

# 3049-5-XX0-00-TS-100

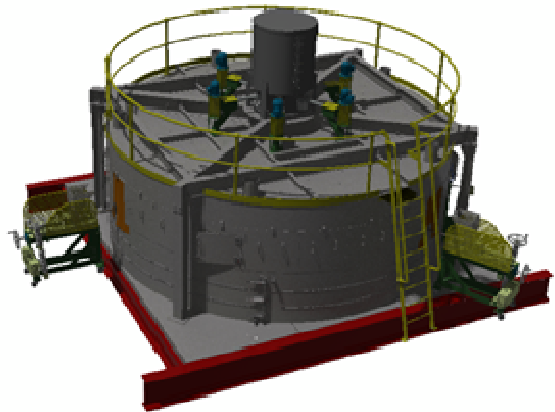
## Project General Specification

Rev	Description	Edited	Check	Iss'd	Appr'd	Date
00	Revision 0	MLG	MLG	OFFER	MLG	Apr 2022
01						
02						
03						
04						
05						

## 1. PROCESS GENERAL DESCRIPTION

Raw materials are stored into storage silos ,dosed , mixed properly and transported to the electric melter ( BE0 ). Loading of silos is carried out mechanically for cullets and pneumatically for other materials. Mixing, weighing and feeding is carried out by the so called batch plant (TT0).

Glass electric melting is carried out by Joule effect, this depends from the specific resistivity of the glass. In case of glass wool it is used glass “C” type. STM developed a special electric melter for this kind of glass, where the melting energy is brought to the glass batch by three molybdenum electrodes fed by a variable voltage transformer.



Melting depends on applied power which is controlled automatically. STM electric melter has cylindrical shape made by special refractory with glass exit in the bottom center. Outside melter structure is cooled by water. Glass coming out from furnace is collected in a fore hearth where it is brought to the fiberizing temperature.

**The main advantages of this melting technology** with respect to gas, oil and oxyfuel glass traditional furnaces:

- No NOX emission, only CO<sub>2</sub> and H<sub>2</sub>O from raw materials.
- No SOX generated.
- No noise due to burners, hot air combustion air and so on.
- The few dust produced by raw material loading is collected by a simple bag filter and recycled.
- Melter can be stopped and started easily with no damage to refractory
- Low breakdown risk, major break downs can be repaired within 3 days, not many days required by the other traditional furnaces
- Very little space is required and total weight is about 10% of the traditional furnaces, meaning big reduction of the steel structure.
- No nitrogen or Hydrogen is requested for electrode
- Very little production loss for refractory rebuilding
- Operation is very simple
- Minimal instrumentations is required
- Electrodes can be changed without production stopping

- Melter can be used continuously or daily, weekly start /stop basis
- External cullet up to 80% can be used in the batch, of course its amount depends from its chemical analysis
- Glass pull is controlled by an automatic gate system
- Capital investment is much less than other types of furnace. Refractory amount is much less than traditional melter.

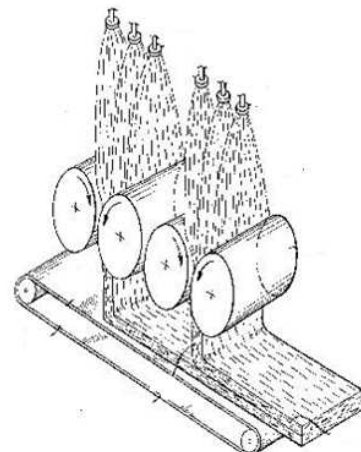
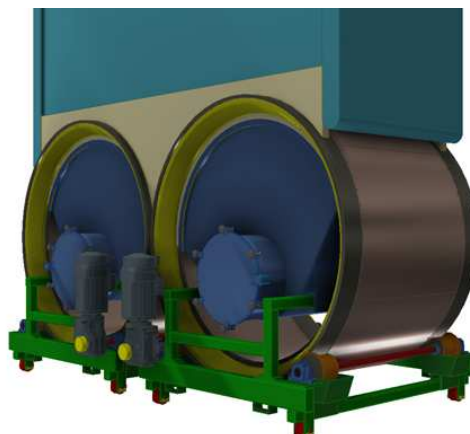
Fore hearth (HH0) is special designed to suit this kind of furnace (BE0). It allows quick start of the production after period of production stop. It can be stopped to cold condition for long time. It transports the molten glass and brought it to the fiberizing temperature. Temperature and glass level is fully automatic.

By special electric heated bushing the fiberizing machine (FF0) is fed by glass where it is extruded, by centrifugal force, from thousands small holes located on the wall of a spinner rotating at high speed. Primary glass filament so formed are attenuated to very fine fibre by the energy coming out from an circular burner and a compressed air blower surrounding the spinner.

All fiberizing parameters are controlled automatically.

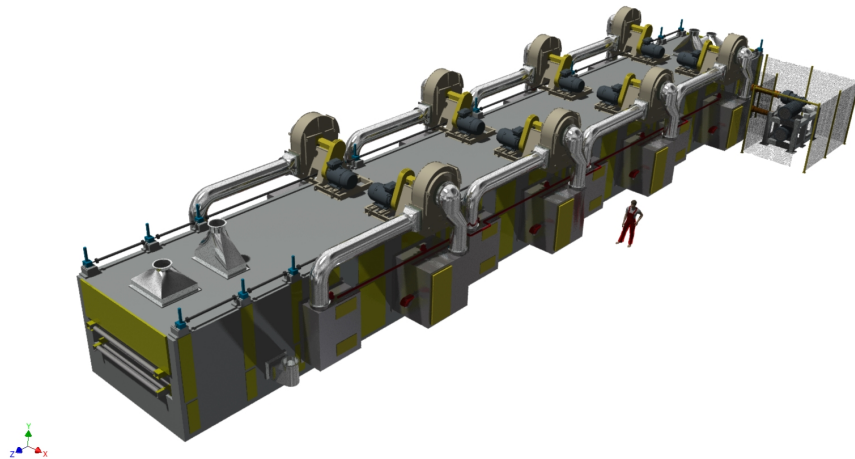


Fibres, sprayed with a special binding agent, are collected into the so called forming chamber ( JJ0 ) kept under negative pressure by means of suction fans.



The binding agent is prepared into the binder storage and preparation plant ( GG0 ).

From the forming chamber the mat is now transported to the curing oven ( SS0 ) where the binder is cured .



The product, coming out from curing oven ( SS0 ) , is cooled ( II0 ) , trimmed on both sides by means of an edge trimming machine ( QK0+QQ0 ) , cut in width by means of a dust less longitudinal ( by KK0 ) and to a pre-set length by means of a ( by NN0 ) . If required the product can be faced with aluminium, kraft paper or other facing material into the facing section ( RR0 ) .

Panels are stacked in a full automatic stacker ( VV0 ) and sent to the packaging section ( WW0 ) . Mattress are rolled and compressed by means of the rollup machine ( LL0 ) and finally packed by means of shrinking section ( OO0 )

3 or 4 pieces of rolls or 3 or 4 pieces of panels packs are packed and compressed together by means of a so called multipack machine ( VW0 ) . One robot will automatically build up a 1,2 m x 1,2 m x 2,4 m pallet with 6 or 4 multipacks ( rolls or panels pack ) all of them finally covered and shrunk together by a polyethylene film in order to be stored also outside.

The fibre recycling system ( QC0 ) allows to handle and recycle all clean fibre scraps to the collection chamber.

The whole line is controlled and supervised by a full automatic control system ( A04 ) based on PLC and SCADA supervision system. Most of motors, in particular all conveyors , fans and process blower are controlled by inverters allowing so the best optimization energy according effective need of the manufacturing process.

The factory will be designed to allow in the future the installation of an ON LINE Pipes Production Line . This Pipes production line will be fed through a secondary glass feeder coming out from main line ( rolls and boards ) fore hearth. The glass coming out from feeder goes to one 300 mm fiberizing that produce the fibre, sprayed with binder, collected by a small forming chamber where the light primary mat is formed . This primary mat is then conveyed to the pipe production line that, cuts at right length , windup, smooth , cure and finally finish the pipes by cutting its edge and longitudinally.



## 2. PROJECT MAIN SPECIFICATION

The proposed line will be able to manufacture C- Glass glass wool products for thermal and acoustical insulation in particular **Board, Rolled Mattress**. The total year production capacity will range between 19,000 ton /year depending on type of products (rolls, boards ), production range and in general factory overall efficiency.

In particular specification of main production units can be summarized as :

### RAW MATERIAL PREPARATION PLANT

- Capacity: 70 t/16h.
- Number and capacity of raw material silos and expected way of loading :
 

○ Dolomite silo	1 pc	ca. 35 t each	pneumatic,
○ Borax silo	1 pc	ca. 70 t each	pneumatic,
○ Limestone silo	1 pc	ca. 35 t each	pneumatic,
○ Feldspar	1 pc	ca. 35 t each	pneumatic,
○ Soda silo	1 pc	ca. 70 t each	pneumatic,
○ Furnace's fines silo	1 pc	ca. 35 t each	pneumatic,
○ Float cullet silo	1 pc	ca. 70 t each	front loader,
○ Borosilicate cullet silo	1 pc	ca. 70 t each	front loader,
○ Internal cullet silo	1 pc	ca. 35 t each	front loader.
○ Sand silo	1 pc	ca. 70 t each	pneumatic
○ Spare	1 pc	ca. 35 t each	front loader.
- Number and capacity of mix silos:
 

○ Mix silo	1 pc	ca.30 t
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Final batch plant configuration will be defined according to raw material available and how they will be delivered.

- Preliminary possible mix composition: C glass – Patented STM Bio soluble :

For reference here below find STM patented bio soluble glass composition :

( SiO<sub>2</sub> = 63,8 %, Al<sub>2</sub>O<sub>3</sub> =2,0% ,Na<sub>2</sub>O=17,50% , K<sub>2</sub>O=0,4 %, CaO =6,8 % , MgO = 3,5 % , B<sub>2</sub>O<sub>3</sub> =6,0 % , F<sub>2</sub>O<sub>3</sub> < =0,2 %)

### **ELECTRIC MELTR & FOREHEARTH: Nominal capacity 60 ton/day**

- Melting method: electric (20 kV available)
- Melting capacity: 58 t/day
- Use of cullet to be maximized
- Fore hearth ( by gas ) with 4 bushings

### **BOARD & ROLL PRODUCTION LINE : Nominal capacity 58 ton/day**

- Working days per year : 330
- Fiberizing capacity : 2450 kg/hr
- Type of binder : phenol formaldehyde (future BIOBINDER)
- Product width : 1200 or 1250 mm.
- Product thickness : 20 – 250 mm.
- Product density : 10 – 100 kg/m3.
- DT index (density x thickness) : 500 x 8000 g/m2 (500 using thickness saw)
- Facing method : hot roll, hot melt.
- Facing type : both side.
- Longitudinal cut : 5 blades
  - Horizontal cut: split in 2 layers
- Product quality Standard : EN13162
- Packaging method:

### **ROLLS**

- Roll width: 1200 m, or 2 x 600 mm packed separately,
- Roll diameter: 400 mm,
  - o primary compression ( depending on products ) max. 1 : 8,
  - o roll packaging: PE foil, heat shrink at both ends,
- pallet size: 1200 x 1200 mm,
- load layout: standing roll, 2 row (24 pc),
- secondary compression: fit to pallet size.

### **BOARDS**

- compression: max. 1 : 6,
- mat packaging: PE foil,
- pallet size: 1200 x 1200 mm.

The pallet pack has to be suitable to be stored outdoor.

Pallet pack transportation method: Fork lift.



### 3. MAIN LINE PROCESS INPUTS

This chapter lists and describes main input to the process.

#### 3.1. Glass Raw Materials

GLASS RAW MATERIALS – see Technical Specification	
ITEM	DESCRIPTION
A	SAND
B	FELDSPAR SAND
C	DOLOMITE
D	RASORITE ( BORAX )
E	CALCIUM CARBONATE
F	SODIUM CARBONATE
G	INTERNAL CULLET
H	EXTERNAL CULLET depending on chemical analysis up to 80%
The final batch formulation and consumption will depend on the chemical composition of the available raw materials and on final chosen glass composition.	

Raw material characteristics must be selected properly both for grain size both for chemical analysis. Local available raw material specifications/characteristics have to be checked by STM Technologies in order to be able to confirm consumptions, emissions and usability.

#### 3.2. Binder Raw Materials

STANDARD BINDER RAW MATERIALS	
ITEM	DESCRIPTION
A1	PHENOLIC RESIN with Urea
A2	PHENOLIC RESIN without Urea (alternative to A1)
B	AMMONIA WATER
C	SILANE SOLUTION
D	MINERAL OIL SOLUTION
E	UREA PELLETS (in case of resin without Urea)
F	WATER

BIO BINDER RAW MATERIALS	
ITEM	DESCRIPTION
A	DEXTROSE
B	AMMONIUM SULPHAMATE
C	CITIRIC ACID
D	AMMONIA SOUTION
E	WATER

The final binder formulation and consumption will depend on the chemical composition of the available raw materials and solid content on final products. Local available raw material specifications/characteristics have to be checked by STM Technologies in order to be able to confirm usability.



### 3.3 Fuels and electricity

<b>INDUSTRIAL WATER</b>	<b>By Buyer</b>
Used for	Binder, Water cooling circuit re-fill
Design quantity (not including cleaning , fire extinguish , offices .)	5 m3/h
Consumption	See chapter 3.
Maximum temperature	30 °C
Delivery minimum pressure	3 bar
Maximum Hardness	25 ° French degrees

<b>GAS</b>	<b>By Buyer</b>
Used for	Fore heart, fiberizing Curing oven
Heat Net Value	8,500 kcal/Nm <sup>3</sup>
Total installed as design	700 Nm3/h.
Consumption	See chapter 3.
Pressure (stabilized and reduced)	0.2 bar

<b>ELECTRIC POWER</b>	<b>By Buyer</b>
Used for	All equipment
Total Installed power (including melter )	8000 KVA approximately. (consumption 2000 kw melter at 20 kV 2500 kw + 500 kw at 400 V for process + building and spare ).
Medium voltage	20 kV – 50 Hz
Low voltage	400 Volt – 50 Hz
Consumption	See chapter 3

#### 4. LINE SPECIFIC CONSUMPTION

The following table list the raw materials and main utilities nominal specific consumption. All data are referred to the nominal capacity considering 5- 6 % of binder solid content into the product and a binder spraying efficiency of 70 %.

##### RAW MATERIALS & ENERGY SPECIFIC CONSUMPTION – REFERENCE TABLE

Description	Consumption/ Ton product	Note
Sand	272 kg	
Dolomite	72 kg	
Rasorite ( BORAX )	101 kg	
Calcium Carbonate	0 kg	
Sodium Carbonate	110 kg	
Float cullet	332 kg	
Internal cullet	200 kg	
<b>If Phenolic Resin Binder ( as reference )</b>		
Phenolic Resin with Urea	100 .140kg	Dynea
Ammonia Water (19 % solid content)	6,3 kg	
Water	770 kg	
<b>If Bio Binder ( as reference )</b>		<b>FUTURE</b>
Dextrose Monohydrate	80 kg	
Ammonium sulfamate	1.4 kg	
Citric acid Monohydrate	14 kg	
Ammonia Water (19 % solid content)	18 kg	
Water	730 kg	
<b>With Phenolic and Bio Binder ( as reference)</b>		
Mineral oil (53%)	9 kg	
Silane ( 2%)	5 kg	
Silicon ( 0,5 % )	1 kg	
Gas for Feeder , Fiberizing Curing	150 160 Nm <sup>3</sup>	
Electricity for Melter	900-1050 kWh	
Electricity for Line	950-1100 kWh	Include compressed air.
Water refill of cooling system.	1,0-1,5 m <sup>3</sup>	
Spinners	< 0.01	Typical life 200 hours
Facing Materials.	Acc. Products	
Hot Glue	Acc. Products	
Polyethylene film	Acc. Products <sup>3</sup>	

The batch formulation is according to STM “Technical specification of the glass raw material. Obviously the final batch formulation and consumption will depend on the chemical composition of the available raw materials and on final chosen glass composition ( p.i .Bio soluble or standard). Internal cullet amount depend on production yield. It is possible to use external cullet up to 70 % of batch.

## 5. WASTES

### 5.1 Air pollution handling and exhausted smokes

All gasses generated by the manufacturing process are treated adopting Best Available Technologies (B.A.T). In details and having as reference process flow scheme shown at previous chapter 1 we have.

- Each silo (TT0 ) has its own high efficient bag filter that work only when material is loaded, some hours per week. Dust captured by bag is discharged into the silo itself pneumatically. Exhaust air is conveyed to a common duct and then to Chimney CM1.
- Each transporting unit of batch plant ( TT0 ) has its own high efficient filter that works only when batch is in operation ( 10 minutes /hour ). Dust captured by bags is discharged into transporting units and conveyed to the melter. Exhaust air is conveyed to a common duct and then to Chimney CM1.
- The silo of the fiber recycling system ( QC0 ) has its own high efficient bag filter that works only when material is loaded, some hours per day. Dust captured by bag is discharged into the silo itself pneumatically. Exhaust air is conveyed to a common duct and then to Chimney CM1.
- Melter ( BE0 ) has its own high efficient bag filter and exhaust air is exhausted to Chimney CM1. Dust captured by bags and recycled by discharging it into bucket elevator loading the daily silo.
- Forming chambers ( JJ0+ EE0 ) polluted gases line are sent to the factory Wet Electro Static Precipitator ( BY0 ) that exhaust the treated and cleaned gasses to the main Chimney CM2.
- Curing oven ( SS0 ) polluted gases are sent to the factory Wet Electro Static Precipitator ( BY0 ) that exhaust then treated and cleaned gasses to the main Chimney CM2.
- Cooling section ( II0 ) polluted air is sent to the factory Wet Electro Static Precipitator that exhaust then treated and cleaned gas to the main Chimney CM2.
- Dust generated by all cutting machines is sucked and filtered by an high efficient bag filter that exhaust cleaned gas to the third factory's chimney CM3.

The total smokes flow rate and pollution coming out from the process have be summarized into the following table

Emission points ( see scheme)	Unit	CM1	CM2	CM3
Process sources		Electric melter + batch Plant + Fiber Recycling	Formings , oven, cooling section	Main line cutting machines
Height of chimney ( see layout)	m	1,5 m above roof	30 m	1,5 m above roof
Outlet section diameter	m	0.8	2.4	0.8
Total maximum flow rate	Nm3/h	25000	240000	35000
Smoke temperature	°C	100	30	40
Treatment system	Type	Bag Filter	Wet Electrofilter	Bag Filter
<b>Note* : typically lower</b>				
<b>Pollutant concentration</b>				
Particulate	mg/m3	< 10	< 10	< 10
Phenol	mg/m3	N.A.	< 5	N.A.
Formladehyde	mg/m3	N.A.	< 5	N.A.
Ammonia	mg/m3	N.A.	< 40	N.A.
SOX as SO2	mg/m3	<20	N.A	N.A.
NOX	mg/m3	N.A.	<30	N.A.
VOC	mg/m3	N.A.	< 30	N.A.

## 5.2 Liquid wastes from process

The process does not produce waste water or liquid, meaning all water produced is recycled internally or consumed. In particular we have:

- Use of softened water to refill the loss for evaporation by the cooling water
- Use of softened water to refill the water filtering system which losses are
  - o water evaporated during filtering process and because some recycled water is used to dilute the binder
- Use of softened water to prepare binder that then is sprayed into the product.
- Use of tap water to cool down/break cullet when not in production. This water, hot ,but not chemically polluted, can be discharged into the city sewage or recycled into a properly dimensioned fire safety water tank /lake cooled by natural evaporation.

## 5.3 Noise levels

The attached drawing 3049-5-XX0-00-TS-950 indicates noise value levels measured at 1 m distance from noise generating source inside the factory.

## 5.4 Solid wastes handling and values

Solid wastes produced by the process are :

- End line scrap caused by not proper line settings , by change of product or line breakdown and that are mainly recycled by means of the Fibre Recycling System ( QC0 ).In detail, not good products are collected manually, milled, stored into a buffer silo and then recycled by introducing them properly (dosed ) into the product as flocks into the forming section ( JJ0 ). In case the amount of not good product is too big and can not be recycled ( for example because of too many stops of line ) , such dry fibre waste can be disposed through authorized companies as bales of compressed wool/fibres by using an hydraulic compacting machine.
- Solid wasted produced by the forming water filtering system used both to wash smokes of suction and oven and to wash the system itself. This system works with dirty water containing fibres and binder recirculating and passing through some static filters. The static filter capture the fibres conveyed then to a press compactor that press it producing cylinders of wet compressed fibres. The filtered water, as said, is used to dilute binder in fiberizing zone. In true this water by recirculating will always increase its concentration of solid binder and will also bring to the formation of mud into the bottom of the filtering tank. With certain frequency , this mud+ water is sucked by a pump and sent to a vacuum rotative filter working by adding special filtering aid material ( perlite ) . The final result of this process is the production of regenerated usable water for filtering system and almost dry mud to be disposed. The solid waste quantity and relevant chemical composition strongly depend on binder used, production capacity and production/process management.

The total amount of solid wastes as wet fibre + mud generated can be estimated in 1,5 % of the total good production and, in most countries of Europe, if fibre are bio soluble , it is classified as CER 17.06.04.

Emission points ( see scheme )	Unit	ZW1
Process sources		Filtering plant system out
Type of solid wastes	Type	mud -fiber
Expected amount	ton/day	< 0,8
Treatment system	Type	Disposal
<b>Solid Pollutant components</b>		
Glass fibers ( most ), Phenolic resin , Ammonium sulphate , Oil , Calcar , water		

## 6. PERSONELL REQUIREMENTS

The proposed basic production line will require the employment of about 90 workers. This number includes only personnel needed to run the main roll and boards production line (production , maintenance ,quality , warehouse ) and does not include administration and marketing.

PERSONNEL TO MANAGE A 58 TON/DAY GLASSWOOL PRODUCTION LINE						
Responsibility Area	Quantity of personnel in one shift				Specialization	Main Activities
	1°	2°	3°	4°		
Batch plant ( storage + preparation)	1	1	1	1	Front loader driver	load raw material
	2	2	2	2	loading worker	manage raw material storage and preparation of batch
Binder plant ( storage + preparation)	1	1	1	1	Binder preparation responsible	manage raw material storage and preparation of binder
Fiberzing	1	1	1	1	Fiberizer	check and mangage all fiberizing system parameters like temperatur, pull , pressure to make machine working perfectly
	2				Fiberizing machine maintenance	Maintenance of fiberizing machines
	1				Technolog	Check batch composition , binder , air , oxigena and all procesi
Control Room Melter / Fiberizer	1	1	1	1	Melter Supervisor	chek melter working paramters
Board and Roll Line	1	1	1	1	Fork lift driver	Move product to warehouse
	2	2	2	2	On line workers	Work along the line (rollup, oven, facing)
	2	2	2	2	End Line workers	Collect product end of line
Control Room Line	1	1	1	1	Line supervisor	Supervise line working condition and manage the product changes
Warehouse	1	1	1	1	Fork lift driver	handle final product and load trucks
	2	2	2	2	Worker	handle final product and load trucks
	1				Warehouse manager	Mange warehouse
Factory management	1	1	1	1	Shift leader	Responble of line for each shift
	1				Production manager	Manage prodction of line
Maintenance	2	2	2	2	Mechanic	Predictive mechanical maintenance and break down maintenance jobs
	1				Electronic	sw and electronic maintenance
	1	1	1	1	Elettrico	Predictive electrical maintenance and break down maintenance jobs
	1				Maintenance Manager	Manage the whole maintenance
Laboratory	3	1	1	1	Laboratory specialist	Check production produzione
<b>Total each shift</b>	<b>29</b>	<b>20</b>	<b>20</b>	<b>20</b>		
<b>Total personnel</b>	<b>89</b>					

## 7. FACTORY SPACE REQUIREMENTS

See attached layout 3049-5-XX0-00-MD900.