Machining Department, CNC equipments

Machining Department, conventional equipments

Assembly area, building 1

Assembly area, building

Building 1 is made of 4 pavilions 20 x 80 m and one pavilion 20 x 60. Building 2 is made of two pavilions 20 x 120 m long. Each pavilion is divided in the center and each line is served by 2 rolling cranes by two bridges of 10 tons each plus one bridge of 5 tons. of 10 tons each.

Transportation of components between building 1 and 2 is made by two small diesel trucks. An additional tractor from casting sector is eventually used to help. Building 1 and casting is served by one 100 Hp compressor, with a 75 HP back-up. When casting (blasting) does not require, two smaller compressors of 15 HP feed building 1. Building 2 has one 30 HP compressor with a 30 HP back-up unit.

Besides building 1 and 2, there are the following constructions: the wood modeling and casting area, the wood models storage room, one room for general purposes storage, one small room for storage of lubricants, one small room for storage of painting material. The main office with administration on the top floor and engineering department on the lower floor. Building one has annexes for electric/electronic, after sales service, planning and control room, medical and safety on labor, and purchase sector. Space in one of the annexes is already provided for future installation of kitchen/restaurant.

Total land is 275 thousand square meters. Buildings used are sitting on land of 129 thousand square meters. The remaining 146 thousand square meters are connected to the area where the buildings are located, but are under separate paper.
One net of 69 computers (including 8 servers, 13 data collectors) plus 18 notebooks are used in the factory. Engineering has 7 Inventor 2.010 stations. CNC machines including sheet cutters are

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programmed on two stations, data transmitted over cable DNCs. Three wireless nets are used in the administration and assembly areas. Communication from the factory to outside is made by a dedicated radio link which connects directly to one telephone/internet hub of a provider.
Electric energy is delivered to the factory in 24 kV. Five transformers bring down the power to 380V, 60 Hz.

UNIVERSAL MILLING MACHINES:

- 1 conventional machine with 1.100 x 1.050mm working table, 2,5ton working piece maximum weight.
- 2 units 4 x 6 m floor-type with rotary table, maximum height 1.500 mm.
- 2 machines with 1.400 x 1.600mm working table, 1.100mm longitudinal displacement. One of them is equipped with rotary table and the other CNC controls.
- 1 Wotan 5 axis CNC machine, 1.800 x 1.700 x 1.500mm X;Y; Z displacement and 4ton working piece maximum weight.
- 1 floor type 7.000mm and 2.500mm (X and Y) displacements, 1.550mm tool shaft displacement and 15ton working piece maximum load.
- 1 FEZER CNC machine Model 763, 6,0ton working piece maximum weight, 1.990x2.000x 2.000mm (X, Y, Z) displacement and rotary table

Machining operation on casting iron gear

FEZER 763 Milling Machine – 6ton

working piece maximum weight – X=1.990, Y=2.000 e Z=2.000

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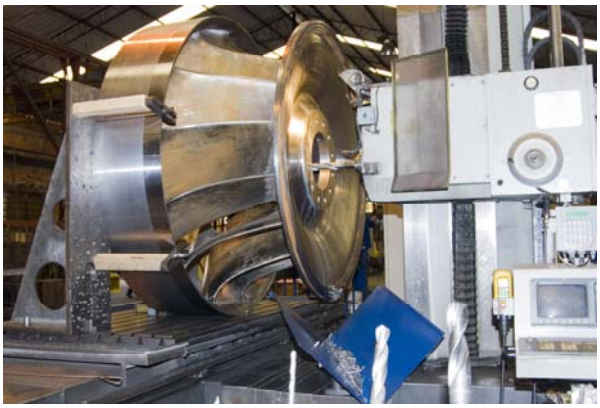
FEZER 763 Milling Machine

Machining operation on stainless steel rotor

Shibaura Milling Machine – 6ton working piece maximum weight – X=2.300, Y=1.400 e Z=1.400



Machining operation on hydroelectric power plant rotor

Wotan Cutmax2 Milling machine - 4ton working piece maximum weight – X=1.800, Y=1.700 e Z=1.500

Machining operation on rotor valve, casting steel

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- Defun Floor type and table milling machine – 10ton working piece maximum weight – X=6.000, Y=1.500, Z=4.000mm

- Shibaura floor type and table milling machine – Machining operation on elevation column

GEAR CUTTERS AND CNC MACHINING CENTERS:

- 1 Heller CNC Machining Center, X;Y;Z de 4.000 x 500 x 560mm;
- 1 Sabre 1500 CNC Machining Center, X;Y;Z de 1.524 x 762 x 820mm;
- 2 Arrow 500 CNC Machining Center, X;Y;Z de 510 x 510 x 510mm;
- 1 Mazak FH 400 CNC Machining Center, X;Y;Z de 560 x 510 x 630 mm (working piece quick exchange system).
- 6 Universal milling machines;
- 1 Planning/Milling machine, 9.200 x 2.050 x 1.100 mm maximum working piece size;
- 1 Vertical planer, 800mm working table diameter;
- 1 Conical gear cutter, 500mm maximum diameter, modulus 1
- 1 Fellows gear cutter, 800mm maximum diameter, modulus 8
- 1 Straight/helical gear cutter, 710mm maximum diameter, modulus 8
- 1 Inside/Outside straight/helical gear cutter, 3.300mm maximum diameter, modulus 20

Mazak FH 400 CNC Machining Center, X;Y;Z de 560 x 510 x 630 mm

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Cincinati CNC Machining Center –X=1.524, Y=762 e Z=820

Heller CNC Machining Center – X=4.000, Y=500 e Z=560

Inside/Outside straight/helical gear cutter, 3.300mm maximum diameter. Machining operation on casting iron gear with inside teeth

Inside/Outside straight/helical gear cutter, 3.300mm maximum diameter. Machining operation on casting iron gear with outside teeth

Inside/Outside straight/helical gear cutter, 3.300mm maximum diameter. Machining operation on casting iron gear with outside teeth

Straight/helical gear cutter, 710mm maximum diameter

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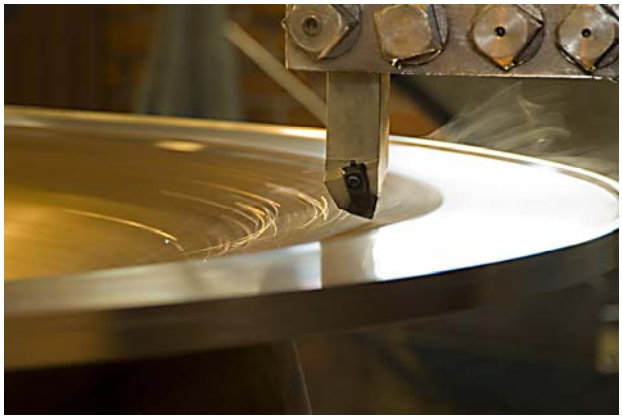
TURNING LATHES:

- 3 CNC Turning lathes, 420mm maximum diameter, 3.000mm maximum length;
- 10 Conventional turning lathes;
- 2 Vertical Lathes; 4.200mm maximum diameter.

Romi Centur 40a CNC Turning Lathe

Romi Cosmos 10u CNC Turning Lathe with automatic loader

Vertical Lathe, 4.270mm maximum diameter. Machining operation on hydraulic turbine stainless steel carcass



Vertical Lathe, 4.270mm maximum diameter – Machining operation on hydraulic turbine rotor

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Vertical lathe, 1.200 mm maximum diameter

Conventional turning lathe – 800 mm diameter x 5.000mm

PLANING – Milling MACHINES:

- One machine 6.000 x 1.200 x 1.200 mm
- One machine 9.200 x 1.200 x 1.200 mm
- One machine 6.000 x 2.050 wide x 1.400 mm

Milling machine maximum 6.000 x 2.050 wide x 1.4 m high parts

Planing/milling machine – Machining operation on 10m long

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DRILLING MACHINES:

- 3 column drilling machines and 2 radial drilling machines. Maximum drilling diameter 100mm;

GRINDING MACHINES:

- 2 flat grinding machines, 4.100mm maximum length
- 2 cylindrical grinding machines, 400mm maximum diameter, 2.500mm maximum length.

Instruments on temperature controlled room. Maintenance and calibration is Tooling. Several machines are installed in this sector to sharpen and set-up made by an specialized outside contractor. Tools for the factory.

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CUTTING AND WELDING:

- 1 CNC Cutting machine, 6in maximum thickness;
- 1 CNC Oxi/Plasma cutting machine, 4in maximum thickness, 1 in in plasma.
- 3 Automatic band saws, one blade saw
- 01 250 tons press
- 01 400 tons bending press up to 6.4 m length material
- 02 eccentric presses, one 65 and one 120 tons.
- 01 rolling machine
- 01 3 m x ¼" plate shear, 01 3 m x 3mm plate shear.
- 01 thin sheet slitter
- 01 thin sheet profile shaper
- 7 Welding stations on 1.5 x 4 m and 2 x 4 m level benches
- 24 Welding equipment (MIG, Electrical);
- 1 electric oven;
- 2 Painting rooms, one carrousel for painting small components hanged on chain conveyor and 2 steel blasting room.

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Acquisition of manufacturing times is made throughout the factory with data collectors. Each part is identified by a bar coded instruction that accompanies the part until completion. Each machining operation is made after passing the bar code in the instruction under the data collector. The operator will pass the instruction again when the machining is finished. This generates instruction to move the part to the next operation. The summation of all operations is then processed to give the total manufacturing time for this part. Assembly of components to finalize a product also has the time run through data collectors. Addition of cost of purchased components will give final product cost. Presently there are 13 data collectors inside the factory, 11 for manufacturing, 2 for assembly.

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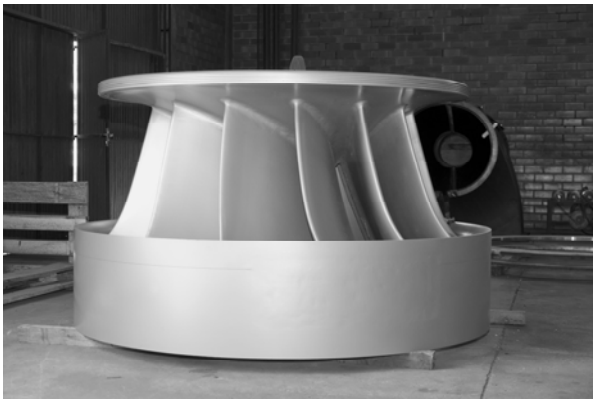
CNC Cutting machine

Welding operation – Hydroelectric power plant suction pipe

- Welding operation – Hydroelectric power plant distribution body



Painting and finishing – Hydroelectric power plant rotor

Rotor/Shaft assembly

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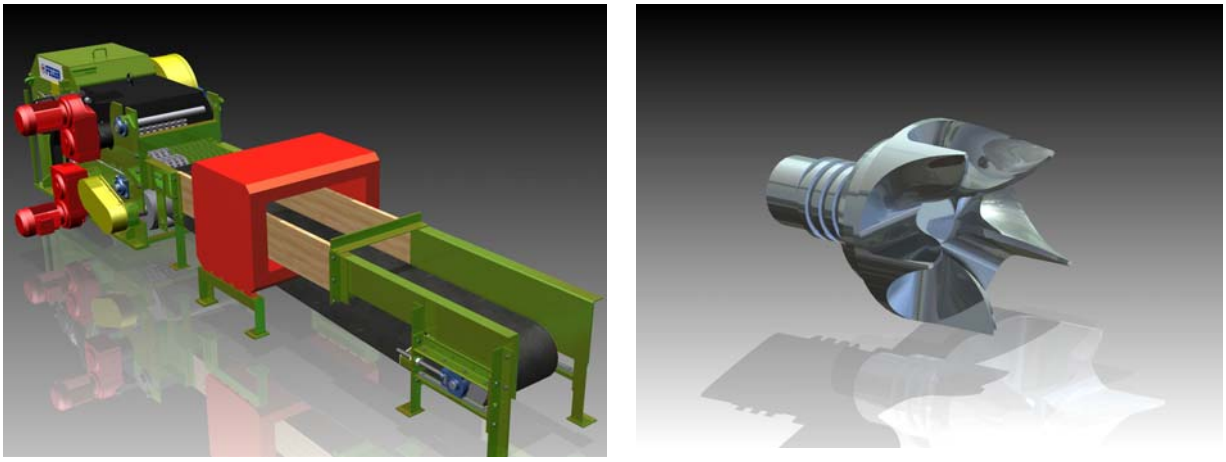

3D CAD design

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