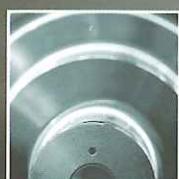


Roll manufacturing



FundiciónNodular
Sociedad Anónima

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Fundación Nodular, S.A.
Leader in rolling mill roll technology



Fundición Nodular, S.A.

Fundición Nodular, S.A. was established in Lugones (Asturias) in 1956, by Mr. José Suñer and various other well-known Asturian entrepreneurs.

Since its beginning, **FUNDICIÓN NODULAR, S.A.** has evolved in accordance with the needs of this particular sector and has become, nowadays, into one of the leading international manufacturer.

The manufacturing process of the rolls, is divided in different sections:

1. Moulding.
2. Melting + Casting.
3. Heat Treatments.
4. Machining.
5. Inspection.
6. Laboratory & R+D.
7. Expedition.

FUNDICIÓN NODULAR, S.A. headquarters is located in the plant nearby the shop facilities.





Our policy: continuous improvement.

Fundición Nodular, S.A. goals, facilities and capacity have greatly improved over the last years due to an important investment in our plant, providing better quality and service. Our growth, which has been possible through extensive investment in our plant has turned our company into a leading firm in Spain and one of the sector reference companies all over the world.

Versatility & quality.

Two great attributes that have turned us into market leaders.

Fundición Nodular, S.A. is prepared to manufacture all range of cast rolls, from small rolls for Bar Mills up to large back-up rolls for Strip Mills. The production capacity is over 15.000 Tn per year.

In continuous innovation.

Our important technological base, along with the development of our own research and the acquisition of state of the art equipment allows **Fundición Nodular, S.A.** to respond to the strong demand in the International Market. All these reasons explain why we are leaders in rollmaking.

Worldwide success.

Nowadays **Fundición Nodular, S.A.** exports to South America, USA, Canada, EEC, East Europe, Middle East, South East Asia and Africa, increasing the number of customers in some countries and opening new markets.



1

Moulding section

The begining of a perfect finishing



Centrifugal casting



Steel static casting

Dosage and automatic mixing.

Moulding sands are prepared with automatic mixing equipment.

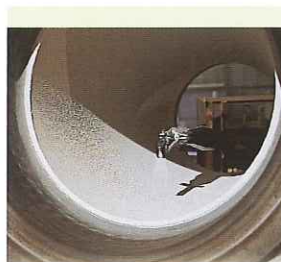
The moulding process is carried out with a sandslinger, Speed-Slinger type.

This section is also equipped with:

- Special sands mixers.
- Three 150 cubic meters unitary capacity drying ovens.
- One 5.000 mm diameter vertical lathe.
- Three automatic painting machines for chill moulds, two vertical and one horizontal.
- Shotblast machiness.

This equipment allows moulding of static rolls up to 1.600 mm diameter and 60 tons weight and spun cast rolls up to 1.300 mm finished diameter and 3.000 mm barrel length.

Throughout the moulding process, sands and other additives are subject to strict quality controls to guarantee a perfect performance during casting operations.



Chill painting machine



Moulding preparation

2 Melting + casting section

Analysis and control

The melting and casting facilities are equipped with four induction acid lining furnaces with capacities of 5, 8, 25 and 50 metric tons and one electric-arc basic lining furnace with a capacity of 50 metric tons.

Dosage and analysis.

Melting process starts with dosage and chemical analysis of different raw materials to be melt down in one of the five furnaces aimed for that purpose.

This process is characterized by a rigorous control.

Various samples are taken to be submitted to immediate thermal and chemical analysis in order to reach a perfect adjustment of the composition.

Upon reaching that goal, the melt is poured into a casting ladle and the composition adjustment is then completed with ladle metallurgy.

Cast.

Rolls can be cast by a static or a spinning system, in both alternatives, simple and double pour.

Two vertical spinning cast machines, automatically controlled with a computer, are used for the delicate operation of spun casting.



Induction furnace



3 | Heat treatments

Technology at service of perfection



Selas furnace (general view)



After the solidification of the material of the moulds, the rolls are subject to different heat treatments, depending of the roll quality:

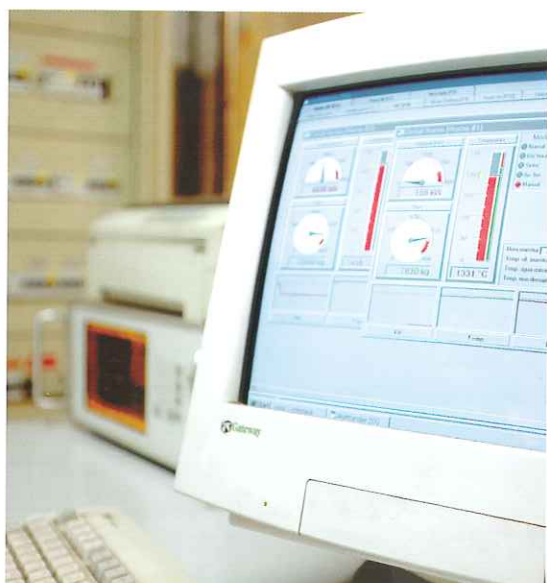
- Stress relief.
- Annealing.
- Quenching and Tempering.



Air quenching



Differential heat treatment



Heat treatments facilities are equipped with:

- Eight car-type furnaces, four of them with a capacity of 80 Tn, three of them with a capacity of 150 Tn and a new one with a capacity of 400 Tn.
- There are also two bell-type furnaces of the latest technology aimed to treat new qualities.

All these furnaces are able to reach 1.100°C of temperature by automatic-control. They also have recirculating-air fans to get an uniform automatically controlled temperature inside the whole furnace.



Air or water Quenching

It is realized in two high technology machines, allowing extreme quenching for new qualities in HSS with automatic temperature monitoring.

3 | Heat treatments

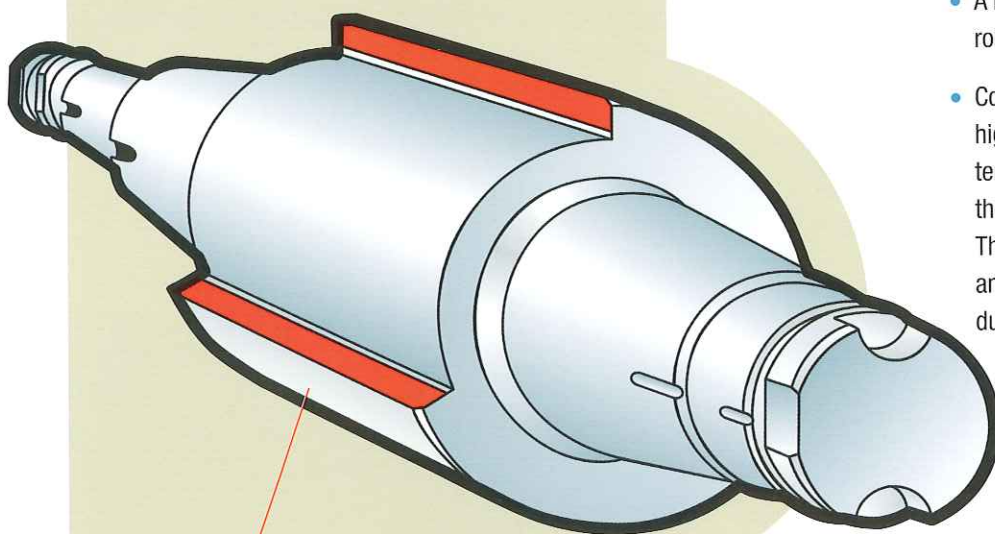
Fundición **Nodular**

Differential Heat Treatment.

Differential Heat Treatments are carried out in a SELAS furnace with capacity for rolls of diameter up to 1550 mm and 2400 mm barrel length.

This is a process that makes possible two different microstructures within the same monoblock-type roll:

- A harder working layer adjusted to the rolling mill requirements.
- Core and necks of lower hardness and higher toughness, due to the critical temperature point is exceeded only in the area of the layer to be hardened. This results in a higher impact strength and higher strength against overloads during the rolling.



1
Working layer
in an SBU - DH
Back up roll

Opposite to conventional treatments, the differential heat treatment overheats only the area corresponding to the work layer. This results in a better performance of the roll in the mill, with larger rolled tonnage and less redressing between campaigns.

The working layer of a differential heat treated roll may have a martensitic, bainitic or pearlitic structure, depending on the type of mill.

4 Machining section

The most stringent quality control

Sophisticated equipment is required at each and every step:

- 1 roughing machine.
- 20 roll lathes, 8 of which with numerical control system, CNC, and capacity up to 10 m distance between centres and 1.600 mm roll diameter.
- 4 finishing grinders, one of them also for roughing.
- 4 milling machines and 7 boring machines.
- 7 drilling machines.
- 7 overhead cranes with capacities up to 60 tons.

During the machining process several testing samples are taken to check out the physical, chemical and metallurgical/metallographic controls requested by the quality control laboratories.

All rolls are subject to bending and tensile strength, elastic limit and elongation, fracture toughness, impact strength and hardness penetration tests, and have their corresponding Quality Certificate.



Roll lathe



5

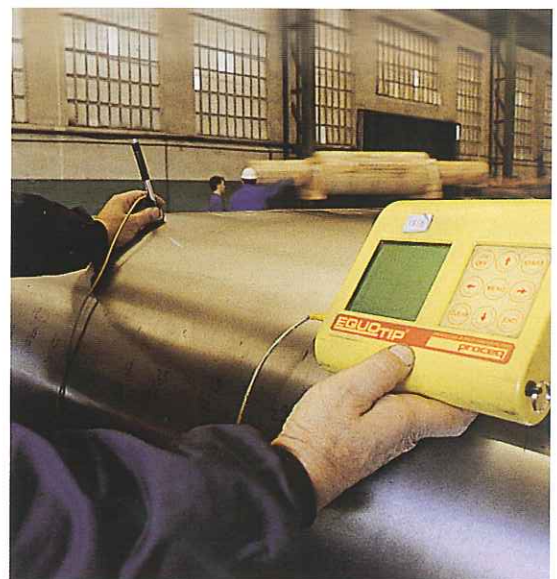
Inspection Aiming to perfection

All our rolls are submitted to exhaustive controls.

Dimensional controls, ultrasound tests, penetrating liquids and hardness testing are carried out in accordance with the main international standards (ASTM, DIN, UNE) in order to guarantee that the rolls were correctly manufactured.

This complete checking process ensures that every roll is in accordance with the specific quality and dimensions required for each rolling mill.

This makes our company a reliable partner for your mill.



Hardness test



R+D+i

Research at service of individual needs



Metallographic test



Chemical analysis



Solidification simulator

FUNDICIÓN NODULAR, S.A. has always being in favor of Research and Development and in continue innovation to provide the best qualities and services to the customers.

We have adjusted to the new demands of the market, promoting research and cooperation of diverse Technical Associations and with the University Metallurgic Departments.

Within our facilities we have our own laboratory and technical team working in the development of new qualities such as high speed steel, microalloyed iron or high chromium steel, as well as in the continuous improvement of traditional qualities like high chromium iron, indefinite chill and 5% Cr back up rolls.

Diverse tasks are carried out in our laboratories, from the investigation of new melt materials to final tests to determine the material mechanical properties (hardness, micro-hardness, material strength...).

In our laboratories we have high-tech machines like spectrometers, spin and static cast simulators, optic microscopy, electronic microscopy, gas analyzers, dilatometers, X-ray diffractometry, durometer, microdurometer and heat treatment furnaces.

7

Shipping

All guarantees for each delivery

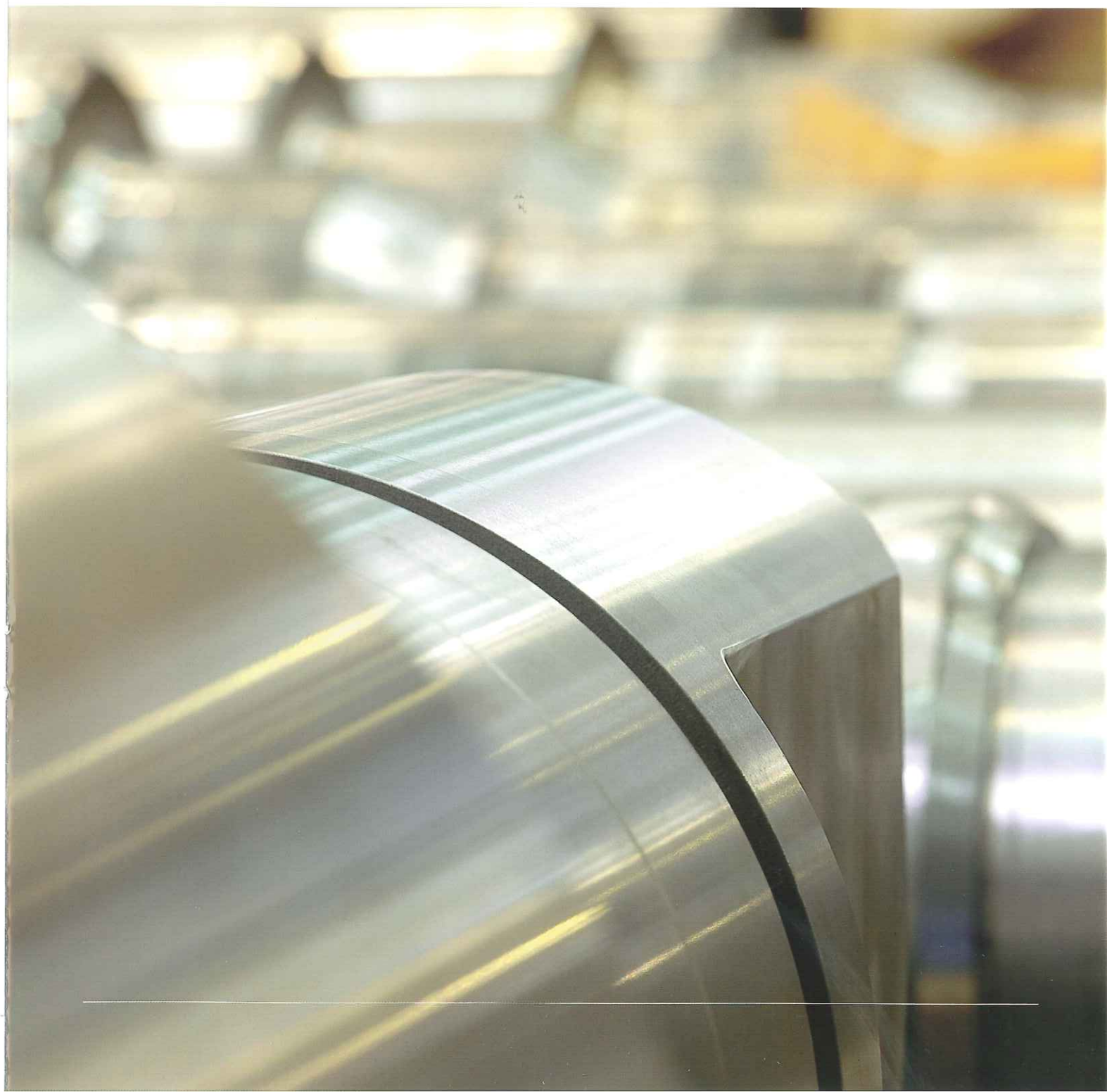


Once finished and checked the rolls are carefully packed to be delivered at destination.

Along with each roll a complete set of documents, with technical specifications and certificates of performed controls, is sent to the customer as a guarantee of quality.

FUNDICIÓN NODULAR, S.A. has got the Quality Central System Certified with ISO 9001.







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