

Pilsa

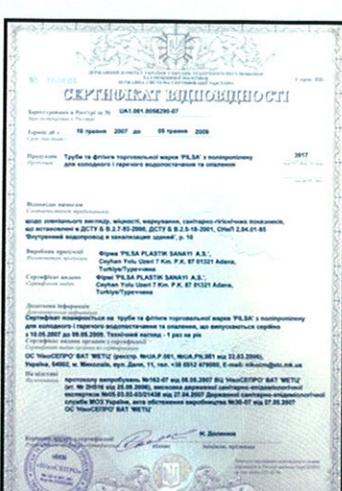
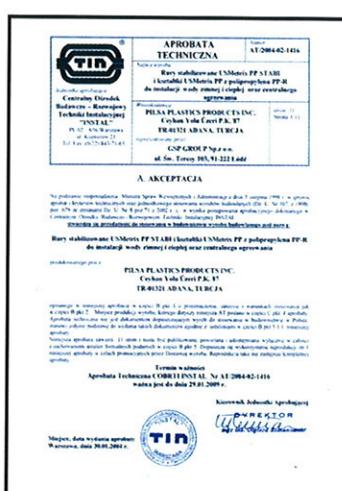
9001 SERIES

PILSATHERM
PIPES AND FITTINGS
**TECHNICAL
CATALOGUE**

**PP-R PIPES
AND FITTINGS**



Pilsa
Plastic Products Inc.



PHYSICAL and MECHANICAL PROPERTIES of RAW MATERIAL (PP-R)

Property		Unit	Test Method	Value
Density at	+23°C	g/cm ³	ISO 1183	0,90-0,91
Melt flow index	MFR 190/5 MFR 230/2,16 MFR 230/5	g/10 min g/10 min g/10 min	ISO 1133 ISO 1133 ISO 1133	0,4-0,6 0,2-0,5 0,8-1,3
Volume flow INDEX	MVR 230/2,16 MVR 230/5	cm ³ /10 min cm ³ /10 min	ISO 1133 ISO 1133	0,4 1,75
Yield stress	50 mm/min	MPa	ISO 527	23-28
Elongation at yield	50 mm/min	%	ISO 527	>10
Tensile modulus	secant	MPa	ISO 527	850
Ball indentation hardness	132 N/30 s	N/mm ²	ISO 2039/1	48
Shore hardness D	3 sec value		DIN 53505	65
Charpy impact strength at	+23°C 0°C -30°C	kJ/m ² kJ/m ² kJ/m ²	ISO 179/1eU ISO 179/1eU ISO 179/1eU	no failure no failure 43
Charpy notched impact strength at	+23°C 0°C -30°C	kJ/m ² kJ/m ² kJ/m ²	ISO 179/1eA ISO 179/1eA ISO 179/1eA	22 4 2,5
Vicat softening temperature	VST/A/50	°C	ISO 306	132
Heat deflection temperature	HDT A HDT B	°C	ISO 75/1+2 ISO 75/1+2	49 70
Melting range	-	°C	DSC	145 - 150
Thermal conductivity	-	W/mK	DIN 52612	0,24
Coefficient of linear thermal expansion (average , 20-90 °C)	-	1/K	DIN 53752	1,5.10 ⁻⁴
Surface resistance	-	Ohm	DIN VDE 0303	>10 ¹⁴

Table - 1

RAW MATERIAL

Pilsatherm PP-R Pipes and Fittings are made of Polypropylene Random Copolymer and designed for hot and cold water supply systems and are also suitable for industrial water conveyance.

LIFE TABLE OF PILSATHERM PIPES

Maximum permissible operating pressures for pipes made of PP-R, media water, C=1,25**

Temperature (°C)	Service Life (Years)	Pressure Group		
		PN10	PN20	PN25
Maximum Permissible Operating Pressure*				
20	1	18,0	36,0	45,3
	10	16,4	32,8	41,3
	50	15,5	30,9	38,9
30	1	15,3	30,6	38,5
	10	13,9	27,7	34,9
	50	13,1	26,1	32,9
40	1	12,9	25,8	32,5
	10	11,8	23,6	29,7
	50	11,0	22,0	27,7
50	1	11,0	22,0	27,7
	10	9,9	19,7	24,9
	50	9,3	18,5	23,3
60	1	9,3	18,5	23,3
	10	8,3	16,6	20,8
	50	7,7	15,3	19,2
70	1	7,8	15,6	19,6
	10	7,8	14,0	17,6
	50	5,1	10,2	12,8
80	1	6,5	13,1	16,4
	10	4,8	9,6	12,0
	50	3,8	7,6	9,6
95	1	4,6	9,2	11,6
	5	3,0	6,1	7,6

Legend :

*Pressure in bar

**C = Safety Factor

Table - 2

CREEP RUPTURE - INTERNAL PRESSURE TEST ON PIPES MADE OF PILSATHERM PIPES

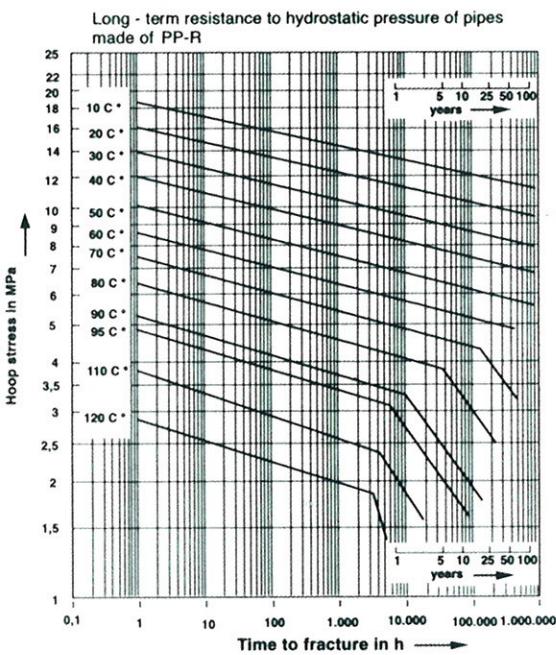


Figure 1.

PILSATHERM PIPE WELDING PRINCIPLES

Pipe Diameter (mm.)	Welding Depth (mm.)	Heating Time (sec.)	Processing Time (sec.)	Cooling Time (min.)	
20	14	6	4	2	
25	16	7	4	2	
32	18	8	6	4	
40	20	12	6	4	
50	23	18	6	4	
63	26	24	8	6	
75	28	30	10	8	
					Manual Welding
					Welding Machine

Table 3.

JOINING PRINCIPLES OF PILSATHERM PIPES

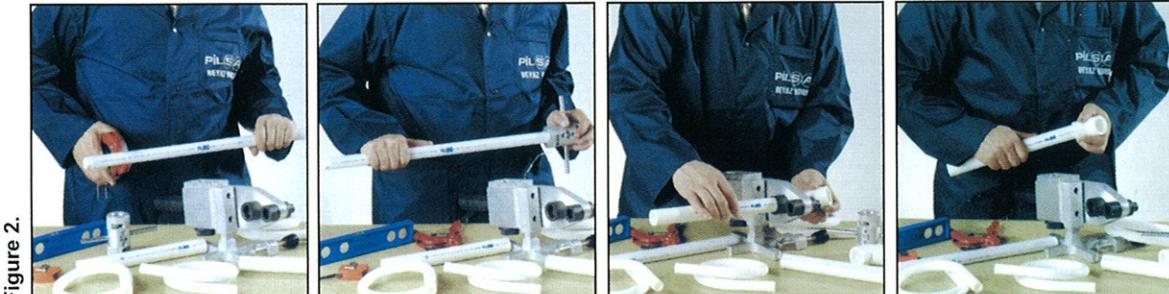


Figure 2.

PIPS IS CUT...

Welding machine is heated up to 260°C. When the control light is switched off, (at 260°C) welding process is started. Pipes should be cut at appropriate length perpendicular to the pipe center. Welding distance should be marked from the pipe.

IF IT IS ALUMINIUM FOILED PIPE...

A special shaver is used to take off the PP-R layer and Aluminium Foil.

Joining surfaces of pipes and fittings should be clean. If necessary, welding parts should be cleaned with alcohol and should be dried with a dry cloth. During welding, neither the pipe nor the fittings should be moved. Duration of heating should be determined as shown in Table 3.

PIPE AND FITTINGS ARE HEATED...

Pipes and fittings should be heated simultaneously after process ends, they should be taken out quickly and without turning they should be joined by pressing one to another axially. Welding machines should be cleaned after every operation for the next use.

AND ARE JOINED NOT BE SEPERATED AGAIN...

STANDARDS AND CODES OF PRACTICE

E DIN

Potable water pipes in private properties
Technical requirements for potable water installation (TRWI)

E DIN 4725

Warm water floor heating systems
Part 1 Terms
Part 2 Thermal testing
Part 3 Thermal performance and design

E DIN 4726

Pipelines of plastic materials used in warm water floor heating systems
requirements special requirements and testing

E DIN 4728

Pipelines of polypropylene type 2 used in warm water floor heating systems; special requirements and testing

dimensions. T-pieces injection moulded for socket welding, dimensions. Sockets and caps injection moulded for socket welding

DIN 16 960

Welding of thermoplastic materials; principles

DVS 2203

Testing of welds of thermoplastic materials

DVS 2207 Part 11

Welding of thermoplastic materials, PP-R Type 1 and Type2, pipes and pipe fittings

DVS 2208 Part 1

Machines and equipment for the welding of thermoplastic materials, fusion tool welding

DIN 8076 Part 1

Pressure pipes thermoplastic materials -metal compression fittings-

DIN 8077

Pipes of polypropylene, dimensions

DIN 8078

Pipes of polypropylene General quality requirements, testing

DIN 16 928

Pipes of thermoplastic, pipe fittings elements for pipes, laying

DIN 16 972

Pipes connections and fittings for pressure pipes of PP-R General quality requirements, testing. Injection moulded elbows for socket welding.

PILSA PP-R PIPE

Pilsa PP-R pipes are manufactured in compliance with Turkish Standards (TS 9937-11451-11755), DIN 8077, DIN 8078. Our products are approved and certified by: GOST (Russia), Ukraine Standard (Ukraine), SJJ (China), Slovakia, Romania, Poland, Bulgaria and have the certificates of guarantee obtained from the Turkish Standards Institute (TSE).

Pilsa PP-R pipes and fittings also have the certificate from Hygiene Institute (Germany).

WHY PILSA?

Being one of the most powerful firms in the country in the plastics sector, PILSA gives the utmost importance to quality and:

- * Uses the most appropriate raw material,
- * Has the most advanced high technology,
- * Produces pipes in compliance with Turkish (TS) and German (DIN) Standards,
- * Pipes produced can be used not only to carry water but a wide range of fluids,
- * Has qualified technical staff at your service to solve your problems,
- * Our name stands for quality.

WHY PILSATHERM PIPE?

Pilsatherm has got the following advantages:

- * Light weight,
- * Easy to carry,
- * Easy to install,
- * Not dangerous to human life, non toxic, non cancerogeneous,
- * Low cost of transportation, loading and unloading,
- * Has much longer service life compared to other piping systems,
- * Has high resistance against corrosion,
- * Can easily be connected to any kind of pipe. Due to low cost of plumbing, it has a wide range of applications,
- * Water is one of the most important compounds contributing to human life; PILSA PP-R Pipes carry this vital fluid to your households in an easy, healthy way at a low cost.

TECHNICAL PROPERTIES OF PILSATHERM PIPES AND FITTINGS

- * Raw material: Polypropylene Random Copolymer,
- * Superior physical characteristics at 90 °C,
- * High chemical resistance,
- * Definite solutions to calcification and corrosion,
- * No bacteria and moss reproduction within the pipes,
- * Light, easy to install and low labour cost of installation,
- * Safe to use various pressurized liquids and gas,
- * No reduction in diameter at the welding points,
- * Longer service life, (50 years)
- * Isolation is not necessary in the buildings,
- * Operation Pressure: 20 Bars at 20 °C and 10 Bars at 90 °C,
- * Compared to the metal pipes it expands more and linearly,
- * Operation temperature is between 70 °C - 90 °C; it does not absorb water. It can easily be used in hot humid environment.
- * Can be used in drinking water systems and has a quality certificate issued by The Ministry of Health and Hygiene-Institute.



PILSATHERM PP-R PIPES AND FITTINGS

Gelsenkirchen 9937
11451
11755 TSE



PIPE PN 20 (SDR 6)		
CODE: PPBB		
HOT AND COLD WATER PIPE		
DIA.	Packing Quant.	Mt/Package
16	30	120
20	25	100
25	20	80
32	10	40
40	5	20
50	5	20
63	3	12
75	2	8
90	2	8
110	1	4
125	1	4



ALUMINIUM FOILED PIPE		
CODE: AL-PPBB		
STABLE PIPE FOR HOT AND COLD WATER		
DIA.	Packing Quant.	Mt/Package
16	25	100
20	20	80
25	15	60
32	10	40
40	5	20
50	5	20
63	3	12
75	2	8
90	2	8
110	1	4
125	1	4



PIPE PN 10 (SDR 11)		
CODE: PPBB		
COLD WATER PIPE		
DIA.	Packing Quant.	Mt/Package
20	25	100
25	20	80
32	10	40
40	5	20
50	5	20
63	3	12
75	2	8
90	2	8
110	1	4
125	1	4



SOCKET		
CODE: PPYD		
DIA.	pcs./BAG	pcs./BOX
16	100	1400
20	50	600
25	40	400
32	20	240
40	15	120
50	10	100
63	6	48
75	6	30
90	1	24
110	1	10
125	1	10



END CAP		
CODE: PPYQ		
DIA.	pcs./BAG	pcs./BOX
16	150	2100
20	100	800
25	80	640
32	50	400
40	25	200
50	10	100
63	10	80
75	6	48
90	4	32
110	2	20



ELBOW (45°-90°)				
CODE: PPYD				
DIA.	pcs./BAG		pcs./BOX	
	45°	90°	45°	90°
16			100	1000
20	50	50	400	450
25	50	50	250	300
32	20	25	120	150
40	10	10	100	80
50	8	5	48	40
63	4	5	24	25
75	3	3	18	15
90			1	8
110			1	4
125			1	4



TEE		
CODE: PPYT		
DIA.	pcs./BAG	pcs./BOX
16	60	600
20	30	240
25	25	150
32	15	90
40	5	50
50	4	32
63	3	18
75	2	12
90	1	6
110	1	4
125	1	4



CROSS		
CODE: ISTAVROZ "TE"		
DIA.	pcs./BAG	pcs./BOX
20	25	200
25	15	150
32	10	90
40	5	50
50	3	24

GREY



WHITE



COLOR OPTIONS

GREEN



BLUE





PILSATHERM PP-R PIPES AND FITTINGS

H Gelsenkirchen 9937
11451 11755 TSE



MALE THREADED END CAP		
CODE: PPDQ		
DIA.	pcs./BAG	pcs./BOX
20x1/2	100	1.000
25x3/4	80	640
32x1	50	400



MANCHON UNION		
CODE: PPYR		
DIA.	pcs./BAG	pcs./BOX
20	15	180
25	10	120
32	5	60
40	5	40
50	5	40



ELBOW (FEMALE-MALE)		
CODE: KUYRKULU PPYD		
DIA.	pcs./BAG	pcs./BOX
20	50	500
25	30	300
25/20	30	300



FEMALE THREADED TEE		
CODE: PPIT		
DIA.	pcs./BAG	pcs./BOX
20x1/2x20	25	200
20x3/4x20	20	140
25x1/2x25	20	120
25x3/4x25	15	120
32x1x32	10	70



MALE THREADED TEE		
CODE: PPDT		
DIA.	pcs./BAG	pcs./BOX
20x1/2x20	15	150
20x3/4x20	10	130
25x1/2x25	10	100
25x3/4x25	10	100
32x1x32	10	60



MALE THREADED ADAPTOR		
PPDA		
DIA.	pcs./BAG	pcs./BOX
16x1/2	25	250
20x1/2	25	250
20x3/4	20	200
25x1/2	15	240
25x3/4	15	150
32x3/4	10	100
32x1	10	100
40x1.1/4	5	25
50x1.1/2	2	16
63x2	1	10
75x2.1/2	1	6
90x3	1	5
110x4	1	3



FEMALE THREADED ADAPTOR		
CODE: PPIA		
DIA.	pcs./BAG	pcs./BOX
16x1/2	20	320
20x1/2	20	320
20x3/4	20	240
25x1/2	25	250
25x3/4	20	280
32x3/4	10	120
32x1	10	120
40x1.1/4	10	40
50x1.1/2	4	24
63x2	2	14
75x2.1/2	2	12
90x3	1	5
110x4	1	4



MALE THREADED ELBOW		
CODE: PPDD		
DIA.	pcs./BAG	pcs./BOX
16x1/2	20	240
16x3/4	15	225
20x1/2	25	200
20x3/4	10	180
25x1/2	20	160
25x3/4	10	140
32x1	10	80



FEMALE THREADED ELBOW		
CODE: PPID		
DIA.	pcs./BAG	pcs./BOX
16x1/2	25	250
20x1/2	25	250
20x3/4	20	200
25x1/2	20	160
25x3/4	15	180
32x1	10	100

COLOR OPTIONS

GREY

WHITE

GREEN

BLUE



PILSATHERM PP-R PIPES AND FITTINGS

Gesenkirchen 9937
11451 11755 TSE



METAL FEMALE THREADED UNION		
CODE: M-PPIR		
DIA.	pcs./BAG	pcs./BOX
20x1/2	10	120
25x3/4	10	80
32x3/4	5	60
32x1	5	60
40x1.1/4	2	24
50x1.1/2	2	24
63x2	2	18



UNDERPLASTER FEMALE ELBOW		
CODE: SABB-F		
DIA.	pcs./BAG	pcs./BOX
16x1/2	20	200
20x1/2	20	200
25x1/2	20	180



METAL MALE THREADED UNION		
CODE: M-PPDR		
DIA.	pcs./BAG	pcs./BOX
20x1/2	10	120
25x3/4	10	80
32x3/4	5	50
32x1	5	50
40x1.1/4	2	24
50x1.1/2	2	20
63x2	2	16



UNDERPLASTER MALE ELBOW		
CODE: SABB-M		
DIA.	pcs./BAG	pcs./BOX
16x1/2	15	180
20x1/2	20	200
25x1/2	20	200



BRIDGE		
CODE: KOPRU		
DIA.	pcs./BAG	pcs./BOX
16	20	240
20	15	135
25	10	90
32	5	45
40	3	27



OMEGA		
FIYONK		
DIA.	pcs./BAG	pcs./BOX
16	7	35
20	5	25
25	3	12
32	1	8
40	1	4



FEMALE MALE REDUCER		
CODE: PPR		
DIA.	pcs./BAG	pcs./BOX
20/16	100	1.400
25/20	40	560
32/25	30	300
32/20	30	300
40/20	30	240
40/25	30	240
40/32	20	200
50/20	25	200
50/25	25	200
50/32	15	150
50/40	10	120
63/25	10	120
63/32	10	120
63/40	5	80
63/50	5	60
75/50	5	50
75/63	5	40
90/63	4	36
90/75	2	24
110/63	1	18
110/75	1	18
110/90	1	18
125/110	1	18



FLANGE ADAPTOR		
CODE: FLANS ADAPTORU		
DIA.	pcs./BAG	pcs./BOX
40	25	250
50	15	150
63	10	80
75	4	36
90	4	36
110	2	20
125	2	20

COLOR OPTIONS

GREY

WHITE

GREEN

BLUE



PILSATHERM PP-R PIPES AND FITTINGS

H Geisenkirchen 9937
11451 11755 TSE



UNEQUAL TEE		
CODE: PPRT (INEGAL "T")		
DIA.	pcs./BAG	pcs./BOX
20x25x20	25	150
25x20x20	25	150
25x25x20	25	150
25x20x25	25	150
32x20x32	15	90
32x20x20	15	90
32x25x32	15	90
32x25x25	15	90
32x20x25	15	90
32x25x20	15	90
32x50x32	4	32
40x20x40	5	50
40x25x40	5	50
40x32x40	5	50
40x50x40	4	32
50x20x50	5	50
50x40x40	4	32
50x40x50	4	32
50x50x40	4	32

DIA.	pcs./BAG	pcs./BOX
50x32x32	4	32
50x40x32	4	32
50x32x40	4	32
50x25x50	4	32
50x32x50	4	32
50x50x32	4	32
63x20x63	2	20
63x25x63	2	20
63x32x63	2	20
63x40x63	2	20
63x50x63	2	20
75x25x75	1	12
75x32x75	1	12
75x40x75	1	12
75x50x75	1	12
75x63x75	1	12
90x75x90	1	8
110x90x110	1	4



CLIPS		
CODE: CLIPS		
DIA.	pcs./BAG	pcs./BOX
16	150	1.800
20	100	1.200
25	80	960
32	50	500
40	40	320
50	25	200



FEMALE-FEMALE REDUCER		
CODE: PPR-FF		
DIA.	pcs./BAG	pcs./BOX
25/20	30	300
32/25	25	250



DOUBLE CLIPS		
CODE: DOUBLE CLIPS		
DIA.	pcs./BAG	pcs./BOX
20	50	500
25	40	320
32	25	200



SADDLE	
CODE: BRANSMAN	
DIA.	pcs./BOX
63/20	600
75/20	600
90/20	600
110/20	600
63/25	600
75/25	600
90/25	600
110/25	600



AL FOIL CLIPS		
CODE: AL FOIL CLIPS		
DIA.	pcs./BAG	pcs./BOX
20	80	1120
25	70	840
32	40	480

COLOR OPTIONS

GREY

WHITE

GREEN

BLUE



PILSATHERM PP-R PIPES AND FITTINGS

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11451 11755 **TSE**



VALVE		
CODE: PP-V NORMAL		
DIA.	pcs./BAG	pcs./BOX
20	5	70
25	5	70
32	3	42



PP-R BALL VALVE		
CODE: PP-V KURESEL		
DIA.	pcs./BAG	pcs./BOX
20	5	120
25	5	120
32	5	80
40	5	80
50	2	28
63	1	15
75	1	15



PP-R BALL VALVE - BUTTERFLY TYPE		
CODE: PP-R BUTTERFLY		
DIA.	pcs./BAG	pcs./BOX
20	5	120
25	5	120
32	5	80
40	5	80
50	2	28
63	1	15
75	1	15



CHROME VALVE		
CODE: PP-V UCGEN		
DIA.	pcs./BAG	pcs./BOX
20	1	60
25	1	60
32	1	50



DECORATIVE VALVE		
CODE: PP-V DEKORATIF		
DIA.	pcs./BAG	pcs./BOX
20	1	60
25	1	60
32	1	50



WELDING HEAD		
CODE: KAYNAK PAFTASI		
DIA.		
20		
25		
32		
40		
50		
63		
75		
90		
110		
125		



WELDING HEAD FOR SADDLE		
CODE: B. KAYNAK PAFTASI		
DIA.		
63		
75		
90		
110		



SHAVER		
CODE: TRAS APARATI		
DIA.	pcs./BOX	
16/20	1	
20/25	1	
32/40	1	
40/50	1	
50/63	1	
63/75	1	



WELDING MACHINE SET		
CODE: KAYNAK MAKINESI		

GREY

WHITE

GREEN

BLUE

COLOR OPTIONS



PILSATHERM PP-R PIPES AND FITTINGS

Gelsenkirchen 9937
11451 11755 TSE



FEMALE THREADED ADAPTOR		
CODE: PPIA-AA		
DIA.	pcs./BAG	pcs./BOX
20x1/2	10	120
20x3/4	10	100
25x1/2	10	100
25x3/4	10	100
32x1	10	60



FEMALE THREADED TEE		
CODE: PPIT-AA		
DIA.	pcs./BAG	pcs./BOX
20x1/2	10	80
25x1/2	10	70
25x3/4	10	70
32x1	5	40



FEMALE THREADED ELBOW		
CODE: PPID-AA		
DIA.	pcs./BAG	pcs./BOX
20x1/2	10	100
25x1/2	10	80
25x3/4	10	90
32x3/4	5	100
32x1	5	40



MALE THREADED ADAPTOR		
CODE: PPDA-AA		
DIA.	pcs./BAG	pcs./BOX
20x1/2	10	100
20x3/4	10	80
25x1/2	10	80
25x3/4	10	80
32x1	5	40



MALE THREADED TEE		
CODE: PPDT-AA		
DIA.	pcs./BAG	pcs./BOX
20x1/2	10	80
25x1/2	10	60
25x3/4	10	60
32x1	5	40



MALE THREADED ELBOW		
CODE: PPDD-AA		
DIA.	pcs./BAG	pcs./BOX
20x1/2	10	80
25x1/2	10	80
25x3/4	10	80
32x3/4	10	100
32x1	10	40

COLOR OPTIONS

GREY

WHITE

GREEN

BLUE



PILSATHERM PP-R PIPES AND FITTINGS

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11451 11755



ADAPTOR WITH NUT		
CODE: PPHA		
DIA.	pcs./BAG	pcs./BOX
20x1/2	10	120
25x3/4	10	120



ELBOW WITH NUT		
CODE: PPHD		
DIA.	pcs./BAG	pcs./BOX
20x1/2	10	100
25x3/4	10	100



MALE FILTER		
CODE: PPPT		
DIA.	pcs./BAG	pcs./BOX
20x1/2	20	200
25x3/4	10	120



BEND		
CODE: PPBE		
DIA.	pcs./BAG	pcs./BOX
20x1/2		20



ADJUSTABLE UNDERPLASTER FEMALE ELBOW		
CODE: PPBE		
DIA.	pcs./BAG	pcs./BOX
20x1/2		



EASY CONNECT SET		
CODE: KOMBI SET		

GREY

WHITE

GREEN

BLUE

COLOR OPTIONS

TECHNICAL PROPERTIES OF PILSA ALUMINIUM FOILED PIPE

- * Raw Material: PP-R and Aluminium foil.
- * Ideal for central heating and plumbing systems.
- * Sound resistant.
- * Resistance to acids and chlorine.
- * Never deflects under heat, minimum stretching.
- * Pressure tolerance: for water at 20 °C 20 bars, for water at 90 °C 10 bars.
- * It is easy to scrape the outer surface and aluminium foil by a simple pipe shaver. Permanent joint is formed at 260 °C by simple fusion welding.
- * Because of the plastic property, the pipes are light and plumbing is easy. This saves a considerable amount of time, labour and transportation costs.

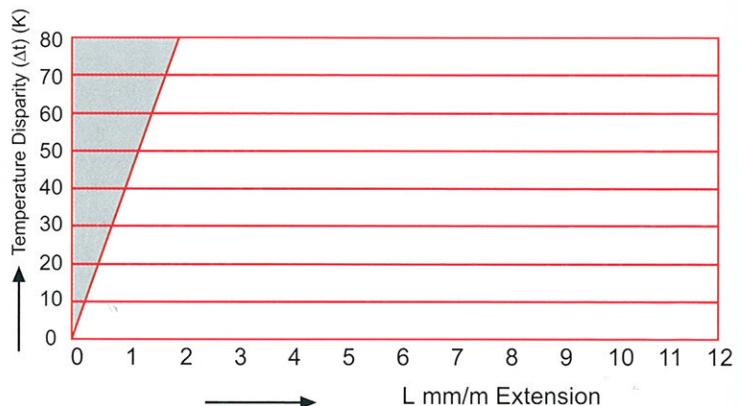


Figure 3

Example:

Temperature Disparity (Δt) = 40 K

Length of pipe (L) = 5m

Amount of extension (ΔL) = 1.4 mm / m x 5,0 m = 7 mm

CALCULATION OF THERMAL EXPANSION

When PP-R pipe is subjected to a temperature difference, the length of pipe changes in longitudinal direction. The thermal coefficients of linear expansion at different temperatures are shown in table below:

LINEAR EXPANSION ELONGATION

Temperature Difference	Test Method	Unit	Coefficient	Elongation per meter
-30°C - 0°C	ASTM D 696 - 44	1/°C	0,65E - 4	0,2 cm
0°C - 30°C	ASTM D 696 - 44	1/°C	1,05E - 4.	0,3 cm
30°C - 60°C	ASTM D 696 - 44	1/°C	1,40E - 4	0,4 cm
60°C - 90°C	ASTM D 696 - 44	1/°C	1,70E - 4	0,5 cm

Table 4.

Horizontal pipes conveying hot liquids must be straddled at intervals not exceeding one meter. The pipe must freely move on the straddle. Vertical pipes should be fixed at the top end, if possible, left free at the lower end.

Example: When the temperature rises from 0°C to 90°C, one meter pipe elongates: $0.3 + 0.4 + 0.5 = 1.2 \text{ cm}$.

PLUMBING / DESIGN

PP-R pipes installed in the same way as conventional galvanized metal pipes. However, special attention should be paid to the higher expansion rate of PP-R pipes compared to the metal pipes. Pipes can be installed in/on the wall. Since the weights of the PP-R pipes and fittings are about one ninth of the metal pipes, installation of PP-R pipes is easier, adjustment for expansion can be done in one direction. However, one should make it certain that pipes move freely in axial direction. If the expansion can't be managed in one direction, U bend or OMEGA compensators should be added to the design. Fixed supports and sliding supports should be chosen in such a way that they do not damage the outer surface of the pipe.

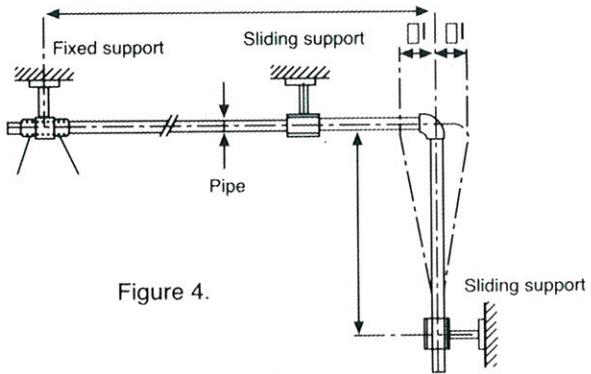


Figure 4.

Expansion pipe segments can be produced during the installation. Four elbows and length of pipe are usually sufficient to do this. The pipe length, necessary for free bend (L_s) is calculated by using the formula; $L_s = C\sqrt{d} \Delta L$ where,

L_s = free bend length in mm.

d = outer diameter of the pipe in mm.

ΔL = elongation in mm.

C = material coefficient (3 for PP-R)

or it can directly be determined by using Figure 8.

When the length of the pipe exceeds 5 meters, it is absolutely recommended to use expansion pipe segment. During installation, bridges are used at the intersection points of pipes so that they lay in the same plane.

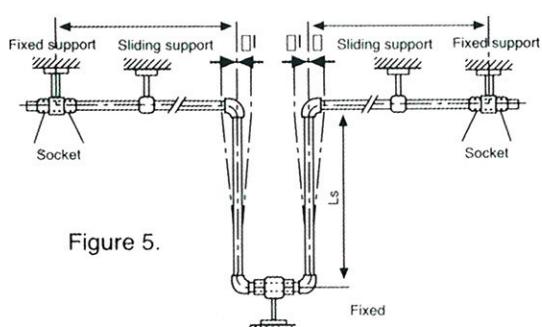


Figure 5.

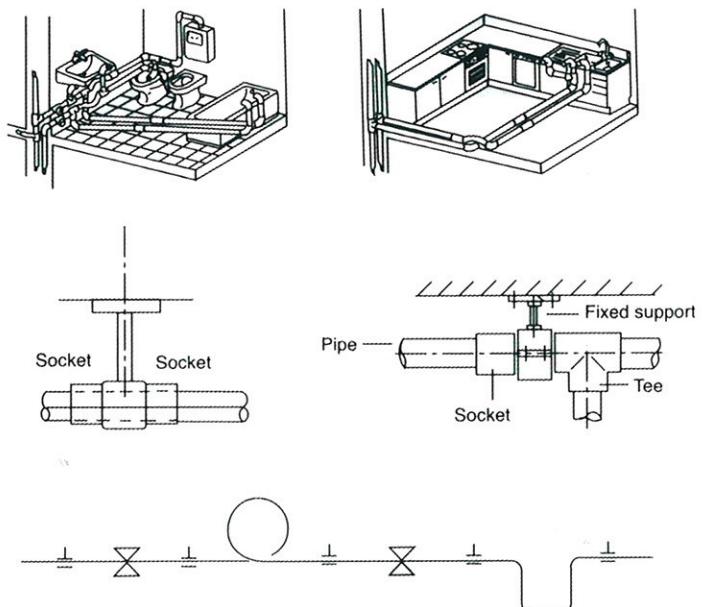


Figure 6.

FIXED SUPPORT

Fixed supports are used to fix the pipe at certain points against undesired pipe movements. Fixed supports should be stronger compared to the sliding supports. Fittings are used to construct fixed supports. At the points where direction changes, fixed supports should not be used. The distance between the fixed supports should be chosen in such a way that pipe elongation is not effected. In general elongation of the pipes is provided by free bending section. Figure 4 and 5 show the effect of elongation and how it is handled in the system.

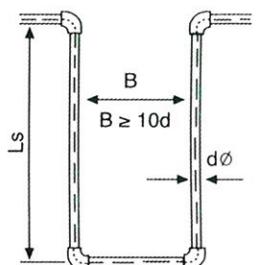


Figure 7.

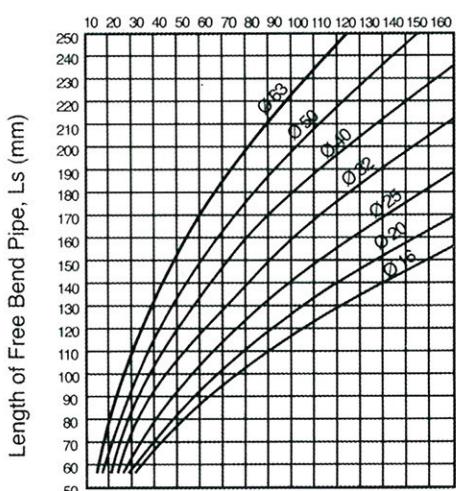


Figure 8.

In some cases pipes are bent by heating. However, pipes should never be allowed to contact to flame, instead heating should be carried out by blowing air. A temperature of 140°C is sufficient to bend the pipes. Recommended radius of curvatures are shown in Table 5. The distance between the two clips in horizontal pipes depends on the factors such as the raw material that pipe is produced from, wall thickness,

weight of the pipe and temperature. Table 5 shows recommended distances between the clips. Practically, same distances can be used for vertical systems.

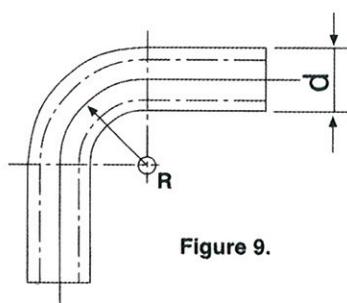
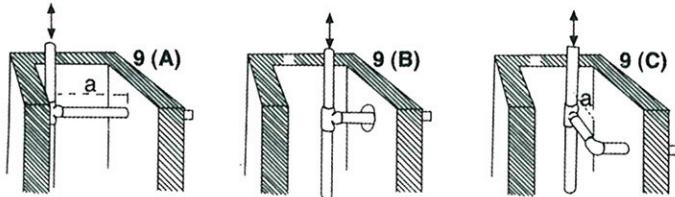


Figure 9.



d	Supported Lengths (water - filled pipes) in cm at						
mm	20°C	30°C	40°C	50°C	60°C	70°C	80°C
16	75	70	70	65	65	60	55
20	80	75	70	75	65	60	60
25	85	85	85	80	75	75	70
32	100	95	90	85	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

Table 5:

d	Radius, min. ($R=8xd$)
20	160
25	200
32	256
40	320
50	400
63	500

Table 6.

APPLICATIONS IN THE MAIN CHIMNEY:

During installation of pipes from the main line to apartments in a building one of the following techniques are used to allow the pipes expand linearly.

Figure 9A: Distance "a" between the tee and wall hole should be provided.

Figure 9B: The hole diameter inside the wall should be bigger than the pipe diameter which crosses the wall.

Figure 9C: L shapen pipe segment is used.

ASSEMBLY OF PIPE AND FITTINGS

Beside the raw material of the pipe, the reliability of plumbing systems depends on the fittings and how they are joined. Since the pipes and fittings are produced from the same material, connections which are usually homogeneous:

There are two main connections:

- a) Threaded connections: Same as in galvanized pipes
- b) Fusion welding:

1) Welding done by heating outer surface of the pipe and inner surface of the fitting.

2) Electrofusion welding.

Since the electrofusion technique is quite expensive, socket welding is commonly used. When a tensile test is applied to the welded pipe and fitting segment, it is observed that welding points are not effected even when the pipe segment reaches of the fracture point. These welded parts are as strong as the pipe itself.

APPLICATION OF SOCKET WELDING

1- Preparation of welding:

Both ends of pipes are cut as perpendicularly to the pipe axis in required length. Chamfers should be given to the outer ends of the pipe by a knife. Parts to be welded should be cleaned by alcohol and dried by clean fabric or paper before welding. Socket depth (welding distance) is marked from the end of the pipe. Temperature is adjusted to 260 (+) 10 °C in the welding machine. Turning off red light on the welding machine indicates that welding temperature is reached. Heaters in the welding machine should always be kept clean.

2- Welding:

Pipes and fitting are pushed axially towards the heaters of the welding machine. Then they are pulled out simultaneously and joined to each other in axial direction. During this, the operation pipe never should be turned radially. After welding heaters should be cleaned for the next use.

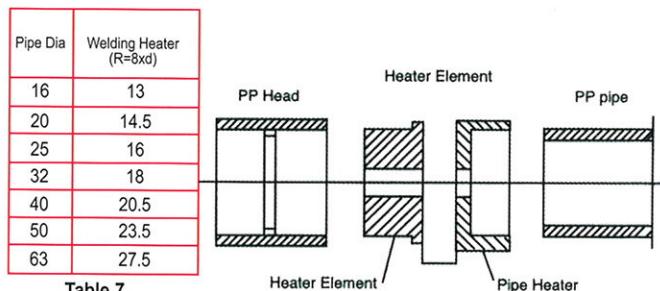


Table 7.

Head depths acc. to the diameters of pipe.

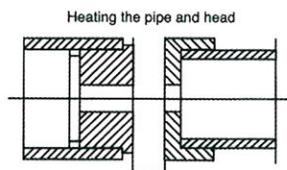
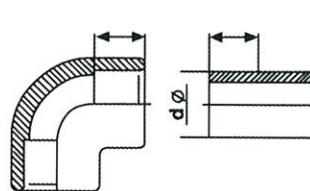
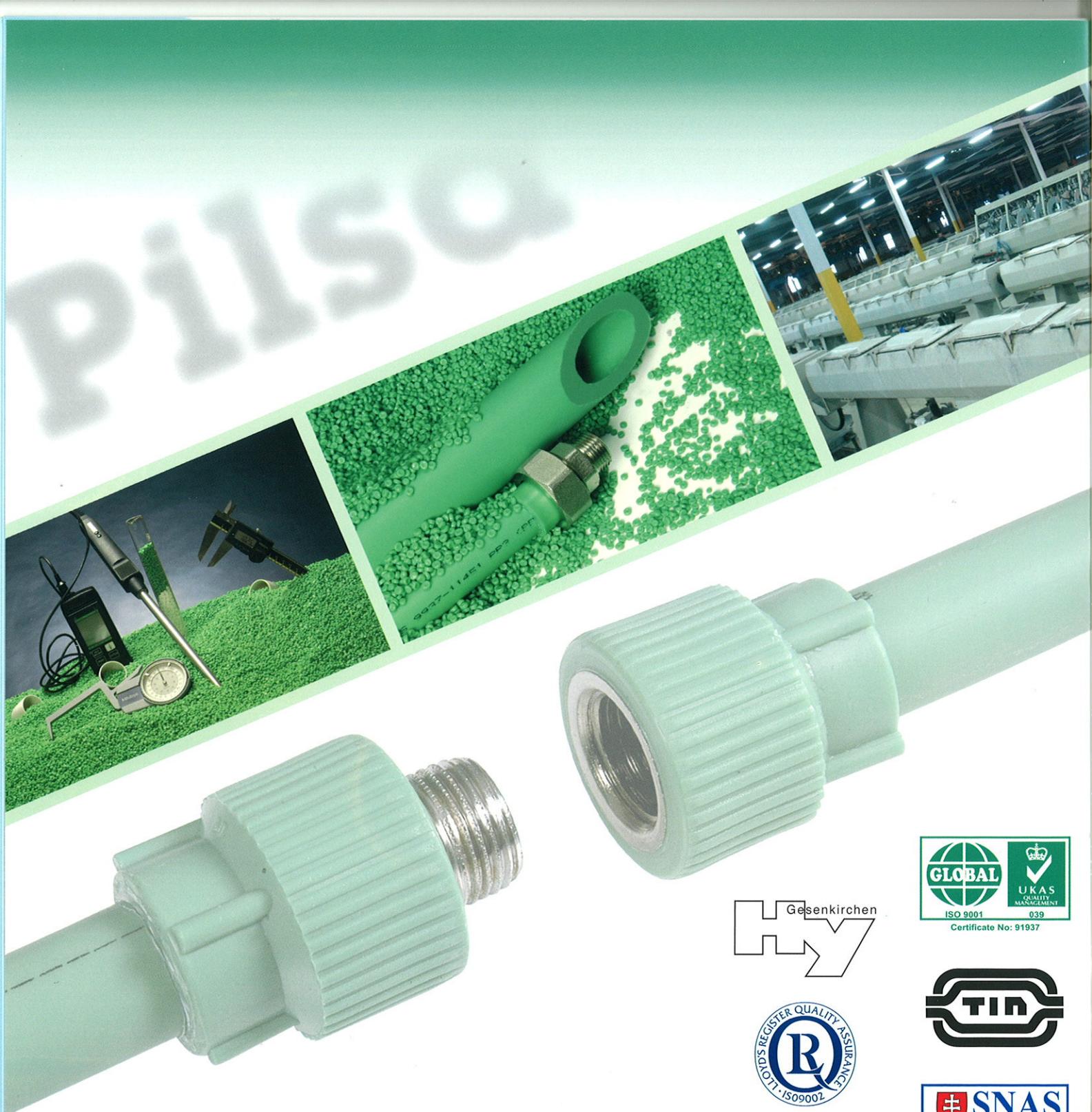


Figure 10.



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