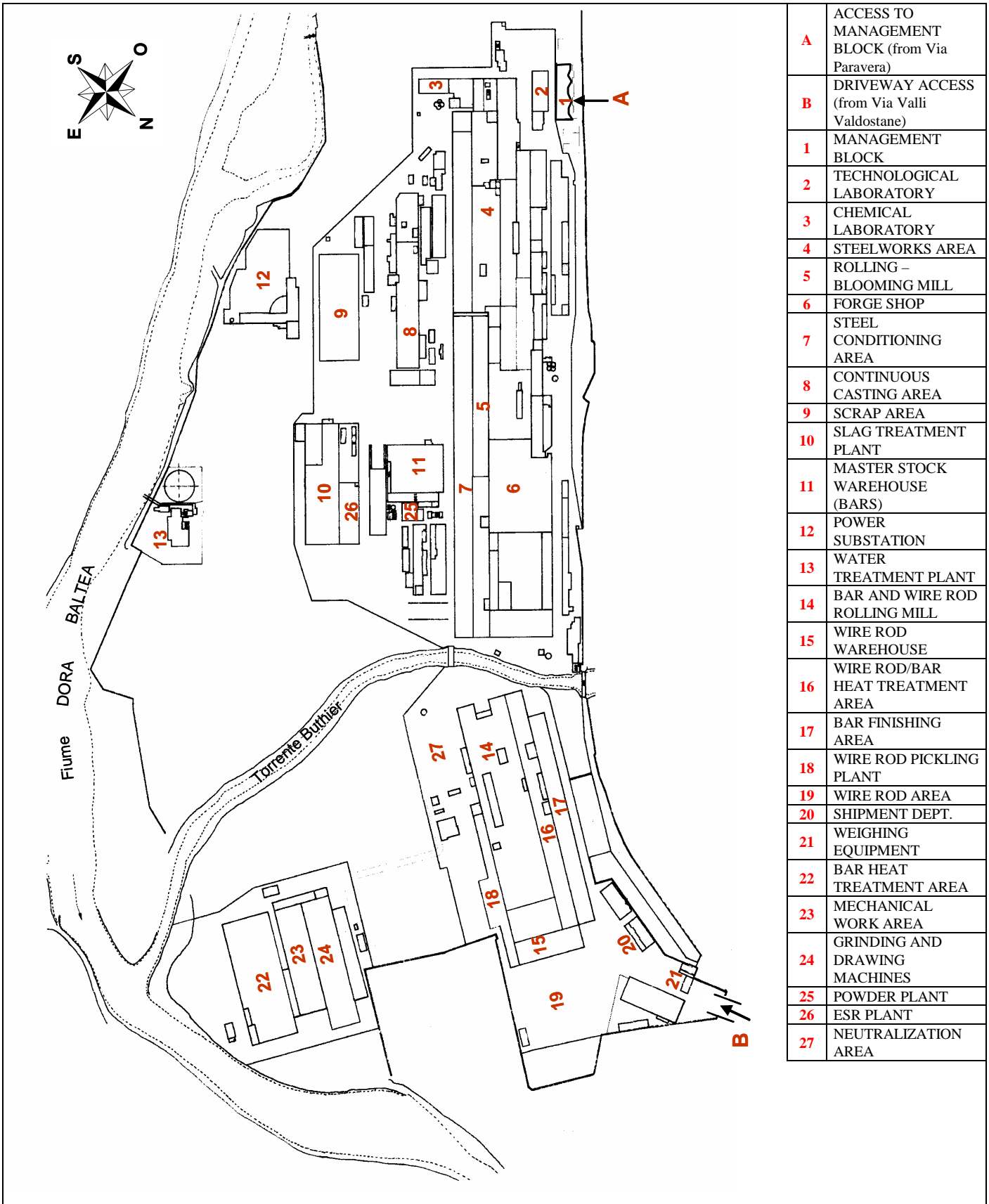




***DESCRIPTION OF INSTALLATIONS AND
MAJOR WORK PROCESSES AT THE
STEELMAKING PLANT IN AOSTA***

Aosta, 22th October 2015

LOCATION PLAN OF AOSTA PLANT



A	ACCESS TO MANAGEMENT BLOCK (from Via Paravera)
B	DRIVEWAY ACCESS (from Via Valli Valdostane)
1	MANAGEMENT BLOCK
2	TECHNOLOGICAL LABORATORY
3	CHEMICAL LABORATORY
4	STEELWORKS AREA
5	ROLLING – BLOOMING MILL
6	FORGE SHOP
7	STEEL CONDITIONING AREA
8	CONTINUOUS CASTING AREA
9	SCRAP AREA
10	SLAG TREATMENT PLANT
11	MASTER STOCK WAREHOUSE (BARS)
12	POWER SUBSTATION
13	WATER TREATMENT PLANT
14	BAR AND WIRE ROD ROLLING MILL
15	WIRE ROD WAREHOUSE
16	WIRE ROD/BAR HEAT TREATMENT AREA
17	BAR FINISHING AREA
18	WIRE ROD PICKLING PLANT
19	WIRE ROD AREA
20	SHIPMENT DEPT.
21	WEIGHING EQUIPMENT
22	BAR HEAT TREATMENT AREA
23	MECHANICAL WORK AREA
24	GRINDING AND DRAWING MACHINES
25	POWDER PLANT
26	ESR PLANT
27	NEUTRALIZATION AREA

Total surface= approx. 550,000 sq.m
 Covered surface = approx. 270,000 sq.m

A) MAIN WORK PROCESSES

Production

Scrap area

Storage of in-house and purchased scraps divided into different types, especially based on their chemical composition.

They are used according to the following principle.

The Charge Manager draws up a charge sheet for each cast indicating the following about the scrap:

- 1) quantity and type;
- 2) division of scrap in 2 to 3 furnace charging baskets.

Cometto bogies

These are used to convey the charging baskets from the Scrap Area to the electric UHP furnace.

Electric UHP furnace

The furnace uses the electricity supplied by a 65 MVA transformer and three oxy-methane burners to melt approx. 80 tons of scrap material in 90 minutes.

The temperature rising from 20° to approx. 1650 °C causes the metal to melt down.

Materials are added during meltdown. These are mainly:

- lime;
- FeSi;
- coke;
- other

(according to the instructions provided in the charge sheet).

When the melting process is completed, the liquid contained in the furnace is transferred to the ladle.

After a short slagging cycle, liquid metal is ready for loading into an AOD converter.

AOD converter

This is a refractory vessel in which the liquid originating from the electric UHP furnace is loaded.

- The liquid molten in the furnace contains a few elements:
C, Si and Cr
which can be considered as low cost fuel.
- A mixture of oxygen and inert gas is poured into the AOD converter to produce the following effects:
C+ O₂ all → CO Gas + heat
Si+ O₂ all → SiO₂(slag) + heat
Cr+ O₂ little → Cr₂O₃(slag) + heat

This process also generates the heat required to melt all the alloys necessary for the chemical tests prescribed for the various castings.

- An amount of lime is added during oxygen injection to dissolve the slagged elements in it.
- At the end of the injection process, metal is supplemented with silicon iron in order to clean the slag from the chromium content that has formed during oxygen injection.
- Lastly, metal is checked several times for its chemical composition.
As soon as the desired chemical composition is obtained, liquid steel is poured into a casting ladle and is prepared for the next casting operations in the LF station.

LF station

This station is used to prepare metal for the casting cycle after it has been spilled from the converter. The main purpose of this station is to heat/cool the liquid steel until it reaches the correct casting temperature. The LF station works as a small electric furnace. Besides its heating function, the LF station is also used to add materials for micro corrections of the analysis.

RH system

This system is used to create vacuum. Prior to casting, some types of steel must be kept under vacuum for approx. 30 minutes.

Casting

After the production cycle consisting in UHP + AOD + LF and possibly RH, steel is transferred to the casting station where the solidification process begins and is completed.

Two different casting systems exist:

- uphill casting;
- continuous casting.

UPHILL CASTING

This is the oldest technology, which is still adopted for special types of steel or whenever the final product is very large in size (and cannot be obtained from continuous casting production).

This technique requires that liquid steel is tapped into cast iron containers (ingot moulds) where the solidification process takes place (induced by the spontaneous drop in temperature from 1600 °C to far below 1000 °C).

The ingot moulds are fed through a series of refractory channels that are installed in a dedicated area intended for the "preparation of slabs".

Besides cast iron containment equipment, these operations also require:

- preformed refractory elements;
- quartzites;
- casting powders (mixtures of inert fusible substances);
- high insulation inserts (in the top part of the ingot mould).

This technique is used in Cogne to produce INGOTS for:

- rolling (from 2000 to 6500 kg);
- forging (from 5600 to 75000 kg);
- ERS Electro-Slag Remelting (from 1200 to 13000 kg).

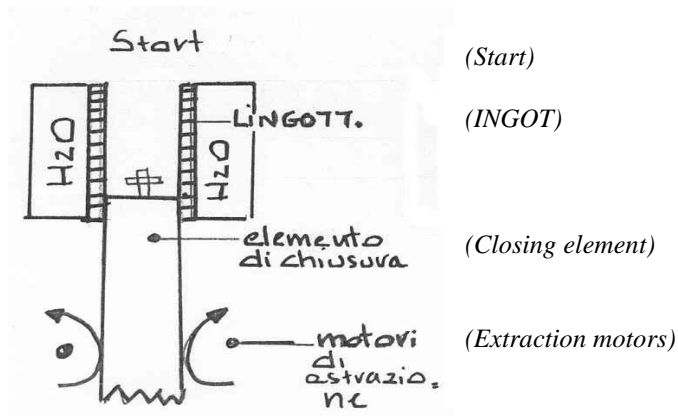
CONTINUOUS CASTING

This is the most cost-effective and common casting technology which produces intermediate semi-finished products:

- billets, 160x160 mm in size
- blooms, 220x270 mm in size

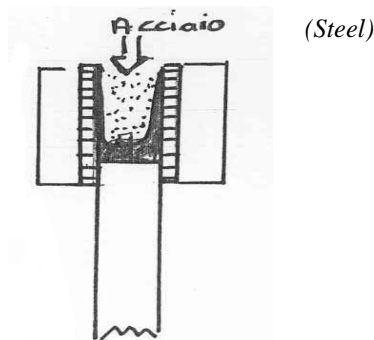
that are relatively easy and quick to convert into finished products.

In continuous casting solidification takes place in an ingot mould that is made of brass and has an open bottom, whose exterior is cooled with water.



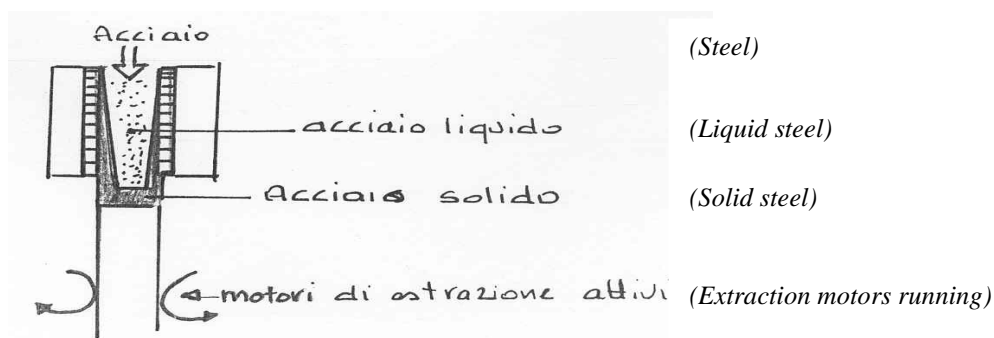
First step:

- the ingot mould is empty and a dummy bar is positioned in it;
- the extraction motors are not running.



Filling step:

- steel solidifies on the bottom and on the walls of the ingot mould;
- the motors are not running.



Extraction step:

- liquid steel continues to be tapped into the ingot mould and to cool on the walls;
- motors continuously extract the solidified material.

For this process steel is transferred from the ladle into an intermediate container, called tundish, the bottom of which presents casting holes.

The plant in Aosta has four casting lines. In theory, 80 tons of liquid steel may produce 4 billets (160x160) approx. 100 metres long.

Actually, the plant is provided with an automatic oxygen and propane gas cutting system to cut billet lengths of approx. 7 metres.

Each casting produces around 55 7-metre long billets.

ESR TECHNOLOGY

After solidification into ingots thanks to ESR remelting, metal is subjected to a purification process to obtain very high property materials to be used in extremely demanding sectors such as:

- armament industry;
- helicopter industry;
- surgery.

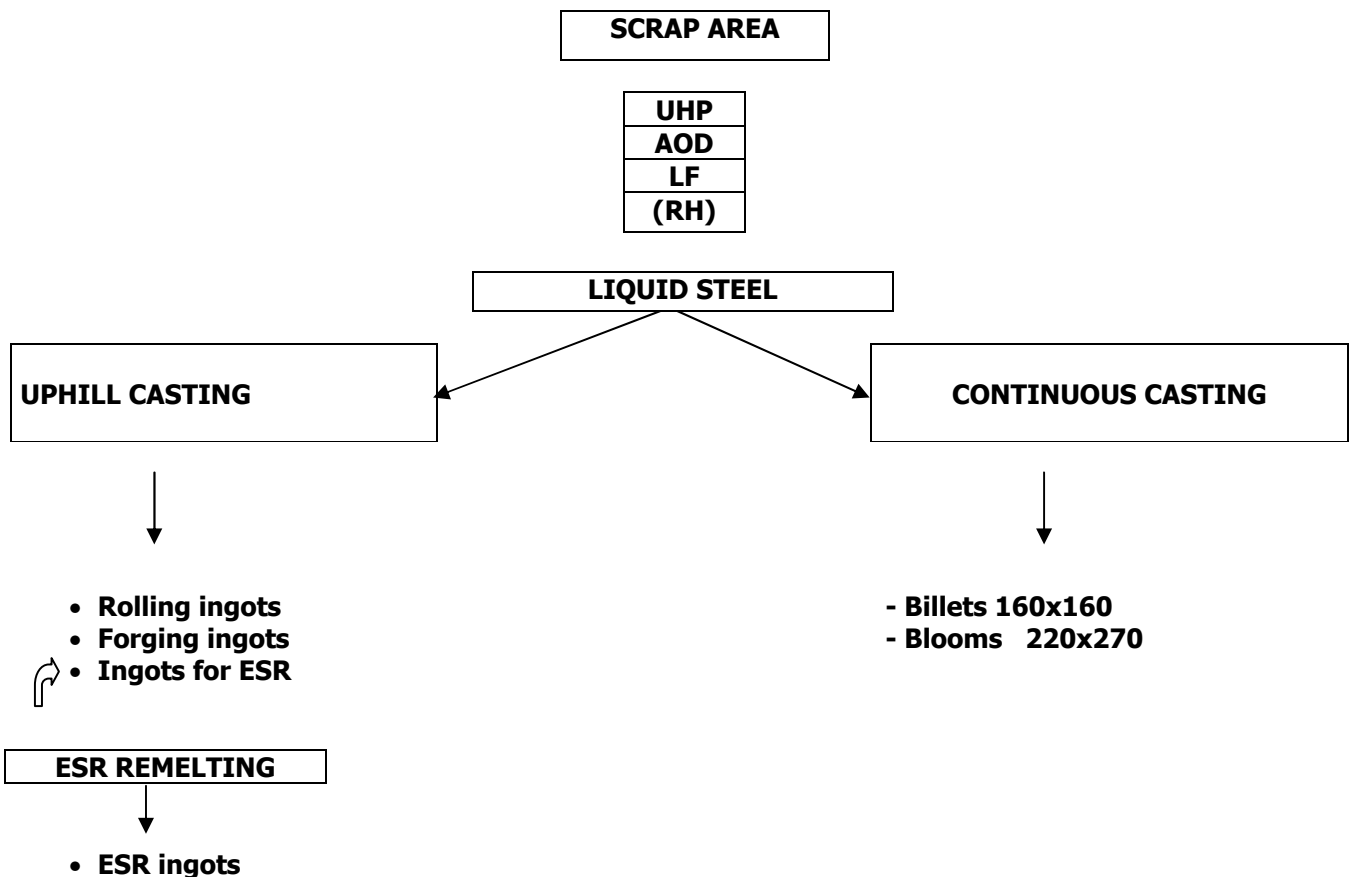
Ingots are one more time brought to a temperature of 1700°C and are made to drop through a liquid slag which is used to remove from the metal any “foreign matter” that may reduce its mechanical features. Re-solidification takes place in a brass, water cooled ingot mould.

The production of a 5000 Kg ingot requires the following times:

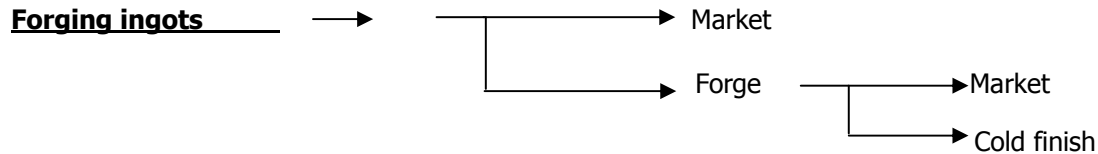
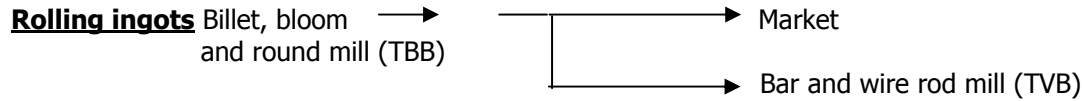
- normal → 3 H
- ESR → 15 H

After proper preparation, ESR ingots are subjected to normal hot transformation processes.

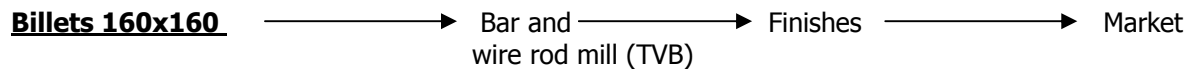
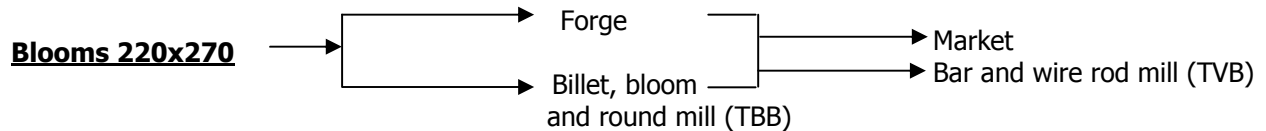
STEELMAKING CYCLE SUMMARY



SUMMARY OF NEXT TRANSFORMATION PROCESSES



ESR ingots Same as "Forging ingots"



BILLET TRANSFORMATION (160X160) FROM CONTINUOUS CASTING (CCO)

This is the major process implemented by the company Cogne. This transformation is required to manufacture wire rods and bars, which represent the company's CORE BUSINESS.

PAC

Prior to being transferred to the bar and wire rod rolling mill (TVB), the billets are subjected to a "conditioning" process.

Material is inspected, and minor defects that may have formed during the casting phase are removed.

The material is repaired using grinding machines where the grinding wheels are mainly made of a mix of alumina and graphite.

BAR AND WIRE ROD MILL (TVB)

The rolling mill consists of a set of cages that are positioned one in series to the other and are used to progressively reduce the metal thickness from the initial cross-section (160 square) to the final profile required (to summarise very briefly, each cage consists of two opposing cylinders and a motor to turn them).

The rolling mill (TVB) produces two different types of product:

Rolls (from diam. 5.5 to 32) called:

- wire rod (from 5.5 to 13 mm in diameter);
- wire rod (from 14 to 32 mm in diameter);

Bars in the 20 to 106 mm range.

BENDOTTI FURNACE

Billet transformation into rolls or bars is a "hot" process.

Billets are heated to a temperature between 1100 and 1300 °C, depending on the type of steel.

The BENDOTTI furnace is used for heating the billets.

The fuel in use is CH₄ mixed with air according to a 1:10 SAFR ratio.

HEAT TREATMENT

Metal transformation from billets into rolls or bars is such a quick process that the metal experiences strong "stresses", both chemically and structurally

(for easier understanding consider that the wire rod rolling speed is 65 metres per second).

To enhance the intrinsic features of steel, stress must be removed through HEAT TREATMENT processes that consist in metal heating in furnaces (at variable temperatures ranging from 600 to 1100 °C according to the type of steel) followed by cooling (also variable according to the steel type).

Types of furnaces in use:

- OLIVOTTO ROTARY FURNACE (air and methane)
- OLIVOTTO CONTINUOUS FURNACE (air and methane)
- FURNACE CH₂ (electric)
- SOFIND FURNACES (N. 2) (air and methane)
- FELIND FURNACES (N. 3) (electric)

Some types of steel have in their chemical composition a very important element which is carbon.

When carbon steel rolls or bars are heated, carbon may disappear due to the high temperature reaction with the oxygen in the furnace atmosphere.

In these cases an inert gas (nitrogen) is used to create the atmosphere inside the furnace.

CH₂, SOFIND AND FELIND FURNACES OPERATE WITH NITROGEN.

FINISHING OPERATIONS

These are the last operations which give steel the appearance and properties for final sale on the market.

Product description and finishing operations

A) WIRE ROD

1. Pickling
2. Straightening, cutting into bars and same finishing as bars

B) BAR

After the required straightening, bars can be subjected to:

1. peeling
2. grinding.

PICKLING

This operation is intended to remove from the roll surface the extra thin layer of scale originating from hot processes.

Despite being very poor in chromium, the presence of scale may lead to stainless steel oxidation. This is the major reason why it has to be removed.

Pickling basically consists in a chemical reaction leading to dissolution which causes the rolls positioned in acid-containing tanks to be cleaned from the superficial layer of oxide until the product acquires the good-looking silvery appearance which is typical of stainless steel.

As the scale is particularly difficult to remove, "pre-cleaning" operations are often required. At the Cogne plant these operations basically consist in SAND BLASTING and SODABLASTING.

Sand blasting

To remove most of the existing scale, steel is subjected to the abrasive action of metal balls that are forcibly propelled against the steel surface at high pressure.

This technique can only be used with stainless steel having a very high content in chromium and some classes of maraging stainless steel.

In most cases sand blasting is performed before sodablasting.

Sodablasting

While sand blasting is a mechanical process, sodablasting is a chemical process to be performed prior to pickling.

Metal is immersed in a very large tank containing SODA (NaOH) in liquid state at a temperature of 400 °C. Soda has a double action:

1. it chemically transforms some of the compounds present in the scale, making them more sensitive to the attack of acid;
2. it warms both the metal and the scale, thus facilitating detachment during the quenching phase when the roll is abruptly cooled in a large water tank located near the SODA area.

Generally, sodablasting consists in the execution of the sequence of operations below:

- SODA 15 to 30 min.
- H₂O quenching

Residual liquids originating from the sodablasting process are transferred to the neutralization system where residual basicity is neutralized.

CHEMICAL PICKLING

This is the last operation involved in the wire rod cycle.

ROLLS

- in their natural state
- sand blasted
- sodablasted
- sand and sodablasted

are made to transit through a set of acid tanks, separated by 4 washing stations, in order to subject them to: the pre-prickling, prickling and passivation processes.

At the end of these processes the rolls are soaked into a lime aqueous solution (at a temp. of 80 °C) which neutralizes minor traces of acid existing on the steel surface.

INSPECTION AND PACKAGING

The quality of the final product is checked. If it is conforming, steel is packaged according to the Customer's Specifications.

PEELING AND GRINDING

These are the typical finishes for bars. The ultimate aim of these processes is the removal of superficial scale basically using:

- > CUTTING TOOLS (peeling);
- > ABRASIVE GRINDING WHEELS (grinding).

INSTRUMENT TESTING

After peeling the steel, the bars are subjected to a set of instrumental tests which are geared at certifying the flawlessness of the product.

NEUTRALIZATION

The aim of this process is to transform the acids and all the elements used for chemical roll pickling into inert substances.

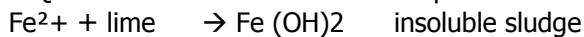
The neutralization process uses fluids coming from the SODA BLASTING area and the DECAFAST. The fluid basically originates from the above-mentioned areas/installations as described below.

From SODABLASTING and DECAFAST

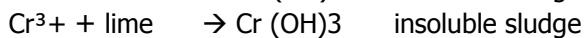
1. BASIC quench waters from SODABLASTING;
2. exhaust solutions of pickling acids containing approx. 100 gr/litre of heavy metals (Fe, Cr³⁺ , Ni²⁺ , Cu²⁺);
3. sludge originating from the pre-treatment of washing waters.

Main fluid neutralization process

1. LIQUID is treated with lime until its pH is 10 to 11.



The existing chemical substances undergo the following process:



2. Water is then separated from the sludge in the sedimentation tank with the help of flocculation agents.
3. Sludge is transferred to a consolidation tank and is then conveyed to a filter-press for compaction and final transfer to the dumping area.
4. Water is conveyed to the end sedimentation tank (final water treatment) from which it is partially poured back into the industrial water loop and partially dumped into the river Dora Baltea.

WASHING WATER PRE-TREATMENT

The waters used for Decafast washing, which contain small quantities of acids and heavy metals, are collected in the pickling fluid accumulation tank and are then delivered to the lamella clarifier.

Process steps

- Treatment with lime to obtain a pH equal to 8-10; separation of water from sludge using special sedimentation cones.
- Delivery of water to the end sedimentation tank.
- Delivery of sludge to the neutralization system from which it is eventually transferred to the filter-press after an additional treatment with lime.

INGOT AND SLAB (220X270) TRANSFORMATION IN THE FORGE

Ingots received at the steelmaking plant are charged in the reheating furnaces of the forge (some brands of steel mandatorily require heat treatment) to uniformly bring the material to the most suitable temperature to guarantee the best hot plasticity characteristics.

The temperatures in use range between 1100 °C and 1250 °C depending on the type of steel.

After the ideal operating temperature is obtained and preserved for a suitable time, the ingot is subjected to hot processing through the intermittent application of a force which breaks the coarse structure of the molten block, thus creating a finer structure, increases compactness and gives the piece a new shape and dimension.

Forging operations in COGNE are performed using the following installations.

PRESS 2000

The press 2000 is a vertical hydraulic DEMAG press featuring two forging manipulators on a rail.

This installation can transform ingots that do not exceed 14000 tons. It is used to forge semi-finished products (bloom blocks, octagonal pieces and rounds that need to be subjected to additional hot processes) to be conveyed to the PAC for grinding or finished round products to be conveyed to the PRS for lathe processing.

PRESS 5000

The press 5000 is a vertical hydraulic HYDROMEC press featuring two forging manipulators on a rail.

This installation can transform ingots exceeding 14000 tons. This is why it is mainly used for the forging of large size ingots (17000, 25000, 30000, 35000 and 40000).

It is used to forge semi-finished products (bloom blocks, octagonal pieces and rounds that need to be subjected to additional hot processes) to be conveyed to the PAC for grinding or finished round products to be conveyed to the PRS for lathe processing.

FORGING HAMMER MACHINE SXP40

This equipment consists in a forging hammer machine GFM with 4 hammers.

The installation is mainly fed with material that has been preventively roughed by press (suitable size octagonal pieces) and has been hot treated directly in the reheating furnaces of the forging hammer machine or after PAC conditioning. It is also fed with continuous casting slabs, 220x270 in size.

The installation is mainly used for forging finished round products (diameters ranging between 90 mm and 360 mm) to be transferred to the PELC peeling machine or round blocks to be sold on the pipe market, manufactured by extrusion and to be conveyed to the PELF peeler.

TT1

At the end of the roughing or forging cycle, depending on the type of steel, the material may be cooled in the air (generally austenitic press forged material), in water (generally austenitic material and duplex forged at the hammer machine) or through any other suitable cooling medium with the TT1 furnaces (maraging and tool material).

Suitable cooling consists in material transfer, while still hot, to the electric annealing furnaces of the TT1 department where it is subjected to the annealing cycle required to stretch the deformed structure, to guarantee the piece flawlessness and to give the material the required mechanical properties if it must be sent directly to the customer.

TT4

After suitable cooling, the finished product is transferred to the TT4 department where (depending on the steel type) the material is subjected to a final heat treatment to give the material the micro structural and mechanical properties required by the customer.

The heat treatments performed are:

- SOLUTION ANNEALING performed on austenitic steel, duplex and superduplex by heating the material at a temperature ranging between 1050 °C and 1100 °C followed by rapid cooling in water;
- HARDENING performed on maraging and tool steel by heating the material at a temperature ranging between 950 °C and 1040 °C followed by quenching using a suitable medium and subsequent tempering to enhance the material characteristics;

- ANNEALING performed on maraging and tool steel by heating the material at a temperature ranging between 700 °C and 850 °C, in some cases after a NORMALIZATION cycle (heating between 1020 °C and 1040 °C and cooling in the air).

Types of furnaces in use:

- SOTTRI 1 bogie furnace, electric, used for annealing and tempering processes;
- SOTTRI 2 bogie furnace, methane, used for solubilization, tempering and normalization processes;
- SOTTRI 3 bogie furnace, methane, used for solubilization, tempering and normalization processes;
- FELIND 4 bogie furnace, methane, used for solubilization, tempering and normalization processes;
- SIGMA TT4 travelling bell furnace, methane, used for annealing and tempering processes;
- SELAS continuous furnace, methane and partially electric, used for spindle hardening.

After the final heat treatment, the material is transferred to the straightening machines (FAMO for TT1, BREDA and DANIELI ROLL FORMING MACHINE for TT4) to be prepared for the peeling phase.

B) PLANT DESCRIPTION

STEELWORKS AREA

The steelworks area includes the departments described below.

"ACC1"

- **ELECTRIC ARC FURNACE "UHP"** (Ultra High Power) featuring a pneumatic injection system for ricarburization
 - Manufacturer: TAGLIAFERRI
 - Year of installation: 1982
 - Installed power: 45000 KVA – 60000 KVA
 - Rated capacity: 70/90 tons of liquid steel
 - Electrode diameter: 550 mm

- **LF FURNACE** (Ladle Furnace) - ladle heating and processing station
 - Year of installation: 1980
 - Manufacturer: TAGLIAFERRI
 - Installed power: 15000 KVA

- **DEGASSING SYSTEM "RH"** – degassing recycling vessel featuring plungers
 - Manufacturer: STANDARD-KESSEL
 - Year of installation: 1973
 - Recycling capacity: 35 t/min.

- **"IF" SYSTEM** - system used for cored wire injection
 - Year of installation: 1983

- **TIAC** - system used to mix steel with Argon

- **CONVERTER "AOD"** (ARGON/OXYGEN/DECARBURIZATION)
 - Manufacturer: UNION CARBIDE - MOISE
 - Year of installation: 1986
 - Rated capacity: 80 tons of liquid steel

"ACC2" HIGH ALLOY

- **E.S.R.** (ELECTRO SLAG REMELTING)
 - Manufacturer: LEYBOLD HERAEUS
 - Year of installation: 1983
 - Installed power: 2 units, 2500 KVA each
 - Max. ingot weight: 38 ton
 - Control system: Siemens with PLC

"CCO" CONTINUOUS CASTING

- **Vertical roll bending MACHINE feat. 4 lines** (bending radius 10.2 m)
 - Manufacturer: DANIELI
 - Year of installation: 1996
 - Average casting speed: blooms: 1.0 m/min.
billets 1.5 m/min
 - Product dimensions: blooms, 220 x 270 mm in size
billets, 160 x 160 mm in size

- REHEATING FURNACE

- Manufacturer : ITALIMPIANTI
- Year of installation : 1977
- Reheating medium : methane
- Type : bogie-type furnace

(out of production)

- MILL

- Manufacturer: VOEST ALPINE
- Year of installation: 1977
- Type: two-high reversing
- Cylinder diameter: 750 mm max.
- Engine power: 1850 KW
- Product dimensions: billets and blooms 82 x 160 mm in size

- 4 COOLING FURNACES (2 are 8 m in length; 2 are 6 m in length)

- Manufacturer: ITALIMPIANTI
- Year of installation: 1979
- Reheating medium: methane
- Type: bogie furnace

- "IF" SYSTEM - system used for cored wire injection

- Year of installation: 1983

"FUC" FORGE

STRAIGHTENING EQUIPMENT

- . Roller straightening machine
 - Manufacturer: FA.MO.
 - Year of installation: 1956
 - Product dimensions: Plates 40-300 mm
Rounds 50-90 mm
Billets 45-75 mm

- FURNACES

- N. 2 reheating furnaces OFU 65/66
 - Reheating medium: methane
 - Type: bogie furnace

- PRESS 20 MN

- . Vertical hydraulic press, pull-down type
 - Manufacturer : DEMAG
 - Year of installation : 1982

. 1 quick quench tank (water)

- FORGING HAMMER MACHINE SXP 40

- . Forging hammer machine featuring 4 hammers (programmed and pin forging available) including an IBS cut-off machine and a marking machine.
 - Manufacturer : STEYR GFM
 - Year of installation : 1981
 - Forging strength per hammer: 900 tons
- . Reheating furnace (4 furnaces)
 - Reheating medium : methane
 - Type : 3 chamber furnaces (methane; 90-91-92)

. 1 quick quench tank (water)

- PRESS, 5000 TON CAPACITY

- . Press
 - Manufacturer : Hydromec based in Brescia (Italy)
 - Year of installation : 2008
 - Press strength : 5000 tons

"TT1" HEAT TREATMENTS

- N. 18 electric furnaces SCEI, bogie-type
- N. 1 FELIND furnace, methane → *(out of production)*
- N. 1 long cooling pit
- N. 2 short cooling pits (12-13)
- N. 2 furnaces SFEAT, bogie-type
- N. 1 furnace SIGMA, bell-type

(under FIN dept. competence):

- TAPING MACHINE "COGNE"

- . Year of installation : 2000
- . Product dimensions : diameter range 100 to 325 mm; max. length 15000 mm

. N. 2 forging manipulators

- Manufacturer : GLAMA
- Type : integrated, on rail
programmed forging available
- Capacity : 10 tons; 16 tm
- . Reheating furnace
 - Type : 2 chamber furnaces (80/81)
: 7 methane furnaces
 - of which : 1 bogie-type furnace (methane), 18 m long (85)
: 4 bogie-type furnaces (methane) (67÷70)

COLD PROCESSES

- . 1 Peeler (PEL S) + Roll forming machine
 - Manufacturer : SCHUMAG
 - Year of installation : 2012/2013
 - Product dimensions : diam. 160÷400 mm; length 3800÷18000 mm

- . 1 Band saw AMADA 1080
 - Manufacturer : AMADA
 - Year of installation : 1990

- . 1 Band saw MISSLER DEB 650 CE
 - Manufacturer : MISSLER
 - Year of installation : 2000

"SPE AREA" (under FIN dept. competence)

- . 1 Peeler (PEL C)
 - Manufacturer : CALLOW "DORNBERG 350"
 - Year of installation : 1990
 - Product dimensions : diam. 100÷350 mm; length 3000÷19000 mm
Max. weight 10 tons

- . 1 Band saw MONACO 400A
- . 1 CUT-OFF MACHINE IBS TS 8125

"PAC" CONDITIONING

- AUTOMATIC AND SEMI-AUTOMATIC GRINDING MACHINES

- . 6 grinding machines (one in revamping, i.e. CM6)
 - Manufacturer : CENTRO MASKIN
 - Year of installation : from 1965 to 1972 → **Revamping 1995/1996**
 - Product dimensions : billets and blooms 75/300 mm in side and max. 9 m in length
- . 1 grinding machine
 - Manufacturer : SCHLUTER
 - Year of installation : 1969
 - Product dimensions : Side forged blooms > 220 mm and
max. 6 m in length
Forged plates: min. 90 mm thick
max. 1000 mm wide
- . 1 grinding machine
 - Manufacturer : N.SIAS using SCHLUTER materials
 - Year of installation : 1980
 - Product dimensions : Side forged blooms > 150 mm and max. 8 m long
Forged plates: min. 90 mm thick
max. 1000 mm wide
Laminated plates: 160 x 60 mm using a dedicated apparatus

- SAND BLASTER

- Manufacturer : FISCHER
- Year of installation : 1990
- Product dimensions : 80/160 mm and max. 6 m and
min. 3 m in length

} **(out of production)**



- STRAIGHTENING EQUIPMENT

- . Pressure straightening machine
 - Manufacturer : LAROCCHI
 - Year of installation : 1972
 - Product dimensions : 80/200 mm

- CUTTING EQUIPMENT

- . 3 Band saws AMADA 1080
 - Manufacturer : AMADA
 - Year of installation : 1979-1981
- . 1 Band saw 600
 - Manufacturer : AMADA
 - Year of installation: 1981
- . 1 Band saw with 2 saw frames
 - Manufacturer : SOITAAB
 - Year of installation: 2007

- . 1 Cut-off machine
 - Manufacturer: BRAUNS
 - Year of installation: 2000
 - Product dimensions: max. diameter 220 mm

- MAGNETIC PARTICLE INSPECTION MACHINE FOR BILLETS

- Manufacturer : MAGNAFLUX
- Year of installation : 1972
- Product dimensions : 65/200 mm – length: max. 7 m and min. 2 m(out of production)
- . 1 Cut-off machine 800
 - Manufacturer : BRAUNS
 - Year of installation : 1972
 - Product dimensions : max. 180 mm, square

ROLLING AREA

The rolling area includes the departments described below.

"TBB" BILLET, BLOOM AND ROUND MILL

- **REAHEATING CELLS** (15 cells)
 - Manufacturer : STEIN
 - Year of installation : from 1954 to 1969
 - Reheating medium : methane
 - Type : well-type

- MILL 950

- Manufacturer : SACK POMINI C.G.E.
- Year of installation : 1962
- Type : two-high reversing
- Cylinder diameter : 985 mm
- Engine power : 4500 HP
- Product dimensions : billets and blooms 110 x 500 mm in size

- 1 Band saw 2000

- Dimensions : min. 110 mm / max. 300 mm

- 1 cutting machine by SACK

- Dimensions : min. 110 / max. 250 mm

- MILL 650

- Manufacturer : SACK POMINI C.G.E.
- Year of installation : 1962
- Type : two-high reversing
- Cylinder diameter : 700 mm
- Engine power : 1800 HP
- Product dimensions : billets and blooms, 75 x 150 mm in size
rounds, diameter 113/210 mm

- BAND SAWS

- N. 2 Pomini dimensions min. 75 mm / max. 212 mm
- N. 1 CMP dimensions min. 75 mm / max. 212 mm

- 1 cutting machine by DANIELI

- Dimensions : min. 75 / max. 160 mm

- SLOW COOLING PITS (7 pits)

- Year of installation : from 1954 to 1966

"TBV" BAR AND WIRE ROD ROLLING MILL**- REHEATING FURNACE**

- Manufacturer : BENDOTTI
- Year of installation : 1995
- Reheating medium : methane
- Max. output : 40 t/h
- Type : side-member
- Operating process : reheating

- DESCALING MACHINE

- Manufacturer : INOXIHP
- Year of installation : 1995
- Max. pressure : 270 bar

- DUO ROUGHING MILL

- Manufacturer : LOEWY-INNOCENTI
- Year of installation : 1995
- Type : two-high reversing
- Cylinder diameter : 700 mm
- Engine power : 2500 HP / 2900 Amp

- CONTINUOUS MILL FEAT. 8 CAGES

- Manufacturer : POMINI
- Year of installation : 1995
- cage 1, type : two-high horizontal
- Cylinder diameter : 610 mm
- Engine power : 600 kW
- cage 2, type : two-high vertical
- Cylinder diameter : 610 mm
- Engine power : 600 kW
- cage 3, type : two-high horizontal
- Cylinder diameter : 460 mm
- Engine power : 600 kW
- cage 4, type : two-high vertical, turning, travelling
- Cylinder diameter : 460 mm
- Engine power : 478 kW
- cage 5, type : two-high horizontal, turning, travelling
- Cylinder diameter : 460 mm
- Engine power : 478 kW
- cage 6, type : two-high vertical, turning, travelling
- Cylinder diameter : 460 mm
- Engine power : 478 kW
- cage 7, type : two-high horizontal, turning, travelling
- Cylinder diameter : 460 mm
- Engine power : 478 kW
- cage 8, type : two-high vertical, turning, travelling
- Cylinder diameter : 460 mm
- Engine power : 478 kW

- N. 4 WATER BOX by DANIELI for WIRE ROD production mill cooling

- CONTINUOUS MILL FEAT. 6 CAGES FOR BAR PRODUCTION

- Manufacturer : POMINI
- Year of installation : 1996
- cage 9B, type : two-high horizontal
- Cylinder diameter : 460 mm
- Engine power : 500 kW
- cage 10B, type : two-high vertical
- Cylinder diameter : 460 mm
- Engine power : 500 kW
- cage 11B, type : two-high horizontal
- Cylinder diameter : 360 mm
- Engine power : 500 kW
- cage 12B, type : two-high vertical
- Cylinder diameter : 290 mm

- Engine power : 350 kW
- cage 13B, type : two-high horizontal
- Cylinder diameter : 290 mm
- Engine power : 350 kW
- cage 14B, type : two-high vertical
- Cylinder diameter : 290 mm
- Engine power : 350 kW
- Product dimensions : diameter range 16 to 105 mm

- Diameter meter SHAPE TECH

- N. 4 FLYING CUTTING MACHINES

- ELIND induction furnace

- CONTINUOUS MILL FEAT. 6 CAGES FOR WIRE ROD PRODUCTION

- Year of installation : 1992
- cage 7, type : two-high horizontal
- Cylinder diameter : 360 mm
- Engine power : 400 kW
- cage 8, type : vertical overhang
- Cylinder diameter : 450 mm
- Engine power : 400 kW
- cage 9, type : two-high horizontal
- Cylinder diameter : 360 mm
- Engine power : 400 kW
- cage 10, type : two-high vertical
- Cylinder diameter : 360 mm
- Engine power : 400 kW
- cage 11, type : two-high horizontal
- Cylinder diameter : 360 mm
- Engine power : 400 kW
- cage 12, type : two-high vertical
- Cylinder diameter : 360 mm
- Engine power : 400 kW
- cage 13, type : two-high horizontal
- Cylinder diameter : 280 mm
- Engine power : 350 kW
- cage 14, type : two-high vertical
- Cylinder diameter : 280 mm
- Engine power : 350 kW
- cage 15, type : two-high horizontal
- Cylinder diameter : 280 mm
- Engine power : 350 kW
- cage 16, type : two-high vertical
- Cylinder diameter : 280 mm
- Engine power : 350 kW
- cage 17, type : two-high horizontal
- Cylinder diameter : 320 mm
- Engine power : 350 kW
- cage 18, type : two-high vertical
- Cylinder diameter : 320 mm
- Engine power : 350 kW
- . Product dimensions : diameter range 14 to 32 mm
hex products diam. range 11 to 28.5 mm



- cage 18Bis, type : two-high vertical
- Cylinder diameter : 320 mm
- Engine power : 80 kW
- Product dimensions : diameter range 14 to 32 mm

- HITEST MACHINE by DANIELI

- 6 FLYING CUTTING MACHINES

- 2 GARRETT COILERS (Danieli)

(for the formation of wire rod rolls with the possibility to cool the product in water) diameter range 14 to 32 mm

- COIL FORMING HEAD (Danieli)

(for wire rod coil formation, diameter range 5.5 to 13 mm)

- COLD PLATE (LOCATED DOWNLINE G14B) (for bars)

- Manufacturer : DANIELI
- Year of installation : 2005
- Type : tubed type
- Length : 42 m

- CUT-OFF MACHINE (for bars)

- Manufacturer : DANIELI
- Year of installation : 2005
- Disc diameter : 1400 mm
- Engine power : 250 kW

- DISCHARGE PLATE (for bars)

- Manufacturer : DANIELI
- Type : chain (2 discharge ways)

- BAR TYING MACHINE

- Manufacturer : SUND

- SLOW COOLER HOPPERS (for bars)

- 1 : 8 m long with covers
- 2 (stationary) : 20 m long with covers
- 3 : 13 m long with covers
- 5 : 10 m long with covers

- FINISHING BLOCK "BGV"

- Manufacturer : DANIELI
- Year of installation : 1992
- Type : 8 pitches (N. 4 di diam. 200 mm in diam.; N. 4 160 mm in diam.)
- Engine power : 2 1650 kW engines

- DIAMETER METER "ORBIS"

- Manufacturer : IPL
- Year of installation : 2000
- Dimension range : diameter range 5.5 to 32 mm

- TILTER by DANIELI

- ROLL AIR CONVEYOR

- ROLL TYING MACHINE "MAC.LE"

FINISHING AREA

The finishing area includes the departments described below.

COLD FINISH

- PEELERS

- . Peeler 1 + Roll forming machine BRONX (see specs on 1st straightening machine)
 - Manufacturer : LANDGRAF T100
 - Year of installation : 1979
 - Product dimensions : diameter 40/102 mm and max. length 15.2 m
- . Roll forming machine DANIELI
- . Peeler 4 + Roll forming machine KIESERLING
 - Manufacturer : LANDGRAF T80
 - Year of installation : 2000
 - Product dimensions : diameter 25/80 mm and max. length 8 m
- . Peeler 2 + Roll forming machine BULTMAN
 - Manufacturer : LANDGRAF 80KZ/40
 - Year of installation : 1996
 - Product dimensions : diam. 20/80 mm and max. length 7 m
- . Peeler + Roll forming machine DANIELI
 - Manufacturer : LANDGRAPH "40K1"
 - Year of installation : 2008
 - Product dimensions : diameter min. 100 mm to max. 350 mm
length min. 3000 mm to max. 19000 mm
- . Roll forming machine
 - Manufacturer : BRONX
 - Product dimensions : diameter 40/110 mm and max. length 15.5 m
- N. 1 cut-off machine REVASS ***(out of production)***

- STRAIGHTENING MACHINES

- . Roller straightening machine
 - Manufacturer : KIESERLING KIE2
 - Product dimensions : diameter 20/60 mm and max. length 7 m
- . 2 parabolic oblique roller straightening machines
 - Manufacturer : MANNESMAN-MEER
 - Year of installation : 1971 and 1973
 - Product dimensions : diameter 25/105 mm and max. length 8.5 m
- . Parallel roller straightening machine
 - Manufacturer : FRORIEP
 - Product dimensions : Plates max. 25x80; squares 15/40 mm
Rounds 15/50 mm; max. length 7 m
- . Oblique roller straightening machine
 - Manufacturer : KIESERLING VRUN60
 - Year of installation : 1988
 - Product dimensions : diameter 16-25 mm and max. length 7 m

- GRINDING MACHINES

- . 2 grinding machines without centres
 - Manufacturer : CINCINNATI
 - Year of installation : 2000
 - Product dimensions : diameter range 20 to 60 mm; max. length 8 m
- . N. 1 milling machine
 - Manufacturer : LANDGRAF
 - Year of installation : 1995
 - Product dimensions : diameter range 20 to 80 mm and max. length 7 m
- . N. 3 chamfering machines
 - Manufacturer : SAS

- . N. 2 Circographs
 - Manufacturer : FORSTER
 - Product dimensions : 1) diameter from 20 to 50 mm
2) diameter from 35 to 105 mm
- . N. 1 cut-off machine HOWARD
 - Year of installation : 2002
 - Product dimensions : diameter range 0 to 180 mm
- . N. 2 cut-off machines
 - Manufacturer : LOEWY
- . N. 2 cut-off machines IBS
 - Year of installation : 2002
 - Product dimensions : diameter range 0 to 180 mm

Furnace "SIGMA 15"

- Manufacturer : SIGMA
- Year of installation : 2008
- TT type : annealing, tempering
- Max. temperature : 900 °C
- Reheating medium : methane
- Max. charge : 15 tons

Furnace "GADDA"

- Manufacturer : GADDA
- Year of installation : 2013
- TT type : solution annealing, tempering, hardening
- Max. temperature : 1150 °C
- Reheating medium : methane
- Max. charge : 15 tons

. Furnace "CH2"

- Manufacturer : HEURTEY ITALIANA
- Year of installation : 1971
- Furnace type : continuous, nitrogen atmosphere
- TT type : solubilization, hardening, re-crystallisation, normalization, annealing at 850 °C
- Product type : bars and (rolls)

"TTD" HEAT TREATMENTS AND PICKLING

. FELIND furnace, electric (3 furnaces)

- Manufacturer : FELIND
- Year of installation : 1987
- TT type : hardening up to 1110 °C in nitrogen atmosphere
- Product type : rolls only

. SOFIND furnace (1-2) SOFI

- Manufacturer : SOFIND
- Furnace type : static in nitrogen atmosphere (max. 900 °C)
- Year of installation : 1998
- TT type : glob. annealing
- Product type : rolls only

. OLIVOTTO furnace (FROL)

- Manufacturer : OLIVOTTO
- Year of installation : 1992
- Furnace type : rotary, 24 positions
- TT type : solubilization and re-crystallisation
- Product type : rolls only

. OLIVOTTO furnace (FCOL)

- Manufacturer : OLIVOTTO
- Year of installation : 1996
- Furnace type : continuous (max. 1100 °C)
- TT type : solubilization, hardening, re-crystallisation and annealing
- Product type : rolls only

- ROLL SAND BLASTERS

- Manufacturer : TOSCA2
- Year of installation : 1996
- Product dimensions : diameter \geq 5.5 mm: Max. 1350 Kg

- SODABLASTING PLANT

- It consists in one line : for all types of steel
- Manufacturer : EKOMOR
- Year of installation : 2006
- Tank capacity : 20 cu.m
- Pre-reheating furnace
- Furnace type : static
- Soda tanks (1) : Caustic soda
- Quench tanks (1) : Water
- Drying tank : Hot water

- PICKLING PLANT DECAFAST (DEC 4)

- It consists in one line : for austenitic and ferrous materials
- Manufacturer : POLIMPIANTI
- Year of installation : 2002
- Tank capacity : 20 cu.m
- PX tanks (4) : Hydrofluoric acid + Sulphuric acid + Hydrogen peroxide
- special PX tank : Hydrofluoric acid + Nitric acid
- lime tank : lime
- washing tanks (4) : Water
- sulphuric acid tank : Sulphuric acid
- cold nitric acid tank : nitric acid

"RET" GRINDING

- GRINDING MACHINES

- . 6 grinding machines
 - Manufacturer : BOCCA MALANDRONE
 - Year of installation : 1986/1987
 - Product dimensions : diameter 6 to 30 mm and length 6 m
- . 3 grinding machines
 - Manufacturer : LANDGRAF R6B/CNC
 - Year of installation : 1986
 - Product dimensions : diameter 6 to 35 mm and length 2 to 7 m
- . 1 grinding machine
 - Manufacturer : MAIR GR30
 - Year of installation : 2005
 - Product dimensions : diameter 5 to 30 mm and length 2 to 7.5 m
- . 4 grinding machines
 - Manufacturer : BOCCA MALANDRONE, type R 120/504
 - Year of installation : 1987
 - Product dimensions : diameter 6 to 30 mm; length 6 m
- . 1 grinding machine
 - Manufacturer : BOCCA MALANDRONE, type R 120/500
 - Year of installation : 2004
 - Product dimensions : diameter 10 to 30 mm; length 6 m
- . 2 grinding machines SH700
 - Year of installation : 1996
 - Product dimensions : diameter 4 to 12 mm

- STRAIGHTENING MACHINES

- 1 bar to bar straightening machine
 - Manufacturer : MONTBARD
 - Year of installation : 1986
 - Product dimensions : diameter 6 to 16 mm and length 6 m
- . 4 roll to bar straightening machines
 - Manufacturer : BOCCA MALANDRONE, type 333/3
 - Year of installation : 1987
 - Product dimensions : diameter 6 to 16 mm and length 6 m
- . 1 roll to bar straightening machine
 - Manufacturer : BOCCA MALANDRONE, type 332/2
 - Year of installation : 1987
 - Product dimensions : diameter 6 to 10 mm and length 8 m
- . 1 roll to bar straightening machine
 - Manufacturer : KOCH
 - Year of installation : 1999
 - Product dimensions : diameter 12 to 20 mm and length 6 m
- . 1 roll to bar straightening machine
 - Manufacturer : KOCH
 - Year of installation : 2004
 - Product dimensions : diameter 17 to 21 mm and length 6 m
- . 1 roll to bar straightening machine
 - Manufacturer : CANDIANI
 - Year of installation : 2006
 - Product dimensions : diameter 17 to 21 mm and length 6 m
- . 1 roll to bar straightening machine
 - Manufacturer : MEYER
 - Year of installation : 2002
 - Product dimensions : diameter 12 to 20 mm and length 6 m

- DRAWING MACHINES

- . 1 drawing plate
 - Manufacturer : DANIELI
 - Product dimensions : diameter 5 to 15
 - . 1 drawing plate
 - Manufacturer : SCHUMAG
 - Product dimensions : diameter 6 to 20 mm
- Length: min. 3000 mm to max. 19000 mm
Max. weight: 10 tons

- 4 TEST LINES

- . 1 MAGNATEST-CIRCOGRAPH-DEFECTOMAT-ULTRASOUND(CND2)
 - Manufacturer : ITECNO/FORSTER/KRAUTKRAMER
 - Year of installation : 1986
 - Product dimensions : diameter 5 to 25 mm
- . 1 MAGNATEST-CIRCOGRAPH-DEFECTOMAT-ULTRASOUND(CND4)
 - Manufacturer : ITECNO/FORSTER/KRAUTKRAMER
 - Year of installation : 1988
 - Product dimensions : diameter 8 to 35 mm
- . 1 MAGNATEST-CIRCOGRAPH-DEFECTOMAT-ULTRASOUND(CND5)
 - Manufacturer : AZ impianti/FORSTER/KRAUTKRAMER
 - Year of installation : 1999
 - Product dimensions : diameter 4 to 14 mm
- . 1 MAGNATEST-CIRCOGRAPH-ULTRASOUND(CND1)
 - Manufacturer : ITECNO/FORSTER/KRAUTKRAMER
 - Year of installation : 2000
 - Product dimensions : diameter 15 to 31 mm

1 CUT-OFF MACHINE

- Manufacturer : IBS
- Year of installation : 2000
- Product dimensions : Cut-off diameter up to 400 mm

- 1 manual CIRCOGRAPH

- Manufacturer : FORSTER
- Year of installation : 1999
- Product dimensions : diameter 5 to 25 mm

"PRS" SPECIAL WORK PROCESSES

- **BLANK PREPARATION LINE >>** The line no longer exists: the equipment is still there

- . Mark-out bench
- . N. 2 band saws AMADA 1000 x 800
- . N. 1 band saw AMADA 700
- . N. 1 band saw BTM 720CNC

- **PROCESSING LINES**

- . Centring machine Cogne
- . Mark-out bench
- . Drilling machine TACCHI 250 x 16000 ELIMINARE
- . N. 2 Boring machine CNC TOS
- . Milling and planing machine KOELMANN 1200 x 1500 x 4200
- . " FMUA 1200 x 1780 x 4750
- . " MECOF 1030 x 10000 (universal head)
- . " LINE' 1200 x 1500 x 8000
- . Threading machine CNC TACCHI 354 x 23000
- . Threading machine CNC CHEBA 430 x 18000

- . Horizontal lathe PROGRES 800 x 16500
- . Horizontal lathe MORANDO 950 x 18500 n. 22
- . " " " 950 x 9000 n. 31
- . " " " 950 x 5000 n. 37
- . Horizontal lathe CNC SAFOP 480 x 20000
- . " " INNSE 20000
- . " " " CNC INNSE 810 x 8000
- . Horizontal lathe NILES 480 x 3000
- . Grinding machine GIUSTINA 940 x 5350
- . N. 2 Lathe RUMENO 460 x 20000
- . N. 1 Lathe RUMENO3 1250 x 6000

"TT4" HEAT TREATMENTS

- CONTINUOUS HARDENING FURNACE, SELAS

- Manufacturer : SELAS
- Year of installation : 1984
- Reheating medium : methane gas and electricity
- TT type : hardening, tempering and solub. for stainless steel
- Max. diameter : 400 mm
- N. 1 hardness tester

- BOGIE FURNACE "SOT 1"

- Manufacturer : SOTTRI
- Year of installation : 1986
- TT type : tempering and annealing
- Max. temperature : 750 °C
- Reheating medium : electricity
- Max. charge : 45 tons

- BOGIE FURNACE "SOT 2"

- Manufacturer : SOTTRI
- Year of installation : 1986 → *revamping 2000*
- TT type : annealing, hardening and solubilization
- Max. temperature : 250 °C – 1200°C
- Reheating medium : methane
- Max. charge : 60 tons

- BOGIE FURNACE "SOT 3"

- Manufacturer : SOTTRI
- Year of installation : 1986
- TT type : Hardening, solubilization and annealing
- Max. temperature : 1200 °C
- Reheating medium : methane
- Max. charge : 60 tons

- BAND SAWS

- N. 1 band saw for spindles SOFINA
- N. 1 band saw MONACO 600S

- N. 1 Band saw Friggi

- N. 1 band saw MONACO MG 1300x1000

- STRAIGHTENING MACHINES

- N. 1 straightening machine BREDA Max. diameter 240

Furnace "SIGMA"

- Manufacturer : SIGMA
- Year of installation : 2008
- TT type : annealing, tempering
- Max. temperature : 900 °C
- Reheating medium : methane
- Max. charge : 80 tons

- BOGIE FURNACE "FELD 4"

- Manufacturer : FELIND
- Year of installation : 1987
- TT type : hardening, solubilization and annealing
- Max. temperature : 1200 °C
- Reheating medium : methane
- Max. charge : 20 tons

- BOGIE FURNACE "10"

- Manufacturer : SCEI
- Year of installation : 1986
- TT type : annealing and tempering
- Max. temperature : 880 °C
- Reheating medium : electricity
- Max. charge : 10 tons



(out of production)

- BOGIE FURNACE "11"

- Manufacturer: SCEI
- Year of installation: 1986
- TT type: annealing and tempering
- Max. temperature: 880 °C
- Reheating medium: electricity
- Max. charge: 10 tons

(out of production)

- COOLING EQUIPMENT (serving the SOTTRI furnaces)

- . **2 tanks** – 1 tank containing a solution of H2O + hydrosoluble polymer
 – 1 tank containing H2O

- . **1 bench** ventilated

POWDER PLANT AREA

The powder area includes the departments described below.

- N. 3 sieving machines RUSSEL, 900 mm in diameter
- N. 1 sieving machine RUSSEL/COGNE, 900 mm in diameter
- 2 electric elevators for sieving machines
- N. 1 hydraulic elevator COGNE for sieving machines
- N. 1 semi-industrial sieving machine GIULIANI
- N. 2 atomising tower with separator cyclone
- N. 1 electronic weighing machine METTLER ID2, 600 kg
- N. 2 weighing machines, 30 Kg, AM30K (one certified for sale)
- N. 1 induction furnace ASEA, 250 kg
- N. 1 induction furnace CALAMARI, 1000 kg
- N. 1 induction furnace CALAMARI, 500 kg
- N. 1 overhead bridge crane, 10 + 1 ton
- N. 1 forklift truck, 2200 kg capacity
- N. 1 laboratory sieving machine GIULIANI
- N. 1 HALL flow meter
- N. 1 laboratory weighing machine METTLER PL 1200
- N. 2 personal computer PENTIUM
- N. 1 ink jet printer EPSON C82
- N. 1 CORAL 1 system for fine powder abatement
- N. 1 CORAL 1 system for powder storage after casting
- N. 1 FILTERING system (external) for the separation of powder from atomising gas
- N. 1 FILTERING system BOLDROCCHI (external)

GENERAL SERVICES

- . Industrial water mains:
 - 9 wells (66000 litres per min.) plus a spare well
- . Drinking water mains:
 - 2 wells
- . Compressed air mains:
 - Operating pressure: 5.5 to 6 bar
- . Gas obtained from fractionation absorber:
 - Oxygen: 2500 Nm³/h
 - Liquid oxygen: 21 Nm³/h
 - Nitrogen: 2200 Nm³/h
 - Argon: 50 Nm³/h
- . Other gases:
 - Hydrogen: 1.7 Nm³/h
 - Steam: Mains network at max. 14 bar
- . Electricity mains network
- . Telephone network
- . IT network
- . Water treatment and purification
- . Fuel distribution service
- . Road and railway transport service
- . Maintenance shops:
 - mechanical, electromechanical, electronic, carpenter, piping and vehicle shops.
- . Spare parts warehouse
- . Canteen facilities
- . Changing rooms

LABORATORY AREA

TECHNOLOGICAL LABORATORY

The technological laboratory includes the departments described below.

"LAB/SPM" MECHANICAL TEST ROOM

- N. 2 universal machines METRO-COM, 20 tons
- N. 1 universal machine METRO-COM, 50 tons
- N. 1 universal machine INSTRON, 20 tons in dynamic mode and 50 tons in static mode
- N. 1 rapid hot tensile testing machine "COGNE"
- N. 1 automatic mark-out machine "COGNE"
- N. 1 Charpy impact tester METRO-COM, 300 J (ASTM)
- N. 1 resilience impact tester Charpy/Izod WOLPERT 300 J (ISO)
- N. 1 universal hardness tester (HB-HV-HRC) WOLPERT, 250 kg
- N. 1 hardness tester Brinell METRO-COM, 3000 kg (OUT OF SERVICE)
- N. 1 hardness tester Brinell AMSLER, 3000 kg
- N. 1 portable digital hardness tester DYNA POCKET
- N. 3 hardness testers Rockwell GALILEO - WILSON - KOYEMANN
- N. 5 creep test machine AMSLER
- N. 1 refrigerating system AIR LIQUIDE for test tubes, temperatures up to - 80°C
- N. 1 DENISON console featuring 3 furnaces for hot drawing
- N. 1 beamer ORAMA 330 STOKVIS
- N. 4 electronic strain gauges METRO-COM
- N. 1 electronic strain gauges for hot drawing MAYES & SON (OUT OF SERVICE)
- N. 13 centesimal dial gauges
- N. 2 digital and analog micro meters
- N. 7 analog centesimal micro meters
- N. 10 eyepieces for Brinell hardness reading
- N. 1 WAZAU proving ring
- N. 2 centesimal dial indicators

"LAB/TTS" HEAT TREATMENTS

- N. 3 salt bath furnaces
- N. 1 electric cyclone furnace
- N. 5 muffle type furnaces for test tube treatment
- N. 1 furnaces including test equipment for Jominy hardenability
- N. 3 muffle type furnaces for medium-size piece annealing

"LAB/OFF" MECHANICAL SHOP

- Machine tools (lathes, milling, grinding, cut-off machines, band saws, planning machines, etc.) required for the preparation of samples needed by the different laboratories for their testing.

"LAB/MACRO ROOM"

- Room equipped with macro attachments (HCl and control) with 2 tanks (dimensions 1000 x 600 x 300 mm)

"LAB/FUC" HOT DEFORMATION

- N. 1 rolling mill, Ø 5÷18 mm
- N. 1 press, 75 tons
- N. 1 hammer, 10 tons

"LAB/MET" METALLOGRAPHIC LABORATORY

- N. 2 automatic polishing machines PRESI, 300 mm in diameter
- N. 2 automatic polishing machines PRESI, 400 mm in diameter
- N. electrolytic polishing machine DISA LECTROPOL
- Misc. equipment for manual sample polishing
- N. 2 presses for sample encapsulation STRUERS
- N. 1 press for sample encapsulation PRESI
- N. 6 metallographic microscopes (REICHERT-LEICA-OLYMPUS)
- N. 1 stereoscopic microscope LEICA
- N. 1 electronic microscope SEM PHILIPS with an EDS micro probe
- N. 1 ferrite meter FISCHER
- N. 1 cut-off machine for metallographic test specimen BUEHLER
- N. 3 digital cameras for optical microscopes and micro hardness tester connected to a computer for image filing and reproduction
- N. 1 hardness tester Leica
- N. 2 digital cameras for LEICA stereoscope and macro pictures
- N. 1 electronic high precision weighing machine PHILIPS, max. capacity 5000 g

"LAB/CND" CND LABORATORY

Ultrasound testing

- N. 2 generators US KRAUTKRAMER, type USN 60
- N. 2 generators US KRAUTKRAMER, type USN 58
- N. 1 generator US KRAUTKRAMER, type USD15
- N. 1 generator US KRAUTKRAMER, type USK 7
- N. 1 generator US KRAUTKRAMER, type USM 35
- N. 1 generator US Gilardoni, type MG 15
- N. 1 generator US Gilardoni, type RDG 450
- N. 1 thickness meter KRAUTKRAMER DM2
- N. 1 thickness meter STRESSTEL, type Pocket MIKE
- N. 2 portable spectrometers XRF OXFORD X-MET 300TX
- N. 8 portable optical emission spectrometers

Magnetic testing

- N. 1 magnetic particle inspection bench GIRAUDI DN 100
- N. 1 magnetic particle inspection bench GIRAUDI DN 500 (out of service)
- N. 1 magnetic particle inspection bench CGM, type Magiscop
- N. 1 magnetic particle inspection trolley CGM, type CCA 3000
- N. 2 portable magnetic yokes CGM
- N. 1 demagnetization tunnel COGNE
- N. 1 tangential magnetic field meter FOERSTER, type Magnetoscop H 1.580
- N. 1 tangential magnetic permeability meter FOERSTER, type Magnetoscop H 1.068
- N. 1 coercivity magnetic field meter FOERSTER, type Koerzimat 1.095
- N. 1 induction meter "GAUSSMETER" – HIRST

Penetrating liquid testing

- colour contrast penetrating liquids, washable in water CGM
- fluorescent penetrating liquids, washable in water CGM
- fluorescent LP developer, ZYGLO method
- sensitivity test panel CGM, crack width 1+2 micron
- pre-cracked aluminium confrontation panels

Induced current testing

- N. 1 FÖERSTER Defectometer 2.837
- N. 1 winding reel equipment FOERSTER, type Magnatest S

A.C. skin effect testing

- N. 1 apparatus KRAUTKRAMER-BRANSON, type Crack-Micro Gauge U 8

CND testing on automatic lines

- TTF: N. 1 line with a FOERSTER instrument, type CIRCOGRAPH DS rotating head RO 130
- TTF: N. 1 line with a FOERSTER instrument, type CIRCOGRAPH S rotating head RO 65
- RET, lines **CND1** featuring CIRCOGRAPH DS + rotating head RO 35L, MAGNATEST I by FOERSTER – EDDY CHECK 5 with winding reels by PRUFTECHNIK - US instrument, type USD 15 with Multiplex by KRAUTKRAMER.
- RET, lines **CND2** featuring CIRCOGRAPH 6.231 + rotating head RO 25, MAGNATEST I, Defectomat C by FOERSTER – US instrument, type USD 15 with Multiplex by KRAUTKRAMER.
- RET, lines **CND4** featuring CIRCOGRAPH 6.231 + rotating head RO 90, MAGNATEST S, Defectomat C by FOERSTER – US instrument, type USD 15 with Multiplex by KRAUTKRAMER.
- RET, lines **CND5** featuring CIRCOGRAPH S + rotating head RO 14, MAGNATEST S, Defectomat S by FOERSTER – US instrument, type USD 15 with Multiplex by KRAUTKRAMER.

"LAB/CHI" CHEMICAL LABORATORY

Steelmaking plant chemical laboratory

- Spectrometer OES 3460 A.R.L for steel examination
- Spectrometer OES SPECTROLAB/M for steel examination
- LECO TC 136 apparatus for simultaneous determination of nitrogen and oxygen in metals
- LECO TC 400 apparatus for simultaneous determination of nitrogen and oxygen in metals
- LECO CS230 apparatus for simultaneous determination of carbon and sulphur in metals
- LECO CS200 apparatus for simultaneous determination of carbon and sulphur in metals
- LECO RH402 apparatus for the determination of hydrogen in metals
- Automatic grinding machine Herzog HTS 200
- Other equipment: HERZOG cut-off and grinding machines, column drill

Central chemical laboratory

- Fluorescence spectrometer X Panalytical AXIOS XRF
- Plasma optical emission spectrometer (ICP) Perkin Elmer DV 5300
- Ion chromatography system Dionex ICS 1000
- Spectrometer FT IR Varian SCIMITAR 1000
- Spectrophotometer UV-VISIBLE Philips PU8700
- Differential Thermal analysis instrument DTA/TGA Setaram 96 LINE
- Salt spray chamber Angelantoni DCTC600P
- Potentiostat/Galvanostat Amel 7050
- LECO CS044 apparatus for simultaneous determination of carbon and sulphur in metals
- Apparatus for the preparation of glass specimen for XRF analysis Philips PERL'X 3
- Apparatus for the preparation of glass specimen for XRF analysis UNIMAT UNIMELT 2TC
- Induction furnace for raw material melting, type LINN HFS-6
- Muffle 1000° HERAEUS
- Muffle 1600° NABEL LHT02
- Muffle 500° BINDER
- Electrolytic analysis instrument BICASA
- Drying stove Carlo Erba UNITERM 1000/A
- Microwave oven/mineralizer MILESTONE MLS1200
- Tablet press HERZOG HTP40
- N°2 analytical balances SARTORIUS
- Technical scales SARTORIUS
- Other equipment: HERZOG grinding machines, column drill, lathe, mill type MG171 with tungsten carbide jar.

METROLOGIC ROOM PRS

This function performs periodic control and calibration of the dimensional measurement instruments existing in the plant. It also issues the calibration certificates and manages the history archive of these instruments.

The plant has approx.:

- 318 micro meters
- 102 dial gauges
- 35 dial indicators

USE OF DATA

The most significant data relating to the operating procedures, controls and testing are collected and processed in order to obtain the information required to monitor the business units and the quality of the produced material.

Control sheets, periodic reports and special studies (research of relationships between the operating procedures and the product characteristics) are the major instruments used to find information on quality, based on quantitative data.