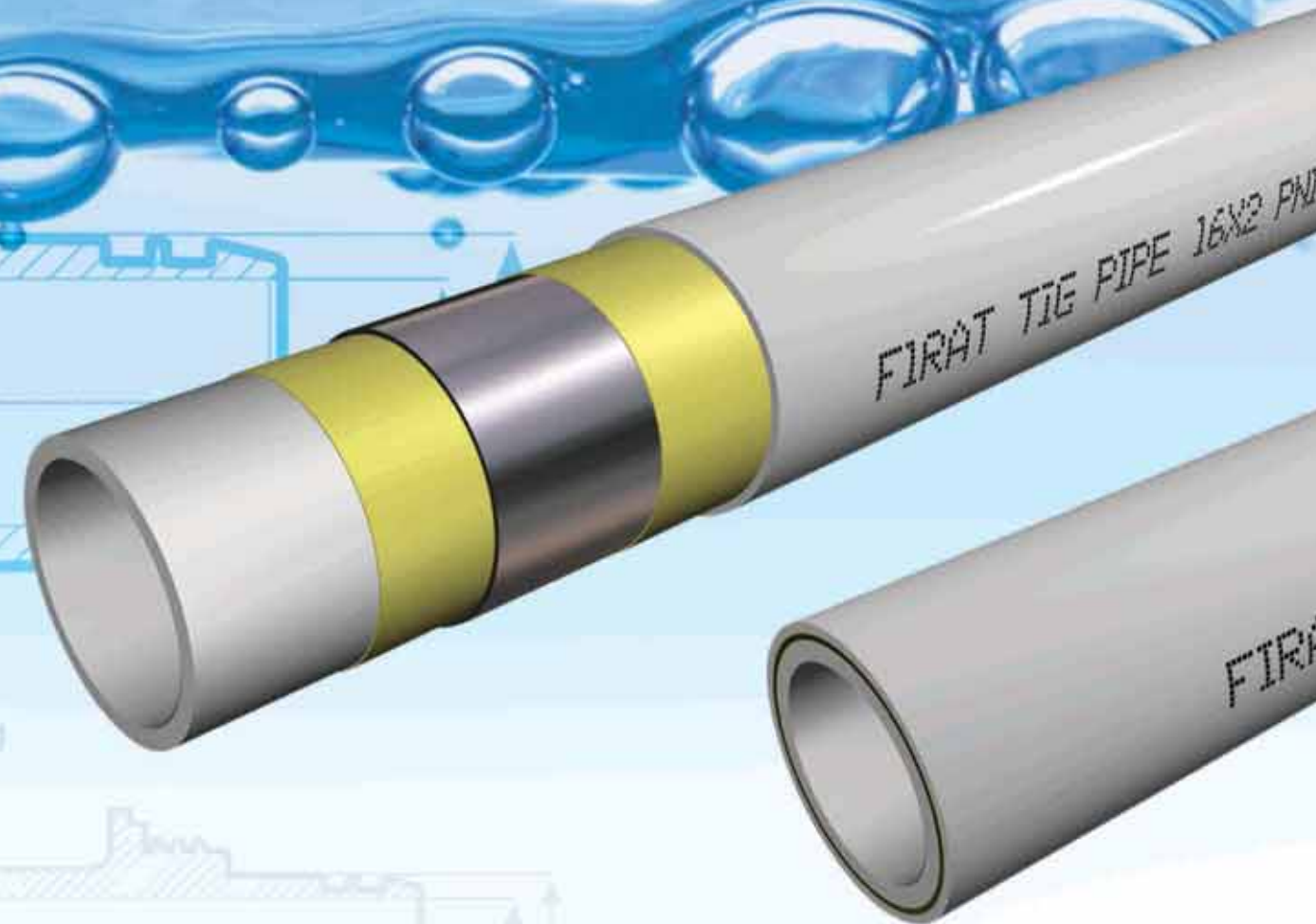


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## PEX-AL-PEX PIPES (MULTI LAYER TIG PIPES)



1181-4106000587-E-09.03.2012







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# FIRAT

## About us

FIRAT was established in 1972 to make production in the field of plastic construction materials FIRAT, who has always followed its principle of "Quality Production at All Times" and "quality product diversity", has managed to become "the leader of sector" as well as "the export leader of sector" as a result of the serious enterprises.

With its plastic-based products, FIRAT makes production for various sectors like construction, agriculture, automotive, medical and white goods. It carries out its manufacturing process for these sectors in its factories of 650.000 m<sup>2</sup> in total in Istanbul-Buyukcekmece and Ankara-Sincan. FIRAT owns one of the five biggest manufacturing complexes of Europe.

According to the survey of Istanbul Chamber of Commerce in 2011, FIRAT ranks as the 57th amongst the 500 big industrial establishment of Turkey. FIRAT ranks as the 51st one in the private sector ranking. According to the Corporate Tax Ranking of T.R. Ministry of Finance Revenue Administration Department in 2011, FIRAT is the 72nd amongst the top tax payer companies of Turkey. FIRAT ranks as the 150th in list of "Leader Exporting Manufacturers of Turkey in 2011", according to Turkey Exporters Committee and is the leader exporter in its sector.



As of the end of 2011, the number of personnel working under FIRAT structure is 1700. Believing in the understanding of "The most valuable factor is human", FIRAT has been constantly arranging in service trainings both for the personnel to increase their experience at work and their corporate knowledge.

### **Product Diversity and Groups**

Product diversity of FIRAT is over 4500. For our customers to obtain the optimum benefit and satisfaction out of these products, FIRAT makes production as integrated (completing one another) systems.

Thousands of FIRAT products like PVC Door and Window Profiles, PVC Rain Gutters and Fittings, PVC Drinking Water Pipes, PVC Waste Water Pipes, PVC Hose Groups, Rubber and PE Based Hoses, PPRC Sanitary Installation Pipes and Fittings, HDPE Pipes, EF Fittings, PE Fittings, PE 80 Natural gas Pipes, Tunnel Type Drainage Pipes, Drainage Pipes, Telecommunication Cable Protection Pipes, EPDM Sealing Manufacturing, TPE Sealing Manufacturing, Metal Injection Production (hinge and window connection components), PEX Mobile System and Floor Heating Pipes, PEX Pipe Metal Fittings, Pex Al Pex Pipes, Drip Watering Pipes, Medical Products render service in numerous parts of Turkey and the world.

FIRAT Company - which has broken the world record by producing PE100 pipes of 1200 mm, 110 mm wall thickness and enduring up to 16 bars in the "Bosphorus Project", and has carried drinking water to the European side of Istanbul - now has performed a first in Turkey and has produced pipes of 500 meters length. These pipes are going to be used in a "purification of the sea - water project" in Libya. They were produced as 1400 mm PE100 pipes, withstanding 6,4 bars pressure with a wall thickness of 55 mm's. By producing these 6 pieces of 500 metersone - piece pipes, FIRAT is a pioneer in continuous pipe production for monolines for the first time in Turkey.

FIRAT manufactures FKS canalisation pipe, the testable operating life of which is 100 years. These pipes which can be manufactured up to 2400 mm diameter from HDPE (high density polyethylene) raw material are resistant against ground motion, gnawing animals, plant roots and chemical wastes. FKS pipes are manufactured with German company Krah technology and licence.



Triplex pipes again manufactured in FIRAT facilities are used in outdoor installations and grounds as well as domestic connections, predominantly in sewer line, rain water drainage lines, industrial waste water installations, water conveying pipes and drainage systems.

Triplex pipe has big advantages like high flow performance, external load resistance, long operating life, transport and storage convenience, its becoming economic, endurance against chemical substances, price and maintenance convenience, imperviousness and filter-free operation choice.

FIRAT is the single firm in the world's plastic sector manufacturing all of the PVC window and door system components excluding glass and screw. Since full harmony of PVC window and door is only possible with integrated manufacturing process; FIRAT manufactures PVC Profile, EPDM seal, TPE seal, reinforcement steel and whole range of metal accessories in integrated manner within its facilities.

FIRAT is capable of conducting welding, heavy rain and wind resistance, blow and milled blow resistance, compression, shear and break-off strength ring rigidity (strength of FKS and Triplex pipes against soil load) tests in its the state-of-the-art test and analysis laboratories. Our products are offered to the service of our customers only after they are confirmed by the Quality Assurance Group related to their conformity to production, sale and outlet.

Following completion of all quality control tests, FIRAT products are offered to the market with "FIRAT Quality Assurance Confirmation". FIRAT holds international quality certificates such as RAL GOST, SKZ, EMI, DVGW, TSE as well as ISO 14001, OHSAS 18001, ISO 10002 and ISO 9001 system certificates.

FIRAT products achieved satisfaction of customers in more than 60 countries and deserved a distinguished place in the markets.





To develop, grow, struggle to achieve perfection through advanced technology and utilize all its resources in order to ensure long lasting customer satisfaction are the objectives of FIRAT.

Thanks to reliable, strong, easily accessible and easy-to-use products and perfect aftersale support, FIRAT achieves its target of perfection.

**FIRAT** Headquarters Building





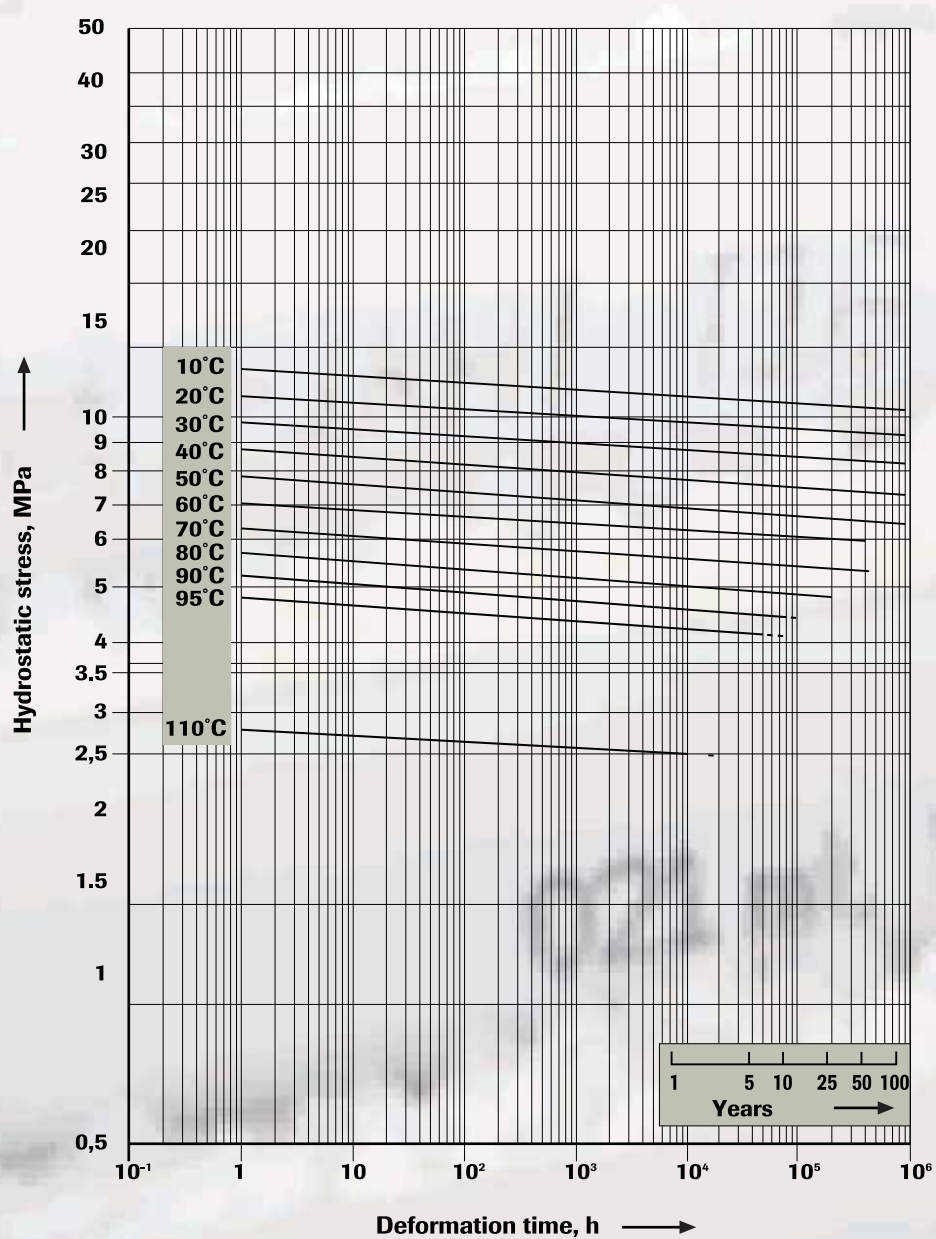
## Raw Material

FIRAT PEX-AL-PEX Pipes pose no negative effect on human health. The facts that it does not downgrade color, taste and smell of water and not contain any carcinogens have been confirmed.

Raw materials of PE-X<sub>b</sub> in PEX-AL-PEX Pipes are procured from the world's proven highest quality raw material producers such as SILON and SOL VAY and all raw materials supplied are subjected to Input Quality Control tests in FIRAT laboratories.



(Pe-X<sub>b</sub>) Raw Material Resistance Curve





## Our Notion of Quality

Quality Control Process implemented in FIRAT laboratories consists of three phases:

1. Incoming Quality Control
2. Process Quality Control
3. Output-Final Quality Control

### **Incoming Quality Control**

All types of raw materials and auxiliary materials from our suppliers are subjected to Input Quality Control tests according to the quality-production standards set out by FIRAT. Samples randomly chosen from each lot of raw materials and auxiliary materials supplied in lots by our suppliers have to pass through Appearance Marking Compliance, Physical Compliance, Chemical Compliance and Functional Compliance tests in GKK Laboratories and obtain **“Suitable for Production”** approval.

### **Process Quality Control**

In the production process implemented with raw materials and auxiliary materials bearing “Suitable for Production” approval, samples taken on production lines during or soon after production are passed through Process Quality Control tests in FIRAT laboratories determined by national (TSE) and international (DVGW, SKZ, ASTM, ISO etc.) standard institutions and recorded regularly. Main Process Quality Control tests are as follows:

- Hydrostatic Pressure Test (for products to be used in pressured lines)
- Adhesion between Layers (resistance to heat)
- Density and MFI Test
- Cross-Linking Degree Test
- Blow Strength Test (strength against external impacts)
- Longitudinal Variation (resistance against heat)
- Density Test
- Homogeneity Test
- Melt Flow Speed Test

#### **Quality Tests \***



Homogeneity



Density



MFI Test

At the phase of Process Quality Control; diameter, thickness and ovality measurements are conducted by ultrasonic measurement devices on all production lines in fully automated manner simultaneously with the production process and faulty production is not allowed upon activation of sound and light warning system under out of standard cases. Our products have to pass through all tests conducted in accordance with the control frequency and numbers set out in the standards and obtain **"Suitable for Sale"** approval.

#### Output-Final Quality Control

Our products which obtained "Suitable for Sale" approval also have to get **"Suitable for Output"** approval passing through Packaging Compliance, Pack Compliance, Description and Label Compliance checks soon after automatic packaging and wrapping processes.

In addition to the quality control tests conducted in FIRAT laboratories, all our products are sampled from our production lines regularly twice a year and subjected to quality and sanitary compliance tests by international test and certification institutions such as DVGW, SKZ, GOST.

Our products which passed through all these tests and met the required quality conditions are offered to our customers.

\*FIRAT has the state-of-art quality, control and test laboratory in the sector.



Cross Linking



Change in length

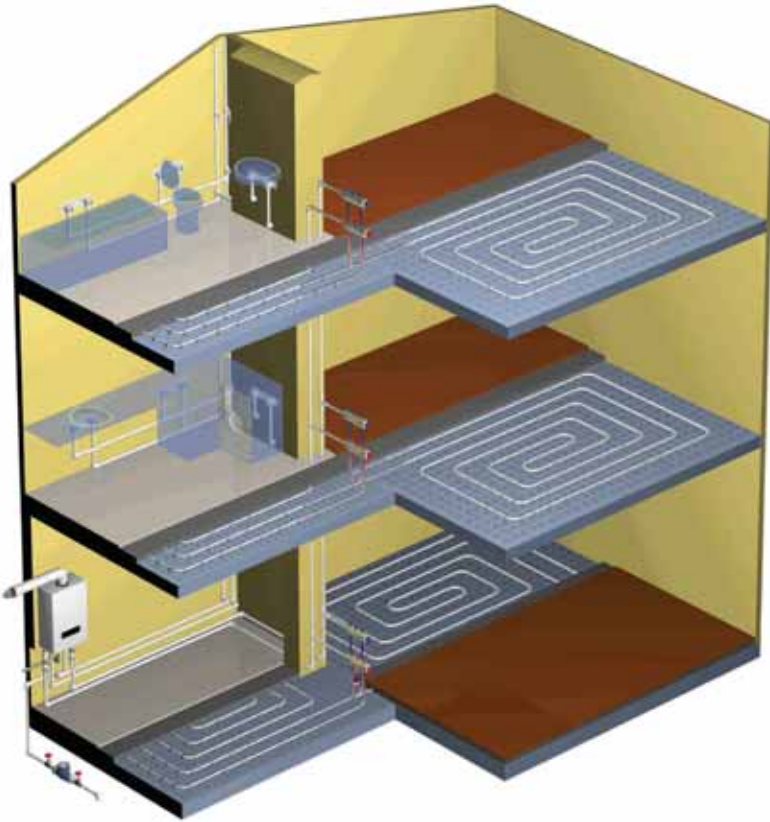


Pressure test



## Our Quality Certificates

No effect on human health, no disturbance to the smell and taste of water and non-inclusion of any carcinogens have been certified for FIRAT Tig Pipes by relevant international institutions such as TZW.



Household Application of PEX-AL-PEX (Multi Layer TIG) Pipes and Fittings



Drinking Water



Underfloor Heating



Radiator



Hot Water



Cold Water



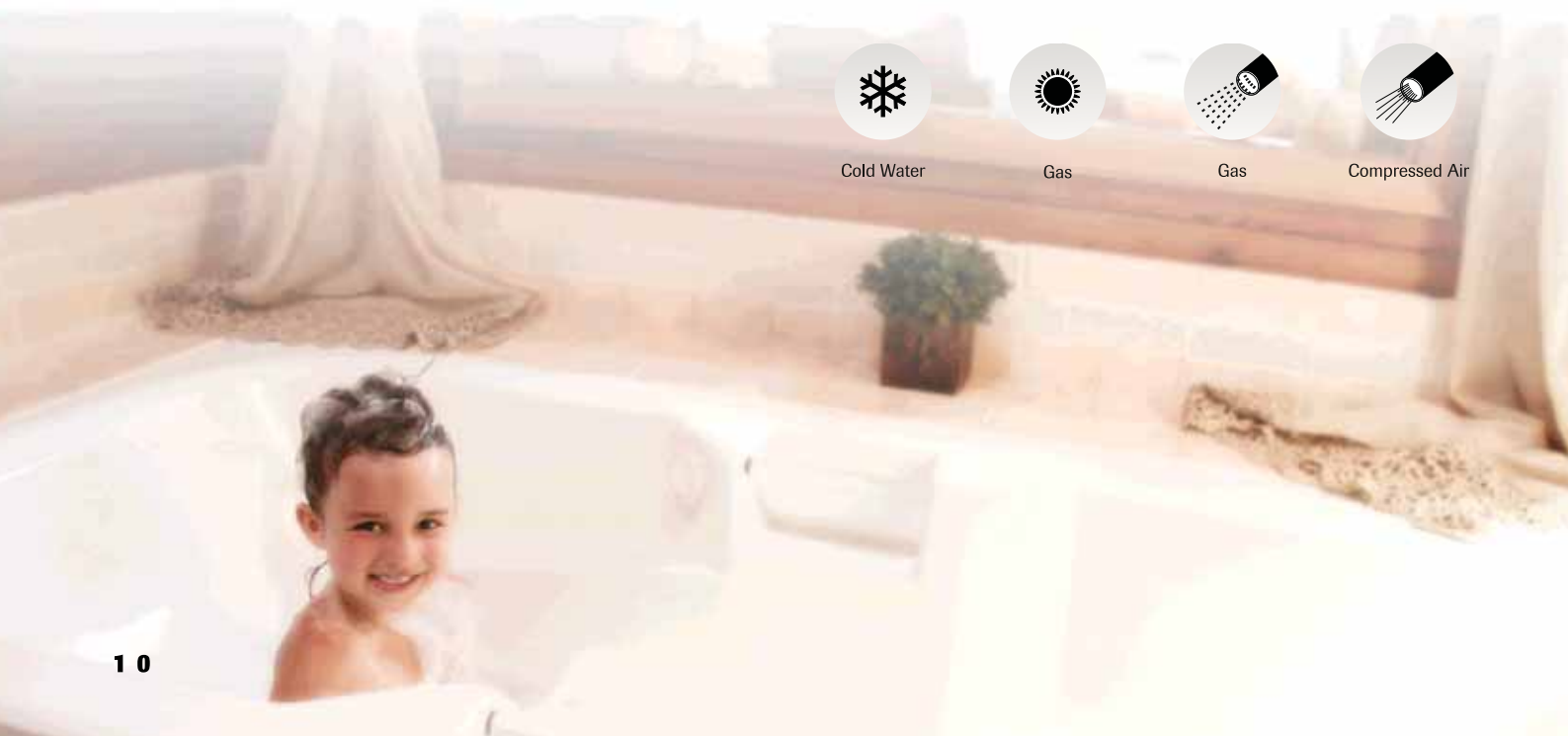
Gas



Gas

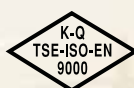


Compressed Air



Quality and compliance with health and food regulations of TIG Pipes are approved by the following institutions:

- TSE – Turkish Standards Institute (Turkey) 
- DVGW (Germany) 
- SKZ (Germany) 
- GOST (Russia and Ukraine)   
- GOST – Hygiene (Russia and Ukraine)   





## Corporate Training

Relying on the understanding of “**Human comes first**”, FIRAT invests in human. FIRAT provides its employees with miscellaneous regular intra-company training programs and offers them opportunities to join necessary training, seminar and congress events both within the country and abroad for the purpose of enhancing both their own corporate know-how and business performance.

FIRAT is the leading organization of its sector also in the area of corporate training through clearly and precisely conveying targeted results to its employees, ensuring its employees to enjoy and efficiently implement their assignments and become more participative in the processes, offering them all types of business, training and organization facilities and acting as a “**team**” with all its employees.

Primarily emphasizing the fact of knowledge-based progress in its training programs, FIRAT adopted the principles of utilizing knowledge and technology in its production processes and aftersale services through researcher and problem-solving, result-oriented employees and ensuring continuous customer satisfaction through regular personnel and dealer training programs.



FIRAT ISO Standard preparatory meeting, Brussels- Belgium



## Environment Friendly FIRAT

Producing by the use of “**Environmental Friendly Production Technologies**” since its foundation, FIRAT proves its sensitivity toward environmental health through its **Environmental Management System** established in 2002 and considers this area as a “**Window of Management**”.

Upon obtaining TS EN ISO 14001 2004 “**Environment Management System**” certificate from SGS in 2003, FIRAT had its sensitivity toward environmental health confirmed in national and international setting.

FIRAT not only retains its established environmental consciousness within its organization but also transforms this consciousness into an environmental policy and shares it with its neighbors, suppliers and customers. Especially during domestic and foreign seminars held for its end-users, FIRAT shares its efforts made toward environmental problems and importance that should be attached to the environmental health primarily with its business partners.

95% of the products of FIRAT consists of re-cycled re-processable materials. It sends its non-household wastes and non-recyclable waste products to “**Disposal Facilities**” licensed by the Rep. of Turkey, Ministry of Environment and Forests and implements recycling process in these facilities.

**Environment Management Programs and Projects oriented to Environmental Health Protection** drawn up by the **Environmental Group** consisting of our environmental engineers are being realized within FIRAT organization.

Committing its compliance with all national and international **Environmental Legislative Directives** and **Environmental Regulations**, FIRAT fulfills all its legal liabilities and declares statutory assessment reports to the relevant Ministry.

FIRAT , awarded by ISO (Istanbul Chamber of Industry) with “**Environment Incentive Reward**” with its environmental project drawn up in 2006, always gives precedence to the importance of environmental health and shows necessary sensitivity in all its investments.





## General Information

TIG Pipes are used for warm and cold water systems, radiator systems, pressured air installations, transmission of cooled fluids, inner-building fresh water systems and floor heating systems. TIG Pipes are produced through a special technology combining the superior features of plastic and metal materials. While the inner and outer layers of TIG Pipes are made of polyethylene, aluminum is used for the production of the middle layer.

The name of this special pipe is derived from the special method used to produce it. Aluminum layer is twisted over the polyethylene layer (its molecule structure includes cross linked PE-X<sub>b</sub>) and these two materials are then fixed with arc welding (Tungsten Inert Gas).

Inner and outer surfaces of TIG Pipes are formed by PE-X<sub>b</sub> layers which are resistant to high temperatures, hygienic, , resistant to corrosion and impacts taking root of external influences, very smooth and which are preventing sedimentation, providing excellent isolation.

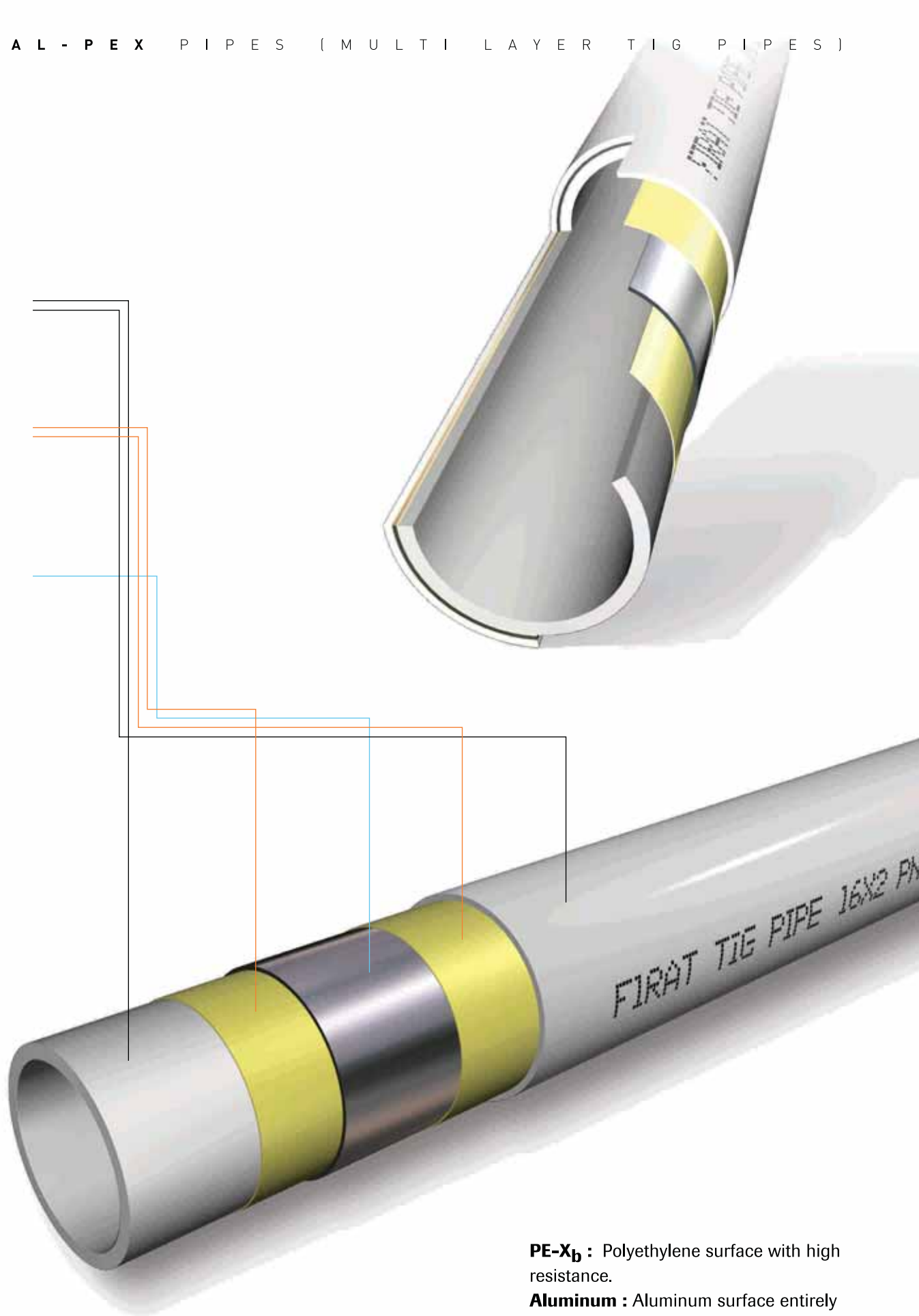
In addition to these, a special adhesive and method is used for fixing the inner and outer PE-X<sub>b</sub> layers with excellent properties to the aluminum layer.



PE-X<sub>b</sub>

Adhesive  
Layers

Aluminum



**PE-X<sub>b</sub>** : Polyethylene surface with high resistance.

**Aluminum** : Aluminum surface entirely covering the inner PE-X<sub>b</sub> surface.

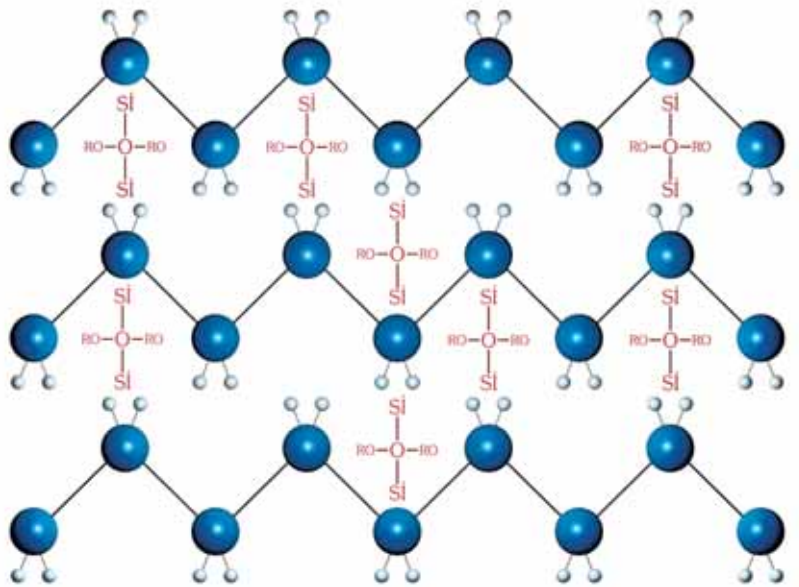
**Adhesive Layers** : High strength binding surfaces for binding aluminum and PE-X<sub>b</sub> surfaces.

## Specifications of PEX-AL-PEX Pipes (Multi Layer TIG Pipes)

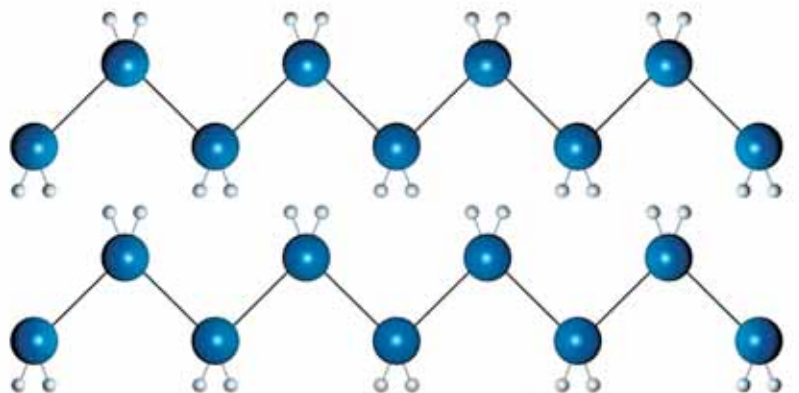
### Properties of Cross-Linking Polyethylene (PE-X<sub>b</sub>)

Currently, pipes produced from HDPE raw material are used for conveying fluids with maximum temperature of 50°C. However, even at 50°C, it is a must to exercise a pressure lowering factor. On the other hand, pipes made of cross-linking polyethylene (PE-X<sub>b</sub>) present an excellent capacity to convey hot water with temperature values higher than 50°C. Service life problem for pipes, related to hot water conveying, is eliminated with the use of cross-linking PE-X<sub>b</sub>.

Cross-linking process forms polymer chains between micro-molecules. This process, conducted with Silan method (PE-X<sub>b</sub>), delivers a much longer service life for pipes.



PE-X<sub>b</sub> with cross-linking



PE without cross-linking



## Advantages Provided by PE-X<sub>b</sub> Layers

- The outer layer made of PE-X<sub>b</sub> prevents corrosion on construction materials (lime, mortar etc.) and the aluminum layer of the pipe. It also provides resistance against impacts.
- The smooth surface of the PE-X<sub>b</sub> inner layer both decreases the pressure value and also prevents sedimentation.
- Thermal conduction property of PE-X<sub>b</sub> is excellent. Thanks to this, energy saving is possible for hot-water applications.
- The cross-linking PE-X<sub>b</sub> forming the inner layer fulfills the human-health requirements for liquid foodstuff and fresh water applications.
- TIG Pipes produced from PE-X<sub>b</sub> raw material are ideal for conveying acidic and alkaline fluids thanks to the properties of the raw material.

## Specifications for PE-X<sub>b</sub>

Density	0,950 gr/cm <sup>3</sup>
Water temperature (application)	+95 °C
Softening temperature	135 °C
Thermal conductivit	0,37 kcal/m h °C
Cross-linking degree (minimum)	65 %
Elongation at break	500-600 %
Breaking strength (at 20 oC)	290-300 kg/cm <sup>2</sup>

## Specifications of PEX-AL-PEX Pipes (Multi Layer TIG Pipes)

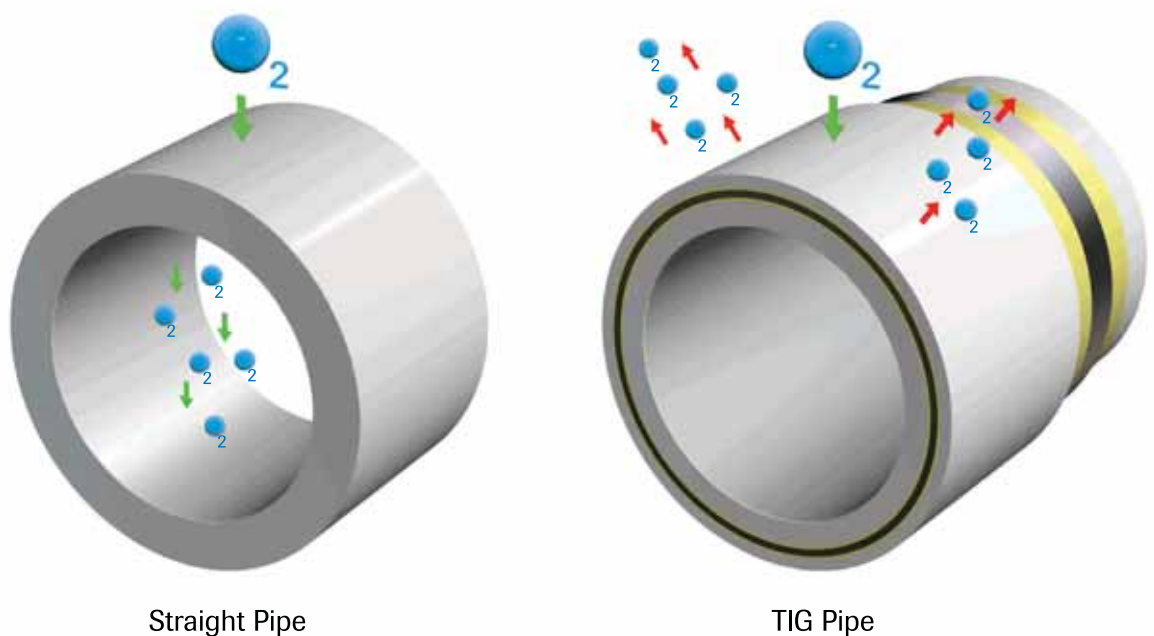
### Properties of Aluminum Material

Middle layer of TIG Pipes is made of aluminum. After being coated on the inner PE-X<sub>b</sub> layer, the aluminum material is then fixed to the structure through the superior technical properties of Tig welding.

### Advantages Provided by Aluminum

- Thanks to the aluminum layer taking place in Tig Pipes, oxygen diffusion from the outer medium to the water inside the pipe is prevented and no oxidation is observed on the metal parts of the system, as a result.
- Thanks to the aluminum layer, Tig Pipes can be very easily buckled and they also keep the new shape formed. As a result of their ability to be buckled at 6 times of its diameter, savings in fitting consumption can be obtained.
- Thanks to the low thermal expansion coefficient of the aluminum layer, no sagging is observed at on-wall Tig Pipe applications.

### The Relation between Tig Pipes and Oxygen



## Welding Technology Used for the Aluminum Layer of Tig Pipes

The welding technique named as Tungsten Inert Gas has been considered to be a very important technological development by the plastics industry in recent years. This method includes bending the aluminum layer onto the PE-X<sub>b</sub> inner layer and then fixing these two layers through arc butt welding. This technology surpasses the old technologies like overlapping in terms of life time and reliability.





## Specifications of PEX-AL-PEX Pipes (Multi Layer TIG Pipes)

### Technical Specifications for Tig Pipes

Pipe definition	Pex-Al-Pex Cross-linked polyethylene + aluminum + Cross-linked polyethnylene
Standards applied	ASTM F 1281 / UNI 10954 / DVGW W 534 / DVGW 542 / SKZ HR 3.12
Welding method for aluminum	Tig welding (Tungsten Inert Gass)
Cross-linking method	PEX <sub>b</sub> (silane)
Oxygen permeability	0,0 % mg/l
Maximum operating temperature	95°C
Maximum operating pressure at 95°C	10 bar
Operating conditions for hot applications (95°C)	10 bar (min. 50 years)
Coefficient of thermal conductivity	0,43 W/m°K
Coefficient of thermal expansion	0,025 mm/m°K
Inner surface roughness	0.006 mm
Bending diameter	DN x 6

### Dimensions for Tig Pipes

Outer Diameter (mm)	Wall Thickness (mm)	Aluminum wall thickness (mm)	Inner Diameter (mm)	Weight (g/m)	Coil length (m)
14	2	0.2	10	102	100
16	2	0.2	12	115	100
18	2	0.25	14	125	100
20	2	0.25	16	145	100
25	2.5	0.35	20	220	50
26	3	0.35	20	260	50
32	3	0.45	26	340	50
40	4	0.5	32	550	50

## Pipe in Pipe System for Pex Al Pex

New Pipe in Pipe system developed by FIRAT decreases the time and the cost of installation in significant amounts. The new product is also providing less cost in transportation and storage. Blue and Red pipes show the flow of hot or cold water therefore enabling an more efficient installation and usage.

<b>alpex pipe</b> diameter mm	<b>cover outer</b> diameter mm	<b>cover inner</b> diameter mm	<b>cover</b> wall thickness mm	<b>coil</b> lenght mt
16	25	20.7	0.45	25-50-100
20	28.2	23.1	0.55	25-50



## Specifications of PEX-AL-PEX Pipes (Multi Layer TIG Pipes)

### Pressure Loses Table for Tig Pipes

Q	14x2			16x2			18x2			20x2		
	R1	R2	V	R1	R2	V	R1	R2	V	R1	R2	V
0.01	0.40	0.33	0.13	0.19	0.14	0.09	0.11	0.06	0.06	0.06	0.02	0.05
0.02	1.44	1.12	0.25	0.39	0.47	0.18	0.21	0.22	0.13	0.12	0.12	0.10
0.03	2.93	2.28	0.38	1.23	0.95	0.27	0.59	0.46	0.19	0.31	0.24	0.15
0.04	4.86	3.77	0.51	2.04	1.58	0.35	0.98	0.76	0.26	0.52	0.40	0.20
0.05	7.18	5.57	0.64	3.02	2.34	0.44	1.45	1.12	0.32	0.77	0.52	0.25
0.06	9.88	7.67	0.76	4.15	3.22	0.53	1.99	1.55	0.39	1.06	0.82	0.30
0.07	12.94	10.05	0.89	5.44	4.22	0.62	2.61	2.03	0.45	1.38	1.07	0.35
0.08	16.35	12.69	1.02	6.87	5.34	0.71	3.30	2.56	0.52	1.75	1.36	0.40
0.09	20.09	15.60	1.15	8.45	6.56	0.80	4.06	3.15	0.58	2.15	1.67	0.45
0.10	24.16	18.76	1.27	10.16	7.89	0.88	4.88	3.79	0.65	2.59	2.01	0.50
0.12	33.25	25.81	1.53	13.98	10.85	1.06	6.72	5.22	0.78	3.56	2.76	0.60
0.14	43.54	33.81	1.78	18.31	14.22	1.24	8.80	6.83	0.91	4.67	3.62	0.70
0.16	55.01	42.71	2.04	23.13	17.96	1.41	11.12	8.63	1.04	5.90	4.58	0.80
0.18	67.60	52.49	2.29	28.43	22.07	1.59	13.67	10.61	1.17	7.25	5.63	0.90
0.20	81.28	63.12	2.55	34.19	26.54	1.77	16.44	12.76	1.30	8.71	6.77	0.99
0.30	165.27	128.33	3.82	69.51	53.97	2.65	33.42	25.95	1.95	17.72	13.76	1.49
0.40	273.42	212.31	5.09	115.00	89.30	3.54	55.30	42.94	2.60	29.32	22.77	1.99
0.50	404.04	313.73	6.37	169.94	131.96	4.42	81.71	63.45	3.25	43.33	33.65	2.49
0.60	555.90	431.65	7.64	233.82	181.56	5.31	112.43	87.30	3.90	59.62	46.29	2.98
0.70	728.03	565.31	8.91	306.22	237.78	6.19	147.24	114.33	4.55	78.08	60.63	3.48
0.80	919.68	714.13	10.19	386.83	300.37	7.07	186.00	144.43	5.20	98.64	76.59	3.98
0.90		877.60	11.46	475.38	369.13	7.96	228.58	177.49	5.85	121.22	94.12	4.48
1.00				571.63	443.87	8.84	274.86	213.43	6.50	145.76	113.58	4.97
1.20				786.48	610.70	10.61	378.17	293.65	7.80	200.55	155.72	5.97
1.40				1030.02	799.80	12.38	495.27	384.58	9.09	262.65	203.95	6.96
1.60					1010.34	14.15	625.65	485.81	10.39	331.79	257.63	7.96
1.80							768.86	597.02	11.69	407.74	316.61	8.95
2.00							924.54	717.90	12.99	490.30	380.71	9.95
2.20								848.21	14.29	579.29	449.82	10.94
2.40										674.57	523.80	11.94
2.60										776.00	602.56	12.93
2.80										883.46	686.00	13.93
3.00										996.83	774.04	14.92



# Pressure Loses Table for Tig Pipes

Q	25x2,5			26x3			32x3			40x4		
	R1	R2	V	R1	R2	V	R1	R2	V	R1	R2	V
0.01	0.02	0.00	0.03	0.02	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.01
0.02	0.05	0.04	0.06	0.05	0.04	0.06	0.01	0.01	0.04	0.00	0.00	0.02
0.03	0.07	0.08	0.10	0.07	0.08	0.10	0.02	0.02	0.06	0.01	0.01	0.04
0.04	0.18	0.14	0.13	0.18	0.14	0.13	0.03	0.04	0.08	0.01	0.01	0.05
0.05	0.26	0.20	0.16	0.26	0.20	0.16	0.07	0.05	0.09	0.02	0.02	0.06
0.06	0.36	0.28	0.19	0.36	0.28	0.19	0.10	0.08	0.11	0.04	0.03	0.07
0.07	0.48	0.37	0.22	0.48	0.37	0.22	0.13	0.10	0.13	0.05	0.04	0.09
0.08	0.60	0.47	0.25	0.60	0.47	0.25	0.17	0.13	0.15	0.07	0.05	0.10
0.09	0.74	0.57	0.29	0.74	0.57	0.29	0.21	0.16	0.17	0.08	0.06	0.11
0.10	0.89	0.69	0.32	0.89	0.69	0.32	0.25	0.20	0.19	0.09	0.07	0.12
0.12	1.23	0.95	0.38	1.23	0.95	0.38	0.35	0.27	0.23	0.13	0.10	0.15
0.14	1.61	1.25	0.45	1.61	1.25	0.45	0.46	0.36	0.26	0.17	0.13	0.17
0.16	2.04	1.58	0.51	2.04	1.58	0.51	0.58	0.45	0.30	0.21	0.17	0.20
0.18	2.51	1.95	0.57	2.51	1.95	0.57	0.72	0.56	0.34	0.27	0.21	0.22
0.20	3.02	2.34	0.64	3.02	2.34	0.64	0.86	0.67	0.38	0.32	0.25	0.25
0.30	6.14	4.76	0.95	6.14	4.76	0.95	1.76	1.37	0.57	0.65	0.51	0.37
0.40	10.16	7.89	1.27	10.16	7.89	1.27	2.92	2.26	0.75	1.08	0.84	0.50
0.50	15.01	11.65	1.59	15.01	11.65	1.59	4.31	3.35	0.94	1.61	1.25	0.62
0.60	20.65	16.04	1.91	20.65	16.04	1.91	5.94	4.61	1.13	2.21	1.72	0.75
0.70	27.05	21.00	2.23	27.05	21.00	2.23	7.78	6.04	1.32	2.90	2.25	0.87
0.80	34.17	26.53	2.55	34.17	26.53	2.55	9.82	7.63	1.51	3.66	2.84	0.99
0.90	42.00	32.61	2.86	42.00	32.61	2.86	12.07	9.37	1.70	4.50	3.49	1.12
1.00	50.50	39.21	3.18	50.50	39.21	3.18	14.52	11.27	1.88	5.41	4.20	1.24
1.20	69.48	53.95	3.82	69.48	53.95	3.82	19.98	15.51	2.26	7.45	5.78	1.49
1.40	91.00	76.66	4.46	91.00	76.66	4.46	26.17	20.32	2.64	9.76	7.57	1.74
1.60	114.96	89.26	5.09	114.96	89.26	5.09	33.06	25.67	3.01	12.33	9.57	1.99
1.80	141.27	109.70	5.73	141.27	109.70	5.73	40.62	31.54	3.39	15.15	11.76	2.24
2.00	169.88	131.91	6.37	169.88	131.91	6.37	48.85	37.93	3.77	18.22	14.14	2.49
2.20	200.71	155.85	7.00	200.71	155.85	7.00	57.72	44.82	4.14	21.52	16.71	2.74
2.40	233.72	181.48	7.64	233.72	181.48	7.64	67.21	52.19	4.52	25.06	19.46	2.98
2.60	268.87	208.77	8.28	268.87	208.77	8.28	77.32	60.04	4.90	28.83	22.39	3.23
2.80	306.10	237.68	8.91	306.10	237.68	8.91	88.03	68.35	5.27	32.83	25.49	3.48
3.00	345.38	268.18	9.55	345.38	268.18	9.55	99.32	77.12	5.65	37.04	28.76	3.73

Inner surface  
roughness : 0.006 mm

Density : 998 kg/m<sup>3</sup> (200°C) Viscosity : 1.02 x10<sup>-6</sup> m<sup>2</sup>/s  
972 kg/m<sup>3</sup> (800°C) 3.70 x10<sup>-7</sup> m<sup>2</sup>/s

Q = flow rate (lt/second) R = pressure loss (mbar/m) V = velocity (m/s)

## Specifications of PEX-AL-PEX Pipes (Multi Layer TIG Pipes)

### Tig Pipes - Temperature Changes - Longitudinal Extension

For the applications of Tig pipes, longitudinal extensions rooted from temperature changes should be taken into consideration.

Longitudinal extensions are defined with the following formula:

$$\Delta L = \lambda \cdot L \cdot \Delta T$$

$\Delta L$  = extension (mm)

$\Delta T$  = temperature change

$L$  = pipe length

$\lambda$  = coefficient of thermal expansion  
(0,025 mm/m°K)

Example:

Room temperature = 20 °C

Fluid temperature = 85 °C

Pipe Length = 18 m

$\lambda$  (coefficient of thermal expansion) = 0,025 mm/m°K

$$\Delta T = 85 - 20 = 65^\circ\text{C}$$

$$\Delta L \text{ (extension)} = 0,025 \times 18 \times 65$$

$$\Delta L = 29,25 \text{ mm}$$

### Comparison of longitudinal extension values for various pipe types at 50 °C temperature change (L=10m)

Stainless steel pipes	5.5 mm
Copper pipes	8.25 mm
Tig Pipes	13 mm
PVC pipes	40 mm
PB pipes	75 mm
PP pipes	75 mm

### Longitudinal expansion at Tig Pipes rooted from temperature change

Length (m)	$\Delta T$ 10	$\Delta T$ 20	$\Delta T$ 30	$\Delta T$ 40	$\Delta T$ 50	$\Delta T$ 60	$\Delta T$ 70	$\Delta T$ 80
0.50	0.12	0.25	0.25	0.50	0.62	0.75	0.87	1.00
1.0	0.25	0.50	0.50	1.00	1.25	1.50	1.75	2.00
2.0	0.50	1.00	1.00	2.00	2.50	3.00	3.50	4.00
3.0	0.75	1.50	1.50	3.00	3.75	4.50	5.25	6.00
4.0	1.00	2.00	2.00	4.00	5.00	6.00	7.00	8.00
5.0	1.25	2.50	2.50	5.00	6.25	7.50	8.75	10.00
6.0	1.50	3.00	3.00	6.00	7.50	9.00	10.50	12.00
7.0	1.75	3.50	3.50	7.00	8.75	10.50	12.50	14.00
8.0	2.00	4.00	4.00	8.00	10.00	12.00	14.00	16.00
9.0	2.25	4.50	4.50	9.00	11.25	13.50	15.75	18.00
10.0	2.50	5.00	5.00	10.00	12.50	15.00	17.50	20.00

### Tig Pipe - Bracelet Spacing

$\Delta T$ (°C)	Ø14 mm	Ø16 mm	Ø18 mm	Ø20 mm	Ø25 mm	Ø26 mm	Ø32 mm	Ø40 mm
0	120	130	135	155	170	170	190	230
10	110	115	120	140	150	150	155	185
20	110	100	110	120	130	130	155	185
30	110	100	110	120	130	130	150	175
40	90	100	110	110	120	120	145	175
50	90	90	100	110	120	120	145	170
60	80	80	90	100	110	110	140	160
70	70	70	80	90	100	100	130	150



## Specifications of PEX-AL-PEX Pipes (Multi Layer TIG Pipes)

### Tig Pipes - Table for Resistance to Chemicals

Compound	Concentration %	T ( C )	Resistance
<b>Acetic Acid</b>	<10	20	R
		60	R
		80	R
	<40	20	R
		60	R
	<60	20	R
<b>Allyl Alcohol</b>	Tg-I	50	NR
<b>Amyl Acetate</b>	Tg-I	20	LR
		60	LR
		80	LR
<b>Amyl Alcohol</b>	Tg-I	20	R
		60	R
<b>Acetone</b>	Tg-I	20	R
		60	LR
<b>Benzene</b>	Tg-I	20	R
		60	x
<b>Calcium Chloride</b>	con.solution	20	R
		60	R
		80	R
<b>Calcium Nitrate</b>	con.solution	20	R
		60	R
<b>Carbon Disuipnide</b>	Tg-I	80	R
		20	x
<b>Carbon Tetra Chiorige</b>	Tg-I	20	LR
		60	NR
<b>Chiorobenzene</b>	Tg-I	20	R
		60	LR
		80	LR
		100	NR
<b>Chiorotorm</b>	Tg-I	20	NR
		60	NR
<b>Ethylene Glycol</b>	Tg-I	20	R
		60	R
		80	R
		100	R
<b>Ethyl Ether</b>	Tg-I	20	R
		20	R
<b>Formic Acid</b>	10	60	R
		20	R
	40	60	R
		20	R
	50	60	R
		20	R
<b>Freon - F12</b>	op.solution	20	R

Tig Pipes - Table for Resistance to Chemicals

Compound	Concentration %	T (C )	Resistance
Heptane	Tg-I	20	R
		60	R
		80	NR
		20	R
Hydrochloric Acid	<10	60	R
		80	R
		100	R
		20	R
	<20	60	R
		80	R
		100	R
		20	R
	>25	60	R
		80	R
		100	R
		20	R
Methyl Alcohol	Tg-I	60	R
		80	R
		100	R
		20	R
		60	R
		80	R
Methyl Ethyl Ketone	Tg-I	20	R
		60	R
		80	R
Mineral Oils	op.solution	20	R
		60	R
		80	LR
Naphtha	op.solution	20	R
		60	R
		80	R
	5	20	R
		60	LR
		80	LR
Nitric Acid	10	20	R
		60	LR
		80	LR
		100	LR
	20	20	R
		60	LR
		80	LR
		100	LR

## Specifications of PEX-AL-PEX Pipes (Multi Layer TIG Pipes)

Tig Pipes - Table for Resistance to Chemicals

Compound	Concentration %	T (C)	Resistance
Potassium Hydroxide	solution	20	x
		60	x
	10	20	R
		60	R
	20	20	R
		60	R
		80	R
		20	R
	50	60	R
		80	R
		20	X
		60	X
Sodium Hydroxide	saturated sol.	20	R
		60	R
	1	20	R
		60	R
	1-35	20	R
		60	R
	40-60	20	R
		60	R
	40	20	R
		60	R
	<10	20	R
		60	R
Sulfuric Acid	15	20	R
		60	R
	15-30	20	R
		60	R
	<50	20	R
		60	R
	50-75	20	R
		60	R
	50-90	20	NR
		60	LR
	95	80	NR
		20	R
	96	60	LR
		80	NR

**s.solution:** Saturated aqueous solution (20 °C)

**solution:** Concentration higher than 10 %, unsturated aqueous solution

**Tg-I:** Fluid with technical purity

**op.solution:** Operatinf solution, with the concentration most widely used in industry

**R:** Resistant

**LR:** Limited resistance

**NR:** Non resistant

**X:** No available data\*

\*Derived from the data of ISO 10358 standard

# Production Line

## TIG Pipe Production Line

The quality control processes of Tig Pipes, which are produced with the latest technology, are carried out simultaneously with the production. Ultrasonic and laser measurement devices working on all production lines measure the diameter, wall thickness and ellipticity values of the pipes fully automatically and prevent faulty production by giving visual and audio alarms in case of a fault detection.





# Installation

## PEX-AL-PEX Pipe (Multi Layer TIG Pipe) Bridge Construction

By the use of a bender, you have the chance to easily give the bridge shape to the Tig pipe in a few steps at the mounting stage.



### TIG PIPE EXPANDER



Code	Pieces	Packing Type
8490000001	1	Pieces

### TIG PIPE CUTTER



Code	Pieces	Packing Type
8490000002	1	Pieces

### TIG PIPE BENDER



Code	Pieces	Packing Type
8490000003	1	Pieces

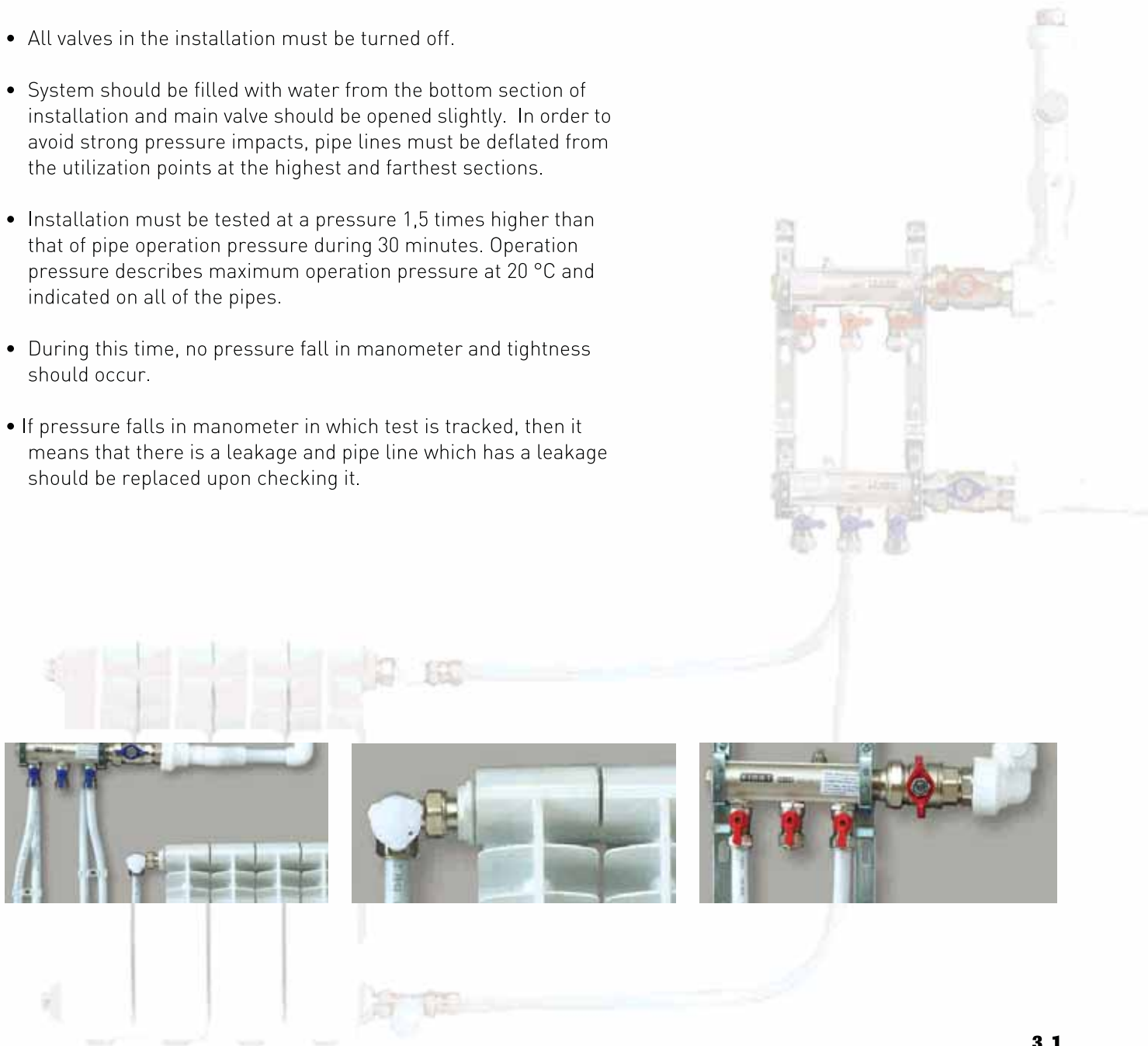
# Test After Installation

## Testing FIRAT PEX-AL-PEX Pipe Installation

Before covering the installation, which is laid, operation, pressure and tightness test must certainly be conducted. Water should be supplied into system with a pump and a manometer that will enable observation of desired pressure value from test pump should be attached.

### For Pressure Test:

- All points that are open in installation which is tested must be closed.
- All valves in the installation must be turned off.
- System should be filled with water from the bottom section of installation and main valve should be opened slightly. In order to avoid strong pressure impacts, pipe lines must be deflated from the utilization points at the highest and farthest sections.
- Installation must be tested at a pressure 1,5 times higher than that of pipe operation pressure during 30 minutes. Operation pressure describes maximum operation pressure at 20 °C and indicated on all of the pipes.
- During this time, no pressure fall in manometer and tightness should occur.
- If pressure falls in manometer in which test is tracked, then it means that there is a leakage and pipe line which has a leakage should be replaced upon checking it.



## **FIRAT sells to a lot of Countries in Europe, Asia and Africa**



### **Countries to which FIRAT exports:**

Afghanistan	India	Poland
Albania	Iran	Portugal
Algeria	Iraq	Qatar
Azerbaijan	Italy	Romania
Bahreyn	Jordan	Russia
Belarus	Kazakhstan	Saudi Arabia
Belgium	Kirghizstan	Serbia
Bulgaria	Kosovo	Slovenia
Bosnia and Herzegovina	Kuwait	South Africa
China	Lebanon	Spain
Croatia	Libya	Sudan
Egypt	Macedonia	Sweden
England	Malta	Syria
Ethiopia	Moldovia	Tajikistan
France	Morocco	Tunisia
Gambiya	Netherlands	Turkmenistan
Georgia	Nigeria	Ukraine
Germany	Montenegro	United Arab Emirates
Greece	TR of Northern Cyprus	Uzbekistan
Hungary	Pakistan	Yemen