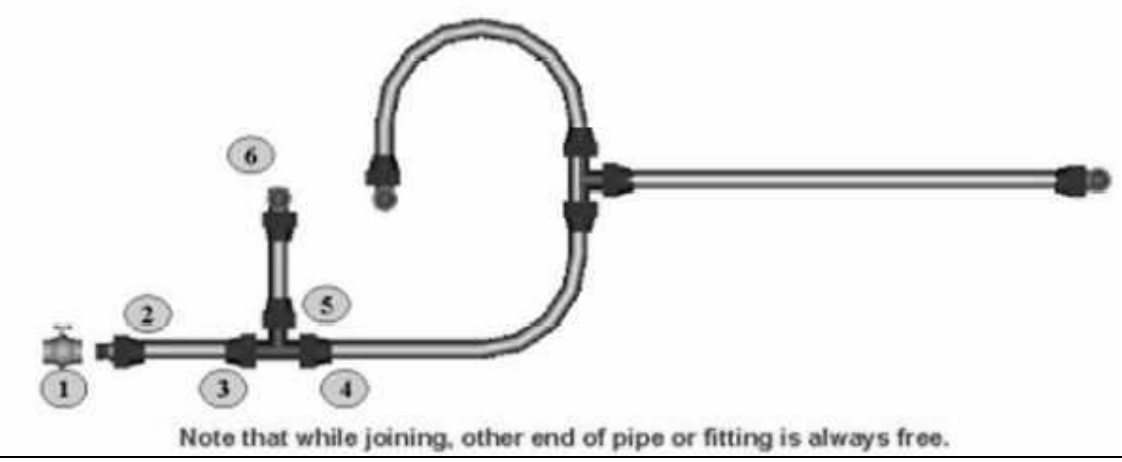
21. Connection of Plumbing accessories with KiTEC male threaded fittings

	Do's	Don'ts
	1. Always use teflon tape for sealing purpose. 2. Use proper spanner for tightening of Male thread connector. 3. Ensure that the thread matching is perfect. Improper thread matching may lead to damaging of threads.	While connecting, do not apply any sealing agent, such as 'hold tight', which has chemical bonding with metal. This may lead to failure of male threaded fitting while removing the fitting from plumbing accessory.

a. Plumbing accessories-Connection with KiTEC female threaded fittings

	
Do's	**Don'ts**
1. Always use tap seal. Insert the seal as shown in the figure inside the female threaded end and tighten the plumbing accessories over it. 2. Teflon tape may be used for sealing purpose.	1. While connecting, do not apply any sealing agent, such as 'hold tight', which has chemical bonding with metal. This may lead to failure of male threaded fitting while removing the fitting from plumbing accessory.

22. Guidelines For Quality and Fast Installation



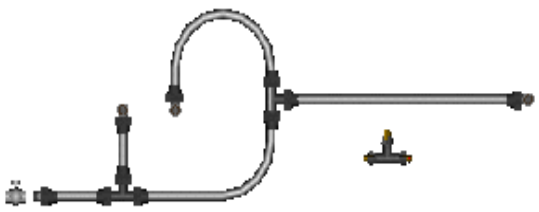
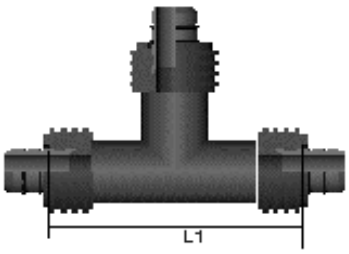
Follow the sequence for jointing.

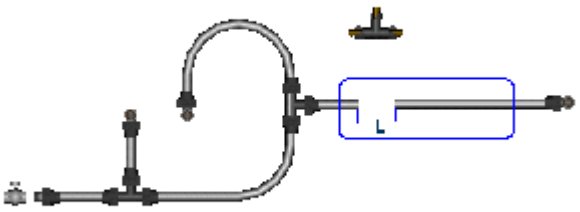
In this example, the installation is started from inlet point (valve).This will ensure to avoid connection of two anchored points, for which different procedure is required which is explained separately. The sequence should be as follows:

- Connect the male thread connector with valve. Connect the pipe with male thread connector. Connect the tee with pipe.
- Connect the pipe to branch end as well as straight end.
- Connect the female thread elbow to branch end. Bend the pipe and connect to inlet end of tee.

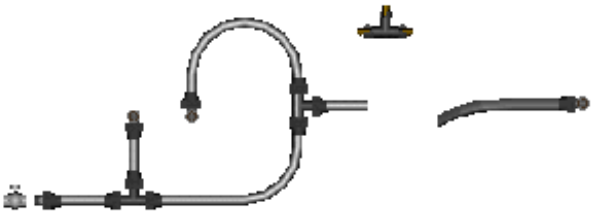
Follow this sequence for completing the installation.

22.1. Guidelines For Insertion of fitting in existing piping

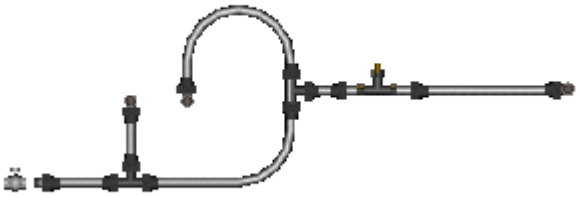
 In this example one tee is required to be inserted in the piping.	 Measure the exact length between two points up to which two ends of pipe are going to touch. (Refer to figure).



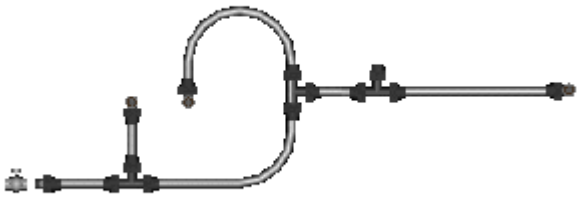
If the piping is concealed, open the area marked by blue square. The length along the pipe line should preferably be 25 times the OD of pipe.
Cut the pipe at desired location for length L.
In case of internal sealing fittings, L=L1
In case of external sealing fittings L=L1-1mm. (L1 is the length measured, when seal is inside the fitting)



Bend the pipe, preferably with internal bending spring, in such a way that there is enough space for insertion of fitting.



Insert the fitting in the pipe. Straighten the bent pipe simultaneously and push over the fitting.



Complete the joint as per jointing procedure.

23. Guidline for On-Site Hydrostatic Testing Of KiTEC Composite Pipelines

KiTEC is a Multi Layer composite pipe having an aluminium tube bonded in between two layers of High Density Polyethylene. High Density Polyethylene is lower modulus visco-elastic material that dilates in diameter (creep-strains) when subjected to higher stress during hydrotest. This means that for a fixed volume of clean fill water, the hydrostatic pressure will decline slightly during the test time, as the polyethylene molecular chains stretch and align under high stress. This pressure decline does not mean the pipe is leaking. It is a visco-elastic material parameter that requires adjustments to the hydrostatic test procedure as compared to rigid elastic metallic pipes. This effect is more noticeable in larger diameter pipes, due to the large mass of clean fill water. Alternately, to hold constant pressure, an additional volume of make-up water will be required to fill the expanded volume of the stretched pipe diameter. Neither of the above two observations means that a leak is present in the pipeline.

The concept behind hydro-testing is to strain the pipe, fittings and appurtenances. Any defects from manufacturing or flaws from construction are typically forced by stress intensification to reveal themselves by weeping, leaking, or rupture. Any remaining defects are considered sub-critical within a tolerable flaw size limit, and should remain stable thereafter at the lower operating pressures. Hydro-testing provides the normal level of assurance for leak integrity and the absence of flaws that exceed an intolerable flaw size.

Test medium: Some plumbers favour the use of air testing kits, as filling pipe work with water whilst properly expelling the air is time consuming. However, testing with air is not an acceptable method in accordance with the Regulations and BS 6700:1997. As air is compressible a leak comprising of a few droplets will be much more visual on a pressure gauge when testing with water. Therefore, the best test medium for water pressure piping is water; that is why the Regulations and BS 6700 both require 'hydraulic testing'.

The need to pressurise: Where joints are to be concealed, simply filling-up a system with water at normal pressure is not an adequate test. A poorly made joint for example may appear to be satisfactory at the fill pressure, and detection will only be possible if the pressure is raised.

Filling for the pressure test: Hand pump test kits are often needed in order to correctly pressurise the pipe work, but they are not efficient for filling-up the system, most pumps will displace only about 25 ml for each stroke of the pump. It is recommended to arrange a temporary hose connection as the method of filling the system.

Selection of Fill-Rate: Slowly fill the test section of the pipeline with water at ambient temperature. Filling is ideally supplied from the lowest point such that the water's entry is submerged and under a "pool" of water inside the pipeline, thus avoiding frothing, air entrainment and air being dissolved into the test water. A slow, submerged, fill velocity

will prevent air entrainment and dissolving when the water stream is cascading through downward slopes along the pipeline. Dissolved air can lead to a large surge pressure event, and can disguise a possible leak. Obviously the high point air vents should be open and monitored. After filling, allow the system to reach thermal equilibrium, AND, to allow time for any dissolved air to “breathe” and exit the system vents. The period of stabilization will depend upon the volume of water within the pipeline. Slow fill rate is recommended with an axial filling velocity of less than 3 Mtrs per minute.

Selection of Test Pressure: The hydrostatic pressure test is a leak test intended to validate the integrity of the pipeline. The test pressure is never less than the designed operating pressure. The maximum hydrostatic test pressure is based on the pipeline component with the lowest design pressure rating. The hydrostatic test pressure is usually between 1.25 times the nominal operating pressure and 1.5 times the Design Pressure Rating of this component. The maximum hydrostatic test pressure must be recorded at the lowest point along the pipeline, and must be compensated for temperatures other than 27ºC.

Pressure gauge: The most common mistake, which installers make when testing, is they do not use a pressure gauge which is capable of giving an adequate response. The dial face should be not less than 80mm diameter. Also make sure the full-scale deflection is not excessively more than your test pressure, for example a gauge scale that goes up to 50 bar will not be responsive enough for your needs. Unfortunately most commercially available hand pump test kits are not fitted with an adequate gauge for thorough testing/And an extra test gauge should be used between the test hose and point of connection to the system. Also you will need to detect pressure drops as small as 0.2 bar, so it would be preferable for the scale to have 0.2 bar graduations.

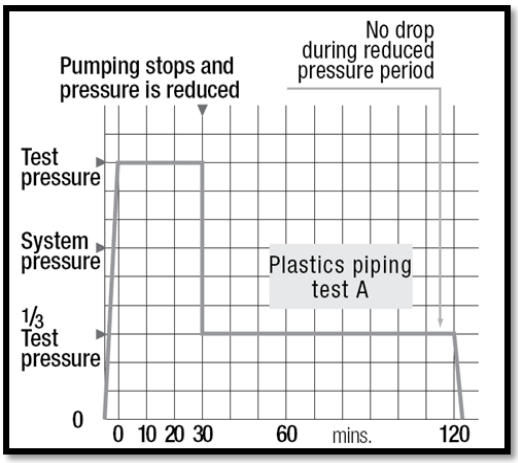
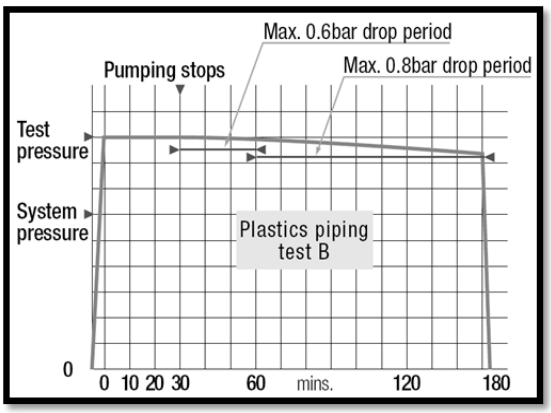
Removal of air: The second mistake is not to expel the air during filling, as trapped air will make the gauge needle response 'spongy'. Installers often use blank caps to form temporary plugs, which is fine for pipe work 'drops'. For upward facing 'tails' forming high points, the use of temporary couplings, which incorporate a drain cock, can be used to 'bleed' the air without causing excessive accidental spillage of water. When testing the 'first fix' pipe work on new housing, the airing cupboard usually contains several upward facing pipe tails, which can be temporarily linked in order that all the circuits are tested in one operation. The temporary fittings employed for testing purposes can be re-used on other plots.

Test duration: If questioned about a suitable duration for a pressure test will often respond with a range of answers from 10 minutes to 24 hours. Such periods are either not sufficient to yield a thorough test or subject the piping to unnecessary pressures. The Regulations prescribe both the method and the optimum duration for the test.

Relevant section of Water Supply (Water Fittings) Regulations 1999 of UK for testing of pipe work is as follows:

12. (1) The water system shall be capable of withstanding an internal water pressure not less than 11/2 times the maximum pressure to which the installation or relevant part is designed to be subjected in operation ("the test pressure").

(2) This requirement shall be deemed to be satisfied- (a) in any other case, where plastic piping is involved, where either of the following tests is satisfied-

TEST A	TEST B
1. The whole system is subjected to the test pressure by pumping for 30 minutes, after which the test continues for 90 minutes without further pumping; 2. The pressure is reduced to one third of the test pressure after 30 minutes; 3. The pressure does not drop below one third of the test pressure over the following 90 minutes; and 4. There is no visible leakage throughout the test. 	1. The whole system is subjected to the test pressure by pumping for 30 minutes, after which the pressure is noted and the test continues for 150 min. without further pumping; 2. The drop in pressure is less than 0.6 bar (60kPa) after the following 30 minutes, or 0.8 bar (80kPa) after the following 150 minutes; and 3. There is no visible leakage throughout the test. 

De-Pressurizing, and Draining the Test Section:

After the hydro-test has been successfully completed, the elevated pressure within the test section is to be safely reduced in accordance with the test plan. When the test section is ready to be drained, the air vents specified shall be opened and the water drained from low points, at a flow-rate in accordance with the test plan. The hydro-test water shall be re-used, treated, or drained to an approved water-way, after-which all connections shall be closed or otherwise re-instated. Remove all temporary blinds, supports, test connections.

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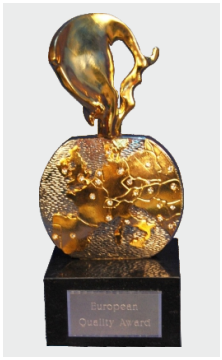

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