

TURN-KEY
MANUFACTURING PLANT
for
PE PIPE FITTINGS

SAUDI ARABIA

~ PRELIMINARY OFFER ~



By pursuing the principles of "quality, technological innovation, high-quality service, reputation", we dedicate our excellent products with good price and service to society and people.

1. General	3
2. System design	3
2.1. Products	3
2.2. Advantage of PE Material	4
2.3. Fields of application of PE Fittings	5
3. PE Fittings Product Characteristics	5
3.1. PE Fittings Joining Types	5
3.2. Diameter and classes	6
3.3. Electro fusion Welding Technique	6
3.4. Fittings.....	7
3.5. Fittings Standards.....	13
4.1-Injection Moulds:	13
4.2-Wire laying Process:	14
4.2-Quality Control Testing Methods.....	19
Factory Layout And Installations	30
Total Extension.....	30
Manufacturing Unit Building.....	30
PE material Store And Feeding System.....	31
Utilities And Ancillary Installations.....	31
Electric Installations	33
Plant Management And General Services Personnel	35
Process Equipment Personnel	35
Fitting Manufacturing, Testing and Handling	35
Total Manpower	36
ACTIVITIES	39

1. General

PE pipe fittings are manufactured from Polyethylene material using injection machine and fittings moulds.

The present report covers the implementation of a new factory for the manufacture of PE Pipe Fittings through the establishment of:

Fittings Moulds and Injection Machine systems

The present quotation incorporates within its scope all necessary machinery, equipment, apparatus and installations that are required for the manufacture of PE Pipe Fittings. The only items that are outside the scope of this quotation are mainly land, construction, infrastructure works, etc.

2. System design

2.1. Products

The final product to be manufactured in the plant is PE PIPE FITTINGS. The specific capacity of the plant has been designed such that the plant may adjust production in accordance with the requirements of the project.

	<u>COUPLER (Electrofusion)</u>		<u>EF EQUAL TEE</u>
	<u>GAS-STOP SYSTEMS</u>		<u>EF REDUCER</u>
	<u>TAPPING TEE (Electrofusion)</u>		<u>EF ELBOW 45°</u>
	<u>VALVE TAPPING TEE (Electrofusion)</u>		<u>EF ELBOW 90°</u>
	<u>SADDLE (Electrofusion)</u>		<u>REPAIR SADDLE (Electrofusion)</u>
	<u>END CAP (Electrofusion)</u>		<u>PE/STEEL TRANSITION FITTING</u>

	<u>EQUAL TEE</u>		<u>REDUCED TEE</u>
	<u>REDUCER</u>		<u>PE/STEEL TRANSITION ADAPTOR</u>
	<u>45° ELBOW</u>		<u>FLANGE</u>
	<u>90° ELBOW</u>		<u>FLANGE ADAPTOR</u>

2.2. Advantage of PE Material

The material used in PE fittings products is polyethylene (PE) which is black and stabilized against the effect of UV radiation by addition of carbon black. It is also compatible with food-stuffs and physiologically and toxicologically safe.

PE materials are classified according to their strengths as PE63, PE80 and PE100. TEGA uses PE 100 raw material in its productions.

Advantages of PE Material

PE is the most widely used in pipeline systems for assembly of buried gas and water piping. This material also offers many advantages in domestic installations and industrial piping systems. Some of these are;

- low weight,
- excellent flexibility and high stability against strokes,
- non-corrosive
- low pipe friction losses,
- good chemical resistance
- low maintenance and repair costs,
- possibility to take service lines from a live main.

PE pipes and fittings are classified on three main criteria;

- Type of material (PE80 , PE100)
- Pressure Number (PN 10, PN 16)
- Standard Dimensional Ratio SDR (ratio of diameter to wall thickness)

2.3. Fields of application of PE Fittings

Water distribution both civil and industrial	Gasoline handling and distribution network
Fire fighting network	Corrosive fluids and vent gas stacks
Water intakes for cooling water systems	Well casing and wells pumps risers
Sealines and river crossings	FGD (flue gas esulphurization)
Process lines for industrial plants	Flue gas stack

3. PE Fittings Product Characteristics

3.1. PE Fittings Joining Types

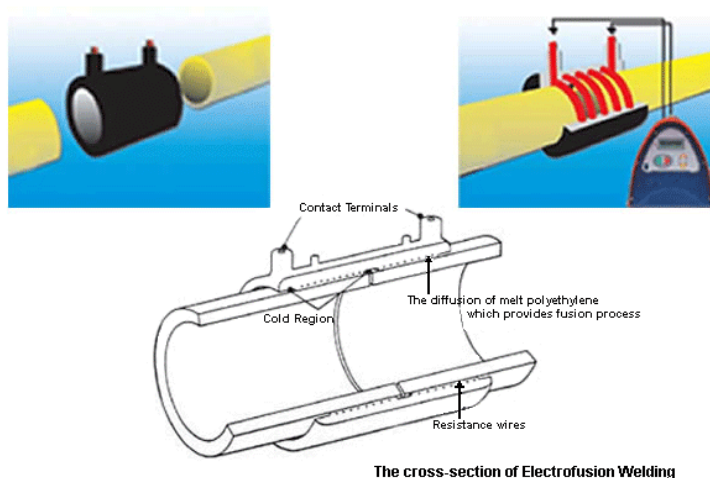
The most common jointing techniques for PE materials are ;

- Electrofusion (EF)
- Socket Fusion
- Butt Fusion

Electrofusion: The socket of the EF fitting incorporates an electrical heating coil. When energized, the coil causes the material adjacent to it to melt and comes into contact with the surface of the pipe.

Advantages of EF Jointing Technique

- there is no decrease in inner diameter of the pipe,
- low weight, low cost and flexibility of the equipment ,
- high operation rates,
- fully automated operation, so need for skilled operator is at minimum level,
- no reduction in strength of material at jointed parts.



3.2. Diameter and classes

- Nominal Diameter:

Generally, PE Pipe Fittings are manufactured in diameters ranging from 20 mm to 630mm. Nominal diameter coincides with the outer diameter
Any nominal diameter can be manufactured
Larger diameters can be manufactured at side by means of special equipment

- Nominal Pressure Classes:

Nominal pressure classes are PN 6, 8, 10, 12.5, 16, 20, 25 bar
Intermediate or higher pressure classes are considered on request or depending on the design conditions

Boru Sınıfı Pipe Class	ISO	PE100 İşletme Basıncı Operating Pressure	PE80 İşletme Basıncı Operating Pressure
SDR 7.4	ISO 3.2	PN 25	PN 20
SDR 9	ISO 4.0	PN 20	PN 16
SDR 11	ISO 5.0	PN 16	PN 12.5
SDR 17	ISO 8.0	PN 10	PN 8
SDR 27.5	ISO 13.3	PN 6	---

3.3. Electro fusion Welding Technique

There are two basic elements of electrofusion jointing system;

- **electrofusion fitting** and
- **electrofusion welding machine** (when connected with the fitting applies the necessary voltage during the fusion period)

All electrofusion fittings employ the same basic principle. Plain pipes are jointed by means of electrofusion (EF) fitting incorporating an electrical heating coil which when electrically activated for the appropriate time by EF welding machine, melts the surface of the pipe & fitting together resulting in complete fusion of the pipe and EF fitting. There is a barcode label on each of the EF fittings. This label includes fusion parameters (such as welding

voltage and duration). Fusion parameters are transferred to the machine from this label either manually or by using the barcode reader.

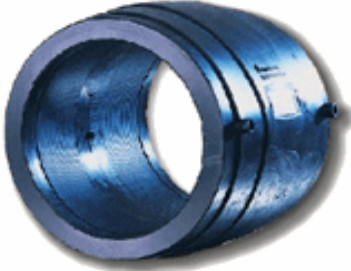
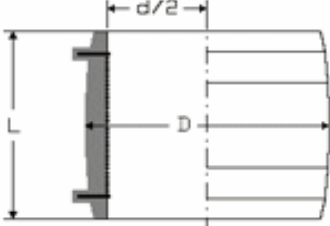
EF Welding Sequence


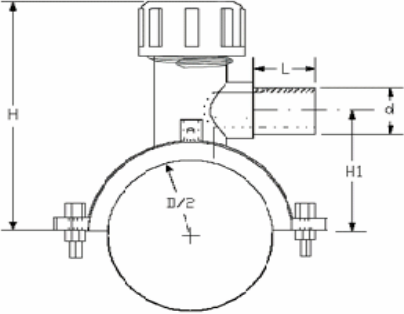
- pipe ends or spigot ended fittings are inserted in the EF fitting,
- contact terminals of the machine are connected with the sockets of the fitting,
- fusion parameters are transferred to the machine,
- necessary energy is applied to the fitting
- heated coil causes the material adjacent to it to melt and comes into contact with the surface of the pipe. This causes the pipe to melt, leading to fusion of pipe and socket.


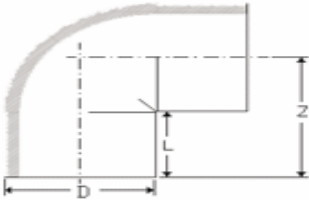

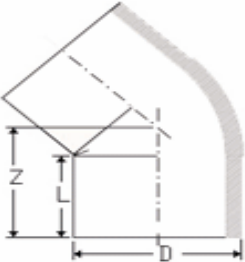
3.4. Fittings

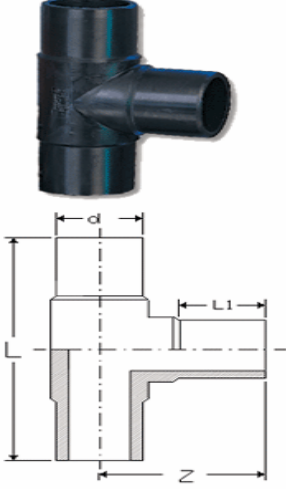
A wide range of fittings and special pieces can be manufactured in PE pipe fittings. They present, therefore, the same characteristics, both chemical and mechanical of the pipes. Fittings are manufactured using injection machine or welding techniques.

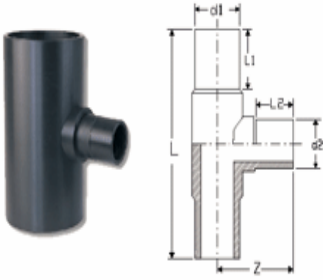
We will offer at the First Phase of the project the following fittings which are widely used on the market. The fittings production includes:


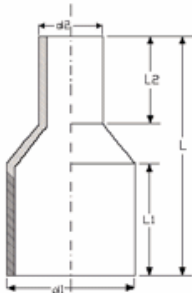
Name	No	Specification mm
<p data-bbox="421 474 798 510">MANŞON / COUPLER</p> <p data-bbox="443 515 775 546">SDR 11, PE 100, Type: EF</p> <p data-bbox="529 548 689 577">Gas: 10 Bar</p> <p data-bbox="517 580 702 609">Water: 16 Bar</p>  	1	20
	2	25
	3	32
	4	40
	5	50
	6	63
	7	75
	8	90
	9	110
	10	125
	11	140
	12	160
	13	180
	14	200
	15	225
	16	250
	17	280
	18	315
	19	355
	20	400
	21	450
	22	500
	23	560
	24	630

Name	No	Specification mm
<p data-bbox="437 725 740 815">SERVIS TEE / TAPPING TEE SDR 11, PE 100, Type : EF Gas : 10 Bar Water : 16 Bar</p>  	1	20 40 x 25 32
	2	20 63 x 25 32 40
	3	50 63 x 63
	4	20 90 x 25 32 40
	5	50 90 x 63
	6	20 110 x 25 32 40
	7	50 110 x 63
	8	20 125 x 25 32 40
	9	50 125 x 63
	10	20 140 x 25 32 40
	11	50 140 x 63
	12	20 160 x 25 32 40
	13	50 160 x 63

Name	No	Specification mm
<p data-bbox="416 389 826 501">DİRSEK / ELBOW-90° SDR 11, PE 100, Type: Spigot Gas: 10 Bar Water: 16 Bar</p>  	1	20
	2	25
	3	32
	4	40
	5	50
	6	63
	7	75
	8	90
	9	110
	10	125
	11	140
	12	160
	13	180
	14	200
	15	225
<p data-bbox="424 1160 834 1283">DİRSEK / ELBOW-45° SDR 11, PE 100, Type: Spigot Gas: 10 Bar Water: 16 Bar</p>  	1	20
	2	25
	3	32
	4	40
	5	50
	6	63
	7	75
	8	90
	9	110
	10	125
	11	140
	12	160
	13	180
	14	200
	15	225

Name	No	Specification mm
<p>EŞİT TE / EQUAL TEE SDR 11, PE 100, Type: Spigot Gas: 10 Bar Water: 16 Bar</p> 	1	20
	2	25
	3	32
	4	40
	5	50
	6	63
	7	75
	8	90
	9	110
	10	125
	11	140
	12	160
	13	180
	14	200
	15	225

Name	No	Specification mm
<p>İNEGAL TE / REDUCED TEE SDR 17, PE 100, Type: Spigot Gas: 4 Bar Water: 10 Bar</p> 	1	90x63
	2	110x63
	3	110x90
	4	125x63
	5	125x90
	6	125x110
	7	140x90
	8	140x110
	9	140x125
	10	160x90
	11	160x110
	12	160x125
	13	160x140

Name	No	Specification mm
<p data-bbox="391 515 702 548">REDÜKSİYON / REDUCER</p> <p data-bbox="406 548 686 577">SDR 11, PE 100, Type: Spigot</p> <p data-bbox="486 577 606 604">Gas: 10 Bar</p> <p data-bbox="486 604 606 631">Water: 16 Bar</p>  	1	32x20
	2	32x25
	3	40x32
	4	63x32
	5	63x40
	6	63x50
	7	90x63
	8	110x63
	9	110x90
	10	125x63
	11	125x90
	12	125x110
	13	140x90
	14	140x125
	15	160x90
	16	160x110
	17	160x125
	18	180x125
	19	180x140
	20	180x160
	21	225x125
	22	225x160
	23	225x180

3.5. Fittings Standards

- DIN 16963

- EN 1555

- EN 12201

4. MANUFACTURING PROCESS

The manufacturing processes are used for PE fittings:

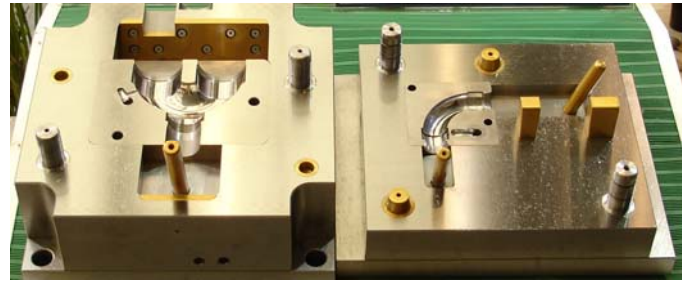
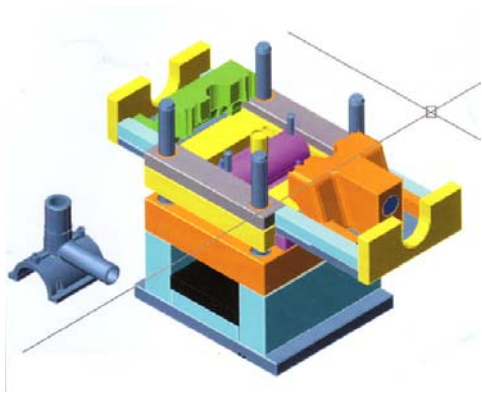
The manufacturing process is based on the injection molding and complies with DIN and EN standards.



4.1- Injection Moulds:

PE fitting is manufactured by inject the molten PE material through injection molding machines into steel moulds. For every type of fittings, a separate moulds are needed.

HDPE 80 or HDPE 100 can be used based on the demand.



4.2-Wire laying Process:

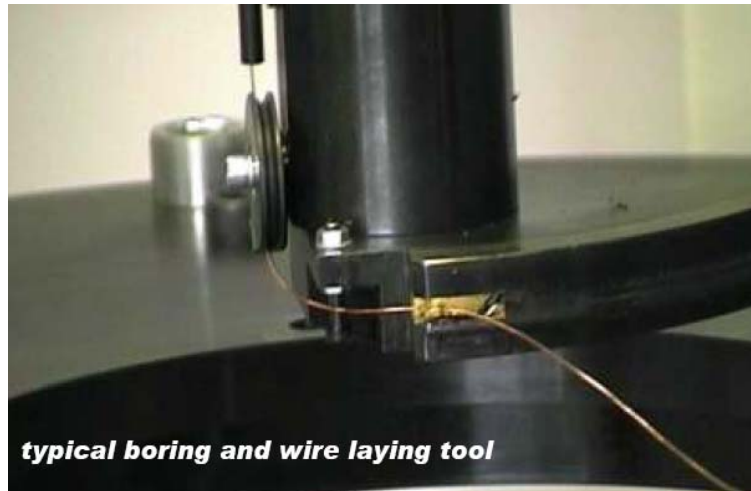
After injection molding process, to manufacture EF fittings, the copper wire is embedded into the fittings by an innovative CNC wire laying machine.



wire laying benefits

Developed as an alternative to inserting wire coils at the initial moulding stage of electrofusion fitting manufacture, laying the wire after the fitting has been moulded offers several advantages unique to the process:

- **injection moulding cycle time can be reduced, thereby increasing the utilisation of moulding machines**
- **moulded fittings are in a stable condition when the wire laying process is carried out, producing a high tolerance product**
- **this results in an increased welding tolerance between pipe and fitting, coupled with increased strength of weld**
- **the process reduces capital set-up costs, reduced setting times and is easy to operate**



basic operation

Moulded fittings or pipe sections are manually loaded into specially designed fixtures fitted to the main spindle(s) of the machine. Each fixture is designed to hold a range of fittings by pneumatically powered clamp and keep plates that suit individual fitting types.

boring and wire laying

The production cycle consists of three main operations:

- > **boring and chamfering**
- > **wire laying cycle**
- > **final boring**

A range of boring and wire laying tooling is available for each machine, covering all fitting sizes. The tooling includes single pass and double wire laying. Special tooling applications can be quoted for.

operating sequence

one

The fitting is manually loaded into the machine fixture.

two

The boring cycle is started, which moves the boring bar into the fitting at high speed in order to bore the inside diameter to size. The machine is programmed to stop the wire laying tool at the first termination on the fitting.

three

The wire is manually hooked through the termination hole in the fitting and attached to the fixture.

four

The wire laying part of the program is then run, typically laying the first fusion zone, cold fusion zone and finally the second fusion zone.

five

The wire laying tool then positions next to the second termination hole of the fitting.

six

The wire is manually pulled through the second hole in the fitting and trimmed.

seven

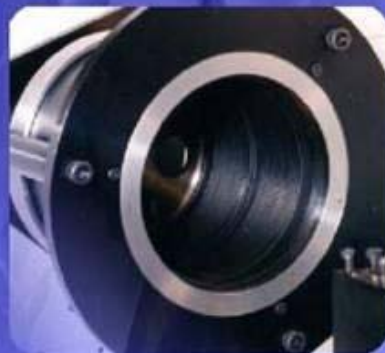
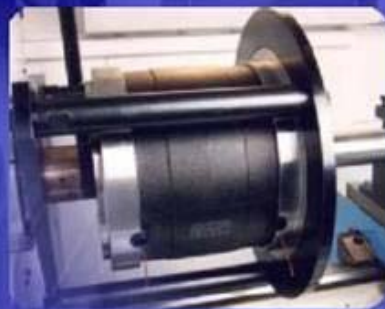
The boring bar then advances and finish bores the fitting at high speed to remove any excess material.

eight

The tool then moves to a pre-set wait position and the machine guards automatically open for manual removal of the fitting.

nine

Another fitting can now be loaded and the operating sequence repeated.



5-PRODUCTION EQUIPMENT SUPPLIED

MACHINE	TYPE	NO
INJECTION MACHINE	160 Ton	1
INJECTION MACHINE	200 Ton	1
INJECTION MACHINE	420 Ton	1
INJECTION MACHINE	500 Ton	1
INJECTION MACHINE	600 Ton	1
INJECTION MACHINE	1300 Ton	1
INJECTION MACHINE	1600 Ton	1
WIRE LAYING MACHINE		2
LATHE	520/1500mm	2
PRESS	10 Tone	1
RADIAL DRILL	Ø 32	1
COMPRESSOR	14m ³ /h	1
JENERATOR	1000kVA	1





4.2-Quality Control Testing Methods

4.2.1 Density Specification (ISO 1183)

It is done in the aim of determining the equipments' weight of unit volume. The equipment is scaled with analytical scale in the air, and then in fluid whose density is known in advance. Then, the density is found using the calculation specified in the standards.

4.2.2 MFI (Melt Flow Index) Specification (ISO 1133)

It is used to investigate the behaviour of the equipment in heat before it is processed. The samples taken from the test done with MFI machine are scaled and the values are loaded into the machine and the result is found with gr/10 min. Unit.

4.2.3 Breaking Resistance (ISO 527)

The equipment's flexibility module and breaking resistance is found in the test in which the behaviour of the equipment against force.



4.2.4 Breaking Stretching (ISO 527)

It is the test in which the stretching amount is determined during the breaking in percentage.

4.2.5 Hydrostatic Pressure Test (ISO 9080 EN 921)

It is the test in which the behaviour of the pipes under pressure in time are investigated in shortened environmental conditions. The changes on the pipes within 50 years are observed applying high pressure to the pipes.

4.2.6 Carbon Black Amount Test (ISO 6964)

It is done to find carbon amount to increase resistance to UV rays under refinery conditions homogenously in percentage. The amount of carbon which will not burn in oven working with nitrogen is found in percentage.



All process equipment and utilities, services, installations and services required for the proper operation of the plant and within the scope of the project have been clearly indicated. All other items and infrastructure that have to be provided by the Client have been indicated separately to visualize the total scope of the investment. All equipment depicted with relevant technical details in this document are being offered as installed in their positions, all connections completed and ready for operation.

2.2. Production Capacity

We have taken into consideration that the plant will operate on one shift of total 8 hours per day and the capacity of the major equipment have been designed to fulfill the required quantity within this period.

This also means that in the future, as market requirements grow, the plant may double or triple its manufacturing capability simply by increasing the number of working shifts per day.

Range of producible fittings and factory capacity, are sized in order to satisfy the local needs of potable water lines and networks, irrigation and sewer systems.

The proposed factory is sized for an average manufacturing capacity of 2400/year of finished fittings products based on 1 shift of 8 working hours each shift, and on 300 working days/year.

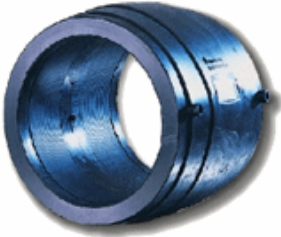
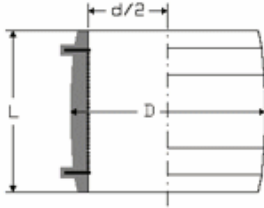
2.6. Engineering and Technical Assistance

All basic and detailed engineering work as well as technical assistance services required for the design, installation and operation of the plant in the best possible way are included within the scope of this offer. These services have been described in detail after contract signed.


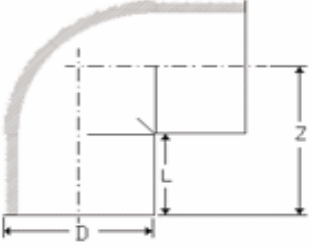
2.7. Training and start-up

The proper training of the plant personnel and the starting up of the plant in the best possible way are included within the scope of this offer and sufficient detailed information have been provided.


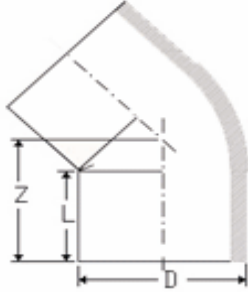
4. Price for the fittings moulds for PE PIPE

No	Adı	Specification mm	Cavity No.	USD
1	<p>MANŞON / COUPLER SDR 11, PE 100, Type: EF Gas: 10 Bar Water: 16 Bar</p>  	20	2	4.375
2		25	2	5.500
3		32	2	6.900
4		40	2	7.200
5		50	2	7.700
6		63	2	9.500
7		75	2	10.500
8		90	1	8.800
9		110	1	12.500
10		125	1	13.250
11		140	1	17.000
12		160	1	18.250
13		180	1	24.500
14		200	1	27.500
15		225	1	32.000

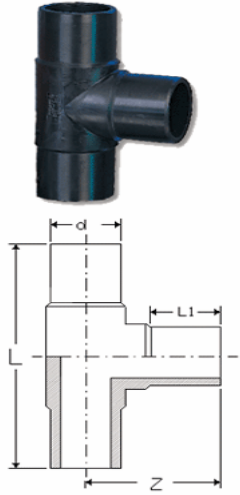
Total: 205.475

No	Name	Specification mm	Cavity No	USD
1	DİRSEK / ELBOW-90° SDR 11, PE 100, Type: Spigot Gas: 10 Bar Water: 16 Bar  	20	2	6.200
2		25	2	7.500
3		32	2	8.000
4		40	2	8.800
5		50	2	11.500
6		63	1	8.000
7		75	1	9.000
8		90	1	11.000
9		110	1	16.500
10		125	1	23.000
11		140	1	28.000
12		160	1	34.000
13		180	1	39.000
14		200	1	40.000
15		225	1	48.000

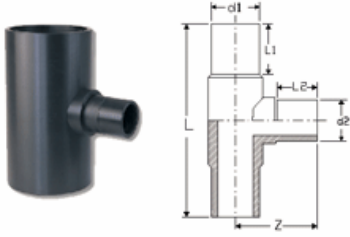
Total: 298.500

No	Name	Specification mm	Cavity No	USD
1	DİRSEK / ELBOW-45° SDR 11, PE 100, Type: Spigot Gas: 10 Bar Water: 16 Bar  	20	2	6.200
2		25	2	7.500
3		32	2	8.000
4		40	2	8.800
5		50	2	11.500
6		63	1	8.000
7		75	1	9.000
8		90	1	11.000
9		110	1	23.705
10		125	1	23.000
11		140	1	28.000
12		160	1	34.000
13		180	1	39.000
14		200	1	40.000
15		225	1	48.000

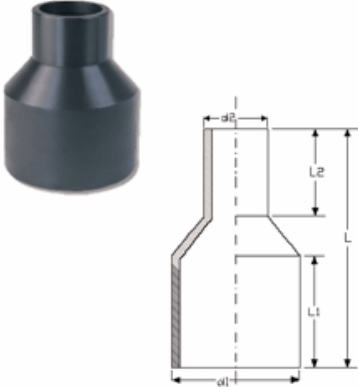
Total: 305.705

No	Name	Specification mm	Cavity No	USD
1	EŞİT TE / EQUAL TEE SDR 11, PE 100, Type: Spigot Gas: 10 Bar Water: 16 Bar 	20	2	7.000
2		25	2	8.200
3		32	2	9.000
4		40	2	12.000
5		50	2	13.500
6		63	1	11.250
7		75	1	14.000
8		90	1	15.000
9		110	1	23.000
10		125	1	27.000
11		140	1	40.000
12		160	1	50.000
13		180	1	59.000
14		200	1	62.000

Total: 350.950

no	Name	Specification mm	Cavity No	USD
1	İNEGAL TE / REDUCED TEE SDR 17, PE 100, Type: Spigot Gas: 4 Bar Water: 10 Bar 	90x63	1	15.000
2		110x63	1	23.000
3		110x90	1	24.000
4		125x63	1	26.000
5		125x90	1	27.000
6		125x110	1	28.000
7		140x90	1	39.000
8		140x110	1	40.000
9		140x125	1	41.000
10		160x90	1	49.000
11		160x110	1	50.000
12		160x125	1	51.000
13		160x140	1	52.000

Total: 465.000

No	Name	Specification mm	Cavity No	USD
1	<p>REDÜKSİYON / REDUCER SDR 11, PE 100, Type: Spigot Gas: 10 Bar Water: 16 Bar</p> 	32x20	2	6.000
2		32x25	2	6.500
3		40x32	2	7.000
4		63x32	2	8.000
5		63x40	2	8.250
6		63x50	2	8.500
7		90x63	1	7.000
8		110x63	1	10.000
9		110x90	1	10.500
10		125x63	1	11.000
11		125x90	1	11.500
12		125x110	1	12.000
13		140x90	1	15.000
14		140x125	1	16.000
15		160x90	1	18.000
16		160x110	1	19.000
17		160x125	1	20.000
18		180x125	1	26.000
19		180x140	1	27.000
20		180x160	1	28.000
21		225x125	1	33.000
22		225x160	1	34.000
23		225x180	1	35.000

Total: **377.250**

5. Manufacturing feasibility cost analysis

In the following pages, separate tables have been provided with all basic elements and factors of costs that will be encountered during the manufacture of PE Pipe fittings. Relevant and real life budget values have been provided for the quantities consumed; relevant data have also been provided for the prices for raw materials that will have to be imported together with operational costs of manpower, electricity, utilities, etc. in order to arrive at the final feasibility of the project.

6. OUR Guarantees

6.1. Manufacturing capacity guarantee

It is under the guarantee of US that the processing Capacity of the plant will not be below **3000 kg / year**

6.2. Product quality guarantee

It is under the guarantee of us that the fittings manufactured in the plant will meet the minimum quality specifications of international standards.

6.3. Plant and equipment quality guarantee

It is under the guarantee of us that each individual specific process equipment and the total of the process plant will meet the design and quality specifications of quotation.

6.4. Technical assistance guarantee

It is under the guarantee of us that all the engineering, know-how, training, supervision and technical assistance services within the scope of this offer will be provided in the best possible way and transferred to the plant within the best proper means.

7. Technical Assistance

The technical assistance services which we will provide for the CLIENT are as follows:

7.1. Basic engineering

The necessary working documentation to be supplied to the Client under Basic Engineering may be summarized as follows:

7.1.1. Architectural

- . • **Site plan (1/1000 scale)**
- . • **Architectural drawings for all floors (1/200 scale)**
- . • **Sections**
- . • **Elevations**

- List of architectural rendering

7.1.2. Civil

- Design loads
- Structural system description
- Foundations system description

7.1.3. Mechanical

- Process piping specifications
- Equipment and piping heat insulation specification
- Preliminary equipment construction drawings
- Column designs for water, heat, sanitary, ventilation and gas systems

7.1.4. Electrical

- System drawings and reports
- Line diagrams for high and low voltage energy supplies
- Process instrumentation design
- Standards, specifications and locations of electrical consumers

7.1.5. Process

- Preliminary layout including equipment arrangement plan showing dimensions and
 - Locations of all equipment
 - Preliminary flow sheets with itemized apparatuses and machines for the process, indicating stand-by equipment, insulation thickness, scheme of pipelines and instrument
- Data sheets with process technique indications for
 - All process equipment
 - Preliminary process description with energy and auxiliary agent scheme, utility flow diagram and list of the measuring and controlling techniques

7.2. Detail engineering

The necessary working documentation to be supplied to the Client under Detail Engineering may be summarized as follows:

7.2.1. Architectural

- Architectural drawings (1/50 scale)
- Details (1/20; 1/10; 1/5; 1/1 scales)
- Furniture settings
- All relevant details for architectural rendering

7.2.2. Civil

- Statical calculations
- R.C. design, structural steel detail drawings

- Foundation detail design
- Detail drawings of roads, paved areas
- All technical infra-structural designs (water supply, sewage, etc.)

7.2.3. Mechanical

- Final procurement lists and specifications
- Constructional drawings of all equipment to be manufactured
- Operation and maintenance manuals of all machinery
- Detailed working drawings of all mechanical engineering systems

7.2.4. Electrical

- Detailed working drawings for all electrical engineering high and low voltage systems
- Detailed working drawings of all process control loops
- Final procurement lists and specifications

7.2.5. Process

- Final process flow sheets showing all machinery and equipment with item numbers and sizes as well as major process pipes and sizes and instrumentation diagrams
- Completion of data sheets
- List of machinery and equipment
- List of drawings
- Preliminary process calculation including chemical calculation

7.2.6. Process Manual

A detailed and complete Process Manual will be prepared as built by us and handed over to the Client. The Process Manual will consist mainly of the following:

- Documentation for operation and maintenance
- Layout specifications and locations
- Process description
- Process calculation
- Equipment drawings including all data (machines, instruments)
- Operation manuals for machines
- Final list of oils and greases
- List of spare parts
- Final drawings of control cabinets and switchboards
- Electrical documentation including lighting plans
- Quantity statement of the material flows, product quantities, utilities, raw materials and auxiliaries

- **List of drawings**
- **All laboratory analytical methods**
- **All technological documents for commissioning**
- **General operation instructions for the whole plant**
- **Lubrication plan**
- **Maintenance instructions**

8. Construction Requirements

Factory Layout And Installations

Total Extension

The factory should cover a rectangular shape plane area of about 10.000 m², of which 2000 m² covered area.

Manufacturing Unit Building

The manufacturing unit consists of a steel or reinforced concrete structure shed of rectangular shape plan and is divided into a process area and service zones.

The shed of the process area is sustained by two rows of columns providing 5 m height at crane hook and is completed with curtain walls made of masonry and transparent material.

The floor is made of leveled concrete 20 cm thick, reinforced with steel net and finished at surface with one cm of quartz paving.

The shed covers the following installations:

- Process area for fittings:
 - one overhead travelling crane (5 tons capacity)
- Services areas:
 - warehouse (shelves, welding and drilling machine, grinders and tools, spare parts).
 - quality control laboratory.
 - dressing rooms, showers and toilets.

pressure test equipment for fittings

PE material Store And Feeding System

PE storage silos should have at least 100 ton capacity. The PE is transferred to the injection machines by means of a air pressure.

Utilities And Ancillary Installations

The manufacturing shed should be completed with the following utilities and ancillary installations:

- fire fighting network, hydrants and hose reel boxes.
- wall mounted powder or CO2 extinguishers.
- fire fighting diesel pump (one unit).
- fire fighting electric jockey pump (one unit).
- concrete raw water reservoir.
- potable water network.
- raw water pump (one unit).
- raw water network.
- sewer network.
- shed venting systems.
- Two frontal fork lift 3 ton capacity
- fence and gates.

The positioning of the utilities equipment is shown on drawing attached herein. Brief description of some utilities is given here below:

- concrete reservoir:

The capacity of the reservoir is about 110 m³ whose 10 m³ are relevant to the raw water consumption, while 100 m³

are assured to the fire fighting system in order to allow for one hour autonomy.

- fire fighting system:

The fire fighting station is composed of one diesel engine operated pump and an electric motor jockey one. The diesel engine is provided with its own fuel daily tanks.

Foreseen head and flow rate of the diesel engine pump are respectively 100 m.c.l. and 100 m³/h, considering the future phase. The jockey pump continuously pressurizes the 8" network, at head and rate of 60 m.c.l. and 10 m³/hr respectively.

When pressure in the fire fighting network reduces below 3 bar, the diesel pump automatically starts and will be stopped by manual operations. Hydrants are distributed along the 8" fire fighting ring, each provided with two hose connections.

The hoses are contained in boxes located nearby the hydrants.

- compressed air system:

Envisaged flow rate is 5,000 l/min. at 7 bar. Compressed air piping, inside the shed, is composed of 2" pipes rings running on steel structures and provided with 1" shed crossing pipes, installed inside the ducts and wall mounted connections.

- potable water:

The potable water is fed by a 2" pipe, sectioned at factory battery limit by a gate valve installed in pit and is directly conveyed in the factory network.

Potable water feeds the office building area, the toilets of the shed and the test and laboratory rooms.

Electric Installations

The total electrical power installed is 1600 KVA and considering a contemporaneity of 75% the required power is 71200 KVA about.

The main electric installations inside the fence of the factory are then the following:

- general electric switch board and control panels.
- power sockets (32 A).
- lighting system inside and outside the shed.
- earthing system.

The diesel generator is located under an own steel shelter and is completed with its own daily tank. Lighting inside the shell is realized by means of roof mounted mercury vapors lamps, 250 W each. Every six meters of shed, two lamps are foreseen.

9. Personnel requirements

Staff and workers requirement for the Fittings factory is set here below.

Plant Management And General Services Personnel

Qualification	Required number
- Manager	1
- Accounting	1
- Secretariat	1
- Storekeeper	1
- Forwarder	1
- Guard and drivers	2
- Technical service	1
Total	8

Process Equipment Personnel

Qualification	
- Foreman	1
- Injection Machine Operator	7
- Wire Laying Machine Operator	3
- Electricians and mechanics	2
Total	13

Fitting Manufacturing, Testing and Handling

Qualification	
---------------	--

- Foreman and leading operator	1
- Laboratory operator – quality control	2
- Workers	3
Total	6

Total Manpower

The personnel of the factory is then composed as follows:

- manager 1
- superintendent 2
- clerks/ workers 24

11. Equipment design and selection

11.7. Compressed air Unit

This section is required for the compressed instrumentation air required throughout the plant.

- No. 1** Air compressor unit, screw type, together with internal air cooler and silencer, with all necessary instrumentation for automatic control, 220 Nm³/hour capacity, 45 kw electric power
 - No. 1** Compressed air regenerative drying system, complete with all necessary instrumentation for automatic control, 300 Nm³/hour capacity, 7.5 kw electric power, 15 dew point
 - No. 1** Compressed air tank, carbon steel, 2,000 liters capacity
 - No. 1** Compressed air humidity filters
 - No. 1** Compressed air dust filters
- Complete with all connections of the unit within itself as well as with related equipment, with all necessary piping and fittings materials, electrical connections, paint and insulation work completed and ready to operate



11.8. Electrical Power Systems

This section is required for the provision of necessary electrical energy requirement of the plant.

- No. 1** High voltage power transformer, 1600 KVA capacity, standard oil filled closed type, 30,000 – 380 volts, complete
- No. 1** High voltage inlet and connection group
- No. 2** Prime power diesel generator set, capacity 1020 KVA continuous power generation

capacity, suitable for non-stop, continuous electrical power generation, complete with electrical panel and switchboard, with sound insulated cabin, 1500 RPM, 50 Hz, fuel consumption at full power 350 liters, at 75% load 270 liters, complete with all operational systems and accessories

No.
2 Generator sets electrical control and switchboard panel

No.
2 Generator set sound insulation cabin

No.
1 Fuel tank, capacity 12,000 liters, complete with all necessary accessories, manufactured from St 37 carbon steel with industrial standard paint

No.
1 Low Voltage Distribution Panel

No.
1 Plant MCC panel

Complete with all connections of the unit within itself as well as with related equipment, with all necessary fittings materials, electrical connections, electrical grounding insulation work completed and ready to operate

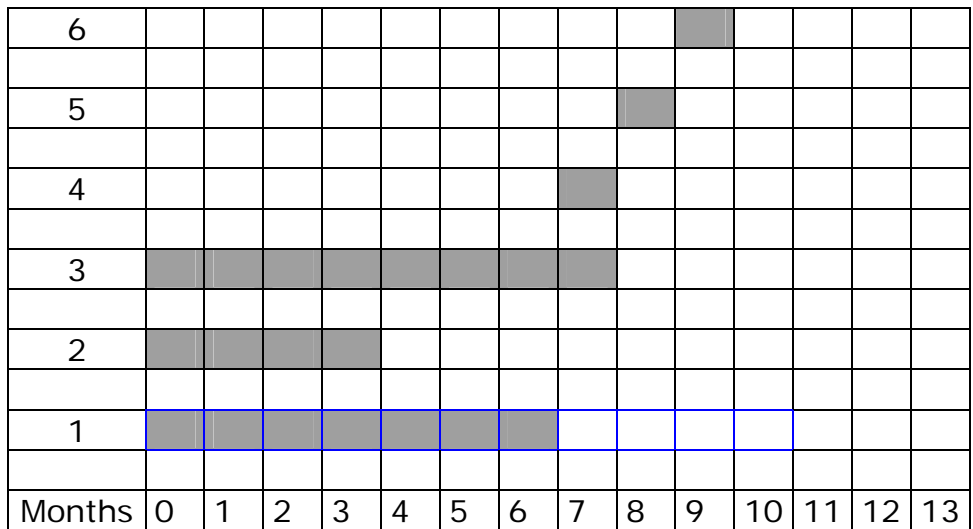


20. Time schedule

It is expected that following the signing and acquiring validity of a contract between the Client and the plant will be put into operation in latest 12 months, provided that the Client completes the construction work during the period specified in the approved time schedule by both parties.

ACTIVITIES

PROGRAM BAR CHART



- 0 APPROVAL OF THE CONTRACT
- 1 CONSTRUCTION OF PROCESS MACHINERY IN TRIAL RUN AT CONSTRUCTION PREMISES AND DELIVERY
- 2 DESIGN OF THE PLANT
- 3 CONSTRUCTION OF BUILDING AND UTILITY PLANT IN LICENSEE'S COUNTRY
- 4 TRANSPORTATION OF PROCESS MACHINERY AND LOCALLY MANUFACTURED EQUIPMENT TO THE INSTALLATION SITE
- 5 ASSEMBLY
- 6 TESTING AND START-UP

21. Exclusions

1. 1. Provision of land and all construction work is not included.
2. 2. All civil works, foundations, floors, roofs, walls, settling ponds, cisterns, roads, access ways, surrounding walls, i.e. anything pertaining to construction other than those specifically noted as included in the scope of supply
3. 3. The supply of electrical energy until the boundaries of the process plant is not included.
4. 4. The electrical energy that will be required during the installation period will be provided free of charge.
5. 5. Water supply, storage and pumping systems for the plant are not included.
6. 6. All raw materials, secondary materials, consumables, chemicals and reagents are not included.
7. 7. Waste discharge systems and facilities for industrial and domestic wastes are not included.
8. 8. All types of cranes, lifting, carrying and loading facilities are not included.
9. 9. Maintenance and repair tools are not included.

22. Warranty

All material and equipment supplied here are warranted for one year from the date of start-up, against all manufacturing defects or material defaults that may arise during the first year of operation. Any repairs or changing of parts except for those normally worn out during this year will be done free of charge.

23. Spare Parts

A complete set of spare parts relevant to all the process and utilities equipment, machinery and apparatus that may be needed for the first 4,000 hours of operation under normal operating conditions, will be supplied free of charge. A separate price list will be submitted for spare parts that may be required after the first year.

24. Delivery period

The complete plant will be ready for start-up within 9 months from the date of receiving a firm order accompanied by a confirmed, transferable and irrevocable Letter of Credit.

25. Offer validity

This offer is valid until DECEMBER 31, 2006.

