Frisa Steel
Start up of a new melt shop
García, México
AGENDA:

- General information about the project and the equipment
- Quality aspects in equipment and process design
- The products
- Advantages
- Project design based on quality
- Process control and operations
- ISO certification plan
- Pictures
FRISA Steel is our most recent investment. Starting 2016, this new steel mill will integrate best-in-class technologies to deliver top-quality steel ingot stock for forging applications.

**Main Equipment:**

- Scrap Yard
- Electric Arc Furnace
- Ladle Furnace
- Deslagging machine
- Vacuum Degassing
- Material Handling System

**Future investments:**

- LF 2
- Upgrade to VOD
- Heat Treatment
Electric Arc Furnace Info:
- Nominal capacity of 50 MT, Tap to tap time of 55 minutes with a 50 MVA transformer
- Melting of scrap and up to 20% DRI if needed
- 2 scarp buckets per heat
- Eccentric Bottom Tapping for slag-free tapping at 15 degrees with Slide Gate system.
- Deslagging through Slag Door at -10 degrees
- Material feeding shute: Additions of alloying elements and slag components during melting are possible via a 5th roof hole
- Injection of oxygen, carbon and lime during melting; 5 burners, 3 injectors.
- Hot heel practice for fast melting down
- Automatic Manipulator for temperature measurement and sampling.
- EAF tapping car with weighing system
- The dedusting system is designed to meet European environmental standards
Ladle Furnace Info:

- Ladle transfer car carries the ladle to the heating position and deslagging position; It includes a tilting frame for deslagging.
- Transformer power is 11 MVA.
- Heating rate >= 4.0 °C/min.
- Purging system (Ar and N).
- Water cooled roof with exhaust system.
- Automatic temperature and sampling manipulator.
- Material feeding shute.
- Wire feeding system for the addition of small quantities of oxidants and alloying elements into steel.
Desslagging machine Info:

- Ladle tilting:
  - LTC with hydraulic tilting frame
- Tilting angle:
  - 39°
- Purging:
  - Yes (automatic coupling device)
- Deslagging:
  - Deslagging machine
- Stroke of slag rake:
  - max. 6000m (chain drive)
- Tilting angle of rake:
  - 15° (hydraulically)
Vacuum Degassing Info:

- 2 Vessels with one roof moving on rails
- Prepared for a VOD conversion
- Temperature and sampling manipulator for Atmospheric operation
- Vacuum alloying Hopper allows addition of alloy material during vacuum treatment
- Wire feeding system for the addition of small quantities of oxidants and alloying elements into steel.
- Atmosphere pressure to <= 1 mbar <= 6 minutes
- Hydrogen removal = <= 1.5 ppm
- Final sulphur content <= 0.003%
**Ingot Casting Info:**

- Casting Car with 3 Axis positioning system for accurate location of ladle over casting trumpet
- Automatic Teeming Rate control during casting for repeatability of casting parameters
- Weighing system to know the steel content in the ladle during casting
- Purging gas control. Argon is supplied to the slide gate to protect the pouring steel against re-oxidation
- Casting stream shrouding system. Argon is also used to protect the liquid steel stream from the ambient air. The flow of Argon is fully automated
- Ingot Mould Cleaning Machine to maintain a high surface quality of the ingots
- Trumpet Erection Station and Plate tilting unit for safety and ergonomics
- Heat treatment furnaces and slow cooling boxes
- Traceability per heat, and per ingot including its position in the casting set
- Molds and refractories were design and selected using simulation and the best suppliers in the world
Material Handling System Info:

The system is designed as one central alloying station which includes:
- Equipment for charging of the storage bin group with big bags or flow bins
- The storage bin group
- Weighing hopper bins
- Transport system to the receiving hopper at the process unit

The systems will be designed for operation in manual and fully automatic mode and carried out with the required steel structures, ladders, platforms, stairways, emergency box and a dedusting system.
WHO WE ARE

THE MASTER PLAN
Our facilities in Garcia
- The main equipment was contracted with Austrian company INTECO, experts in specialty steels ingot casting.
- Capacity: 350,000 tpy
- Ingot size from 13” to 69”
- Ingot weight from 3 tons to 100 tons
Our start up catalogue

## WHAT WE DO

### OUR PRODUCTS - Quality Steel Ingots

<table>
<thead>
<tr>
<th>CARBON &amp; LOW ALLOY STEEL</th>
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OUR PRODUCTS - Quality Steel Ingots
Our start up catalogue

ROUND MOLDS

| Ingot | Ingots per heat | DIMENSIONS (inch) | WEIGHT (lb) | | | |
|-------|-----------------|-------------------|-------------| | | |
|       |                 | A | B | C | D | Uncropped | Cropped |
| 13 R  | 25              | 13| 13| 185| 191| 6,883     | 6,479   |
| 16 R  | 10              | 16| 16| 191| 208| 10,719    | 10,090  |
| 20 R  | 6               | 20| 21| 197| 213| 17,299    | 16,288  |
| 24 R  | 5               | 24| 25| 167| 180| 21,202    | 19,960  |
| 31 R  | 3               | 31| 32| 167| 180| 35,335    | 33,267  |
| 39 R  | 2               | 40| 40| 156| 167| 51,956    | 48,913  |

POLYGONAL MOLDS

| Ingot | Ingots per heat | DIMENSIONS (inch) | WEIGHT (lb) | | | |
|-------|-----------------|-------------------|-------------| | | |
|       |                 | A | B | C | D | Uncropped | Cropped |
| 52 P  | 2               | 44| 54| 98 | 111| 53,682    | 46,991  |
| 69 P  | 1               | 58| 69| 106| 123| 99,502    | 86,004  |
Project design based on quality

- The Scrap Yard is a covered building with boxes to avoid humidity and guarantee scrap segregation
- The EAF has a capacity of 50 MT per heat, tap to tap time of 54 minutes. It has Eccentric Bottom Tapping to avoid slag carry over
- The Dedusting system is designed to meet European environmental standards
- Our Material Handling System for ferroalloys serves the EAF tapping position, the LF and both VD tanks, this allows optimization of the alloys and control of the chemical composition
- We have a Deslagging Machine between the LF and VD for clean steel practices
- The Ingot Casting Car has 3-axis positioning to guarantee the alignment between the Ladle and the casting trumpet
- Automatic Teeming Rate control during casting for repeatability of casting parameters
- We use Argon shrouding between the Ladle and the trumpet, and also among the 3 plates of the slide gate in order to protect the liquid steel from oxidation
- We have selected the best Refractories with up to 90% alumina in order to minimize the risk of erosion and therefore non-metallic inclusions
- We use simulation and the best suppliers of Molds for optimal quality and metallic yield of our ingots
Level 2 System. Operations and Process Control

- Capabilities for quality control
- Human Interface
- Metalurgical Models
- Paper supporting the M.Models
- ETC

Design of Operational Practices

- Cook Books
- Training
- Technology cluster
- Simulation tools
- Organization chart
- Supply Chain (refractories, materials, inspection, control, supplier development, etc)
Some of the advantages for Frisa and our customers:

- Quality Control of our steel
- Savings in freight cost
- Shorter lead times and quick response to customer needs
- Hot charge of ingots for Open Die Forging
- Ingot weight adjustment for yield optimization
- Use of the scrap generated in our cutting, forging and machining operations
- We can design customized molds for specific requirements
- Flexible set up of our production program
# ISO Certification Plan

## Plan ISO 9001:2015-Frisa Stee

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**Activity**

- **Documentary Audit by Lloyds Register**
- **Frisa Steel Operations start up**
- **Frisa Steel Records**
- **Internal Audit**
- **Audit by Lloyds Register - phase 1**
- **Audit by Lloyds Register - phase 2**
- **Issue of Certificate ISO 9001:2015 for Frisa Steel**
Pictures

the forging evolution
PROJECT STATUS

LF

LF Erection

LF
WHO WE ARE

VD

VD Erection

VD
Casting area overview
WHO WE ARE

IC

Casting car

Ar shrouding protection
Ingot pusher

Trumpet preparation
Plate tilting unit

Mould cleaning machine
First Heat

Stripping of first ingot
WHO WE ARE

First Heats
Heat Treatment Furnaces
WHO WE ARE

MHS
DESSLAGING

PROJECT STATUS
FRISA STEEL

Fume Treatment Plant
Water Treatment Plant