

An introduction to the basic equipment and production processes in Khouzestan Oxin Steel Co.

Slab yard area

Raw materials are transferred by trucks or trains to a yard of some 7650 square meters (430*255), which is armed with three magnetic cranes; these cranes could alternatively be used as grab cranes for hot slabs discharged from furnaces. The lifting capacity of a crane equals 800 KN – in other words 80 tons.

Reheating furnaces

The reheating furnaces, which are of the walking beam type, are located after the slab yard area and are 34.7 m in length, 10 m in width, and 4.5 m in height.

The slabs are conveyed to the charging table and are automatically moved on a rolling table in a specific order which are fed into the furnaces after having been weighed. The charging and discharging procedures are carried out automatically.

These furnaces are comprised of four zones:

- 1- Recuperative zone: 13.1 m in length without torch
- 2- Reheating zone: 7.3 m in length with 12 torches
- 3- Heating zone: 7.3 m in length with 12 torches
- 4- Isothermal zone: 7 m in length with 34 torches

The second and third zones are divided into two subareas and the isothermal zone is subdivided into 4 areas. In general, heating of slabs are carried out using 58 torches whose temperatures are controlled by thermocouples.

These furnaces use natural gas to operate. The reheating air is heated using fans based on recuperative systems to supply the required air for the operation of torches. The output gasses are measured by means of some analyzers.

The movement of the materials in heating furnaces are monitored by cameras. This process is done by means of constant or moving beams. The cooling of the beams in the furnace is performed by a close-circuit water cooling system.

The whole processes of charging, discharging, and heating as well as tracking of the slabs are controlled using the Level 1 and Level 2 automation programs. Considering the size of slabs, the heating time will be approximately 3.5 hours for each slab.

Slab size for charging furnaces:

Thickness: 110 to 300 mm

Width: 1200 to 2200 mm

Length: 3000 to 4500 mm

Exit temperature: 1250 °C

Descaling system

As the oxidation of iron happens at high temperatures, a descaling system is installed after the furnaces to remove layers of oxide from the discharged slabs.

At this point, water, with a discharge pressure of 255 bars, causes the slabs to be descaled and removed of any superficial layers of iron oxide. The distance between slabs and water nozzles is set according to the thickness of slabs.

High Reversing Mill Stands

After descaling process is done, slabs are led to the rolling stand consisting of four rollers of which two rollers are known as work rollers and the others as back-up rollers. The slab milling is done by a backward and forward movement. An intended thickness is achieved by a turn table that rotates slabs at 90° and charges them into furnaces.

Hydraulic Automatic Gap Control

This system controls the gap between work rollers during the milling process which greatly enhances the accuracy of thickness measurement. The reaction force generated during the milling process reaches 100.000 KN or 10.000 tons.

According to the type of milling process, rollers are then cooled by water using required pressure. Due to the high temperature of the sheet, a thin layer of oxide is formed which is removed by help of an onboard descaling unit using a water discharge pressure of 255 bars.

X ray machine

This machine, located after the stand, is used to continuously measure the thickness of the sheet during the process and send a report to the next milling phase to set up HAGC.

Gamma ray machine

This machine, located after the X-ray machine, measures the length, width, and thickness at three points as a transverse profile and sends a report to Level 2 program for any further control and modification of the milling process. This equipment is highly sophisticated and unique in Iran.

Accelerated cooling system

This machine, located after the stand, engages in the thermo-mechanical milling (changing the microstructure, granulation, and mechanical properties) which reduces the sheet temperature to the required level.

This system consists of:

- 1- Top header cooling pipes are equipped with some spray nozzles for discharging water on the sheet surface. These are some 13 pipes in U-shaped forms which produce a water discharge pressure of 0.8 bars.
- 2- Bottom headers cooling pipes are equipped with some 26 nozzles for discharging water on lower surface of sheets. These nozzles produce a water discharge pressure of 0.3 bars.
- 3- Air pipes, installed at the beginning and the end of the system, are used to dry any water from the surface of the sheets.

Plate dimensions

Thickness: 5-50 mm

Width (Max): 4650 mm

Length: 40000 mm

Hot plate leveler

Hot plate leveler, located after the stand and ACC system, is responsible for leveling out the hot plates after the milling process. The hot leveler comprises of nine rollers four of which are installed on the upper cassette and five more on the lower cassette which are cooled by a circulation of water.

To eliminate waves at different points transversely, the machine chooses from tilting, skewing, or bending states to finally remove any sort of waves or ripples.

Hot plate leveler

Steel grade: Carbone steel API steel HSLA

Plate thickness: 5-50 mm

Plate width: 1200-4650 mm

Hot mother plate marking:

This machine, located after the hot leveler, registers an ID number on plate for further tracking and identification of the plate during other stages. Temperature of the mother plate could maximally reach 900 °C.

Cooling bed area

This area is comprised of the following:

- 1- Cooling bed 1
- 2- Cooling bed 2
- 3- Inspection bed
- 4- Slow cooling area (12)

The cooling beds are of disk type into which hot plates enter after having been marked. Cooling bed 1 and 2 are consisted of three parts each including the charging machine, rotating disks, and the discharging machine. Each cooling bed has an area of 1840mm, that is the length and width are 46m and 40m respectively.

Each bed includes two sections of which either Sec 1 or Sect 2 or both could be opted according to the length of plates. Temperature of the cooling beds output plates would not be more 120 °C. Plates with a max thickness of 50 mm are led to the inspection part after discharging from the cooling beds.

Slow cooling area is employed in thermo-mechanical milling or in case the reduction of H2 is required whereby plates of 500 °C are discharged form cooling beds and piled until they are cool.

Plate inspection table utilizes a turn over device that enables both side of the plates to be inspected. All procedures are monitored and guided in the cooling bed areas using cameras and precision instruments.

Mother plate dimensions:

Plate thickness for cooling bed: 5-150 mm

Plate thickness for inspection bed: 5-50 mm

Plate width: 1200-4650 mm

Max. plate length: 40000 mm

To obtain the customer order specifications, plates with a thickness of more than 50 mm are transferred to the cutting torch hall using overhead cranes after they reach the rolling table at the end of the cooling beds.

Ultrasonic device

This device, located after the inspection bed and before the trimming machine, is used to detect all the internal defects including faults or pores and the like. Plates are analyzed based on the order and as per customer required standards. The results of this stage are crucial to the side trimming and dividing procedure.

Technical data:

Plate width: 1200-4650 mm

Plate thickness: 5-50mm

Plate temperature: ≤ 100 °C

Side trimmer

This device, considering the ultrasonic test results, trims off sides of the plates to produce the desired plate. One side of this equipment is fixed and the other side is moveable that can be set as per order.

Technical data:

Plate thickness range: 5-50 mm

Width (before trimming): 1200-4650mm

Width (after trimming): 1100-4500mm

Length: 6000-40000mm

Max. plate temperature=120 °C

Slitting shear

This device, located after side trimmer, is responsible for cutting of plates in length whereby a plate, for instance, of 4m in width is divided into two plates of 2m width. The cutting procedure is similar to that of side trimmer.

Technical data:

Plate thickness range: 5-50 mm

Width (before slitting): 2200-4500 mm

Width of slit plate: 1100 mm

Cold leveler

This device, located after slitting shear, is responsible for leveling out waves and other small deformations resulted from cutting of plates up to 25 mm in thickness. When the plates are through the cold leveler, they are free of any completely flat and even. The operation of this device is much similar that of the hot leveler but it is dissimilar regarding the number of rollers that is 11. Five rollers on the upper cassette and 6 rollers on the lower cassette which are supported by backup rollers each.

The device opts from tilting, bending, or skewing according to the changes resulted from cutting of the plates.

Technical data:

Levelled material thickness: 5-25 mm

Plate width: 1100-4500mm

Dividing shear

Plates are led into the dividing shear after passing the side trimmer, shear slitting, and cold leveler.

In parallel with cutting the both ends of mother plates, this device divides plates in desired length as per customer orders. Using the controlling and precision instruments, the shearing device produces plates that meet customer standards in terms of shape and size.

Technical data:

Max. plate thickness: 50 mm

Cutting speed: 18 cuts/ min

Max. plate width: 4650 mm

The plates are marked and weighed by the respective devices. Where heating process is needed, plates are conveyed to the heating operation area otherwise they are led to the packing and plate yard areas to be delivered to customers.

Pilers

At the end of the production line, two piling devices are responsible for transporting plates from the rolling tables either to the exit table or heating operation area. These devices are capable of lifting plates of 2.5 through 24 m.

Labeling and bonding

On the exit table, pilers put plates of similar size on one another and lead them to the bonding and labeling machines. The plates are then packed by means of special straps. Each package is then labeled which bears plates specifications and customer needed data. Then the packages are conveyed to the storage area by means of magnetic cranes to be delivered to customers by trucks or trains. Three magnetic cranes carry out the loading of packages.

Heating operation area

This area contains the following equipment:

- 1- ANF Furnace (Austentizing and/or Normalizing)
- 2- CQM (Continuous Quenching Machine)
- 3- TNF (Tempering and/or Normalizing Furnace)
- 4- Cooling beds
- 5- Warm plate leveler

The following two processes are done in the heating operation area:

1- Quench-Temper operation

Initially, the plates are put on the input conveyer of an ANF furnace. According to the thickness, rollers speed is calculated. Then, they are austentized to be moved to the quenching machine. The quenching machine is comprised of some upper and lower rollers as well as nozzles. Controlled pressurized water is discharged from upper and lower sides on the surface of plates and rollers, with controlled pressure, are applied on the surface which would result in eliminating any deformation. After having been cooled down, they are led to TNF furnaces and the tempering operation is carried out on them. The plates are gradually cooled down on cooling beds at room temperature to be sent to warm leveler.

2- Normalizing operation

It is noteworthy that both ANF and TNF furnaces are capable of accomplishing normalizing operation. This could be done by creating similar temperature in both furnaces through which plates are conveyed to be austentized. After their discharge, they are cooled down at room temperature in cooling beds.

Plate characteristics

Plate size

Thickness: 10-120 mm

Quenched and tempered products: 10-60 mm

Width: 1100-4500 mm

Length: 2500-15000 mm

Max. plate weight: 21T

Steel qualities

C + Mn

High Carbon

Micro alloyed

Low/High Alloy

Scope

Structural

Welded pipes

Ship building

Pressure vessels

Weather resistance

Off – shore platforms

Petrochemical Industry



Warm plate leveler

This device is used to level out plates undergone heating operations. This device operates in a way similar to hot leveler.

Technical data

Plate thickness: 10 – 60 mm

Plate width: 1100-4500 mm

Max. plate temperature Up to 600°C

The plates are sent to the storage area after having been leveled out and marked.

