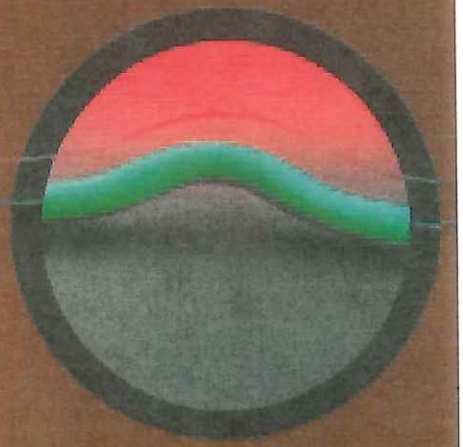
POLYPROPYLENE PIPING SYSTEM



KAI

الشركة الكويتية العالمية للصناعات المتطورة (ش.م.ك.)

Kuwait Intl. Advanced Industries Company (K.S.C.)

Kuwait Intl. Advanced Industries

Kuwait International Advanced Industries (KAI) is a unique venture offering advanced and integrated piping systems for all types of industrial and domestic fluid management.

Our extensive range of pipes and fittings have been designed to meet the demands of present and future fluid management while still providing adaptable solutions for today's existing systems for fluid supply and disposal management.

KAI is committed to the continued development of leading international technologies and products within the State of Kuwait. As a result, we ensure that our products have proven global reputation for excellence. Locally manufactured under technical assistance with international partners KWH-Finland, our pipes and fittings are made from the highest quality raw materials using the latest technology and machinery.

KAI dynamic corporate structure and efficient manufacturing capabilities offers a tough product with flexible marketing strategy, that guarantee customer satisfaction.

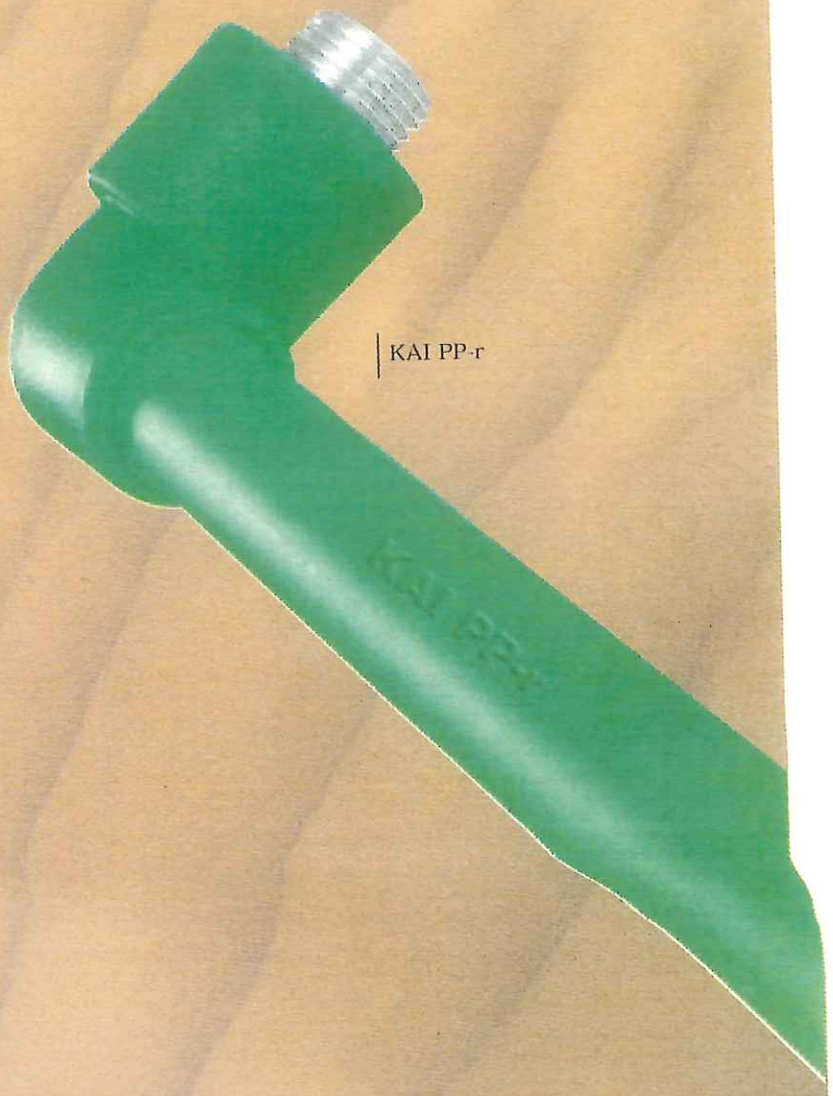
THE BETTER ANSWER

PP-r pipes earned a reputation throughout the the world as a more flexible and efficient alternative to traditional materials such as copper and steel.

KAI PP-r pipes as a Polypropylene Random Copolymer (PP-r) piping has proved ideal for plumbing, heating, air condition systems and for a wide range of industrial and medical uses.

Now, the system has been further improved with the addition of a full range of (PP-r) fittings that can be welded to the PP-r pipes to create fully watertight systems, even under the most severe conditions of use.

KAI PP-r pipes have been aproved by Ministry of Public works and Tested by Kuwait University and Ministry of Electricity and Water.



MECHANICAL AND THERMAL PROPERTIES

Property	Test method	Typical Value
Density	ISO 1183	900 kg/m^3
Melt Flow Rate (230°C/2.16 kg)	ISO 1133	0.3 g/10 min
Tensile strength at yield	ISO 527/1A,50 mm/min	26.1 MPa
Tensile strength at break	ISO 527/1A,50 mm/min	21.5 MPa
Elongation at break	ISO 527/1A,50 mm/min	>400 %
Tensile Elastic Modulus	ISO 527/1A,50 mm/min	808 MPa
Flexural Modulus	ISO 178.2 mm/min	874 MPa
Flexural Strength	ISO 178.2 mm/min	30.5 MPa
Izod, notched at	ISO 180/1A	
23°C	2.75 J	22.5 kJ/m^2
0°C	1.0 J	5.6 kJ/m^2
-20°C	1.0 J	3.4 kJ/m^2
Shore D Hardness (15 sec value)	ISO 868	60
Vicat Softening Temperature	ISO 306, method A, 50K/h	131.3°C
Melting range	ISO 3146-19	142.4°C
Specific heat at 20°C	DSC	2.0 J/g K
Coefficient of thermal expansion (30-90°C)	Dilatometer	1.8x10^{-4} /K
Thermal Conductivity (10-60°C)	DIN 52 612	0.21 W/m°C
Heat deflection themperature	ISO 75, method A	45.2°C

CHARACTERISTICS

NO CORROSION
KAI PP-r pipes withstands all types of water hardness and will withstand acid and alkaline substances across a wide concentration and temperature range. (See table of Chemical Resistance page 17).

LESS PRESSURE LOSS
The smooth internal finish of KAI PP-r pipe creates no distrubance to flow and does not allow sediment to build up and reduce pressure loss. The pressure changes caused by opening and closing the cock is sufficient to wash off any sediments (Pressure loss data is given on page: 10).

LESS NOISE
A KAI PP-r pipes system will absorb water hammers which cause annoying vibration and noise in the buildings.

LESS CONDENSATION AND HEAT LOOS
Like all plastic materials, KAI PP-r pipe is a poor heat conductor, and it therefore provides good thermal insulation.

LONG-LIFE
The molecular structure of copolymers and special additives ensure a high mechanical resistance and a long life.

Depending on operating temperature and pressure a KAI PP-r pipe system can be expected to last up to 50 years.

FROST RESISTANT
KAI PP-r pipes will not burst in a cold spell. The elasticity of the material allows the pipe to increase its section according to the volume of the frozen liquid inside it.

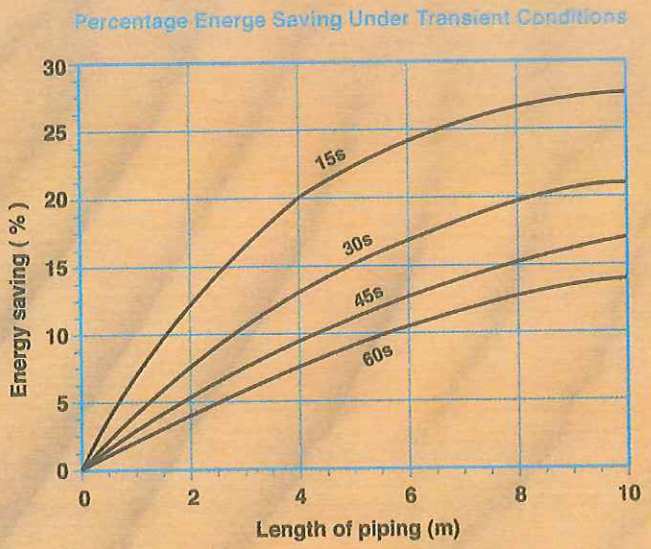
ABRASION RESISTACNE
KAI PP-r pipes has four times the abrasion resistance of metal piping, allowing higher water velocities, without abrasion problems.

DAMAGE RESISTANT
Being made from a non-rigid material, a KAI PP-r pipes system does not suffer major damage as a result of building movement. KAI PP-r pipe is recognised by the Commission of International Engineering as being fit for use in seismic areas.

HYGIENIC AND NON TOXIC:
KAI PP-r pipes system is non toxic in accordance with current international standards.

ENERGY SAVING

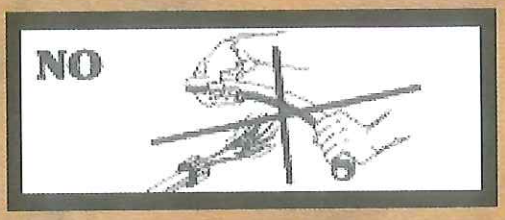
KAI PP-r Pipe systems reach their operating temperature much faster than metal piping systems. Less energy is wasted heating the pipe and less insulation is needed.



FITTING INSTRUCTIONS:

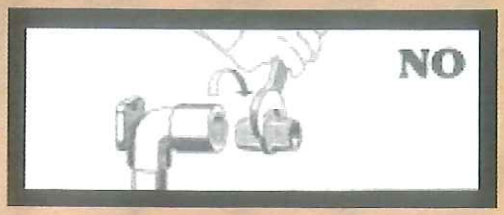
In order not to prejudice the reliability of KAI PP-r pipes systems we recommend that you adhere strictly to the following directions:

1 - Do not use a blow torch flame to bend or shape the pipes or fittings. The temperature cannot be controlled accurately and the molecular structure of the Polypropylene could be damaged.



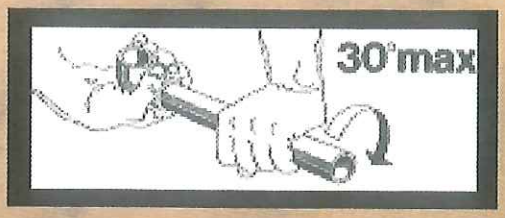
2 - Pipes and fitting should not be directly exposed to UV radiation. Pipes and fittings should be stored out of direct sunlight and exposed installations should be protected by a suitable sheathing.

3 - Do not try to fit any cast iron conical threads to the brass female end unions. Any high driving torque will destroy the brass threads. Besides Teflon and liquid sealants, hemp can also be used as a seal if in suitable quantity.

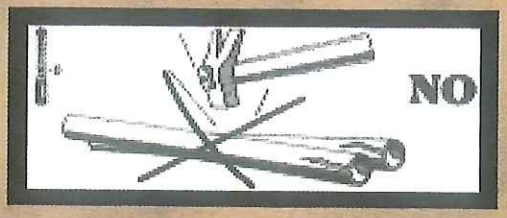


4 - When welding in site, hold the welder prependicular to the pipe and the fitting in order to avoid partial weldings.

5 - Any re-aligning between the pipe and the fitting should be made just after the welding and without exceeding 30° rotation.



6 - Extra care should be taken when working conditions are below 0°C to avoid impact damage to the KAI PP-r pipes. Avoid heavy loads and sharp bends.



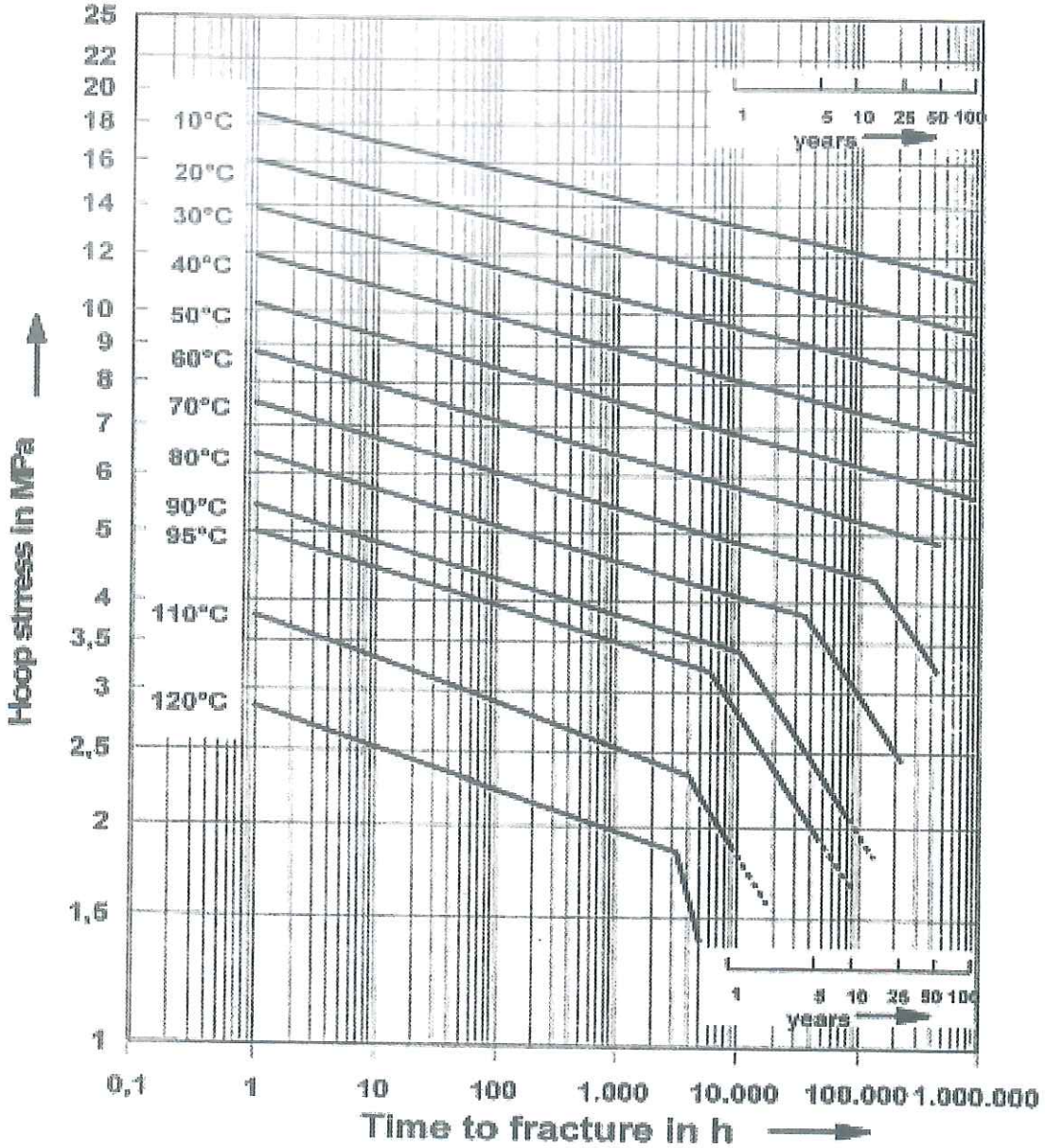
7 - Avoid all draughts during welding operation of pipes from 40 -75 mm diameter in order to prevent tensions in the weldings.

Allowable working pressure for Pipes with various temperature safety factor 1.5

Pipe Series	S 2.5	S 2.3	S 2.0
Stanard Dimension Ratio	SDR 7.4	SDR 6	SDR 5
Temperature	50 years Maximum Pressure in bar		
10°C	24.0	30.3	38.1
20°C	20.4	25.7	32.4
30°C	17.3	21.8	27.4
40°C	14.5	18.3	23.1
50°C	12.2	15.4	19.4
60°C	10.1	12.7	16.0
70°C	6.7	8.5	10.7
Temperature	10 years Maximum Pressure in bar		
80°C	6.3	8.0	10.0
Temperature	1 year Maximum Pressure in bar		
95°C	6.1	7.7	9.7

LONG-TERM RESISTANCE TO HYDROSTATIC PRESSURE OF PIPES

PP-R 80



DIMENSIONS

KAI PP-r pipes is manufactured in compliance with the DIN 8077/78 Standards.

Dimension Chart as per DIN 8077 for Polypropylene (PP-r) Pipes

Pipe Series	S 3.2		S 2.5		S 2.0	
Standard Dimension Ratio	SDR 7.4		SDR 6		SDR 5	
Pipe Size	Mean I.D.	Min. Wall Thickness	Mean I.D.	Min. Wall Thickness	Mean I.D.	Min. Wall Thickness
(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)
16	11.25	2.20	10.25	2.70	8.95	3.30
20	14.05	2.80	12.75	3.40	11.25	4.10
25	17.55	3.50	16.05	4.20	14.15	5.10
32	22.65	4.40	20.55	5.40	18.25	6.50
40	28.40	5.50	25.90	6.70	22.90	8.10
50	35.55	6.90	32.55	8.30	28.75	10.10
63	45.00	8.60	41.00	10.50	36.40	12.70
75	53.45	10.30	48.85	12.50	43.35	15.10
90	64.35	12.30	58.75	15.00	52.15	18.10
110	78.45	15.10	71.75	18.30	63.85	22.10
125	89.40	17.10	81.70	20.80	72.60	25.10
140	100.05	19.20	91.45	23.30	81.35	28.10
160	114.55	21.90	104.65	26.60	93.05	32.10
180	128.95	24.60	119.65	29.00	104.75	36.10
200	143.10	27.40	130.90	33.20	--	--

CALCULATION OF PIPE INSIDE DIAMETER RE-QUIRED

The inside pipe diameter reuired can be calculated according to the water pressure and flow.

$$di = 35.7 \sqrt{\frac{Q}{V}}$$

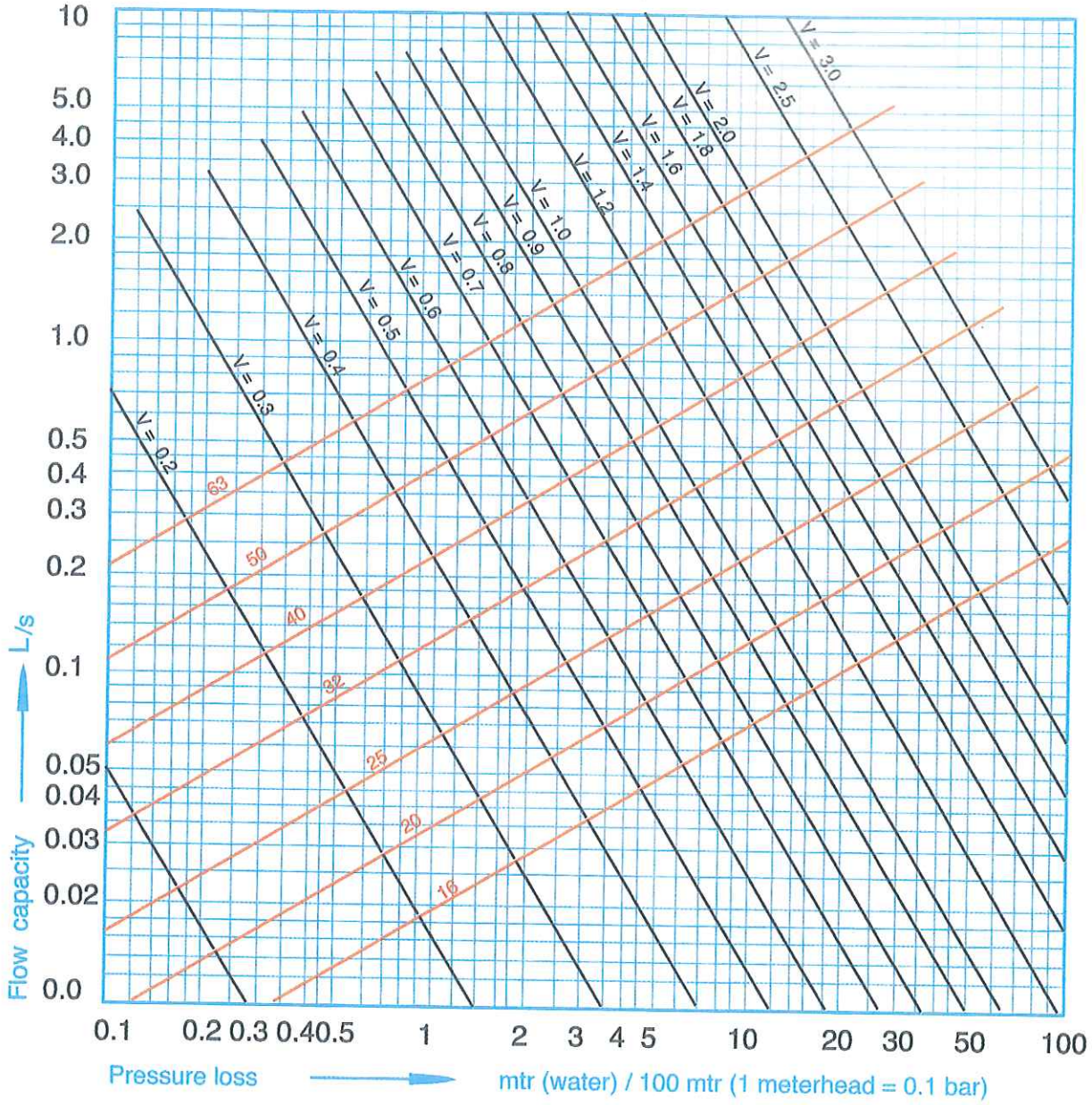
Where
di = inside diameter of the pipe (mm)
Q = volume flow rate (I/s).
V = flow speed (m/s)

Reference values for V is
1.0 ~ 3.0 m/s for liquids
10 ~ 30 m/s for gases

In heating systems
di = 0.60
where.
H = heating capacity (Kcal/h)
Δt = temperature difference (°C)

PRESSURE LOSS:

The pressure loss per meter of KAI PP-r Pipes (PN 20) as a function of the flow can be seen in the following diagram.



THERMAL EXPANSION

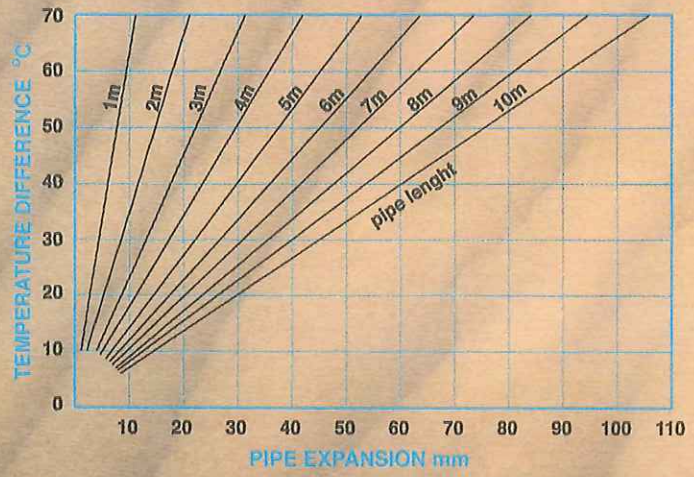
The expansion ΔL is calculated according to the following formula:

ΔL = OC x L x Δt

where,

ΔL = pipe expansion (mm)
OC = linear expansion coefficient
KAI PP-r pipes (average value) = $0.15°C^{-1}$
L = pipe length (m)
Δt = tempreture difference between warm water and ambient temprature (°C)

The following diagram reports the pipe expansion depending on temprature difference e.g with water passing from 20°C to 60°C, Δt = 40°C

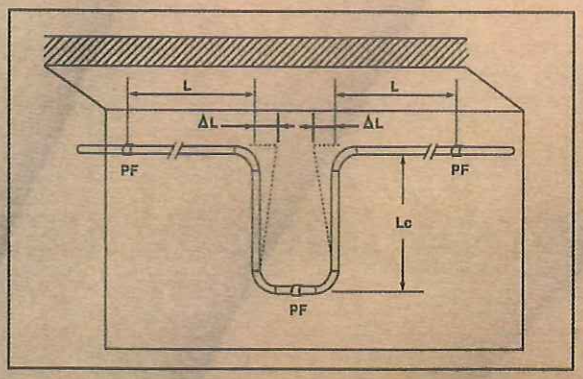


The above mentioned values are only apply to surface - mounted systems. Values are lower when pipes are installed in a wall or under a floor. Note: KAI PP-r pipes can be laid directly in the wall, in touch with lime, gypsum or cement.

CATERING FOR THERMAL EXPANSION

Thermal expansion at double offset sections are obtained by the following formula:

$$Lc = 30 \sqrt{d.\Delta L}$$

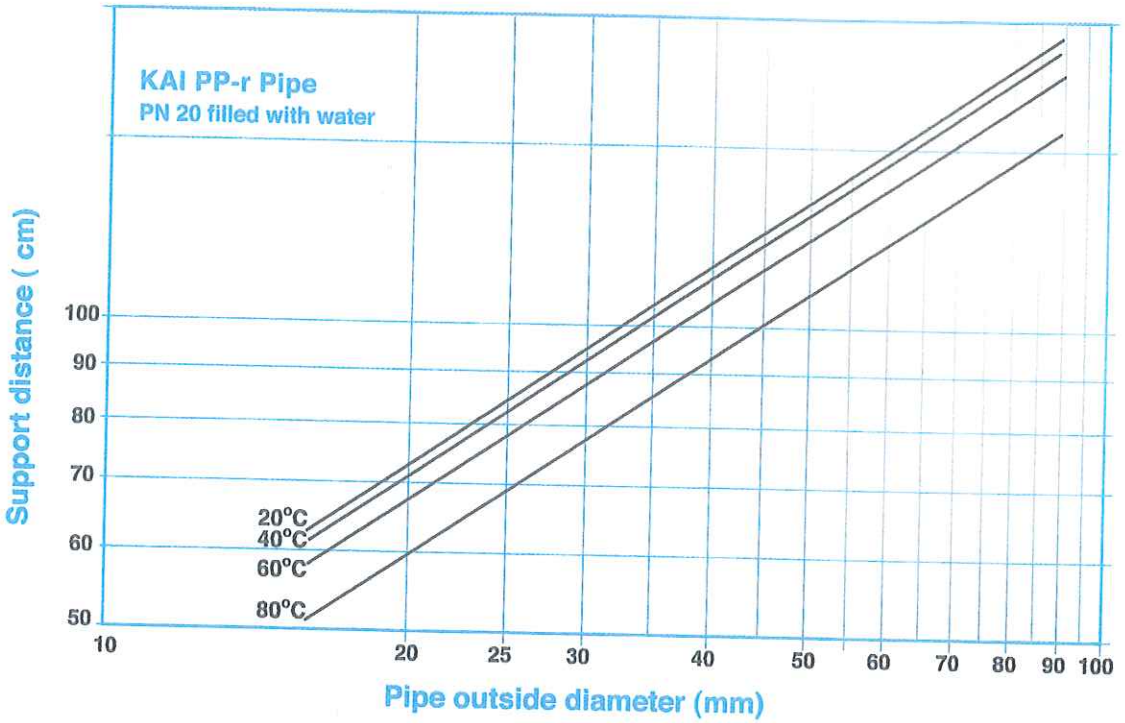


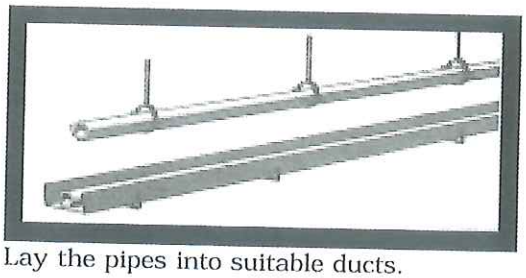
where,

Lc = length of double offset expansion bend
d= outer diameter of pipe (mm)
ΔL = expansion of pipe (mm)

CALCULATING SUPPORT DISTANCE

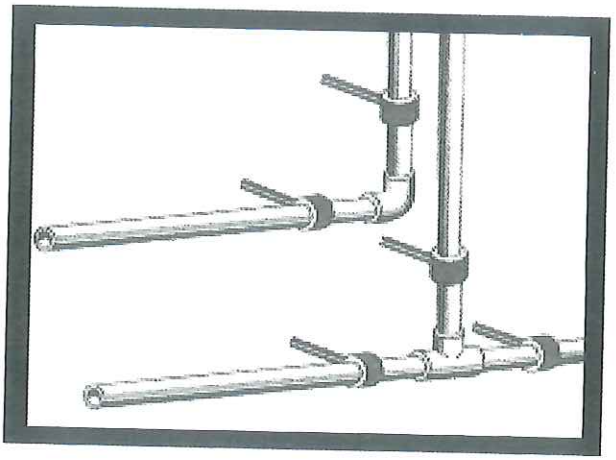
Diagram for the determination of support distances with regard to free-layed pipelines in relation to temprature and pipe outside diameter.



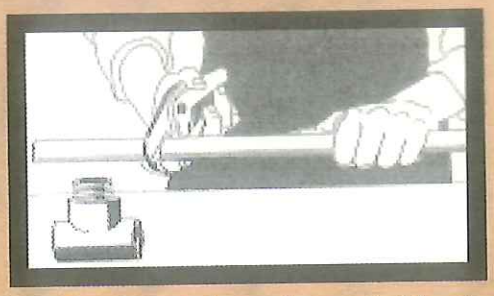


Lay the pipes into suitable ducts.

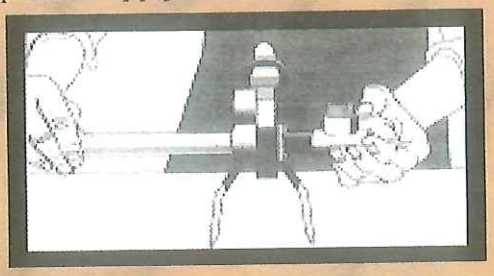
We also recommend the use of rigid hangers or anchorings to absorb hydraulic thrusts in the braces (tees or elbow) and in reducing sockets.



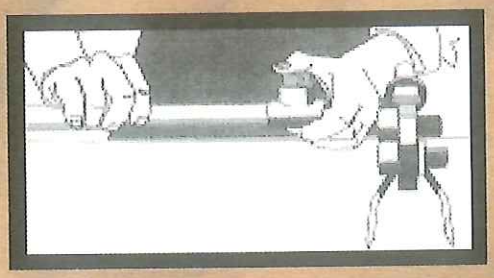
Cutting and Socket Fusion Welding



Cut the pipe at right angles using suitable nippers.
Mount the dies corresponding to the diameter of the pipe to be welded and connect the welding tool to the 220V AC power supply.



Wait until the welding tool attains the working tempreture of 260°C (the green light goes off).
Make sure that the pipe is perfectly clean before welding. Insert the pipe and the coupling simultaneously into the die, exerting a slight pressure. Heat both parts according to the time indicated in the table below.

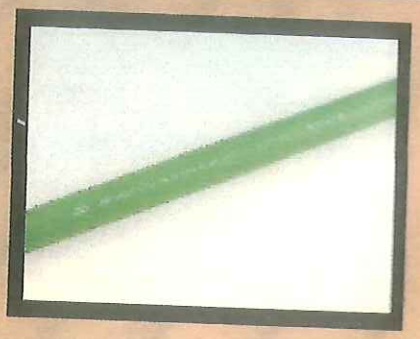


Quickly insert the pipe into the coupling, exerting a light pressure.
Any misalignment should be corrected immediately after the insertion, in order to avoid any tension in the weld.

This type of junction ensures a perfect sealing that withstand the most severe conditions.

ø	Heating sec.	Assembling sec.	Testing After min.	pipe Insertion mm.
20	5	4	2	14
25	7	4	3	16
32	8	6	4	18
40	12	6	4	20
50	18	6	4	23
63	25	8	6	26
75	30	10	8	28
90	35	12	9	38
110	40	14	10	42

KAI PP-r Pipes 20 BAR UNIT: METER

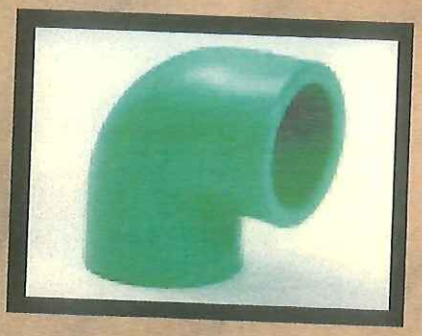


Item No.	Size
R200116	16 mm
R200120	20 mm
R200125	25 mm
R200132	32 mm
R200140	40 mm
R200150	50 mm
R200163	63 mm
R200175	75 mm
R200190	90 mm
R2001110	110 mm

SOCKET UNIT: PIECE

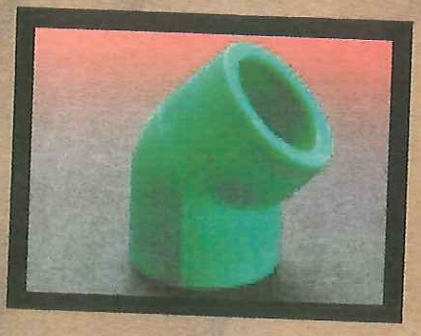
Item No.	Size
R2S0316	16 mm
R2S0320	20 mm
R2S0325	25 mm
R2S0332	32 mm
R2S0340	40 mm
R2S0350	50 mm
R2S0363	63 mm
R2S0375	75 mm
R2S0390	90 mm
R2S03110	110 mm

Elbow 90° Unit: Piece



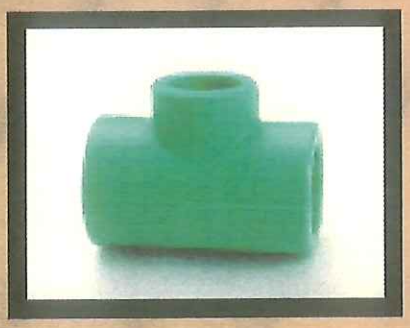
Item No.	Size
R2S0416	16 mm
R2S0420	20 mm
R2S0425	25 mm
R2S0432	32 mm
R2S0440	40 mm
R2S0450	50 mm
R2S0463	63 mm
R2S0475	75 mm
R2S0490	90 mm
R2S04110	110 mm

Elbow 45° Unit: piece

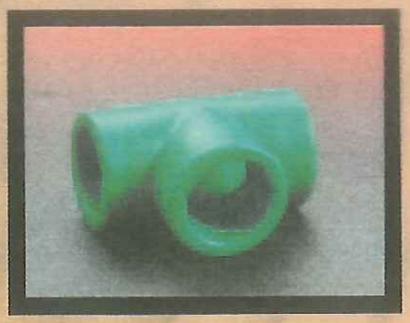


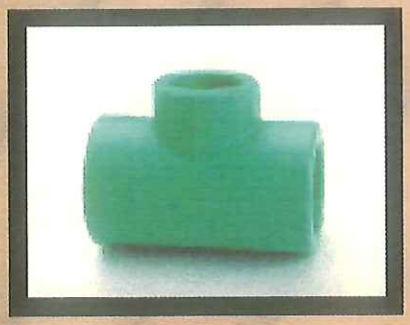
Item No.	Size
R2S0516	16 mm
R2S0520	20 mm
R2S0525	25 mm
R2S0532	32 mm
R2S0540	40 mm
R2S0550	50 mm
R2S0563	63 mm
R2S0575	75 mm

TEE	Unit:piece	Item No.	Size
		R2S0616	16 mm
		R2S0620	20 mm
		R2S0625	25 mm
		R2S0632	32 mm
		R2S0640	40 mm
		R2S0650	50 mm
		R2S0663	63 mm
		R2S0675	75 mm
		R2S0690	90 mm
		R2S06110	110 mm

Reduced Tee	Unit: Piece	Item No.	Size
		R2S0701	20 x16x20 mm
		R2S0702	25x16x25 mm
		R2S0703	25x20x25 mm
		R2S0704	32x20x32 mm
		R2S0705	32x25x32 mm
		R2S0706	40x20x40 mm
		R2S0707	40x25x40 mm
		R2S0708	40x32x40 mm
		R2S0709	50x20x50 mm
		R2S0710	50x25x50 mm
		R2S0711	50x32x20 mm
		R2S0712	50x40x50 mm
		R2S0713	63x25x63 mm
		R2S0714	63x32x63 mm
		R2S0715	63x40x63 mm
		R2S0716	63x50x63 mm
		R2S0717	75x32x75 mm
		R2S0718	75x40x75 mm
		R2S0719	75x50x75 mm
		R2S0720	75x63x75 mm

Reducer	Unit: Piece	Item No.	Size
		R2S0801	20x16 mm
		R2S0802	25x16 mm
		R2S0803	25x20 mm
		R2S0804	32x20 mm
		R2S0805	32x25 mm
		R2S0806	40x20 mm
		R2S0807	40x25 mm
		R2S0808	40x32 mm
		R2S0809	50x20 mm
		R2S0810	50x25 mm
		R2S0811	50x32 mm
		R2S0812	50x40 mm
		R2S0813	63x20 mm
		R2S0814	63x25 mm
		R2S0815	63x32 mm
		R2S0816	63x40 mm
		R2S0817	63x50 mm
		R2S0818	75x25 mm
		R2S0819	75x32 mm
		R2S0820	75x40 mm
		R2S0821	75x50 mm
		R2S0822	75x63 mm
		R2S0823	90x75 mm
		R2S0824	110x90 mm

TEE	Unit: piece	Item No.	Size
		R2S0616	16 mm
		R2S0620	20 mm
		R2S0625	25 mm
		R2S0632	32 mm
		R2S0640	40 mm
		R2S0650	50 mm
		R2S0663	63 mm
		R2S0675	75 mm
		R2S0690	90 mm
		R2S06110	110 mm

Reduced Tee	Unit: Piece	Item No.	Size
		R2S0701	20 x16x20 mm
		R2S0702	25x16x25 mm
		R2S0703	25x20x25 mm
		R2S0704	32x20x32 mm
		R2S0705	32x25x32 mm
		R2S0706	40x20x40 mm
		R2S0707	40x25x40 mm
		R2S0708	40x32x40 mm
		R2S0709	50x20x50 mm
		R2S0710	50x25x50 mm
		R2S0711	50x32x20 mm
		R2S0712	50x40x50 mm
		R2S0713	63x25x63 mm
		R2S0714	63x32x63 mm
		R2S0715	63x40x63 mm
		R2S0716	63x50x63 mm
		R2S0717	75x32x75 mm
		R2S0718	75x40x75 mm
		R2S0719	75x50x75 mm
		R2S0720	75x63x75 mm

Reducer	Unit: Piece	Item No.	Size
		R2S0801	20x16 mm
		R2S0802	25x16 mm
		R2S0803	25x20 mm
		R2S0804	32x20 mm
		R2S0805	32x25 mm
		R2S0806	40x20 mm
		R2S0807	40x25 mm
		R2S0808	40x32 mm
		R2S0809	50x20 mm
		R2S0810	50x25 mm
		R2S0811	50x32 mm
		R2S0812	50x40 mm
		R2S0813	63x20 mm
		R2S0814	63x25 mm
		R2S0815	63x32 mm
		R2S0816	63x40 mm
		R2S0817	63x50 mm
		R2S0818	75x25 mm
		R2S0819	75x32 mm
		R2S0820	75x40 mm
		R2S0821	75x50 mm
		R2S0822	75x63 mm
		R2S0823	90x75 mm
		R2S0824	110x90 mm

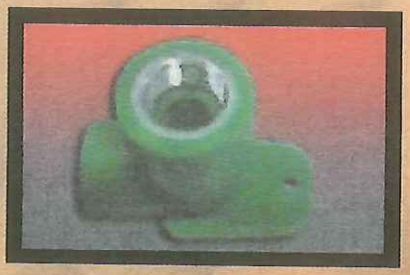
BRIDGE Unit: Piece

Item No.	Size
R200916	16 mm
R200920	20 mm
R200925	25 mm
R200932	32 mm

PLUG Unit: Piece

Item No.	Size
R2S1016	16 mm
R2S1020	20 mm
R2S1025	25 mm
R2S1032	32 mm
R2S1040	40 mm
R2S1050	50 mm
R2S1063	63 mm
R2S1075	75 mm

FLUSH WALL DISC UNIT: PIECE

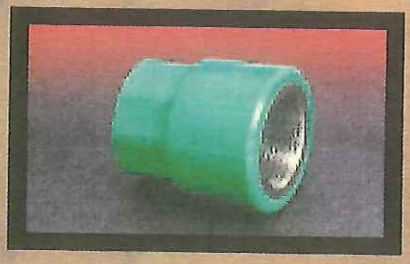


Item No.	Size
R2S1116	16 x 1/2"
R2S1120	20 x 1/2"

MALE ADAPTER UNIT: PIECE

Item No.	Size
R2S1216	16 x 1/2"
R2S1220	20 x 1/2"
R2S1225	25 x 3/4"
R2S1232	32 x 1"
R2S1240	40 x 1 1/4"
R2S1250	50 x 1 1/2"
R2S1263	63 x 2"
R2S1275	75 x 2 1/2"

FEMALE ADAPTER UNIT: PIECE



Item No.	Size
R2S1316	16 x 1/2"
R2S1320	20 x 1/2"
R2S1325	25 x 3/4"
R2S1332	32 x 1"
R2S1340	40 x 1 1/4"
R2S1350	50 x 1 1/2"
R2S1363	63 x 2"
R2S1375	75 x 2 1/2"

CHEMICAL RESISTANCE

Polypropylene is one of the polymers with highest chemical resistance. The chemical resistance of pipes and fittings made of Polypropylene Random Copolymer according to the German Standard DIN 8078/February 1992 is given in the following table.

Chemical resistance is dependent on the kind of chemical, its composition, concentration, temperature and the duration of exposure. Therefore the concentrations of the chmicals and resistance at three different temperatures are included in the table.

Chemical resistance is presented in the following four groups:

● Resistive
⊙ Limited resistance
° Nonresistive
- Insufficient information

The following symbols desribe the chemicals concentrations:
VL : Diluted (mass ratio ≤ 10%)
L : Diluted (mass ratio > 10%)
GL : Saturated dilution at 20°C
H : Commercial grade
TR : Technically pure

Agressive Media	Concentration	Chemical Resistance		
		20°C	60°C	100°C
Acetaldehyde	Rare	°	°	°
Acetaldehyde	TR	⊙	-	-
Acetephenon	TR	●	●	-
Acetic acid anhydride	TR	●	-	-
Acetic acid, diluted	TR	●	⊙	°
Acetic acid diluted	40%	●	●	-
Acetone	TR	●	-	-
Acid - acetanhydride	40%	●	●	-
Acrilonitrile	TR	●	⊙	-
Adipic acid	TR	●	●	-
Air	TR	●	●	●
Alaune Me-Me III sulphate	GL	●	●	-
Allyl alcohol, diluted	96%	●	●	-
Alum	GL	●	●	-
Aluminium chloride	GL	●	●	-
Aluminium sulphate	GL	●	●	-
Amber acid	GL	●	●	-
2 - Amino - ethanol	TR	●	-	-
Ammonia, gas	TR	●	●	-
Ammonia, liquid	TR	●	●	-
Anilin	TR	●	-	-
Ammonia, water	GL	●	●	-
Ammonium acetate	GL	●	●	-
Ammonium carbonate	GL	●	●	-
Ammonium chloride	GL	●	●	-
Ammonium floride	L	●	●	-
Ammonium nitrate	GL	●	●	●
Ammonium phosphate	GL	●	●	●
Ammonium sulphate	GL	●	●	●

Agressive Media	Concentration	Chemical Resistance		
		20°C	60°C	100°C
Amyl acetate	TR	⊙	-	-
Amyl alcohol	TR	●	●	●
Aniline	TR	⊙	⊙	-
Anilin hydrochloride	GL	●	●	-
Anon	TR	⊙	⊙	-
Anon (Cyclohexanone)	TR	⊙	○	○
Antifreeze	H	●	●	●
Antimony trichloride	90%	●	●	-
Apple acid	L	●	●	-
Apple acid	GL	●	●	-
Apple wine (ortho)	H	●	●	-
Aquar regia	H	●	●	●
Arsenic acid	40%	●	●	-
Arsenic acid	80%	●	●	⊙
Barium hydroxide	GL	●	●	●
Barium salts	GL	●	●	●
Battery Acid	H	●	●	-
Beer	H	●	●	●
Benzaldehyde	GL	●	●	-
Benzine - Benzol mixture	8090/2090	⊙	○	○
Benzol	TR	⊙	○	○
Benzyl Cloride	TR	⊙	-	-
Borax	L	●	●	-
Boric acid	GL	●	●	●
Bromine	TR	○	○	○
Bromine vapours	All	⊙	○	○
Butadiene, gas	TR	⊙	○	○
Butane (2) diol (1,4)	TR	●	●	-
Butanediol	TR	●	●	-
Butanetriol (1,2,4)	TR	●	●	-
Butin (2) diol (1,4)	TR	●	-	-
Butyl acetate	TR	⊙	○	○
Butyl alcohol	TR	●	⊙	⊙
Butyl phenol	GL	●	-	-
Butyl phenon	TR	○	-	-
Butylene glycol	10%	●	⊙	-
Butylene glycol	TR	●	-	-
Butylene, liquid	TR	⊙	-	-
Calcium carbonate	GL	●	●	●
Calcium chloride	GL	●	●	●
Calcium hydroxide	GL	●	●	●
Calcium hypochlorite	L	●	-	-
Calcium nitrate	GL	●	●	-
Carboline	H	●	-	-
Carbon dioxide, gas	All	●	●	-
Carbondoixide, liquid	All	●	●	-
Carbonhydride	Rare	●	●	-
Carbonimonoxide	All	●	●	-
Carbonsulphide	TR	○	○	○

Agressive Media	Concentration	Chemical Resistance		
		20°C	60°C	100°C
Caustic soda	60%	●	●	●
Chloral	TR	●	●	-
Chloramine	L	●	-	-
Chlorethanol	TR	●	●	-
Cloric acid	1%	●	⊙	°
Chloric acid	10%	●	⊙	°
Chloric acdi	20%	●	°	°
Chlorine	0.5%	⊙	-	-
Chlorine	1%	°	°	°
Chlorine	GL	⊙	°	°
Chorine, gas	TR	°	°	°
Chlorine, water	TR	°	°	°
Chlorocetic acid	L	●	●	-
Chlorobenzol	TR	⊙	-	-
Chloroform	TR	⊙	°	°
Chlor sulphon acid	TR	°	°	°
Chromic acid	40%	⊙	⊙	°
Chromic acid/Sulphuric acid/water	15/35/50%	°	°	°
Chrotonic aldehyde	TR	●	-	-
Citric acid	VL	●	●	●
Citric acid	VL	●	●	●
City gas	H	●	-	-
Coconut fat alcohol	TR	●	⊙	-
Coconut oil	TR	●	-	-
Cognac	H	●	●	-
Copper (II) Chloride	GL	●	●	-
Copper (I) cyanide	GL	●	●	-
Copper (II) nitrate	30%	●	●	●
Copper sulphate	GL	●	●	-
Corn oil	TR	●	⊙	-
Cotton oil	TR	●	●	-
Cresol	90%	●	●	-
Cresol	>90%	●	-	-
Cyclohexane	TR	●	-	-
Cyclohexanol	TR	●	⊙	-
Cyclohexanone	TR	⊙	°	°
Dextrine	L	●	●	-
Dextrine	L	●	●	-
DEXTROSE	20%	●	●	●
1,2 Diaminoethan	TR	●	●	-
Dichloro acetic acid	TR	⊙	-	-
Dichloro acetic acid	50%	●	●	-
Dichloro benzene	TR	⊙	-	-
Dichloro ethylene (1.1-1.2)	TR	⊙	-	-
Diesel oil	H	●	⊙	-
Diethyl amine	TR	●	-	-
Diethyl ether	TR	●	⊙	-
Diglycolic acid	GL	●	●	-
Dihexyl phatalate	TR	●	⊙	-

Agressive Media	Concentration	Chemical Resistance		
		20°C	60°C	100°C
Di - iso octylphatalate	TR	●	⊙	-
Di - iso propylether	TR	⊙	○	-
Dimethyformamide	TR	●	●	-
Dimethyl amine	100%	●	-	-
Di - n butyl ether	TR	⊙	-	-
Dinonyl phatalate	TR	●	⊙	-
Dioctyl phatalate	TR	●	⊙	-
Dioxane	TR	⊙	⊙	-
Drinking water	TR	●	●	●
Ethanol	L	●	●	-
Ethalon + 2% toluene	96%	●	-	-
Ethyl acetate	TR	●	⊙	○
Ethyl alcohol	TR	●	●	●
Ethyl benzol	TR	⊙	-	○
Ethyl chloride	TR	○	○	○
Ethylene diamine	TR	●	●	-
Ethylene glycol	TR	●	●	●
Ethelene oxide	TR	○	-	-
Fatty acid	20%	●	-	-
Fatty acids > C4	TR	●	⊙	-
Fementation malt	H	●	●	-
Fertilizer salts	GL	●	●	-
Fiml bath	H	●	●	-
Fluroine	TR	⊙	-	-
Fluosilicic acid	32%	●	●	-
Formaldehyde	40%	●	●	-
Formic acid	10%	●	●	⊙
Formic acid	85%	●	⊙	○
Fructose	L	●	●	●
Fruit wuices	H	●	●	●
Furfuryl alcohol	TR	●	⊙	-
Gelatine	L	●	●	●
Glucose	20%	●	●	●
Glycerine	TR	●	●	●
Glycolic acid	30%	●	⊙	-
Grease	H	⊙	-	-
HCL/HN03	75% / 25%	○	○	○
Heptane	TR	●	⊙	○
Hexane	TR	●	⊙	-
Hexanetriol (1,2,6)	TR	●	●	-
Hydrazine hudrate	TR	●	-	-
Hydrobromine acid	48%	●	⊙	○
Hydrochloric acid	20%	●	●	-
Hydrochloric acid	20-36%	●	⊙	⊙
Hydrochloric acid	40%	●	●	-
Hydrofluoric acid	70%	●	⊙	-
Hydrogen	TR	●	●	-
Hydrogen chloride	TR	●	●	-
Hydrogen proxide	30%	●	⊙	-

Agressive Media	Concentration	Chemical Resistance		
		20°C	60°C	100°C
Hydrosynaic acid	TR	●	●	-
Hydroxylammonium sulfate	12%	●	●	-
Iodine solution	H	●	⊙	-
Isooctane	TR	●	⊙	°
Isopropyl	TR	●	●	●
Kerosen	H	●	⊙	°
Lastic acid	90%	●	●	-
Lanolin	H	●	⊙	-
Lead acetate	GL	●	●	°
Linseed oil	H	●	●	●
Lubricating oils	TR	●	⊙	°
Magnesium chloride	GL	●	●	●
Magnesium hydroxycarbonate	Gl	●	°	°
Magnesium salts	GL	●	●	-
Magnesium sulphate	GL	●	●	●
Menthol	TR	●	⊙	-
Methanol	TR	●	●	-
Methanol	5%	●	●	⊙
Methyl acetate	TR	●	●	-
Methyl amine	32%	●	-	-
Methyl bromide	TR	°	°	°
Methyl chloride	TR	°	°	°
Methyl ethyl ketone	TR	●	⊙	-
Mercury	TR	●	●	-
Mercury salts	GL	●	●	-
Milk	H	●	●	●
Mineral water	H	●	●	●
Molasses	H	●	●	●
Motor oil	TR	●	⊙	-
Natural gas	TR	●	-	-
Nickel salts	GL	●	●	-
Nitric acid	10%	●	⊙	°
Nitric acid	10-50%	⊙	°	°
Nitric acid	>50%	°	°	°
2- Nitrotoluen	TR	●	⊙	-
Nitrous gases	All	●	●	-
Oleum (H2SO4 + SO3)	TR	°	°	°
Olive oil	TR	●	●	⊙
Oxalic acid	GL	●	●	°
Oxygen	TR	●	-	-
Ozone	0.5 ppm	●	⊙	-
Paraffin emulsions	H	●	●	-
Paraffin oil	TR	●	●	°
Perchloric acid	20%	●	●	-
Perchloroethylene	TR	⊙	⊙	-
Petroleum	TR	●	⊙	-
Petroleum ether	TR	●	⊙	-
Phenol	5%	●	●	-
Phenol	90%	●	-	-

Agressive Media	Concentration	Chemical Resistance		
		20°C	60°C	100°C
Phenyl hydrazine	TR	⊙	⊙	-
Phenyl hydrazine hydrochloride	TR	●	⊙	-
Phosgene	TR	⊙	⊙	-
Phosphates	GL	●	●	-
Phosphoric acid	85%	●	●	●
Phosphorus oxychloride	TR	⊙	-	-
Phthalic acid	GL	●	●	-
Photo emulsions	H	●	●	-
Photo fixing baths	H	●	●	-
Picric acid	GL	●	-	-
Potassium bichromate	GL	●	●	-
Potassium bromate	10%	●	●	-
Potassium bromide	GL	●	●	-
Potassium carbonate	GL	●	●	-
Potassium chlorate	GL	●	●	-
Potassium chloride	GL	●	●	-
Potassium chromate	GL	●	●	-
Potassium chromate	GL	●	●	-
Potassuim cyanide	L	●	●	-
Potassium fluoride	GL	●	●	-
Potassium hydrogen carbonate	GL	●	●	-
Potassium hydrocide	50%	●	●	●
Potassium iodide	GL	●	●	-
Potassium nitrate	GL	●	●	-
Potassium perchlorate	10%	●	●	-
Potassium permanganate	GL	●	°	-
Potssium persulfate	GL	●	●	-
Potassium sulfate	GL	●	●	-
Propane, gas	TR	●	-	-
Propanol (l)	TR	●	●	-
Propargyl alcohol	7%	●	●	-
Propionic acid	>50%	●	-	-
Propylene glycol	TR	●	●	-
Phridin	TR	⊙	⊙	-
Seawater,brine	H	●	●	●
Silicic acid	All	●	●	-
Silico fluoric acid	32%	●	●	-
Silicone emulsion	H	●	●	-
Silicone oil	TR	●	●	●
Silver nitrate	GL	●	●	⊙
Silver salts	GL	●	●	-
Sodium acetate	GL	●	●	●
Sodium benzoate	35%	●	●	-
Sodium bicarbonate	GL	●	●	●
Sodium bisulphate	GL	●	●	-
Sodium bisulphite	L	●	-	-
Sodium carbonate	50%	●	●	⊙
Sodium chlorate	GL	●	●	-
Sodium chloride	VL	●	●	●

Agressive Media	Concentration	Chemical Resistance		
		20°C	60°C	100°C
Sodium chlorite	VL	●	●	●
Sodium chlorite	2-20%	●	⊙	○
Sodium chromate	GL	●	●	●
Sodium hydrox	60%	●	●	●
Sodium hypochloride	20%	○	○	○
Sodium hypochlorite	10%	●	-	-
Sodium hypochlorite	20%	⊙	⊙	○
Sodium nitrate	GL	●	●	-
Sodium silicate	L	●	●	-
Sodium sulphate	GL	●	●	-
Sodium sulphide	GL	●	●	-
Sodium sulphide	40%	●	●	●
Sodium thiosulphate	GL	●	●	-
Sodium triphosphate	GL	●	●	●
Soyabean oil	TR	●	⊙	-
Strach solution	All	●	●	-
Strach syrup	All	●	●	-
Sulphurdoixide	All	●	●	-
Sulphurdioxide, gas	TR	●	●	-
Sulphurdioxide, liquid	All	●	●	-
Sulphuric acid	10%	●	●	●
Sulphuric acid	10-80%	●	●	-
Sulphuric acid	80% - TR	⊙	○	-
Sulphuric acid		○	○	○
Sulphuric acid	All	●	●	-
Sulphur trioxide	All	●	●	-
Tar oil	H	●	○	○
Tetrachloroethane	TR	⊙	○	○
Tetrachloroethylene	TR	⊙	⊙	-
Tetrachloromethane	TR	○	○	○
Tetraethyl lead	TR	●	-	-
Tetrahydrofurane	TR	⊙	○	○
Tetrahydronaphatalene	TR	○	○	○
Thionyl chloride	TR	⊙	○	○
Tin (II) chloride	GL	●	●	-
Tin (IV) chloride	GL	●	●	-
toluene	TR	⊙	○	○
Trichloroethylene	TR	○	○	○
Trichloro asetic acid	50%	●	●	-
Tricresyl phosphate	TR	●	⊙	-
Triethanolamin	L	●	-	-
Wine vinegar	H	●	●	●
Xylene	TR	⊙	○	○
Yeast	All	●	-	-
Zinic	GL	●	●	-
Trioctyl phosphate	TR	●	-	-
Urea	GL	●	●	-
Vaseline oil	TR	●	⊙	-
Vinegar	H	●	●	●
Vinyl acetate	TR	●	⊙	-
Washin powder	VL	●	●	-
Waste gases containing hydrogen fluoride	Rare	●	●	-
Water, pure	H	●	●	●
Wax	H	●	⊙	-
Wine acid	10%	●	●	-
Wines	H	●	●	-

MINISTRY OF ELECTRICITY & WATER
WATER RESOURCES DEVELOPMENT CENTER
RESEARCH & DEVELOPMENT SECTION

TOXICITY TEST OF NON-METALLIC MATERIALS
(Trace Elements & Organic Compounds)

Material : Polypropylene pipe (KAI)
Tested for : Kuwait International Advanced Industries Company K.S.P.Co
Lab.ref.nos : 13306-13309 &13313-13314 &13320-13321 &13332-13333& 13325-13326 &13354
MTLN : 3362 Date received : 13/8/2001. **Date out** : 3/9/2001

APPLICATION DETAILS:
PolyPorpylene (80) Pipe applied by ____ " ____ on ____ " ____ cured for ____ to be used in contact with potable water.

TEST DETAILS:
Physical and chemical results of the soaking test carried out on the samples for ten days for trace metals and six days for organic compounds in chlorinated potable water at 30°C are as follows:

1.Taste,odor or color
2.pH value
3.Release of T.O.C
4.Release of toxic metals
5.Release of T.H.M
6.Release of phenols
7.Release of other organics

WITHIN THE ... NIL
: WITHIN THE ALLOWABLE RANGE
: WITHIN THE ALLOWABLE RANGE
: WITHIN THE ALLOWABLE RANGE
: WITHIN THE ALLOWABLE RANGE
: WITHIN THE ALLOWABLE RANGE

Based on the above results, the material submitted passes the tests for trace elements and organic compounds.

Note :
- The results quoted in this report relate only to the sample submitted for evaluation.
- The Ministry of Electricity & Water is not responsible for any changes in the specifications of the material.

OPERATOR

HEAD OF SECTION

DIRECTOR

Kuwait International Advanced Industries Company

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