PRINCE
AQUA SYSTEMS

PRINCE
MUMBAI
INDIA

TECHNICAL MANUAL

SAVE WATER, SAVE LIFE.

ISO 9001:2000 Certified

100% LEAK PROOF

HOT & COLD WATER

PRINCE PP-R PLUMBING SYSTEMS

PRINCE is one of the world's leading manufacturers in high utility plastic products since 1970

In 1983, **PRINCE** started manufacturing uPVC pipes & Fittings. We manufacture and market a wide range of quality pipe systems for use in water supply & distribution system in Agriculture, Construction, Industries, and Commercial & Residential Premises etc. Currently we are present everywhere in India.

Ever since its inception, it has been the endeavor of **PRINCE** to be the best. Right from the very first product to today's diverse range of products, the very same principle applies i.e. "pursuit of excellence." Having already anticipated the opportunities and also the competition, we at **PRINCE** have deployed all our resources judiciously to meet the emerging challenges.

Today, armed with a global perspective together with a diverse and impressive business portfolio, we march confidently towards becoming a significant member of the global village.

We at **PRINCE** always emphasis on synergy between manpower and technology, which are the two factors that we intend to deploy to the fullest, to achieve our mission which is growth and bring to reality our

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1.0 INTRODUCTION

1.1 PREFACE

Progressive development of civilization results in people aspiring for the better living standards. This can be met by using new materials in building industry which are more fit for the use as well as more aesthetic than the traditional ones.

Today, the use of plastic products in construction as well as other industries is extremely widespread. Rapid changes in plastic raw materials and processing techniques provide advantages which cause these materials to be preferred in place of traditional construction and industrial application materials. One of these innovations is plumbing pipes and fittings produced out of POLYPROPYLENE RANDOM COPOLYMER(PPRC or commonly known as PP-R) material.

The superior physical characteristics of PP-R material such as working temperatures upto 95 °C along with excellent chemical resistance as well as providing a definite solution to oxidation and calcification, make PP-R an ideal material, primarily for hot and cold water plumbing systems in buildings and industrial piping installations ensuring a high quality performance.

PRINCE PIPES & FITTINGS PVT. LTD., an ISO 9001:2000 certified company a leading manufacturer of uPVC piping systems since last 2 decades. Understanding the need of the customer, PRINCE has established manufacturing of pipes, fitting & valves in PP-R material, using the best available technologies. PRINCE is proud to offer a complete range of high quality and reliable PP-R piping system for the modern construction industry.

1.2 WHY PP-R ?

The primary advantages which make PP-R Piping Systems preferred over traditional ones are :-

MATERIAL PROPERTIES	ADVANTAGES
1 Lightweight	Easy to handle, transport and install. Saves Labour cost.
2. Better Corrosion Resistance	No scaling, can withstand higher 'pH' values.
3. Nontoxic, Hygienic ' Green product'	Safe for drinking water. No harmful effect to human & ecology.
4. High Vicat Softening Temperature	Ensures thermal stability for hot water application.
5. UV resistant	Three layer pipes are suitable for outdoor installations exposed to direct sunlight.
6. Good Thermal Insulation	Ensures lower heat losses & saves energy up to 15%
7. Good Chemical Resistance	Suitable for most of the industrial liquids.
8. Better Impact Strength	Better performance at lower temperature also.
9. Heat Fusion Jointing (No use of solvent)	Results in a homogeneous plastic system ensuring leak proof joints. Safe and reliable to use for concealed and exposed installations. Saves considerable jointing time.
10. Better Noise Insulation	Reduces water hammer sound.
11. Bacteriologically Neutral	Can be used underground. Also inside fluid remains free from bacterial growth.
12. Very Less Coefficient of Friction	Low-pressure drop. Extremely high flow properties. Reduces pumping cost.
13. Resilience	Suitable for use in seismic areas.
14. Good Abrasion Resistance	Allow higher flow velocities of fluid up to 5 m/sec.
15. High volume Resistivity	Poor conductor of electricity. No effect of stray currents.
16. Long life	Can exceed 50 years when operating under rated temperature and pressure conditions.
17. Economical	Cost effective. Added value for money.

All the above advantages make PRINCE PP-R piping system as the most cost effective solution than any other plumbing system.

1.3 COMPARISON BETWEEN DIFFERENT PIPING SYSTEMS

Sr. No	Property/ Parameter	Galvanized Iron	Copper	C-PVC	PRINCE PP-R
1	Pipe length	6M	5M	5M/3M	3M
2	Type of joint	Threaded	Soldering	Solvent welding	Poly-fusion welding. For transition joints, fittings with threaded metal inserts (Brass with nickle plating) are also available.
3	Effectiveness of joint	Joint may leak	Joint may leak	Good but can open due to repeated hot and cold water cycles	Homogeneous, ensuring 100% leakproof joints.
4	Installation	Tedious and time consuming	Time consuming & requires skill	Less time required	Easy installation, saves time and labour cost.
5	Corrosion resistance	Not resistant	Not resistant	Free from corrosion	Free from corrosion
6	Chemical resistance	Not resistant	Not resistant	Resistant	Excellent chemical resistance even at higher temperatures
7	Bore Smoothness	Rough. Less flow	Smooth. Moderate flow	Smooth. Good flow	Very smooth. Very high flow
8	Scale formation	Very common	Common	No scaling	No scaling
9	Hygiene / Potability	Unhygienic due to scaling and encrustation of salts	Unhygienic due to scaling and copper sulphate	Unhygienic due to use of Solvent cement which is harmful to human health	Totally hygienic as there is no leaching of any chemical and jointing is also chemical free.
10	Suitability in cold areas - sub-zero temperatures	Not suitable. Pipe bursts	Not suitable. Pipe bursts	Impact strength considerably reduces at lower temperatures and hence not suitable.	Most suitable due to typical elastic nature and good impact strength
11	Insulation requirements	Essential	Essential	Essential	Heat conductivity is low and hence much saving on insulation cost.
12	Impact strength	Excellent	Less	Less (brittle nature)	High impact strength
13	Crack propogation	Slow	High	High	Very Low
14	Life span under rated pressure & temperature	5 - 15 years	20 - 30 years	30 - 40 years	can exceed 50 years
15	Behavior in Fire	Resistant	Resistant but de-shapes or punctures	High percentage of chlorine and toxic gases are generated which are harmful.	Melts like all other plastics, but no generation of any toxic gases.

1.4 APPLICATION OF PRINCE PP-R PLUMBING SYSTEMS

1. Indoor & Outdoor installations of hot & cold water piping systems.
2. Drinking water transportation.
3. Liquid food transportation.
4. Pharmaceuticals.
5. Solar water heating systems.
6. Heating system inside building including floor, wall & radiator heating.
7. Air conditioning system.
8. Compressed air supply system.
9. Piping systems for transportation of aggressive fluids in industries.

1.4 AREAS OF INSTALLATION

1. Residential & Commercial Buildings.
2. Public places such as Hospitals, Schools & Colleges, Hotels, Cinema halls, Airports, Railways, Bus stations, Swimming pools, etc.
3. Industries such as Chemical plants, Breweries, Petroleum & Gas plants, Oil plants, Mineral water plants, Water treatment plants, etc.
4. Solar Heating Systems.

2.0 PRODUCT CHARACTERISTICS

2.1 PP-R TECHNICAL SPECIFICATIONS

2.1.1 PHYSICAL PROPERTIES

PROPERTY	TEST METHOD	UNITS	VALUE
Density, at 23°C	ISO R 1183	g /cm³	0.897
Melt Flow Index	ISO R 1133		
MFI 190°C / 5 kg		g/10min	0.50
MFI 230°C/2.16 kg		g/10min	0.30
MFI 230°C/5 kg		g/10 min	1.30
Viscosity	ISO 1191 ISO 1628 T3	cm³/g	420 - 430

2.1.2 THERMAL PROPERTIES

PROPERTY	TEST METHOD	UNITS	VALUE
Thermal Conductivity	DIN 52612	W/m.K	0.24
Specific heat, at 23°C	Calorimeter	KJ/kg.K	2.0
Coefficient of linear expansion	DIN 53752	mm/M°C	1.5×10^{-4}
VICAT Softening Point	ISO 306	°C	132
Melting Temperature Range	ISO 3146	°C	140 - 150

2.1.3 MECHANICAL PROPERTIES

PROPERTY	TEST METHOD	UNITS	VALUE
Tensile Stress at Yield (50mm / minute)	ISO 527-1,2	MPa	24
Tensile Strain at Yield (50mm / minute)	ISO 527-1,2	%	10
Tensile modules (secant)	ISO 527/1,2	MPa	850
Flexural Modulus	ASTM D 790	MPa	850
Tear Strength	ISO 527	MPa	40
Elongation at tear	ISO 527	%	800
Shore D Hardness	DIN 53 505	-	65
Pipe Friction factor	-	-	0.007
CHARPY Impact Strength 23°C	ISO179/leA	KJ/m²	22
0°C	ISO179/leA	KJ/m²	4.0
-30°C	ISO179/leA	KJ/m²	2.5

2.1.4 ELECTRICAL PROPERTIES

Die electric constant	DIN 53483	-	2.3
Volume Resistivity	DIN 53482	Ohm-cm	> 1 x 10^{16}
Die electric strength	DIN 53481	Kv/mm	³ 20

2.2 STANDARD WORKING CONDITIONS & SERVICE LIFE

Long-term performance curve show the behavior of pipe line depending on pressure and operating temperature. It establishes the average life expectancy of a pipe line as a function of hoop stress acting on the pipe walls.

Hoop stress is in proportion with the pressure according to the following formula:-

$$\delta = S_f \times p \times \frac{(d-s)}{2s}$$

Where,

δ = hoop stress (MPa)
S = Safety factor
p = Internal pressure (MPa)
d = Outside diameter of pipe (mm)
s_f = Wall thickness of pipe (mm)

If we extrapolate the hoop stress from the long term performance curve and apply the formula using 1.5 safety factor, the admissible operating pressures are obtained as given in the table.

ADMISSIBLE OPERATING PRESSURE

Temperature °C	Service Life In Years	Pipe Series according to DIN 8077/8078		
		SDR 11	SDR 7.4	SDR6
		PN 10	PN 16	PN20
		Safety-factor 1.5		
		Nominal pressure for PP-R pipes (kgs/cm²)		
10 °C	1	17.6	27.8	35.0
	5	16.6	26.4	33.2
	10	16.1	25.5	32.1
	25	15.6	24.7	31.1
	50	15.2	24.0	30.3
	100	14.8	23.4	29.5
20 °C	1	15.0	23.8	30.0
	5	14.1	22.3	28.1
	10	13.7	21.7	27.3
	25	13.3	21.1	26.5
	50	12.9	20.4	25.7
	100	12.5	19.8	24.9
30 °C	1	12.8	20.2	25.5
	5	12.0	19.0	23.9
	10	11.6	18.3	23.1
	25	11.2	17.7	22.3
	50	10.9	17.3	21.8
	100	10.6	16.9	21.2
40 °C	1	10.8	17.1	21.5
	5	10.1	16.0	20.2
	10	9.8	15.6	19.6
	25	9.4	15.0	18.8
	50	9.2	14.5	18.3
	100	8.9	14.1	17.8
50 °C	1	9.2	14.5	18.3
	5	8.5	13.5	17.0
	10	8.2	13.1	16.5
	25	8.0	12.6	15.9
	50	7.7	12.2	15.4
	100	7.4	11.8	14.9
60 °C	1	7.7	12.2	15.4
	5	7.2	11.4	14.3
	10	6.9	11.0	13.8
	25	6.7	10.5	13.3
	50	6.4	10.1	12.7
70 °C	1	6.5	10.3	13.0
	5	6.0	9.5	11.9
	10	5.9	9.3	11.7
	25	5.1	8.0	10.1
	50	4.3	6.7	8.5
80 °C	1	5.5	8.6	10.9
	5	4.8	7.6	9.6
	10	4.0	6.3	8.0
	25	3.2	5.1	6.4
95 °C	1	3.9	6.1	7.7
	5	2.5	4.0	5.0
	(10)*	(2.1)*	(3.4)*	(4.2)*

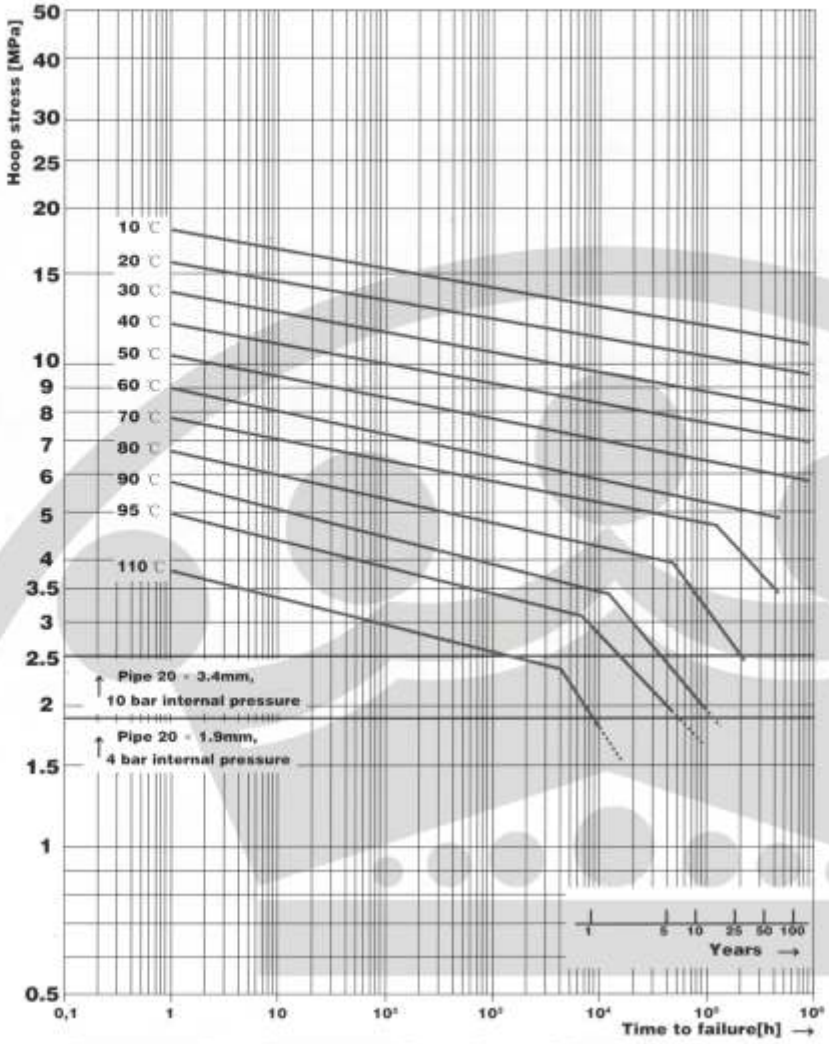
Explanations :-

= Recommended application - cold water installation

= Recommended application - hot water installation

= Recommended application - central heating installation

* Bracketed values apply where testing can be shown to have been carried out for longer than 1 year at 110°C



3.0 PRODUCT DETAILS

3.1 REFERENCE STANDARDS

DIN 8077 Polypropylene (PP) pipes - Dimensions

DIN 8078 Polypropylene (PP) pipes - General quality requirements and testing.

DIN 16962

Part 5 - Pipe joint assemblies and fittings for (PP) pressure pipes General quality requirements and testing.

Part 6 - Pipe joint assemblies and fittings for (PP) pressure pipes Injection moulded Elbows for socket welding.

Part 7 - Pipe joint assemblies and fittings for (PP) pressure pipes Injection moulded Tee pieces for socket welding.

Part 8 - Pipe joint assemblies and fittings for (PP) pressure pipes Injection moulded Sockets and caps for socket welding.

Part 9 - Pipe joint assemblies and fittings for (PP) Pressure pipes Injection moulded Reducers and nipples for socket welding.

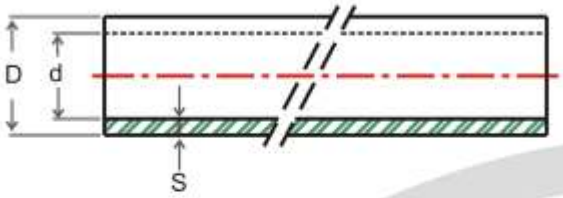
Part 10 - Pipe joint assemblies and fittings for (PP) Pressure pipes Injection moulded Fittings for but welding

IS 9845 Method of analysis for determination of specific and/or overall migration of constituents of plastic materials and articles intended to come into contact with foodstuffs.

IS 10500 Specification for polypropylene and its copolymers for its safe use in contact with food stuffs, Pharmaceuticals and drinking water.

3.2 PRODUCT RANGE

3.2.1 PIPES



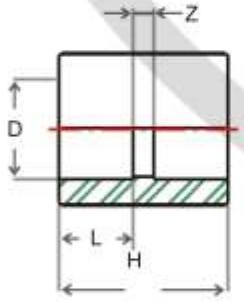
SIZE	D	SDR 11 (PN-10)		SDR 7.4 (PN-16)		SDR 6 (PN-20)	
		d	S	d	S	d	S
20	20.0	-	-	14.4	2.8	13.2	3.4
25	25.0	-	-	18.0	3.5	16.6	4.2
32	32.0	-	-	23.2	4.4	21.2	5.4
40	40.0	32.6	3.7	29.0	5.5	26.6	6.7
50	50.0	40.8	4.6	36.2	6.9	33.4	8.3
63	63.0	51.4	5.8	45.8	8.6	42.0	10.5
75	75.0	61.4	6.8	54.4	10.3	50.0	12.5
90	90.0	73.6	8.2	65.4	12.3	60.0	15.0
110	110.0	90.0	10.0	79.8	15.1	73.4	18.3
160	160.0	130.8	14.6	116.2	21.9	-	-

The PIPE is used for conveying hot and cold water / fluids / chemicals / compressed air in various plumbing installations such as,

1. Single layer (Green Colour) PP-R pipes for indoor installations.
2. Single layer (Black Colour) PP-R pipes for solar heating systems.
3. 3 Layer PP-R pipes for outdoor installations.
   - Outer layer (Green Colour) PP-R is UV resistant, which makes pipes suitable for use under direct sunlight.
   - Inner layer (White Colour) PP-R is antimicrobial which adds in safety against inside bacterial growth.
   - Middle layer (Black Colour) PP-R ensures the required strength of the pipes.

3.2.2 FUSION WELD

COUPLER



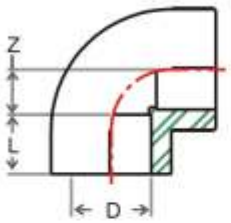
SIZE	D	L	Z	H
20	19.5	14.5	3.0	32.0
25	24.5	16.0	3.0	35.0
32	31.5	18.0	3.0	39.0
40	39.45	20.5	3.0	44.0
50	49.45	23.5	3.0	50.0
63	62.5	27.5	3.0	58.0
75				
90				
110				
160				

Details available on request.

The COUPLER is used to joint two pipes to each other by means of fusion welding. It provides advantage for joining short length cut pipes or replacing faulty piece of pipe.

ALL DIMENSIONS ARE IN MM.

ELBOW 90°

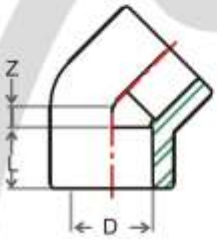


SIZE	D	L	Z
20	19.5	14.5	11.0
25	24.5	16.0	13.5
32	31.5	18.0	17.0
40	39.45	20.5	21.0
50	49.45	23.5	26.0
63	62.5	27.5	32.5
75			
90			
110			
160			

Details available on request.

The ELBOW is used at corners where pipeline makes a turn of 90°

ELBOW 45°

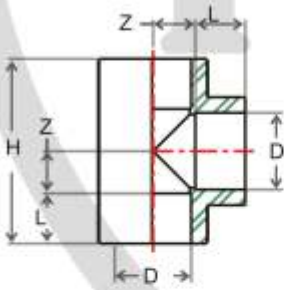


SIZE	D	L	Z
20	19.5	14.5	5.0
25	24.5	16.0	6.0
32	31.5	18.0	7.5
40	39.45	20.5	9.5
50	49.45	23.5	11.5
63	62.5	27.5	14.0
75			
90			
110			
160			

Details available on request.

ELBOW 45° is used where the pipeline changes direction through 45°

EQUAL TEE

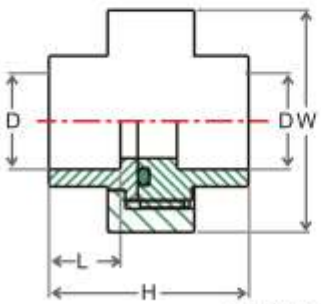


SIZE	D	L	Z	H
20	19.50	14.5	11.0	32.0
25	24.50	16.0	13.5	35.0
32	31.50	18.0	17.0	39.0
40	39.45	20.5	21.0	44.0
50	49.45	23.5	26.0	50.0
63	62.50	27.5	32.5	58.0
75				
90				
110				
160				

Details available on request.

EQUAL TEE is used to take an outlet/branch at 90° from main pipe line.

PLAIN UNION

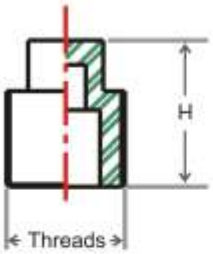


SIZE	D	L	H	W
20	19.5	14.5	46	51
25	24.5	16.0	50	57
32	31.5	18.0	57	68

PLAIN UNION is used to joint two pipes coaxially. It provides facility of reopening the joint, basically for maintenance.

ALL DIMENSIONS ARE IN MM.

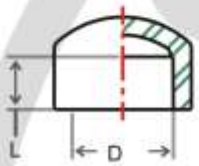
END PLUG



SIZE	Threads	H
20	½"	22.5
25	¾"	25.0
32	1"	28.0

END PLUG is used to seal the pipe ends having female threaded fitting. It is also used during pipeline testing.

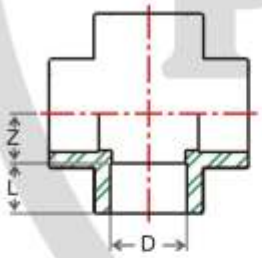
END CAP



SIZE	D	L
20	19.5	14.5
25	24.5	16.0
32	31.5	18.0
40	39.45	20.5
50	49.45	23.5
63	62.5	27.5
75		
90	Details available on request.	
110		
160		

END CAP is used as a stopper at the dead end of pipeline. It is also to seal the top end of pipeline column for pressure leakage test after completion of piping work.

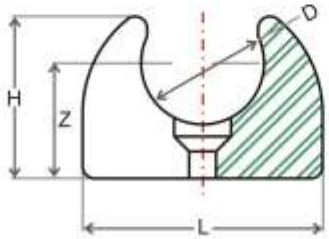
EQUAL CROSS TEE



SIZE	D	L	Z
20	19.5	14.5	11.0
25	24.5	16.0	13.5
32	31.5	18.0	17.0

EQUAL CROSS TEE is used to take two branches/outlets at 90° from pipe line at the same junction but in opposite direction.

PIPE CLAMP

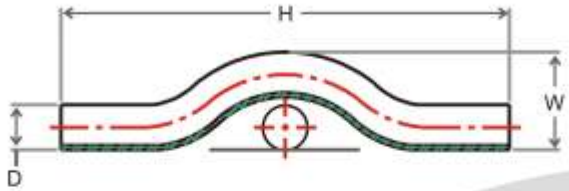


SIZE	D	H	L	Z
20	20.50	27.00	40.0	19.25
25	25.50	31.00	40.0	21.75
32	32.50	37.00	48.0	25.25

PIPE CLAMP is used to secure the pipeline in it's installed position on the wall.

ALL DIMENSIONS ARE IN MM.

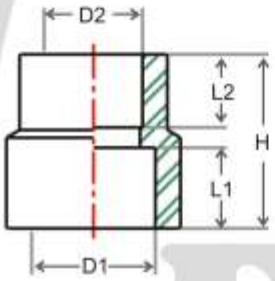
CROSSOVER



SIZE	D	W	H
20	20.0	55.0	400.0
25	25.0	56.0	400.0
32	32.0	72.0	450.0

CROSSOVER pipe is used where two pipes cross each other and one has to bridge over the other pipe.

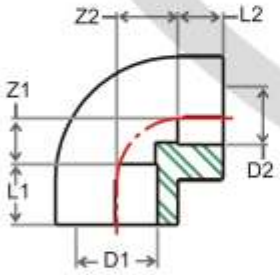
REDUCER



SIZE	D1	D2	L1	L2	H
25X20	24.5	19.5	16.0	14.5	33.5
32x25	31.5	24.5	18.0	16.0	37.0
32X20	31.5	19.5	18.0	14.5	35.5
40X32	39.45	31.50	20.5	18.0	41.5
40X25	39.45	24.5	20.5	16.0	39.5
40X20	39.45	19.5	20.5	14.5	38.0
50X40	49.45	39.45	23.5	20.5	47.0
50X32	49.45	31.5	23.5	18.0	44.5
50X25	49.45	24.5	23.5	16.0	42.5
50X20	49.45	19.5	23.5	14.5	41.0
63X50	62.5	49.45	27.5	23.5	54.0
63X40	62.5	39.45	27.5	20.5	51.0
63X32	62.5	31.5	27.5	18.0	48.5
63X25	62.5	24.50	27.5	16.0	46.5
63X20	62.5	19.5	27.5	14.5	45.0

REDUCER is used to joint bigger dia pipe to smaller dia pipe coaxially.

REDUCING ELBOW 90°

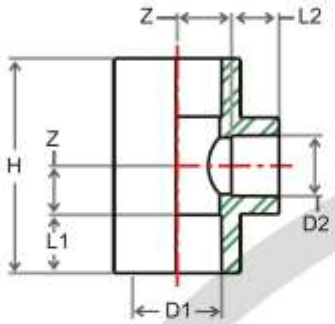


SIZE	D1	D2	L1	L2	Z1	Z2
25X20	24.5	19.5	16.0	14.5	13.5	15.0
32X25	31.5	24.5	18.0	16.0	17.0	19.0
32X20	31.5	19.5	18.0	14.5	17.0	20.5
40X32	39.45	31.5	20.5	18.0	21.0	20.5
40X25	39.45	24.5	20.5	16.0	21.0	25.5
40X20	39.45	19.5	20.5	14.5	21.0	20.5
63X40	62.5	39.45	27.5	20.5	32.5	39.5

REDUCING ELBOW is used to joint two different sizes of pipes at 90° corner / turn.

ALL DIMENSIONS ARE IN MM.

REDUCING TEE

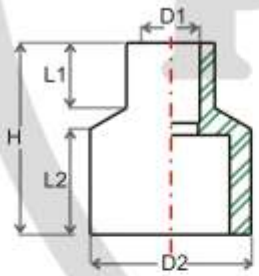


SIZE	D1	D2	L1	L2	Z	H
25X20	24.5	19.5	16.0	14.5	13.5	59.0
32X25	31.5	24.5	18.0	16.0	17.0	70.0
32X20	31.5	19.5	18.0	14.5	17.0	70.0
40X32	39.45	31.5	20.5	18.0	21.0	83.0
40X25	39.45	24.5	20.5	16.0	21.0	83.0
40X20	39.45	19.5	20.5	14.5	21.0	83.0
50X40	49.45	39.45	23.5	20.5	26.0	99.0
50X32	49.45	31.50	23.5	18.0	26.0	99.0
50X25	49.45	24.50	23.5	16.0	26.0	99.0
50X20	49.45	19.5	23.5	14.5	26.0	99.0
63X50	62.5	49.45	27.5	23.5	32.5	120.0
63X40	62.5	39.45	27.5	20.5	32.5	120.0
63X32	62.5	31.5	27.5	18.0	32.5	120.0
63X25	62.5	24.5	27.5	16.0	32.5	120.0
63X20	62.5	19.5	27.5	14.5	32.5	120.0
75X63						
75X50						
75X40						
75X32						
90X75						
90X63						
90X50						
90X400						
110X90						
110X75						
110X63						
110X50						
160X110						

Details available on request.

REDUCING TEE is used to take a smaller size branch pipe at 90° from main pipe line.

REDUCING BUSH

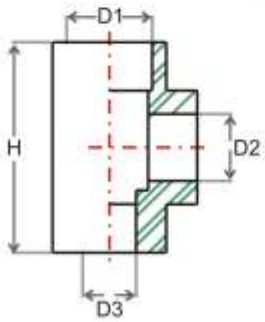


SIZE	D1	D2	L1	L2	H
25X20					
32X20					
40X32					
40X25					
40X20					
50X40					
50X32					
50X25					
63X50					

Details available on request.

REDUCING BUSH is used to joint a bigger diameter Pipe to a smaller diameter Pipe coaxially.

UNEQUAL TEE



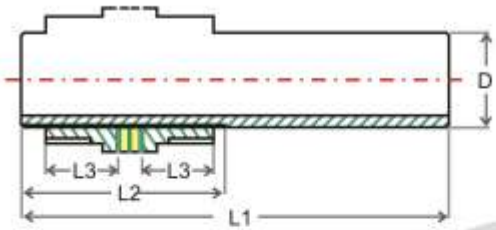
SIZE	D1	D2	D3	H
25X20X20				
32X25X25				
32X25X20				
32X20X20				

Details available on request.

UNEQUAL TEE is used to take different diameter outlets / branches from main pipeline.

ALL DIMENSIONS ARE IN MM.

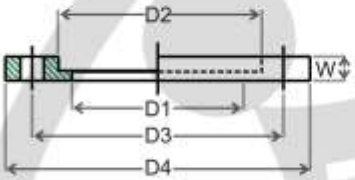
TANK NIPPLE



SIZE	D	L1	L2	L3
20	20	140	65	20
25	25	146	70	22
32	32	150	75	25

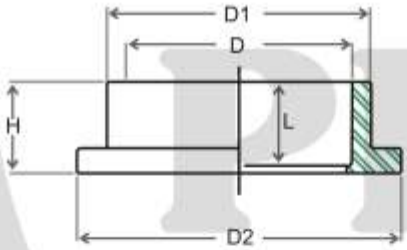
TANK NIPPLE is used to take an outlet from tank.

FLANGE



SIZE	D1	D2	D3	D4	W
32					
75					
90	Details available on request.				
110					
160					

FLANGE CORE

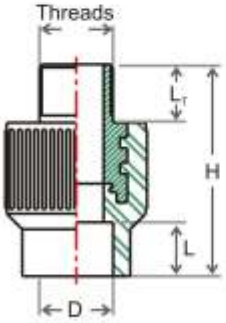


SIZE	D	D1	D2	L	H
75					
90					
110	Details available on request.				
160					

FLANGE & FLANGE CORE are used together along with a suitable gasket to joint two pipelines or to fix a flange end fitting in the pipe line. Flange joint provides flexibility of reopening the joint, basically for maintenance.

3.2.3 TRANSITION FITTINGS WITH METALLIC THREADED INSERTS

MALE THREADED ADAPTOR



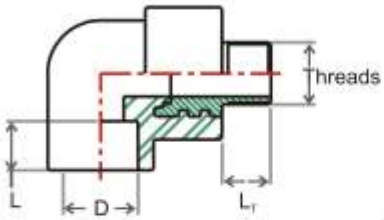
SIZE	D	Threads	L	L_T	H
20X½"	19.5	½"	14.5	15.0	54.5
20X¾"	19.5	¾"	14.5	17.0	58.0
25X½"	24.5	½"	16.0	15.0	56.0
25X¾"	24.5	¾"	16.0	17.0	58.0
32X¾"	31.5	¾"	18.0	17.0	60.0
32X1"	31.5	1"	18.0	19.0	62.0
40X1¼"	39.45	1 ¼"	20.5	22.0	72.0
50X1½"	49.45	1 ½"	23.5	22.0	75.0
63X2"	62.5	2"	27.5	26.3	88.3

NOTE: 1. 1/2" & 3/4" 14-TPI.
2. 1" & ABOVE 11-TPI.

MALE THREADED ADAPTOR is used to joint female threaded metallic fitting with PP-R line.

ALL DIMENSIONS ARE IN MM.

MALE THREADED ELBOW

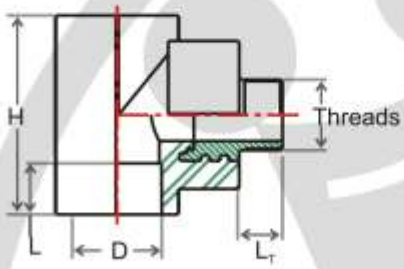


SIZE	D	Threads	L	L_T
20X½"	19.5	½"	14.5	15.0
20X¾"	19.5	¾"	14.5	17.0
25X½"	24.5	½"	16.0	15.0
25X¾"	24.5	¾"	16.0	17.0
32X1"	31.5	1"	18.0	19.0
40X1 ¼"	39.45	1 ¼"	20.5	22.0
40X1 ½"	39.45	1 ½"	20.5	22.0

NOTE: 1. 1/2" & 3/4" 14-TPI.
2. 1" & ABOVE 11-TPI.

MALE THREADED ELBOW is used to joint female threaded metallic fitting with PP-R line at 90° corner / turn.

MALE THREADED TEE

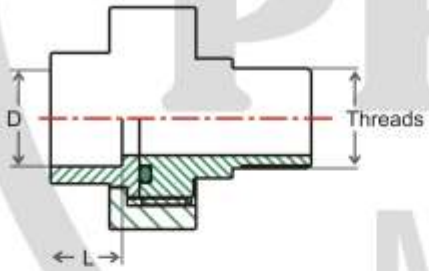


SIZE	D	Threads	L	L_T	H
20X1/2"	19.5	½"	14.5	11.0	51.0
25X1/2"	24.5	½"	16.0	13.5	59.0
25X3/4"	24.5	¾"	16.0	13.5	59.0
32X3/4"	31.5	¾"	18.0	17.0	70.0
32X1"	31.5	1"	18.0	17.0	70.0

NOTE: 1. 1/2" & 3/4" 14-TPI.
2. 1" & ABOVE 11-TPI.

MALE THREADED TEE is used to joint a female threaded metallic fitting with PP-R line for taking outlet.

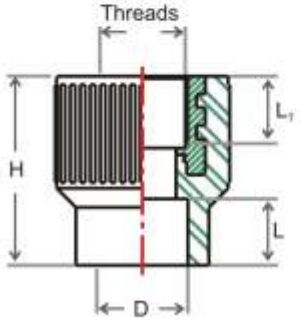
MALE THREADED UNION



SIZE	D	Threads	L
20	19.5	½"	14.5
25	24.5	¾"	16.0
32	31.5	1"	18.0

MALE THREADED UNION is used to joint PP-R pipe with metallic pipe line coaxially. It provides facility of reopening of joint, basically for maintenance.

FEMALE THREADED ADAPTOR



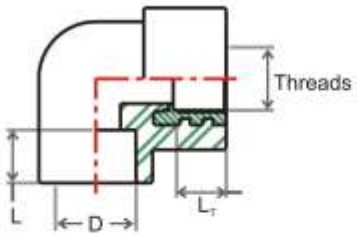
NOTE: 1. 1/2" & 3/4" 14-TPI.
2. 1" & ABOVE 11-TPI.

SIZE	D	Threads	L	L_T	H
20X½"	19.5	½"	14.5	15.0	39.5
20X¾"	19.5	¾"	14.5	16.3	41.0
25X½"	24.5	½"	16.0	15.0	41.0
25X¾"	24.5	¾"	16.0	16.3	41.0
32X¾"	31.5	¾"	18.0	16.3	43.0
32X1"	31.5	1"	18.0	19.1	43.0
40X1 ¼"	39.45	1 ¼"	20.5	21.4	50.0
50X1 ½"	49.45	1 ½"	23.5	21.4	53.0
63X2"	62.5	2"	27.5	25.7	62.0

FEMALE THREADED ADAPTOR is used to joint male threaded metallic fitting with PP-R line.

ALL DIMENSIONS ARE IN MM.

FEMALE THREADED ELBOW

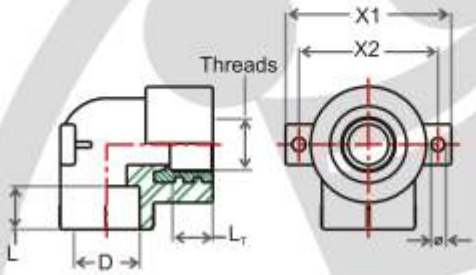


SIZE	D	Threads	L	L_T
20X½"	19.5	½"	14.5	15.0
20X¾"	19.5	¾"	14.5	16.3
25X½"	24.5	½"	16.0	15.0
25X¾"	24.5	¾"	16.0	16.3
32X¾"	31.5	¾"	18.0	16.3
32X1"	31.5	1"	18.0	19.1
40X1 ¼"	39.45	1 ¼"	20.5	21.4

NOTE: 1. 1/2" & 3/4" 14-TPI.
2. 1" & ABOVE 11-TPI.

FEMALE THREADED ELBOW is used to joint male threaded metallic fitting with PP-R line at 90° corner / turn.

FEMALE THREADED ELBOW WITH SUPPORT

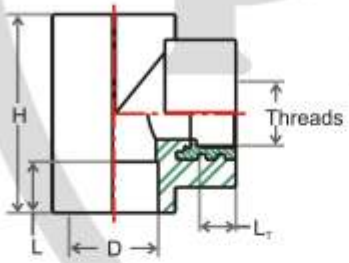


SIZE	D1	Threads	L	L_T	X1	X2	ø
20X1/2"	19.5	½"	14.5	15.0	60.0	50.0	5.0
25X1/2"	24.5	½"	16.0	15.0	64.0	54.0	5.0
25X3/4"	24.5	¾"	16.0	16.3	64.0	54.0	5.0

NOTE: 1. 1/2" & 3/4" 14-TPI.

FEMALE THREADED ELBOW WITH SUPPORT is used to take an outlet from PP-R line, using male threaded metallic fitting at 90°. The support bracket is screwed to wall / flooring to ensure a rigid base for the outlet to take care of frequent operation.

FEMALE THREADED TEE

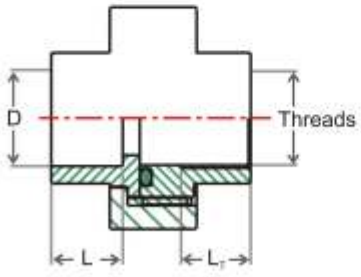


SIZE	D1	Threads	L	L_T	H
20X½"	19.5	½"	14.5	15.0	51.0
25X½"	24.5	½"	16.0	15.0	59.0
25X3/4"	24.5	¾"	16.0	16.3	59.0
32X½"	31.5	½"	18.0	15.0	70.0
32X3/4"	31.5	¾"	18.0	16.3	70.0
32X1"	31.5	1"	18.0	19.1	70.0

NOTE: 1. 1/2" & 3/4" 14-TPI.
2. 1" & ABOVE 11-TPI.

FEMALE THREADED TEE is used to joint a male threaded metallic fitting with to PP-R line for taking outlet.

FEMALE THREADED UNION



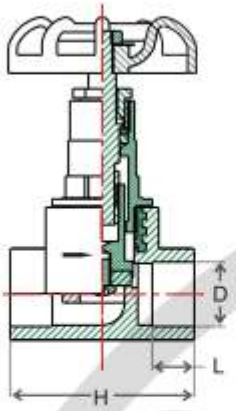
SIZE	D	Threads	L	L_T
20X½"	19.5	½"	14.5	15.0
25X¾"	24.5	¾"	16.0	16.3
32X1"	31.5	1"	18.0	19.1
40X1 ¼"	39.45	1 ¼"	20.5	21.4
50X1 ½"	49.45	1 ½"	23.5	21.4
63X2"	62.5	2"	27.5	25.7

FEMALE THREADED UNION is used to joint PP-R pipe with metallic pipe line coaxially. It provieds facility of reopening of joint, basically for maintenance.

ALL DIMENSIONS ARE IN MM.

3.2.4 VALVES

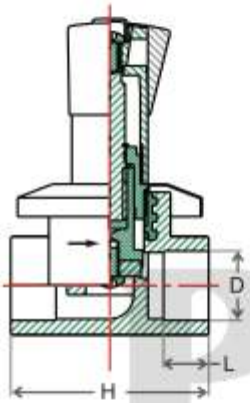
GATE VALVE



SIZE	D	L	H
20	19.5	14.5	61.0
25	24.5	16.0	70.0
32	31.5	18.0	85.0

VALVE is used to start, regulate and stop the water flow in pipe line.

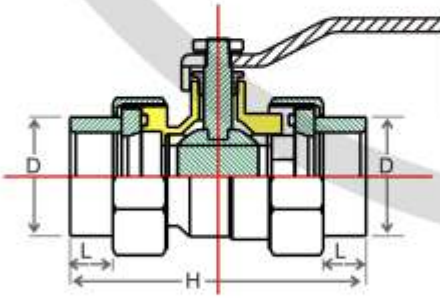
DESIGNER VALVE



SIZE	D	L	H
20	19.5	14.5	61.0
25	24.5	16.0	70.0
32	31.5	18.0	85.0

DESIGNER VALVE is used in concealed piping to start, regulate and stop the water flow in pipe line. It is designed to have an aesthetic look.

DOUBLE UNION BALL COCK



SIZE	D1	L1	H
20	19.5	14.5	61.0
25	24.5	16.0	70.0
32	31.5	18.0	85.0
40	39.45	20.5	95.0
50	49.45	23.5	114.0
63	62.5	27.5	133.5

DOUBLE UNION BALL COCK is used to start, regulate and stop water flow in pipe line. It has fusion weld type valve ends & metallic body with double union joint. The arrangement provides facility of opening the valve, basically for maintenance.

ALL DIMENSIONS ARE IN MM.

3.2.5 WELDING ACCESSORIES

CUTTER

SIZE
20 - 40mm
50 - 110mm

DIE SET

SIZE
20 - 63mm
75 - 110mm
160mm

WELDING DEVICE

SIZE
20 - 63mm
75 - 110mm

LARGE DIAMETER WELDING MACHINE

SIZE
75 - 160mm

REPAIR SECTION (7x11mm)

REPAIR BAR (7x11mm)

3.3 QUALITY TESTS

In order to assure a high and consistent quality level, PRINCE PP-R products undergo strict quality control at every stage of their realization. The company has established a laboratory with modern testing equipments, which are handled by highly skilled and trained technicians.
The quality assurance plan covers-

A) **Acceptance Tests**

1. Incoming Inspection & Testing of
   - Raw material for MFI.
   - Product accessories for Surface Finish, Fitment and Operation.
   - Rubber parts for Hardness and Dimensions.
2. Inprocess Inspection & Testing of
   - Pipes, Fittings & Valves for Visual appearance, Fitment with gauges and Dimensions.
3. Final Inspection & Testing of
   - Pipes for Visual appearance, Dimensions, Hydraulic Test, Heat Reversion Test and Hammer Test.
   - Fittings for Visual Appearance, Dimensions, Hydraulic Test and Hammer Test.
   - Valves for Drip Proof ness Test & Hydraulic Test.

B) **Type Tests**

1. Pipes & Fittings for Long Term Hydraulic Test.
2. Valves for Thermal Shock Test.
3. Piping installation including assemblies of pipes, fittings & valves for
   - Hot & Cold Water Cycle Test.
   - Water Hammer Test.
4. Threaded Brass Inserts for Torque Test and Material composition.

ALL DIMENSIONS ARE IN MM.

3.4 QUALITY ASSURANCE CERTIFICATES & APPROVALS

4.1 THERMAL EXPANSION

A pipe line which is subjected to a variation of temperatures changes its length if it is free to do so. This change in length is proportional to the unit linear coefficient of thermal expansion. Any linear expansion or contraction caused by a thermal gradiant can easily be calculated using the following formula.

$\Delta L = \propto X L X \Delta T$

where:

ΔL = Expansion(+) or contraction(-) in length,(mm)
L = Initial pipe length, (Meter)
$\propto$ = Coefficient of thermal expansion(for PP-R $\propto$ = 0.15mm/m°C)
ΔT = Temperature, difference(°C)

Example: for 5 meter PP-R line operating between 25 to 55°C
$\Delta T = (55-25)=30°C$
$\Delta L = 0.15 X 5 X 30 = 22.5mm$

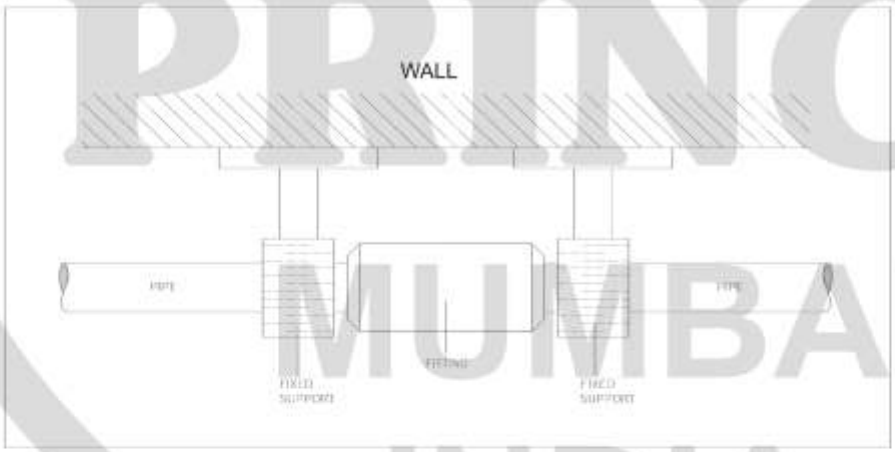
The expansion and contraction adjustment of PP-R pipeline is generally made in longitudinal direction only. Enough space shall be provided and proper type of supports shall be used to allow the free movement of pipe in axial directions.

Once the change in length of pipeline on account of thermal expansion/contraction has been calculated, a correct planning of pipelines is necessary to ensure that its effect do not cause deformation of the piping itself. PP-R systems make it possible to install easy and convenient compensation for change in length using the suitable provision of following:

- Fixed supports & Sliding supports.
- Free flexible pipe segment; (Expansion Arm).
- Free flexible pipe loop (Compensation Loop).

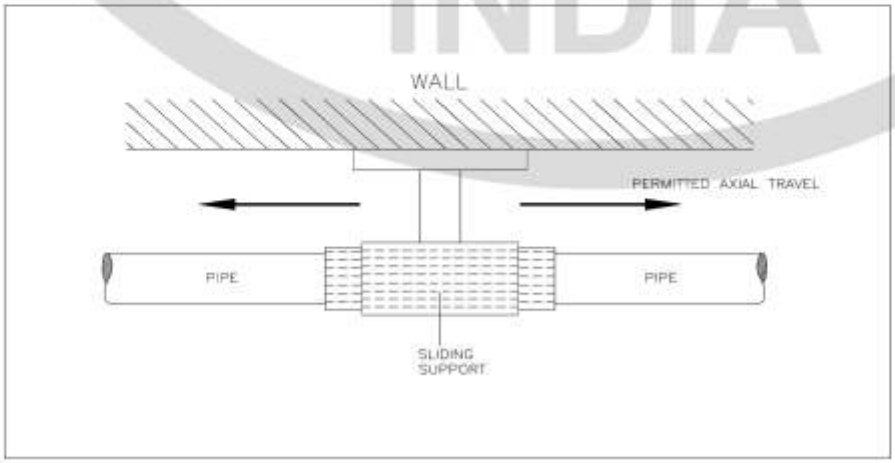
Fixed and Sliding supports secure external pipelines to the masonry structure of the building, to prevent the movements generated by thermal expansion, totally or partially.

Fixed Supports: - are used when the axial expansion of the pipeline should be limited. Fixed support provides a rigid connection between external pipeline installations with masonry structure. The fixed supports must normally be positioned where the system changes direction (Elbows, Tees, etc.) & near to Valves, Cocks, Water meter, etc. to ensure that expansion forces are not discharged in these points. In all cases, fixed support should always be provided next to any joint in the pipeline created using any welded fitting.



Obviously the fixed supports limit the length of section of pipe free to expand, and reduce the relative change in length value.

Sliding Supports: - are used to allow the pipe to move axially in both directions. They have to be positioned well away from joints made using welded fittings, on a free length of the pipes surface. The sliding support collar must be absolutely free from pipe diameter otherwise it may damage the surface of the pipe where it is installed.



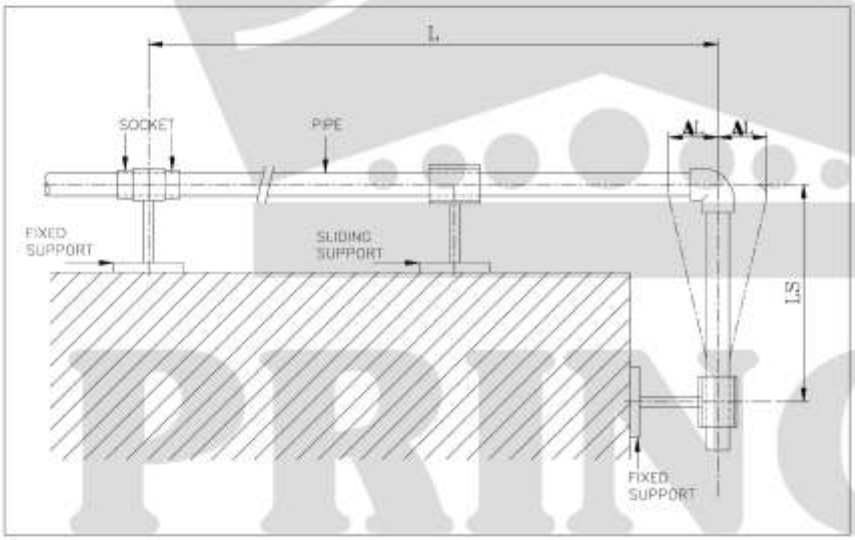
Sliding support also ensures that the pipeline remain straight in spite of thermal stresses.

Support Spacing: - For horizontal and vertical external pipeline installation on wall, the recommended distances between supports are given in following tables pipe diameter wise.

PIPE DIA.	Horizontal clamp spacing distance according to temperatures , cm						
mm	20°C	30°C	40°C	50°C	60°C	70°C	80°C
20	65	63	61	60	58	53	48
25	75	74	70	68	66	61	56
32	90	88	86	83	80	75	70
40	110	110	105	100	95	90	85
50	125	120	115	110	105	100	90
63	140	135	130	125	120	115	105
75	155	150	145	135	130	125	115
90	165	160	155	145	140	130	120
110	175	175	170	165	155	145	135

PIPE DIA.	Vertical clamp spacing distance according to temperatures , cm						
mm	20°C	30°C	40°C	50°C	60°C	70°C	80°C
20	85	82	79	78	75	69	62
25	98	96	91	88	86	79	73
32	117	114	112	108	104	98	91
40	143	143	137	130	124	117	111
50	163	156	150	143	137	130	117
63	182	176	169	163	156	150	137
75	202	195	189	176	169	163	150
90	215	208	202	189	182	169	156
110	228	228	221	215	202	189	176

Free flexible pipe segment (Expansion Arm) : - With the help of free flexible pipe segment, provided at the position of change in direction, the change in length of pipeline is totally compensated. The length of free flexible pipe segment is calculated using following formula:

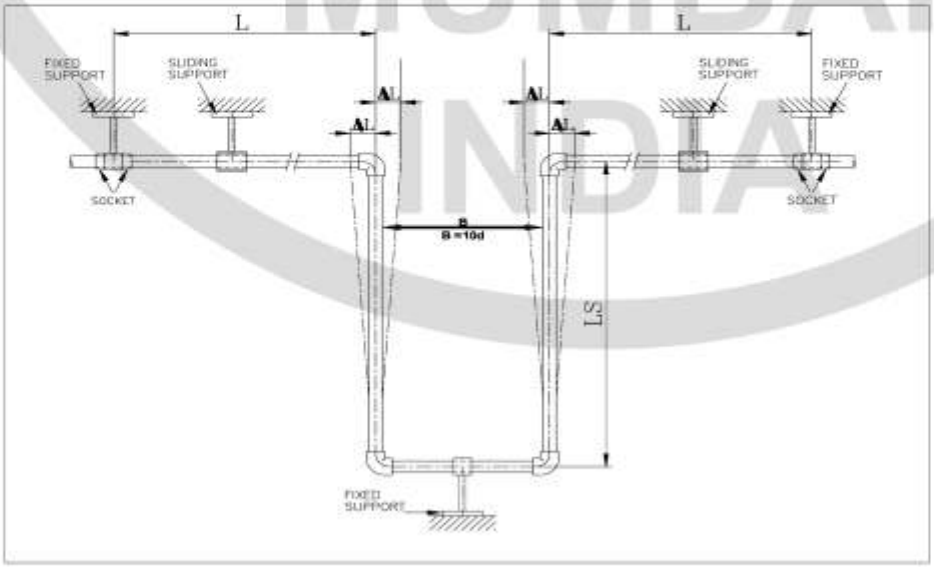


Length of free flexible segment = $LS = C \sqrt{d \times \Delta L}$

Where,

LS = Length of free flexible segment (mm).
C = Constant of material (for PP-R, C= 30).
d = Pipe outside diameter (mm).
ΔL = Expansion or contraction length (mm).

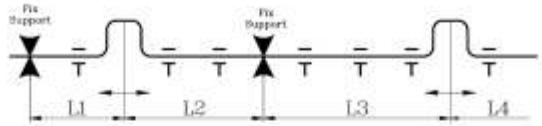
Free flexible pipe loop (Compensation Loop): - If the change in length cannot be compensated using expansion arm, it is necessary to install a free flexible loop (Compensation loop). Free flexible bend can be easily prepared on site with required lengths of PP-R pipe & 4 nos. of 900 elbows.



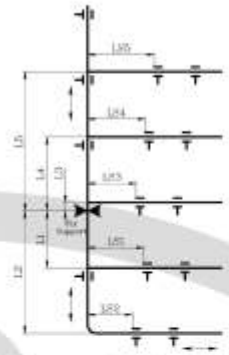
To prepare a free flexible loop you have to calculate:

- The length of free flexible segment (LS) with the help of formula as explained in Free flexible pipe segment (Expansion Arm)
- The minimum width (B) between two arms of the loop = 10 times the outside diameter of the pipe.

Examples of fixed and sliding supports in pipe section:-



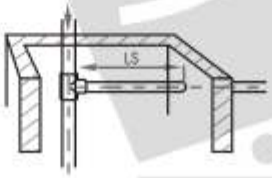
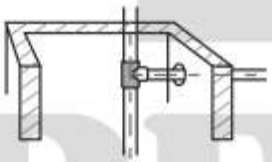
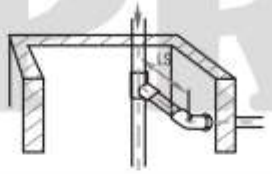
Length absorption with compensation loop in a straight section of pipe



Fixed support in the middle of the vertical pipe section

Fixed support at base of vertical pipe section

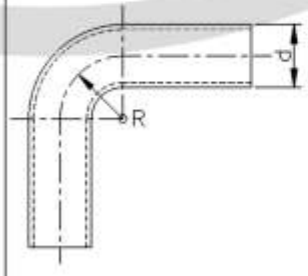
4.2 LAYING IN SANITARY SHAFT / PIPE DUCT OF A BUILDING

No.	RECOMMENDATION FOR PIPE CONNECTION	DESCRIPTION
1		PIPE CONNECTION CAN BE MADE AT SOME DISTANCE AWAY FROM THE WALL
2		THE CONNECTING PIPE CAN BE PASSED THROUGH A HOLE MUCH LARGER THAN THE PIPE DIAMETER
3		THE CONNECTION CAN BE MADE THROUGH A BRANCH PIPE TO PROVIDE FLEXIBILITY

When making the apartment pipe connections from main pipe going through the sanitary shaft of the building, the alternative techniques shown above, can be applied in order to compensate for thermal expansion & contraction.

4.3 BENDING

During laying of pipeline, PP-R pipes may be required to be bent. Bending shall be done by using hot air blowing at 140 °C. Direct heating by open flame shall be avoided. Radius for PP-R pipe bend should be minimum 8 times its diameter. The table given besides indicate minimum bending radius for each sized of pipe.

DRAWING	PIPE DIAMETER (mm)	MINIMUM BENDING RADIUS (mm)
	20	160
	25	200
	32	256
	40	320
	50	400

4.4 INSULATION

4.4.1 FOR HOT WATER

When conveying hot water through any pipe, heat is transferred through the pipe wall. PRINCE PP-R pipes posses a much lower coefficient of thermal conductivity (0.24W / mK) compared to metal pipes. Therefore, normally it may not be required to insulate the pipelines which is used for hotwater concealed application. However, for centralised heating systems, to prevent heat loss and isolate the pipelines from other utilities, it is advisable to insulate these lines. The required thickness of insulation is quite lower as compared with conventional lines. Given besides are the recommended insulation thickness for different pipe size

Pipe Size mm	Thermal conductivity of Insulation material	
	0.030 W / m.K	0.035 W / m.K
	Recommended minimum insulation thickness in mm	
20	6	10
25	6	10
32	10	13
40	10	13
50	10	13
63	13	20
75	20	20
90	20	25
110	25	32

4.4.2 FOR COLD WATER

Potable cold water plants have to be protected against heat gain and the formation of condensation. Standard value for the minimum thickness as stipulated in DIN-1988, part 2 have to be taken from the following table.

Minimum insulation thickness for the insulation of potable water pipes (10°C) as per DIN 1988, part 2	
Type of installation	Insulation thickness (for 0.04 W / m.K thermal conductivity material) in mm
Open installed pipes, in non heated room (I.e. celler)	4mm
Open installed pipe in heated room	9mm
Pipe in a duct, without warm pipe	4mm
Pipe in a duct, beside warm pipe	13mm
Pipe in a pipe chase riser	4mm
Pipe in a pipe chase, beside warm water pipes	13mm
Pipe on concrete floor	4mm

(Note :- Recommended insulation for all sizes of pipes for different water temperature at different humidites are available on request)

4.5 RESISTANCE TO ULTRA VIOLET (UV) RAYS :-

PRINCE PP-R pipes & fittings are having sufficient U.V. stability in order to protect them from UV rays during storage in open area for a period of about 6 months. However, it is not advisable to use these pipes and fittings under direct sunlight continuously. For outdoor installation on pipelines, PRINCE offers 3 layers PP-R pipes, which are resistant to U.V. rays.

4.6 SUITABILITY FOR DRINKING WATER :

PRINCE PP-R pipes & fittings meet the requirements of IS 10500-91 for drinking water and IS 10146-87 for leachable additives as its safe use for drinking water.

4.7 FIRE RESISTANCE :

PRINCE PP-R pipes & fittings have combustion point 330°C & burning point 360°C. These conform with B2 class fire requirements of normal combustibility according to DIN 4102. On fire, PP-R pipes & fittings emits carbon dioxide and water. Other than this, carbon monoxide gas, molecular hydrocarbon and oxidation products of these are also emitted in proportion to the availability of oxygen. Even if the fire is incomplete, the materials emitted are less poisonous than wood or similar materials of fire under the same conditions.

The smoke that comes out of PP-R fire does not cause rusting.

4.8 LOW TEMPERATURE RESISTANCE :

At lower temperature of 0°C and below, the flexibility of PP-R pipes reduces and impact strength also reduces. This makes pipes more prone to mechanical damages against impact loads. To avoid the damages at low temperature, it is advisable to insulate the pipe lines. (Refer 'Insulation' given under 4.2.2)

5.0 DESIGNING

5.1 GENERAL GUIDELINES

While designing the PP-R piping system , one should be aware that PP-R piping is quiet different than other traditional materials like GI or Copper as well as PVC or CPVC. For good and safe design and installation, the following shall be taken into account.

- Pipes & fittings have different dimensions from other types of pipes and fittings. Even though the bore diameter of pipe is less than the equivalent metal or plasticl pipe, the flow is more due to smoothness & less friction (Refer table : "Pipe Friction Loss & Flow Rate") Hydraulic calculation should be done each time for the best choice of pipeline diameters.
- Linear thermal expansion/contraction of PP-R pipes is more as compared with metal pipes. This needs to be taken care during designing and installation to avoid stressing of pipeline by providing flexible free length and proper supporting. (Refer section 4.1 Thermal expansion).
- Refer section 2.3 for STANDARD WORKING CONDITION AND SERVICE LIFE for designing.
- Use 3 layer pipes for outdoor installations.
- Use Black pipes for solar heating system.
- Provide insulation for centralized heating systems and chilled water systems (Refer section 4.4 Insulation)
- Refer section 8 for Dos & Don'ts.

5.2 PIPELINE DESIGN

5.2.1 FLOW RATE

Analytical flow is typical for each analytical section. Draw-off point's water quantity shall be worked out, taking into consideration water consumption (which is not simultaneous at all draw-offs). Following table gives formula for calculating the analytical flow for the different types of application :-

Application	Design flow rate Q_p in lps as per DIN 1988 part 3 can be calculated from following formula	
	Formula for $0.07<\Sigma q< 20$lps	Formula for $\Sigma q> 20$lps
Residential buildings	$Q=0.682\ (\Sigma q)^{0.45} - 0.14$	$Q=1.7\ (\Sigma q)^{0.21} - 0.7$
Commercial buildings	$Q=0.682\ (\Sigma q)^{0.45} - 0.14$	$Q=0.4\ (\Sigma q)^{0.54} - 0.48$
Hotels & shopping Malls	$Q=0.4(\Sigma q)^{0.398}$, $Q=0.698(\Sigma q)^{0.5} - 0.12$	$Q=1.08\ (\Sigma q)^{0.5} - 1.82$, $Q=1.08(\Sigma q)^{0.5} - 0.12$
Hospitals	$Q=0.698\ (\Sigma q)^{0.5} - 0.12$	$Q=0.25\ (\Sigma q)^{0.65} - 1.25$
Schools	$Q=4.4\ (\Sigma q)^{0.27} - 3.41$	$Q=-22.5\ (\Sigma q)^{0.5} - 11.5$

Where, Q = Standard outflow from the draw-off points , lps

Σq = Sum of all standard outflows from the draw-off points serviced by dimensional section of the installation , lps

Q_p = Design flow , lps

- Maximum design flow velocity in service pipe should be 2 M/s.
- In supply mains, the maximum flow velocity shall be between 2.5 to 5.0 M/s.
- Select the size of main pipe considering the flow ΣQ.

DESIGN FLOW RATES OF COMMON WATER POINTS

Minimum Pressure	Type of water point	Calculated Flow on Taking :	
		Mixed water cold/warm	Only cold or warm potable water
Bar	Designation	lps	lps
0.5	Taps Without air inlet DN 15	-	0.30
0.5	Taps Without air inlet DN 20	-	0.50
0.5	Taps Without air inlet DN 25	-	1.00
1.0	Taps With air inlet DN 10	-	0.15
1.0	Taps With air inlet DN 15	-	0.15
1.0	Shower heads for purification showers DN15	0.10	0.20
1.2	Flush Valves DN 15 (Toilet)	-	0.70
0.4	F.V. DN 25 (Toilet)	-	1.00
1.0	Flush Valves DN 15 (Urinal)	-	0.30
1.0	Domestic dish washers DN 15	-	0.15
1.0	Domestic washing machine DN 15	-	0.25
	Mixing battery for :		
1.0	Shower-bathes DN15	0.15	-
1.0	Bath-tubs DN15	0.15	-
1.0	Kitchen sinks DN 15	0.07	-
1.0	Washstands DN 15	0.07	-
1.0	Bidet DN 15	0.07	-
1.0	Mixing battery DN20	0.30	-
0.5	Geyser DN 30	-	0.15
1.0	Geyser DN 20	-	0.20

5.2.2 PRESSURE LOSS

In normal piping, two types of pressure loss can be found,

1 Distributed pressure loss related to pipe roughness, dimensions, physical properties and velocity of the liquids.

2 Local loss related to elbows, tees, valves and fittings which cause a remarkable variation in the liquid flow.

5.2.2.1 DISTRIBUTED PRESSURE LOSS

The PP-R pipe has extremely smooth inner surfaces compared to metal pipes. Therefore, pressure loss is quiet low.

Pressure loss changes are very little in the normal span of operating temperatures (upto 60 ^{0}C) in potable water pipeline.

The details are available on request.

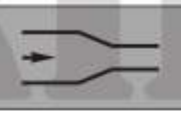
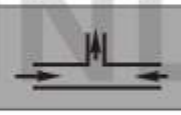
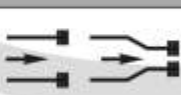
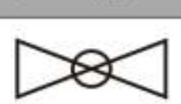
5.2.2.2 LOCAL PRESSURE LOSS

In pipeline, local pressure loss takes place due to presence of fittings which can be calculated using following formula

$$R = \frac{(r)\, V^2 б}{2g}$$

Where,
- R = Total local pressure loss in (mm)
- r = Local resistance coefficient value as given in following table
- V = Mean velocity of fluid in (m/s)
- g = Acceleration of gravity = 9.81 (m/s^2)
- б = Specific gravity of water = 1000 (kg/m^3)

Local resistance coefficient "r" for PRINCE PP-R plumbing fittings.

Name of pp-r fitting	Symbol for pp-r fitting	Coefficient value (r)
Coupler		0.25
Reducer Single stage reducer Double stage reducer Three stage reducer Four stage reducer		0.50 0.60 0.70 0.85
Elbow 90^0 Elbow 45^0		1.2 0.5
Tee		1.8
Male / Female Threaded Tee		1.8
Reducing Tee		3.0
Male/Female Threaded Adaptor Reducing Male/Female Adaptor		0.5 0.8
Male / Female Threaded Elbow Reducing Threaded Elbow		1.4 1.6
Valve 20 25 32		9.5 8.5 7.6
Union		8.3

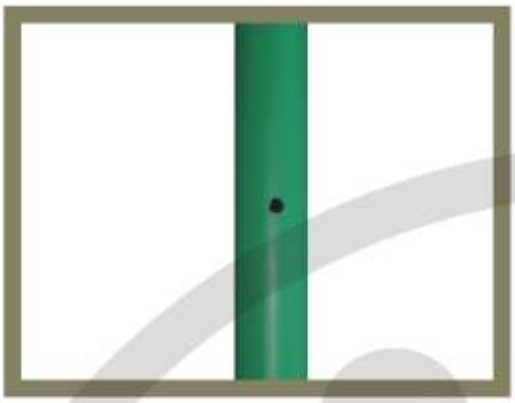
Note : -

1) These are reference values and they vary according to water temperature.

2) As fitting diameter increases, the value of 'r' decreases.

5.3 HOLE REPAIRING

In case of accidental hole formation in pipe line due to drilling or piercing of pointed object, the pipe line can be repaired as follows :-



1

Accidental hole formation in pipe line.

2

Simultaneously heat the hole section in the pipe line and repair bar using repair section die and welding device for about 5 to 7 seconds depending upon the pipe thickness.

3

Insert heated repair bar in the hole up till the full depth and hold it for a minute.

4

After cooling, cut the repair bar projected outside the pipe line using pipe cutter. Kindly do the needful in case the printing is not yet started.

6.0 TESTING THE INSTALLATION

6.1 PRESSURE TEST

According to DIN 1988 PP-R Pipeline for potable water installation have to be (before concealing) hydraulically pressure tested as described under -

While carrying out the pressure test the material properties of PP-R pipes lead to expansion of pipe. This influences the test result .A further influence of the result can be caused by the thermal expansion of PP-R pipes. Different temperatures of pipe & test medium lead to alteration of pressure. (A temperature change of 10°C corresponds to pressure difference of 0.5 to 1 bar). Therefore, the highest possible constant temperature of the test medium has to be ascertained at the hydraulic pressure test of installations with PP-R pipes.

6.1.1 PRIMARY TEST

For primary test, a pressure of 1.5 times of rated pressure shall be applied for a duration of 30 minutes. During this test, pressure drop shall be < 0.6 bar.
If the pressure drops is > 0.6 bar, check the pipeline for leakage & retest.

6.1.2 MAIN TEST

After completion of primary test, main test must be conducted, which has to be effected with a test pressure of alternate 1 bar and 10 bar for every 5 minutes interval for 2 hours.

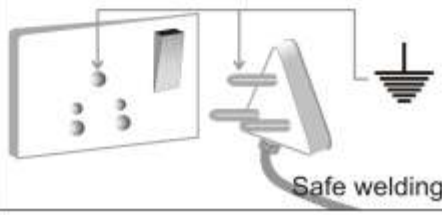
7.0 CHEMICAL RESISTANCE CHART

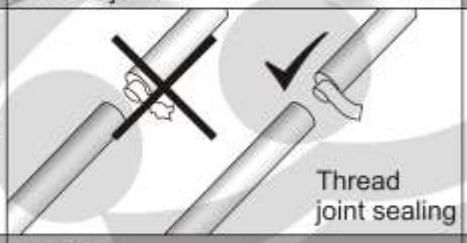
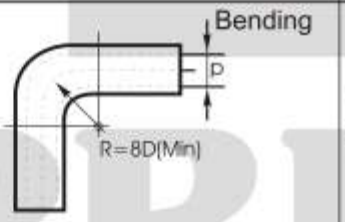
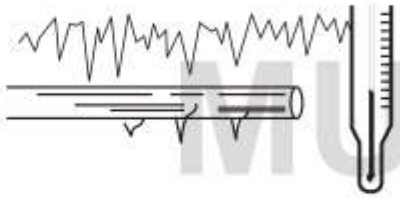
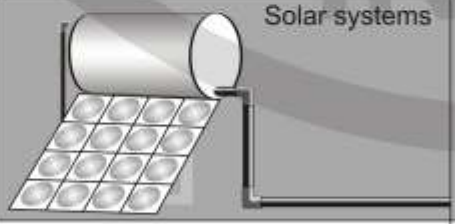
CHEMICAL	CONC.	PP - R	
		TEMPERATURE	
	%	20	60
Acetone	100	R	C
Acetic Acid	100	R	C
Acetic Anhydride	100	R	C
Alum	sat.	R	R
Ammonia Aq.	conc.	R	R
Ammonium Acetate Aq.	any	R	R
Ammonium Phosphate	any	R	R
Amyl Alcohol pure		R	R
Aniline	100	R	C
Beer		R	R
Benzaldehyde	100	R	C
Benzene	100	N	R
Borax Aq.		R	R
Boric Acid Aq.	sat	R	R
Butanol	100	R	R
Butyl Acetate	100	R	N
Calcium Chloride Aq.	sat.	R	R
Calcium Nitrate	sat.	R	R
Citric Acid Aq.	sat.	R	R
Coconut oil		R	C
Cyclohexanol	100	R	R
Cyclohexanone	100	R	N
Formaldehyde	40	R	R
Formic Acid	50	R	R
Glycerine	100	R	R
Heptane	100	R	N
Hydrochloric Acid	conc.	R	R
Hydrogen Peroxide	10	R	R
Isopropyl Alcohol	100	R	R
Lactic Acid	85	R	R
Linseed oil		R	R
Magnesium Salts Aq.	sat.	R	R
Methyl Alcohol	100	R	R
Olive Oil		R	R
Oxalic Acid Aq.	sat.	R	R
Palm oil		R	N
Peanut oil		R	C
Phospheric Acid	50	R	R
Potassium Chlorate Aq.	sat.	R	R
Pottacium Dichromate Aq.	sat.	R	R
Potassium Sulphate Aq.	sat.	R	R
Pyridine	100	R	C
Salted Water	any	R	R
Sea Water		R	R
Soap		R	R
Sodium Bicarbonate Aq.	sat.	R	R
Sodium Chloride Aq.	sat.	R	R
Sodium Perborate Aq.	sat.	R	R
Sodium phosphates Aq.	sat.	R	R
Sodium Sulphate Aq.	sat.	R	R
Starch, Starch solutuion Aq.	any	R	R
Sugar (dry)		R	R
Sulphuric Acid	96	R	C
Tartaric Acids Aq.	sat.	R	R
Toluene	100	C	N
Urea Aq.	sat.	R	R
Vinegar	comm.	R	R
Water	100	R	R

R = Recmmended , Durable
C = Caution, Practically durable under suitable conditions
N = Not Recommended

* For more details please ask us

8.0 DOS & DON'TS FOR PP-R PIPE PLUMBING SYSTEM

No.	ACTIVITY	RECOMMENDATION
1	Storage 	Although PP-R Pipe system material is stabilized for use at elevated temperature do not expose the pipes & fittings to direct sunlight.
2	Storage 	PP-R Pipe storage height should not be more than 1.5 meter.
3	Transportation 	During transportation, PP-R pipes should be loaded in proper manner, otherwise pipes may get deformed.
4	 Handling	The PP-R Pipe system should be protected from impact of hard and sharp objects.
5	 Cutting	Avoid cutting tools which create burrs & ensure cutting should be square to pipe axis (use only provided cutters.)
6	Preparation for welding 	Before welding / jointing clean the surface of PP-R Pipes & Fittings with clean piece of cloth and then start welding.
7	 Heating	While welding of PP-R Pipes and fittings check that thermostat of welding machine and dies have reached correct temperature(260°C). While welding, the pipe must not be twisted.
8	 Welding	Avoid air droughts during welding to avoid stress in the welds.
9	 Safe welding	Welding machines shall be earthen properly during use.

No.	ACTIVITY	RECOMMENDATION
10	 Safe welding	Do not cool welding machine in water.
11	 Thread joint	Do not over-tight threaded fittings & valves.
12	 Thread joint sealing	Use only Teflon tape or Teflon thread sealant for threaded joints and avoid over wrapping by excess amount of tape.
13	Bending 	Do not apply direct flames to obtain bends or crossover pipes, as the direct exposure to flames may cause damage to the PP-R pipes. Use only hot air blowing equipment at 140°C. (Cross overs are readily available.)
14		While bending the pipe, the bending radius shall be more than 8 times the diameter of pipe.
15	installation at Lower temperature 	PP-R Pipe & fittings kept at lower temperature are to be welded / jointed at ambient temperature.
16		At sub zero temperatures (0°C & below) PP-R Pipe system tends to break under impact. Therefore, installation at low temperatures should be made with care, and the pipe lines shall be insulated.
17	 Solar systems	Use black PP-R pipes for solar heating systems.
18	 Outdoor installation	Use 3 Layer Pipe for outdoor application

9.0 JOINTING METHOD OF PRINCE PP-R PIPES & FITTINGS

CUTTING

- Cut the pipe at right angle to its axis using burr-free cutter.
- Ensure that pipe is free from burrs or cutting chips.
- Clean the pipe & fitting perfectly before welding.
- Mark welding depth at the end of pipe.

HEATING

- Mount the suitable dies on heating element of welding machine according to the diameter of pipe and fitting to be welded.
- Connect the welding machine to 220 volts A.C. power supply.
- Select 2600C temperature on the welding machine thermostat.
- Wait for reaching the required working temperature.
- Insert the pipe and the fitting in the dies by exerting light pressure.
- For heating time, refer the table given for different sizes of pipes.

WELDING

- After heating, quickly insert pipe into the fitting by exerting light pressure.
- Any misalignment should be corrected immediately after insertion to avoid any stress in the weld.
- Allow the joint to cool as per cooling time given in table.

This type of connection ensures perfect sealing even under the severe working conditions.

RECOMMENDED TIME FOR PP-R FUSION JOINTS

PIPE DIA. (mm)	WELDING DEPTH (mm)	HEATING TIME (Sec)	WELDING TIME (Sec)	COOLING TIME (Min.)
20	14.50	6	4	2
25	16.00	7	4	2
32	18.00	8	6	4
40	20.50	12	6	4
50	23.50	18	6	4
63	27.50	24	8	6
75	30.00	30	8	6
90	33.00	40	8	6
110	37.00	50	10	8
160	55.00	60	15	10

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