PROPOSAL
CONSTRUCTION OF PLANT MANUFACTURING COMPOSITE MATERIALS

TURKMENISTAN

TABLE OF CONTENT

1-INTRODUCTION

The present proposal covers the implementation of a new factory for the manufacture of Composite products at Turkmenistan subject of the contract is the delivery on a "Turn Key Basis" for the following products:

- Composite GRP Pipe
- Composite GRP Construction Profiles
- Composite Connection Elements for Pipe

To manufacture these products the following equipments will be supplied:

- 5 lines, Complete process machinery for Composite Pipe
- 32 lines, Complete process machinery for Composite Construction Profiles
- 2 lines, Composite Connection Elements
- Know-How and system engineering,
- Testing and laboratory equipment
- Services
- Complete set of spare parts for 2 years
- Erection and commissioning of the plant

Waste water system, fire fighting system and heating system are included the proposal.

Supplies of raw material for 6 months are also included our proposal.

The Equipment will be delivered in accordance with the technical Specifications and Scope of supply in our proposal.

Delivery of the Equipment on"turn-key basis" is defined as follows:

- Preparation of the Equipment positioning layouts
- Manufacturing and readiness for shipment of the Equipment

- Preparation of documentation which includes the technical specifications of the Machines and the mechanical layout
- Transportation of all machines
- Supplying all standards and specifications of products
- Assembly of the Equipment at the Client site,
- Erection and installation of the Equipment at the Client site,
- Start-up of the Equipment
- Test-run of the Equipment
- Commissioning of the Equipment,
- Training of the Client's operators on the Equipment
- Technical Documentation of the Equipment including operation and maintenance documents
- Ensuring the performance of the Equipment in full conformity with the stipulations made in the present proposal

All Equipment will be new.

Proposal covers also the following items:

- Construction of industrial buildings, offices and service buildings.
- Warehouses and maintenance equipment (mechanical, electric)
- Electric power network and lighting
- Air compressor and compressed air network
- Raw water pumps and network
- Heating center and heating pipe network
- Waste water treatment plant
- All external storage tanks, resin transfer pumps, resin piping system
- Ventilation system
- Sand storage silos
- Electric transformer
- Diesel generator set
- Vehicles and material handling equipments

Purchase of industrial area, electric, water and natural gas supply are excluded our proposal.

TERMS OF PAYMENT.

The total value to be paid by the Client to the Supplier is USD ..... and will be paid as follows:

30 % of the total contract price equal to USD ....., as down payment at contract's signature, by bank transfer into the bank account to be designated by

70 % of the total contract price equal to USD ……., will be paid against the monthly progress payment report.

TERMS OF DELIVERY

The process equipments and machines as specified at this proposal will be supplied within the contract period to the Client on the delivery parity CIF Turkmenistan.
The project will be completed at 24 months after the date of down payment.
The breakdown of time table for the machine and equipments as follows:

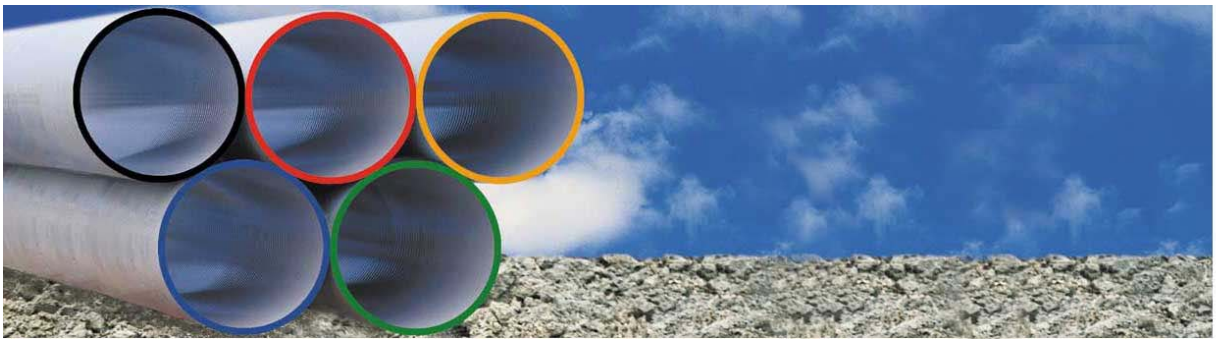
- Equipment and machines shipment CIF Turkmenistan: 20 (twenty) months from the date of down payment.
- Completion of erection and installation at the site: 60 days after unloading.
- Completion of start-up of the Equipment and Training during production: 60 days after installation.

PART - 1

CONSTRUCTION OF PLANT

FOR MANUFACTURING

COMPOSITE GRP PIPE



PART – 1 CONSTRUCTION OF PLANT FOR MANUFACTURING COMPOSITE GRP PIPE

1. General

Composite GRP Pipes are manufactured from polyester resins and fibrous glass reinforcements and depending on type with inorganic filler. The design philosophy of GRP pipes is to provide products with suitable properties and the required margin of safety, that will enable the pipe to perform satisfactory after an extended period of operation (more of 50 years) under typical service conditions.

The present quotation covers the implementation of a new factory for the manufacture of composite GRP pipes through the establishment of:

Discontinuous line for the production of GRP pipes with diameters from 75 to 1200 mm.

The present quotation incorporates within its scope all necessary machinery, equipment, apparatus and installations that are required for the manufacture of Composite GRP Pipe. The only items that are outside the scope of this quotation are mainly land.

2. Products

The final product to be manufactured in the plant is Composite GRP Pipe with five complete lines.
The specific capacity of the plant has been designed such that the plant may adjust production in accordance with the requirements of the project.

3. GRP Pipe Product Characteristics

3.1. Pipes Wall description

The G.R.P. pipe wall consists of three layers perfectly adherent with one

another, each having different characteristics and properties in relation to their function. The properties of chemical resistance and impermeability are, anyway, equivalent for the three layers, which are namely:

-liner:

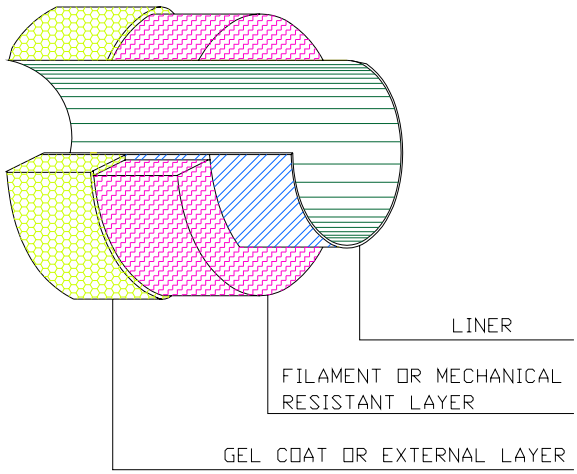
It is in direct contact with the conveyed fluid and guarantees the maximum resistance to the chemical attack from the fluid itself. Moreover, the liner presents an internal surface particularly smooth, without defects, cracks or delaminated zones. The liner is composed of one glass veil and one glass mat tape resin impregnated and is produced in two steps (inner liner and outer one)

-filament or mechanical resistant layer:

Its function is to render the pipe wall resistant to the stresses due to the design conditions (stresses due to the internal and/or external pressure, flexural strength due to the external loads etc.) and generated by transport and laying operations. The thickness of the filament depends, then, upon the design, conditions. The mechanical layer is composed of continuous glass filament roving resin impregnated.

- gel coat or external layer:

It has a thickness of about 0,2 mm and consists of pure resin without glass reinforcement. It guarantees the complete impregnation of the peripheral fibers, thus yielding the external pipe surface completely free of protruding fibers and well finished. The external coating is always added with ultraviolet ray inhibitor in order to prevent the nearly negligible weathering effects.



3.2. Diameter and classes

- Nominal Diameter:

GRP pipes will be manufactured in diameters ranging from 75 mm to 1200 mm. Nominal diameter coincides with the internal diameter

- Nominal Pressure Classes:

Nominal pressure classes are 4, 6, 10, 16, 20, 25 bar

Intermediate or higher pressure classes are considered on request.

- Specific Pipe Stiffness Classes..

Specific pipe stiffness classes are 1250, 2500, 5000 and 10000 Pa.

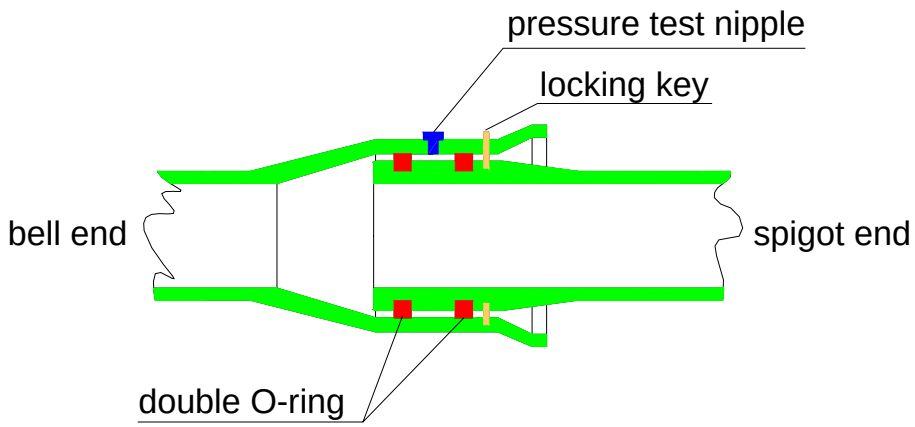
Intermediate or higher specific pipe stiffness classes will be available on request.

3.3. Pipes ends

G.R.P. pipes ends coupling is the bell and spigot one that allows ease installation of sections and very good hydraulic sealing by means of rubber gaskets. The supplied pipes manufacturing equipment and moulds are then foreseen in order to produce bell and spigot pipes ends. This kind of joint can be moreover completed with locking device that assures axial continuity to the pipes. It is possible to produce also plain ends pipes.

Hydraulic sealing

The hydraulic sealing for bell and spigot ends pipes is obtained by means of one or two elastomeric gaskets (O-Ring), installed into circumferential grooves machined on the spigot end. The mentioned scheme of bell and spigot report the position of the gaskets on the spigot end.



BELL AND SPIGOT JOINT

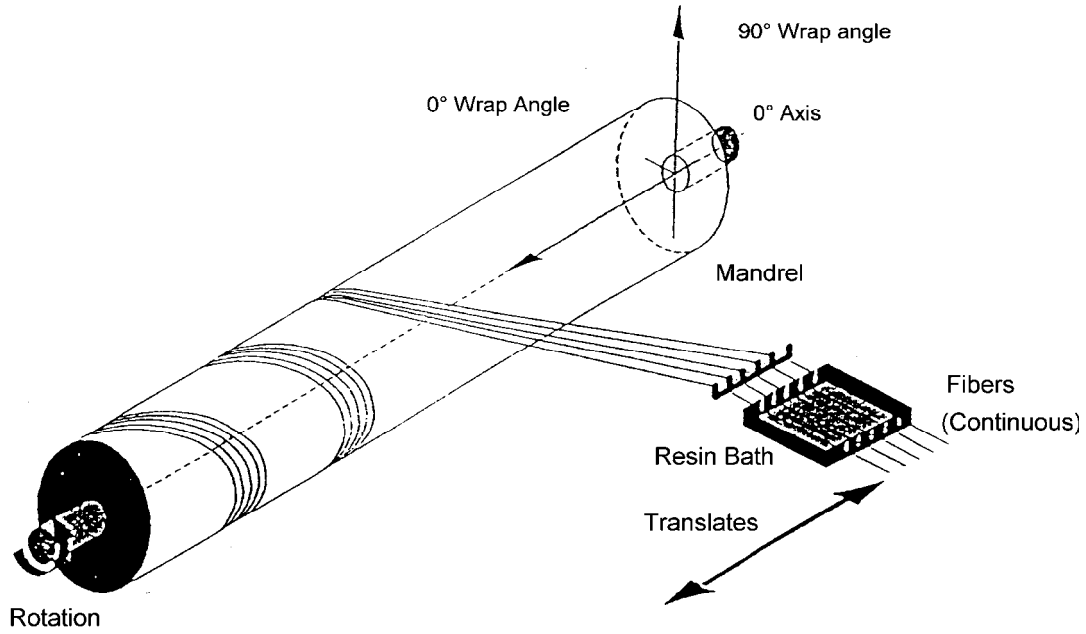
4. MANUFACTURING PROCESS

The manufacturing processes are used for G.R.P. pipes:

The manufacturing process is based on the filament winding technique and complies with A.S.T.M. code D 2996 (Standard Specification for Filament Wound Reinforced Thermosetting Resin Pipes) type 1, grade 2, class E and ASTM D3517, ASTM D3754, ASTM 3262, BS 5480:1990, AWWA C950, AWWA Manual M45

4.1-Method of manufacturing of Composite GRP Pipe- Discontinuous Filament Winding

The manufacturing process proceeds step by step as follows:
This process manufactures G.R.P.pipes in standard lengths (usually 12 mt)



on rotating mandrel. By adjusting the relative speeds of mandrel rotation and glass distribution head movement, helical reinforced pipe is formed. Adjusting the raw materials ratio, which can include high purity silica sand, can also change pipe properties.

The discontinuous production of GRP pipes through the filament winding process avails itself of a mandrel which surface is made of steel.

A special mylar release film, protecting the surface of the mould and useful during extraction operations, is applied to the mandrel. Then, a ply of chemical resistant "C" glass is laid up the mandrel. This glass reinforcement, suitably impregnated with liquid resin, will be the chemical-resistant inner liner of the pipe, being rich in resin (90% resin, 10% glass) and having a predetermined thickness.

The final layer (external liner) will have the same characteristics as first.

Two other layers are applied between the first and the last ones:
a - an anti-diffusion barrier made of 70% of resin and 30% of glass fiber (second liner)
b - a mechanical resistant layer which thickness, composition and glass yarns disposal depend on the mechanical characteristics required for the pipe.

These internal layers consist of the following raw materials:
- Resin
- Continuous glass yarns (roving)
- Silica inserts, if needed.

The continuous roving, circumferentially wound, assures the required circumferential resistance, while the function of the chopped glass (chopped glass yarns 25-30 mm length randomly applied) is to grant, through the axial resistance contribution of each glass yarn, the required axial resistance.
The silica inert, when applied, increases the stiffness characteristics and the pipe wall thickness, without exceeding the quantity of glass foreseen.
The chopped roving is laid on the pipe surface through the slit of a hopper placed upon the mandrel. The continuous glass yarns, supplied by the feeding units, are hoop-wound on the manufacturing pipe by driving the roving through some tensioning devices, thread guides and distributing rack. The required quantity of continuous roving can be obtained by defining the suitable number and substance of yarns, while disposal of yarns in the different pipe section layers can be suitably arranged by modifying the position of the yarns in the thread guides and in the distribution rack.
The silica inert, if required, is applied through the slit of a hopper placed upon the Mandrel.

The resin is already mixed with catalyst in the due proportion. Mixing operations are carried out in two different mixers, one for each feeder. The quantity of resin and catalyst required, as for other raw materials, depends on the mandrel speed and is defined through a suitable electronic batching system.

Polymerization of the resin (hardening of the product) is carried out in an oven with 4 differentiated areas with radiant heating units. For each area the heat to be supplied can be controlled so that assure the maintaining of the required values of gelification, isothermal peak and post-polymerization in the oven.

Whenever required, pipes manufactured are subjected to an hydraulic pressure test: each pipe bar is filled with water and then, by means of a suitable press, its internal pressure is increased up to 1.5 or 2 times more than the nominal pressure the pipe should withstand.

4.2 Testing

Manufacturing of pipes is subjected to constant checking. The checks are carried out on raw materials, at each production phase and, lastly, on the finished product.

The mechanical strength of finished products is tested periodically on lengths of pipe chosen at random from standard products. The test consists in reproducing the conditions which the pipe will have to undergo during working and also, in a dimensional check. The inspected pipe, if accepted, is indelibly marked with indications relevant to Manufacturer lot, manufacturing date, diameter, pressure class and then it is sent to the factory stockyard waiting for shipping.

Before starting up production a check is made on the quality and characteristics of the resins relatively to the temperature and relative humidity in the production shops.

Optimum values of viscosity and temperature to be applied to the resin are pre-established, and the percentage of catalyst to be employed in the production phase is determined.

Controls in the production shops:

- control of lay-up (unit weight per square meter of resin and glass,

type of resin and type of reinforcement)
- internal quality control
- check on the type of glass reinforcement used
- dimensional control of the positioning of the accessories according to technical specifications
- check on thickness
- Checking the Barcol hardness: Measurement of the hardness gives an indication of the degree of polymerization. This test is carried out on fifty percent of the products made.

Moreover, all pipes produced are subjected to a careful quality control by means of systematic non-destructive tests as:

- thickness measurement
- Barcol hardness measurement
- visual examination

In addition to the above, some samples are subjected to the following destructive tests:

- parallel plate press test
- axial tensile stress test
- axial and circumferential bending test.

Both destructive and non destructive tests are carried out according to ASTM (American Society for Testing and Materials) standards.

The quality control on the final product is preceded by a careful production process and raw materials control. For example, with respect to resin, controls are made on viscosity, reactivity, styrene content, elongation to rupture. With respect to silica inerts, granulometry, humidity content, silica and iron content are checked. For glass, controls are made on external aspect, humidity content, losses after calcining, roving stiffness, resistance to grinding.

5. PROCESS EQUIPMENT

The plants proposed are the following machines and equipments:

5.1. Discontinuous Filament Winding

Characterised by high product flexibility, suitable for the production of GRP pipes both with sand and without. The production range includes pipes that withstand both high and low operating pressures (according to the type of joint), within any market segment:

MODEL OF THE MACHINE : AL - 1200 Line

Nominal diameter	ND 75 - 1200 mm
Nominal pipe length	12 mt
Nominal pressure	up to 25 bar
Stiffness	up to 10.000 N/m^2
Filling with inert	up to 60%
Joining	bell and spigot
Average production capacity	300.000 meters or 14.000 tons 3 shifts and 300 days per year with pipe diameter 300 mm

COMPOSITE PIPE MACHINE

1-Equipments for Composite Pipe Machine

-Liner Making Machine
-Winding Machine
-Curing Station
-Calibration Machine
-Gantry Ejection Machine
-System of Mixing Resin
-Hydraulic Pipe Test Machine

Specifications of production are φ75mm~φ1200mm composite pipe and length is 12M.

2-Scope of supply of equipment:

2.1- DNφ75-1200x12000mm Liner Making Machine (12.7kw) 3 set

1) Drive head of liner making machine 1 set
2) Tail of liner making machine 1 set
3) Railway of liner making machine(16m) 1 set
4) Carriage of liner making machine 1 set
5) System of timing with frequency conversion 1 set
6) Electric control system 1 set
7) System of feeding-resin 1 set

2.2-DNφ75-1200x12000mm Filament Winding Pipe Machine (18.5Kw) 5 set

1) Drive head of winding machine(ladder) 1 set
(one axis two gear)
2) Tail of winding machine(ladder) 1 set
3) Railway of winding machine(20m) 1 set
4) Winding carriage 1 set
5) Reinforce-mortar carriage 1 set
6) Resin groove type soaking in bottom 1 set
7) Draw-fibre shelf type simple 1 set
8) System of timing with frequency conversion 1 set
9) Control system of computer, main electric control board and

accessorial electric control board 1 sets

10) Reinforce-mortar head type oblique-under-side and electric control board 1 sets

11) System of feeding-resin 1 sets

12) Air pressing roll (400kg) 1 sets

13) bracket of mylar

14) Groove of catching resin 1 sets

2.3- DNφ75-1200x12000mm Curing Station (23.8kwx4=95.2kw) 15 sets

1) Drive head of curing station 4 sets

2) Tail of curing station 4 sets

3) Infrared heating device 4 sets

4) Electric control system 4 sets

2.4- DNφ75-1200x12000mm Calibration Machine (11.75kw) 3 set

1) Drive head of calibration machine 1 set

2) Tail of calibration machine 1 set

3) Calibration head 1 set

4) Electric control system 1 set

5) Spray and dust remove device 1 set

2. 5- DNφ75-1200x12000mm Gantry Ejection Machine(19.4kw) 3set

1) Gantry ejection stop stand (Including four hydraulic telescopic arms) 1 set

2) Ejection small carriage 2 sets

3) roller of Hydraulic 1 set

4) Tractor 1 set

5) 5T windlass and its foundation 1 set

6) Hydraulic system 1 set

7) Electric control system 1 set

2.6-System of Mixing Resin(21kw) 5 set

1) Mixing tin of liner layer (with one pump) 1 set

2) Mixing tin of structural layer (with one pump) 1 set

3) Pipe 、valve and accessory 1 set

2.7. Quartz Sand Equipments

1) Quartz sand store receptacle ($2m^3$) **5 set**
2) Quartz sand transfer receptacle ($0.3m^3$) **5 set**

2.8. Hydraulic Pipe Test Machine

1) Machine for Composite GRP Pipe test with hydraulic water system **3 set**
2) Plugs for diameter 150-250-300-400-600-1200mm **3 set**

Total Power of Capacity: **179Kw ±2%** (Without Power of Capacity of the Air compressor, Travelling Crane and Testing Equipments)

3-Technical capability of product line

1. General explanation:

2. Technical Capacity:

2.1 Liner making machine:

1) Main technical data:

a. Specification of production: DNφ75-1200x12000mm
b. Power of main axis: 7.5KW
c. Power of carriage of liner making machine:2.2KW
d. Main axis and carriage is timing with frequency conversion
e. Feeding-resin system: Flow:0-20KG/min. Flow is regulated with frequency conversion. Power: 3KW

2)Use and characteristic

a. Use

This machine is specially used in the COMPOSITE GRP PIPE product line for making the inner liner of pipe.

b. Characteristic

+ The carriage is moving by driving the main axis. Two of them can disjoin as well as interlock. It is to be adjusted the span while disjoining, and to be adjusted the speed while interlocking.
+ Carriage of liner making machine is equipped with a feeding-resin system and a head of pouring-resin. No manual work of resin-brush is needed.

+ This machine is equipped with a shelf of winding polyester film and 4-roller air pressing roll to wind polyester film and glass fiber mesh. The 4-roller air pressing roll can remove air bubble from the inner liner.

3) Configuration and method:

This machine consists of:

-Railway of liner making machine

-Drive head of liner making machine

-Tail of liner making machine

-Carriage of liner making machine

-Electric control system

-Feeding-resin system

-Head of pouring-resin

-Air pressing roll

-Shelf of winding polyester film

The mould used for making pipe is circumvolving by the drive head of liner making machine; the carriage setting on the railway keep moving left and right along the axial of mould. At the same time, the electric control system, feeding-resin system, air pressing roll and shelf of winding polyester film setting on the carriage do the process of laying and soaking resin by polyester film, surface mat, and woven roving on the mould. So the process of making liner is finished.

2.2 Winding machine:

1) Main technical data of the winding machine:

a. Power of main axis:7.5kw
b. Power of winding car & reinforce-mortar carriage: 4kw
c. Power of feeding-resin system: 3kw x 2= 6kw
d. Power of lifting device of reinforce-mortar head:1kw
e. Specification of production: DNφ200-1000x12000mm
f. Accuracy of draw-fiber: ±0.5mm
g. Winding angle: ≥45°≤90°
h. Speed of draw-fiber: ≤130m/min
i. Form of winding: screw or round change automatically
j. Form of control: manual, auto loading, automatic
k. Form of draw-fiber: linear

l. Form of reinforce-mortar: reinforce mortar at oblique-under-side with multilayer
m. Form of drive: drive by rack
n. The winding length as L, the width of reinforces mortar roving as B, the winding angle as a, and the length of resting on the end as c. When the winding length L is fixed, any two parameters of the other three can be fixed.
o. The top or the end of a pipe can be winded as the zero point of winding.
p. This machine can directly change from the form winding by round with single layer to the form winding by screw.
q. This machine can pour mortar, flow-in resin, reinforce mortar in each time, and it can continuous reinforce mortar to and fro.
r. Auto thickening at the inserting end of pipe.
s. The feeding-resin flow of feeding-resin system for reinforces mortar and pouring-resin is 45kg/min (timing with frequency conversion). The thickness of reinforce mortar each time come up to 4-20mm. The thickness is not influenced by man-made and too-heavy of mould. The difference between design thickness and actual thickness (after pressing by roll) is 1.5-2mm.

2) Use and characteristic

a. Use

This machine is the best important equipment of the COMPOSITE GRP PIPE product line for winding and making reinforce mortar on the structural layer of a GRP pipe.

b. Characteristic

+ The main axis is circumvolving and the winding car is moving with a setting mathematical model controlled by a computer in a manual, auto-loading or automatic form.

+ This machine has been equipped with two feeding-resin systems, two heads of pouring-resin, one set of air pressing roll, one resin groove type soaking in bottom, one reinforce-mortar device, one shelf of winding fiberglass and one electric control system on the winding car and the reinforce-mortar carriage. The winding car can

load people and can control the whole winding process and reinforce mortar process on the structural layer by an electric control system.

+ Winding car and reinforce-mortar carriage are drove by rack accurately and smoothly.
+ The form of reinforce-mortar is to reinforce mortar at oblique-under-side with multi-layer each time and the thickness of reinforce mortar each time come up to 20MM. The resin content of reinforce-mortar layer is controlled by the computer and its accuracy comes up to ±3%.
+ The speed of draw-fiber increases from 54m/min as the standard speed was to 100m/min.
+ Use original product of SIEMENS of Germany as the servo system for a high operational reliability.

3) Configuration and method

This machine consists of:

-Railway of winding machine
-Winding car
-Resin groove type soaking in bottom
-Reinforce-mortar carriage
-Reinforce-mortar device
-Air pressing roll
-Fiberglass shelf
-Feeding-resin system
-Head of pouring-resin
-Cable shelf
-Control system
-Drive head of winding machine
-Tail of winding machine
-Groove of catching resin

The drive head of winding machine drive the pipe mould to circumvolve; the winding car equipped on the railway moving with a setting mathematical model to and fro along the axial of the pipe mould, and winds the fiberglass from the resin groove type soaking in bottom on the pipe mould. While the reinforce-mortar device is putting quartz sand with a setting thickness and setting resin content on the pipe mould, the

feeding-resin system and the head of pouring-resin feed a setting volume of resin to the resin groove type soaking in bottom and on the quartz layer. The air pressing roll presses air bubbles out from the reinforce-mortar layer for pressuring solid. So the process of making structural layer of pipe is finished.

2.3 Curing Station:

1) Main technical data of the curing station

a. Speed of main axis: 5rpm

b. Power: 2.2kw

c. Infrared heating board: 24 piecesx0.9kw=21.6KW

2) Use and characteristic

a. Use

This machine is specially used in the COMPOSITE GRP PIPE product line for making the inner liner layer or structural layer of pipe for solidifying.

b. Characteristic

The main axis rotates the pipe mould. Heating system is using with infrared method.

3) Configuration and method

This machine consists of:

-Drive head of curing station

-Tail of curing station

-Infrared heating board

-Electric control system

The drive head of curing station rotates the pipe mould, which has finished its inner liner or structure layer, to avoid resin flowing down. The infrared heating boards which are equipped beside heat the inner liner or structure layer to accelerate for solidifying.

2.4 Calibration Machine:

1) Main technical data of the calibration machine

a. Power of main axis: 5.5KW

b. Calibration power: 5.5KW

c. Power of water pump: 0.75Kw

d. It can calibrate 1/32 taper and the joint of double seal ring type-O

e. Form of dust collection: water tank (moveable)

f. Diameter of calibration: φ200-1000MM Length: 12000MM

g. Mode of speed controlling: timing with frequency conversion

2) Use and Characteristic

a. Use

This machine is specially used in the COMPOSITE GRP PIPE product line for calibrating the joint of GRP pipe.

b. Characteristic

+ Calibrating the pipe with mould.

+ The main axis is rotating and the calibration head is moving fore and aft with a form automatically. A lead screw drives the cutting feed.

+ The main axis is rotating and the calibration head is moving fore and aft with a speed automatically and changeable.

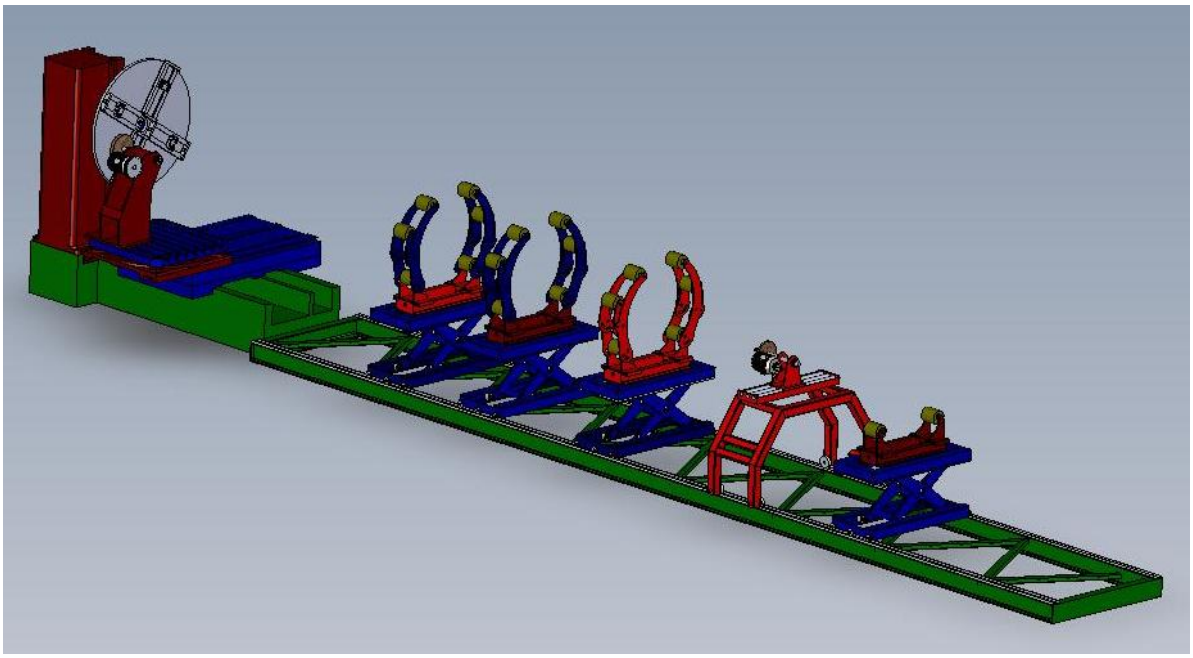
+ Calibrating the joint of pipe with a forming cutter in one time

3) Configuration and Method

This machine consists of:

- Railway of calibration machine
- Drive head of calibration machine
- Tail of calibration machine
- Calibration head
- Electric control system

The drive head of calibration machine rotates the mould with the pipe which is required for calibration. The calibration head with a forming cutter which equipped on the railway calibrates the joint of pipe after adjusting the span.



2.5 Gantry Ejection Machine:

1) Main technical data of the gantry ejection machine:

a. Specification of production: Diameter: φ75-1200MM Length: any length

b. Ejection force: 40T Power of main oil pump: 7.5KW

c. Traction force of windlass: 5T Power: 7.5KW

d. Ejection big car and tractor can stop automatically

2) Use and characteristic

a. Use

This machine is specially used in the COMPOSITE GRP PIPE product line for ejection the GRP pipe.

b. Characteristic

+ This machine is equipped a gantry ejection device with strong traction force and work smoothly.
+ Making ejection force by a hydraulic oil cylinder with overload protective device and it has a nice force.
+ Both the ejection big car and the tractor can step automatically for simplifying the ejection process and raising the ejection efficiency.
+ It has a large ejection span with diameter from DNφ75mm to φ1200mm and the length is unlimited.

3) Configuration and method

This machine consists of:

-Gantry ejection stop stand

-Ejector

-Telescopic arm

-Ejection small car

- Roller of Hydraulic

-Tractor

-Windlass

While the telescopic arm is fixing the ejection ring of pipe mould, the tractor fixes the joint of pipe mould, then force a pulling to take out the pipe from the mould by the force of hydraulic ejector. The ejection small car carries the pipe with mould before ejection as well as the pipe after ejection, while the ejection roller of Hydraulic and the tractor carry the pipe mould after ejection. So the ejection process is finished.

2.6 System of Mixing Resin:

1) Main technical data of system of mixing resin

a. Power of mixing tin: 3kw x2=6kw
b. Power of gear pump: 3kw x 2=6kw
c. Mixing tin: more than $1m^3$
d. Mixing speed of impeller: 200rpm
e. Gear pump: Flow: 20L/min

2) Use and characteristic

a. Use

This machine is specially used in the COMPOSITE GRP PIPE product line for supply with pre-mixing resin added hardener for the COMPOSITE GRP PIPE product line.

b. Characteristic

The resin is fed into the tin and out the tin by the gear pump for reducing the labor intensity of the workers.

3) Configuration and method

This machine consists of:

-Mixing tin

-Impeller for mixing

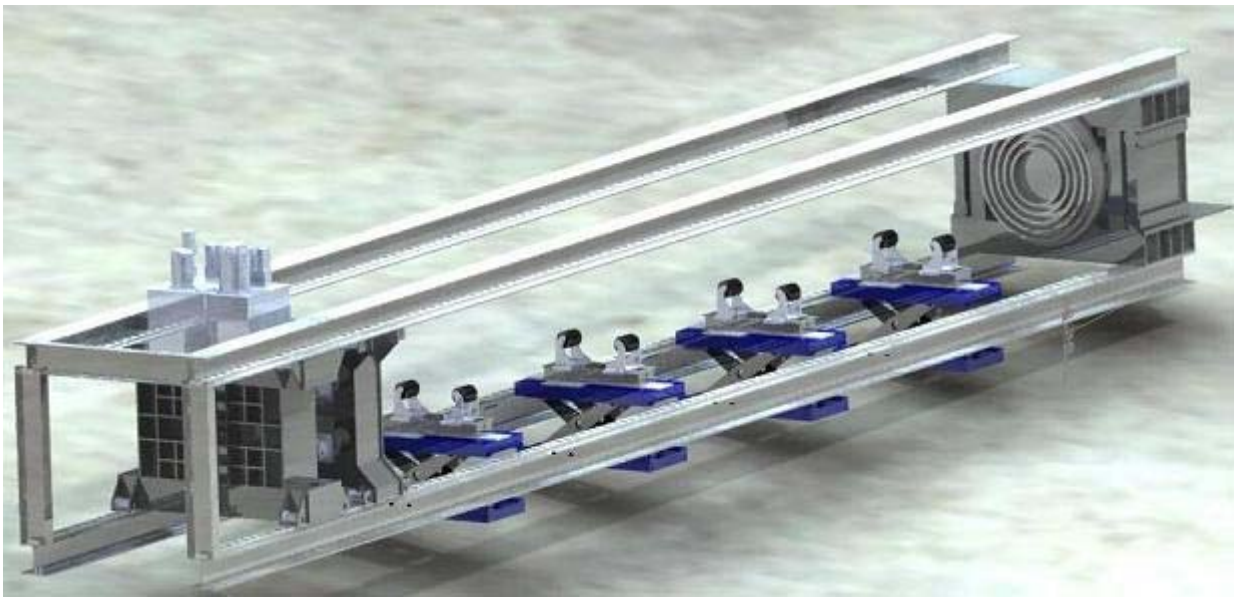
-Gear pump

-Electric control system

The resin is fed into the mixing tin by pump, then add hardener into and mixing for 20 minutes, and then feeding the resin by pump to the using resin place. So the mixing resin and feeding resin process is finished.

2.7 Hydraulic Pipe test machine:

Equipment for the hydrostatic testing of GRP pipes with diameters up to 1200. The test is carried out on the pipe bar before delivery to site. Test will be done according to BS 5480 standards, appendix K and M. The machine has been designed to test pipes pressure 20 bar.

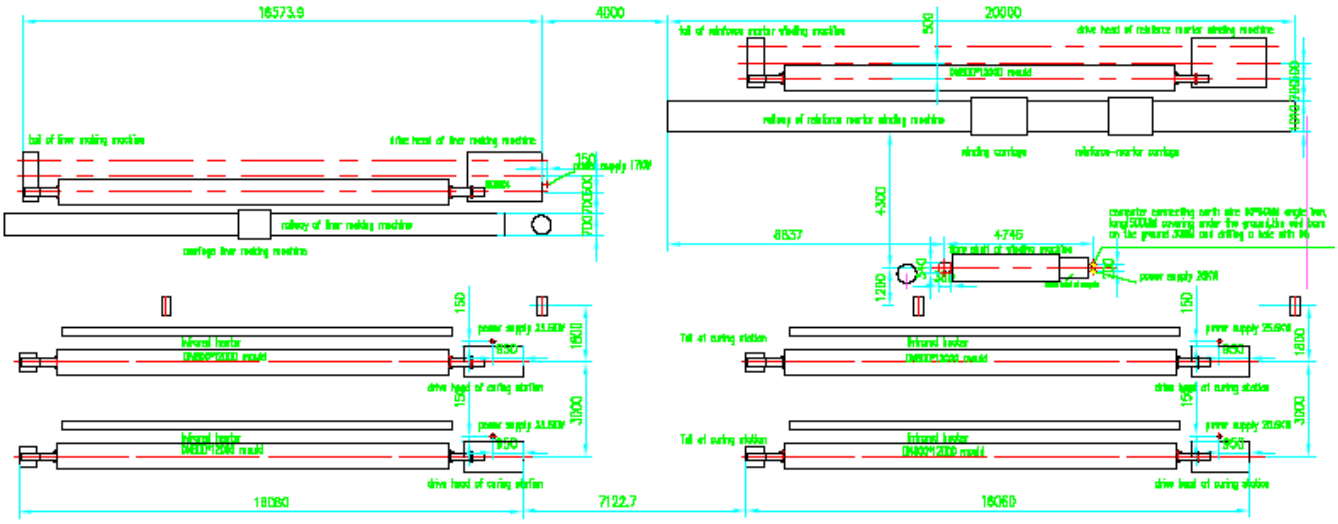


4- Detailed Technology Requirement for Making Composite Pipe:

a. Main axis: Domestic normal electric motor. Coder and system of timing with frequency conversion are made by the SIEMENS of Germany. Power of the electric motor of main axis is 11KW
b. Winding car: Servo motor, coder and system of timing with frequency conversion are made by the SIEMENS of Germany. Winding car can load people and it setup accessorial electric control board to control the whole winding process. Torque of the winding car is 16N.m
c. Resin groove type: Type soaking resin in bottom. Equipped with a resin controllable sweep board and a winding head.
d. Fiber glass shelf: Mechanical type tensile force, adjustable, can load 80

spindles fiber glass. □fiber is drawn from spindles core□

e. Computer: Industry Control Computer, the control software is the excursion system with no zero point made by Manufacturer. Control board: cold plate, sprayed surface, domestic high quality electronic component.

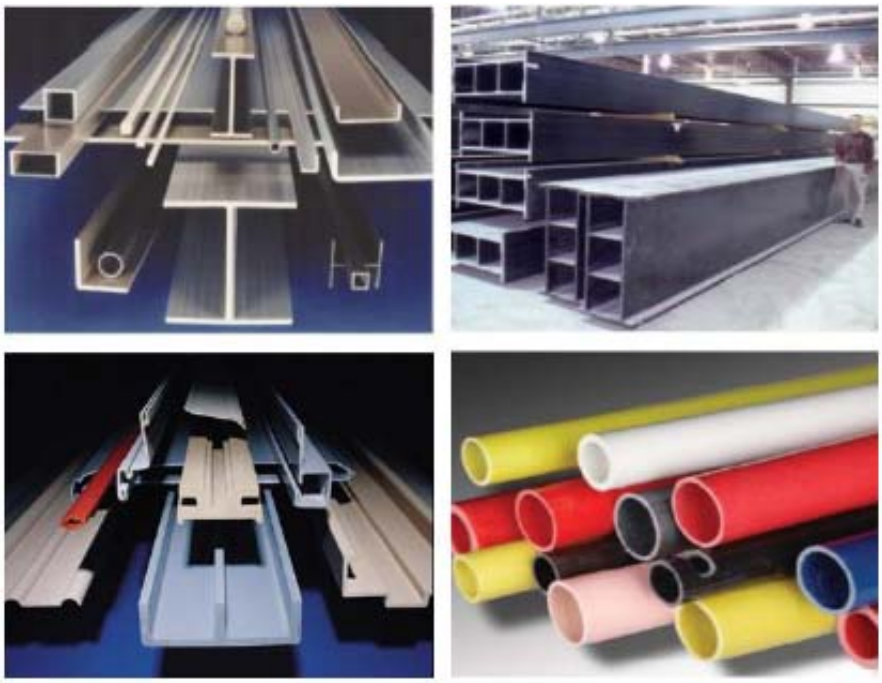


PART - 2

CONSTRUCTION OF PLANT

FOR MANUFACTURING

COMPOSITE CONSTRUCTION PROFILES



PART – 2 CONSTRUCTION OF PLANT FOR MANUFACTURING COMPOSITE CONSTRUCTION PROFILES

GENERAL:

The term pultrusion combines the words, "pull" and "extrusion". Extrusion is the pushing of material through a shaped die. Whereas pultrusion, is the pulling of material, fiberglass and resin, through a shaped die.
Pultrusion is a continuous, automated closed-moulding process that is cost effective for high volume production of constant cross section parts. Due to uniformity of cross-section, resin dispersion, fibre distribution & alignment, excellent composite structural materials can be fabricated by pultrusion.

The basic process involves pulling of continuous fibres through a bath of resin, blended with a catalyst and then into pre-forming fixtures where the section is partially pre-shaped & excess resin is removed. It is then passed through a heated die, which determines the sectional geometry and finish of the final product. The profiles produced with this process can compete with traditional metal profiles made of steel & aluminium for strength & weight.

Pultrusion Process

The pultrusion process starts with racks or creels holding rolls of fiber mat or doffs of fiber roving. This raw fiber is pulled off the racks and guided through a resin bath or resin impregnation system. Resin can also be injected directly into the die in some pultrusion systems.

The raw resin is sometimes combined with fillers, catalysts, and pigments. The fiber reinforcement becomes fully impregnated (wetted-out) with the resin such that all the fiber filaments are thoroughly saturated with the resin mixture.

As the resin rich fiber exits the resin impregnation system, the un-cured composite material is guided through a series of tooling. This custom tooling helps arrange and organize the fiber into the correct shape, while excess resin is squeezed out, also known as “debulking.” This tooling is

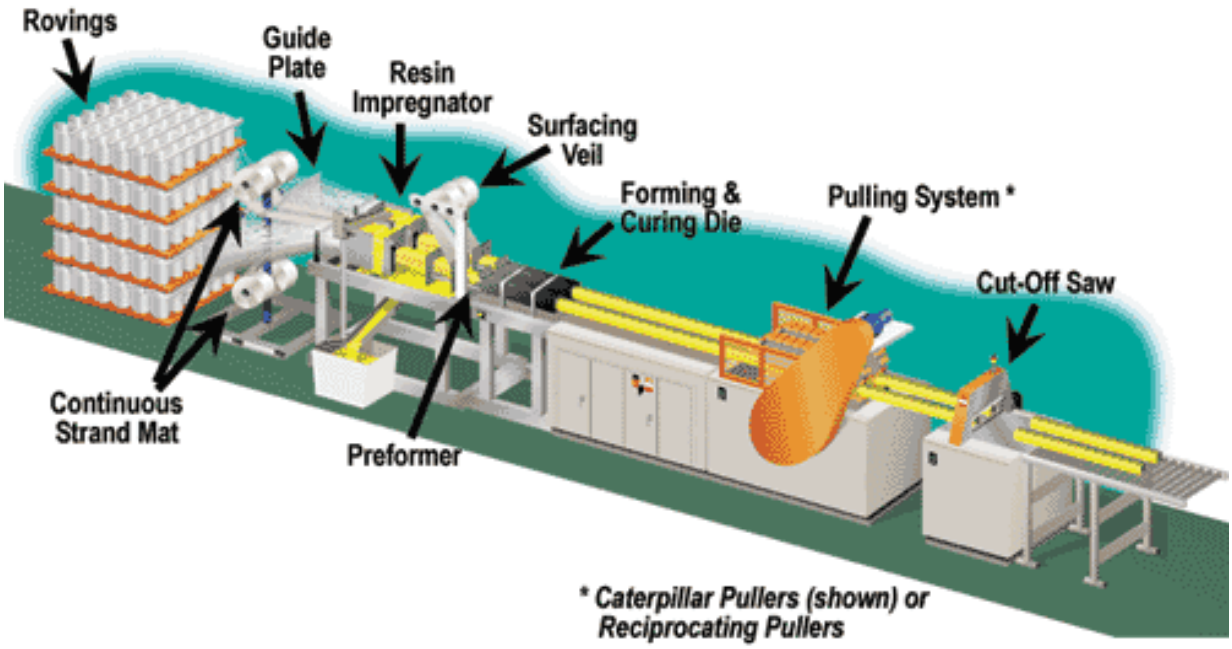
known as a "pre-former." Often continuous strand mat and surface veils are added in this step to increase structure and surface finish.

Once the resin impregnated fiber is organized and removed of excess resin, the composite will pass through a heated steel die. Precisely machined and often chromed, the die is heated to a constant temperature, and may have several zones of temperature through-out its length, which will cure the thermosetting resin. The profile that exits the die is now a cured pultruded GRP composite.

This GRP profile is pinched and pulled by a "gripper" system. Hydraulic clamps are used to pull the composite through the pultrusion die on a continuous basis.

At the end of this pultrusion machine is a cut-off saw. The pultruded profiles are cut to the specific length and stacked for delivery.

Schematic representation of pultrusion process is given in following figure :



a) Material In-Feed : Reinforcements are to be in a package designed for continuous feeding of the material. The continuous fibre creels are usually the first station on a process line. After the roving creels there is a creel

meant for rolls of mats, fabric or veil. As materials travel forward toward the impregnation area, it is necessary to control the alignment to prevent twisting, knotting and damage to the reinforcements. This can be prevented by using creel cards or vinyl tubes.

b) Resin Impregnation/Material Forming : The impregnation of reinforcement with liquid resin forms the basis of every pultrusion process. A dip bath is most commonly used. In this process, fibres are passed over and under wet-out bars, which causes the fibre bundles to spread and accept resin. A comb or grid plate is generally provided at the entrance and exit ends of the resin bath to keep the roving in alignment as they pass through the tank.

Forming is usually accomplished after impregnation, preforming fixtures consolidate the reinforcement and move them closer to the final shape provided by the die. A proper sizing of the preforming fixtures avoids excess tension on the relatively weak & wet materials, but also allows sufficient resin removal, avoiding too high hydrostatic force at the die entrance. The commonly used materials for forming guides are Teflon, ultrahigh molecular weight polyethylene, chromium-plated steel and various sheet steel alloys.

c) Die Heating : Die heating is one of the critical process control parameters as it determines the rate of reaction, the position of reaction within the die, and the magnitude of the peak exotherm. Improperly cured material will exhibit poor physical and mechanical properties, yet may appear identical to adequately cured products. Excess heat inputs may result in products with thermal cracks or crazes, which destroy the electrical, corrosion resistance, and mechanical properties of the composites.

d) Clamping/Pulling Provision : A physical separation of 3 m (10 ft) or more between the die exit and the pulling device is provided in order to allow the hot, pultruded product to cool in the atmosphere or in a forced water or air cooling stream. Thus allows the product to develop adequate strength to resist the clamping forces required to grip the product and pull it through the die. The pulling mechanism varies in design, but three general categories of pulling mechanism that are used to distinguish

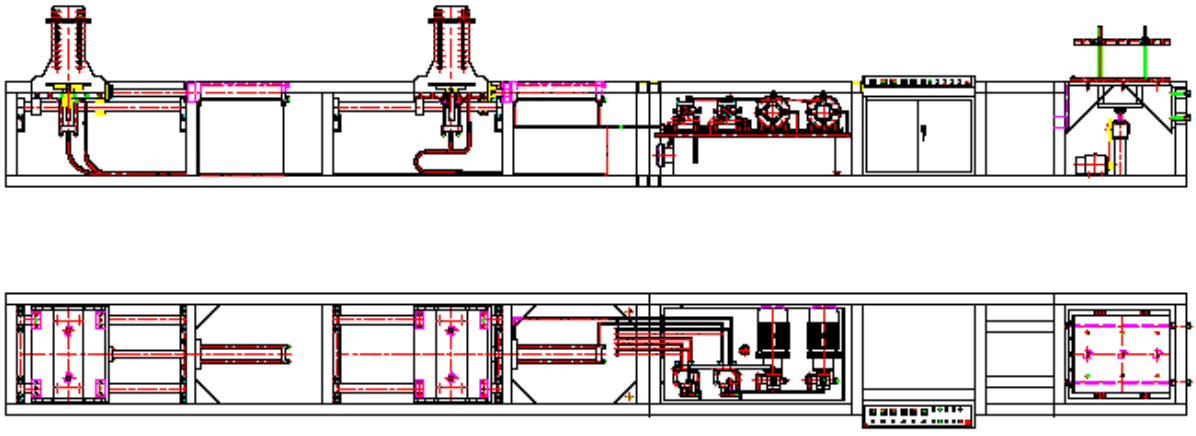
pultrusion machines are intermittent-pull reciprocating clamp, continuous-pull reciprocating clamp and continuous belt or cleated chain.

e) Cut-off Station : Every continuous pultrusion line requires a means of cutting product to desired length. Both dry-cut and wet-cut saws are available but regardless of design, a continuous grit carbide or diamond edged blade is used to cut pultruded products. The saw is clamped to the pultrusion product during the actual sawing operation.

Machine and equipment list

PULTRUSION MACHINES		
Pultruder min. 30 tons pulling capacity	no	32
heating elements 8 units each one	no	256
plate for mats	no	32
side plates for mats	no	96
batch bins for roving	no	64
screw thread	no	192
remote membrane pump for resin	no	80
moulds 50 x50 x3 square	no	4
mould 100x100x4 square	no	4
mould 150x150x4 channel	no	4
mould 200x80x8 channel	no	4
mould 38x32 pipe round	no	4
mould 50x50x6 angle	no	4
mould 280 siding	no	4
mould 508 plank	no	4
mould 200x200x10 beam	no	4

8 units chop strand mat slicer machines will be supplied.



PART - 3

CONSTRUCTION OF PLANT

FOR MANUFACTURING

COMPOSITE GRP PIPE CONNECTION

PART – 3 CONSTRUCTION OF PLANT FOR MANUFACTURING COMPOSITE GRP PIPE CONNECTION

There are two lines for manufacturing of composite connecting elements. Area for the stocking will be provided in the building. Ventilation system will be constructed to provide good working environments.

Moulds for 45 and 90 bends for diameter 150 to 300 will be supplied.

Connection elements for the different type will be manufacturing by hand layup method.

PART - 4

CONSTRUCTION OF PLANT

FOR MANUFACTURING BUILDINGS AND SERVICES

PART – 4 CONSTRUCTION OF PLANT FOR MANUFACTURING BUILDINGS AND SERVICES

Manufacturing Unit Building:

The manufacturing units and warehouses consist of a steel structure shed of rectangular shape plan and are 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.
All buildings have main doors which is size 4 meter to 4.5 meter enable to enter a big truck for loading and unloading.

Manufacturing Buildings will be:

1-Composıte Pipe manufacturing Building
2-Composite Pipe Fitting Building
3-Composite Pultrusion manufacturing Building

Warehouses will be:

1-Raw Material Building
2-Finished Product Building

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.
- Potable water network.
- Raw water network.
- Sewer network.

- Shed venting systems.
- Glass powder suction system.
- Hydraulic test equipment facilities.

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.
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 bars. 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 as per the machine specifications. 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.

Service Buildings

Service buildings will be reinforced concrete structure shed.
The following buildings are envisaged to be installed inside the factory area:

1. Administrative Building
2. Cafeteria
3. Workshop
4. Power Station Building
5. Fire Brigade
6. Heating center
7. Security and Gate

Open Spaces
Not covered spaces extend for about 40.000 m2 and are partially asphalted or otherwise treated for storage of finished products, internal roads and open air tests.
The factory area is fenced and provided with one main and two services gates.

Basic design criteria and information about Buildings:

1-Composite Pipe Plant:
Steel frame rectangular shape buildings with three halls each one width is 18 meters and length is 125 meter, cover the five composite GRP pipe lines including the three hydro test pipe machine. Each hall has a two main gate and two overhead cranes capacity 5 tons. Height of the buildings is 5 meters

2-Composite Pipe Fittings Plant:
Steel frame rectangular shape buildings width is 18 meter and length is 50 meter. There is one 5 tons overhead cranes. Height of the buildings is 5 meters

3-Pultrusion Plant:
Two identical steel frame buildings have 4 halls each one.Width of the hall is 25 meters and length is 54 meter. Each hall has a one 5 tons capacity overhead crane. Height of the buildings is 5 meters

4-Warehouses:
Two steel frame warehouses will be constructed one for raw materials and others will be used for the finish product. Each warehouses width is 30 meters and length is 80 meters. Shelves will be inside to store the materials, accessories.

5-Administrative Building:
Reinforced concrete, with two floors Administrative buildings provide the following facilities, personal service room for technical personal, lab and control buildings. Offices will be at the second floor.

6-Cafeteria:
Reinforced concrete building, which is total area, 1150 sqm. Kitchen and other facilities are included.

7-Workshop:

Reinforced concrete building width is 13 meters and length is 36 meter. Workshop is divided into three sections, mechanical, electrical and welding.

8-Power Station Building

9-Fire Brigade

10-Heating center

11-Security and Gate

12-Landscaping:
Plant will be landscaped with different types of trees bushes and lawn. Watering will be done sprinklers and drip irrigation pipe.

All building design will be done in strict compliance to construction norms of Turkmenistan with consideration of a seismic stability in accordance with the terms of references issued by the seismological research institute under the ministry of construction and construction materials of Turkmenistan.

The area of the buildings as follows:

1	COMPOSITE PIPE PLANT	m2	6.750
2	COMPOSITE FITTINGS PLANT	m2	900
3	PULTRUSION PLANT-1	m2	5.400
4	PULTRUSION PLANT-2	m2	5.400
5	ADMINISTRATION	m2	800
6	RAW MATERIAL WAREHOUSE	m2	2.400
7	FINISH PRODUCT WAREHOUSE	m2	2.400
8	DINNING HALL&CAFETERIA&CLINIC	m2	1.150
9	WORKSHOP	m2	468
10	TRANSFORMER BUILDING	m2	180
11	FIRE BRIDAGE	m2	468
12	HEATING CENTER	m2	150
13	WASTE WATER TREATMENT	m2	50
	TOTAL		26.516

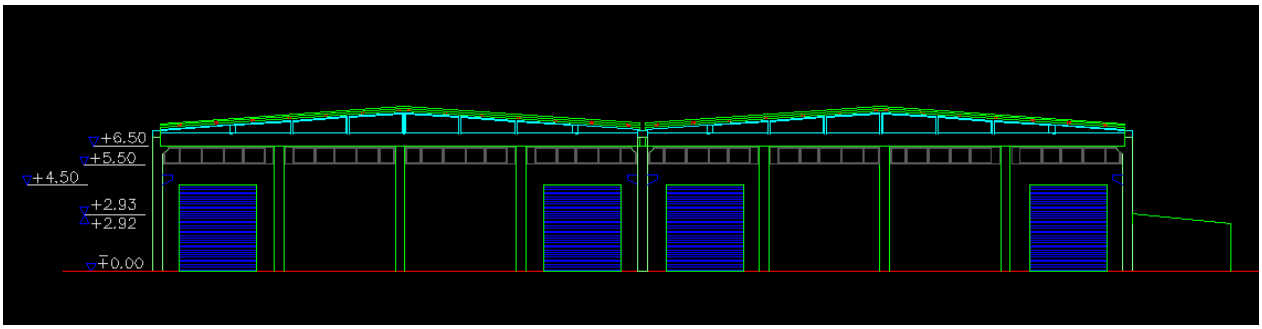
PART - 5

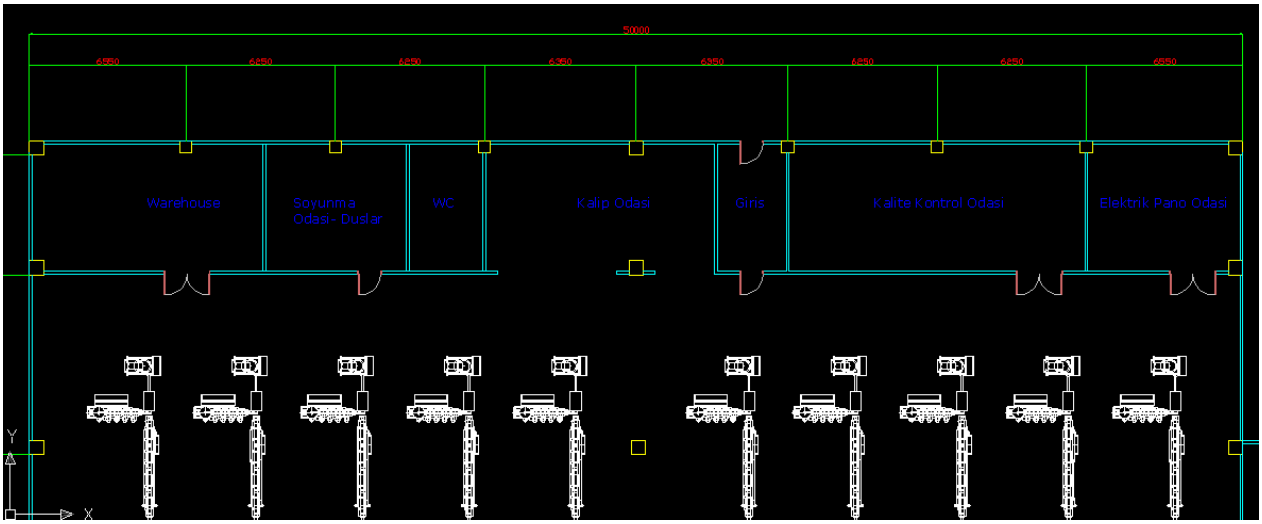
FINANCIAL PARTS

PART – 5 FINANCIAL PARTS

PART - 6

LAYOUT





PART – 6 LAYOUT

Factory Layout And Installations

Total Extension:

The factory should cover a rectangular shape plane area of about 100.000 m2, of which is 27.000 m2 covered area.

Layout of the project is attached as a printed format to the proposal.