

# **COURSE DIDACTIC GUIDE**

## **Hot Rolling of Long Products**

### **Vision**

This course offers the contribution of scientific and technological knowledge and its practical implementation and engineering in a hot steel rolling mill for long products. Participants will acquire technical criteria and knowledge that can be used in their rolling mill, in the development of new pass designs, in the expansion of the product range and steel qualities, in the understanding of rolling issues, in solving quality problems, in selecting heating practice and energy consumption, fundamentals of roll pass design for long products, semis design, rolling mill down time reduction, production yield optimization, revamping aspects, a vision of the sector and a long etcetera. This course will provide attendees with tools to identify, understand and overcome problems arising in a rolling mill, and deal with them, together with a vision of development of any rolling mill.

There is no doubt this course can benefit your company. Practical knowledge, based in technical and engineering principles that can be used directly in your rolling mill to enhance productivity is one of the best things you can bring in your company.

### **Program description and objectives**

The hot rolling of long products requires to focus on three main aspects that are reviewed in this course, steel as material and different qualities that can be obtained, long product roll pass design for different sections, and aspects of productivity, layout and facilities. All these contents are not disconnected one from each other, and are actually intimately related among them.

An initial view of the market and productions as a global sector y followed by a vision of rolling mills configuration and Layout, followed by a metallurgical overview of the steel as a material together with its behavior in a rolling mill will be described related

to product quality, product mechanical properties, 'new' qualities and to act about them.

A revision of roll pass design for long products is to be made, including specific aspects for different shapes, providing an overview of methods, calculations and parameters towards the development of new pass design and how to review existing roll pass designs. All parameters (temperature, groove shape and material shaping, guiding, etc) and their influence will be explained.

An overview of productivity and overall process efficiency will be described from the end of a continuous casting to the final product stock yard and certification, including a revision of quality issues and how to manage them from an overall view and specific improvements.

This course considers different contents, especially the different calculation methods in the design of rolling grooves, total magnitude calculations, finite element method (FEA) and network of independent points are shown and explained.

## Style and learning

This course is oriented towards a practical profile because the content and technical material is explained using a certain visualization in the exposition of the concepts, which the student can identify in their professional environment, or their company environment, and provoking and accepting any discussion or questions that may arise from students through the platform's forums, chat and messaging, promoting addressing all content in an interactive study dynamic.

## Materials and course documentation

The didactic material has been structured into four modules.

In the first place and to obtain a vision of the sector and its socio-economic environment, the type of industrial facilities, and innovation, the first module exposes

the state of the steel sector, globally, in terms of market and productions, to understand its strategic and evolutionary vision and its companies. With this, knowledge of the sector is acquired, also about the behavior of companies and about key aspects that guide strategy and activity in the steel industry. Also, within this first module, a general description of the industrial facilities of a rolling mill is made, so that the participant is able to identify different configurations, and at the same time, common facilities within the sector.

In the second module the participant is trained so that can understand and analyze the metallurgy of steel, learn new technical knowledge for it and generate links and connections between metallurgical theory and the results in a rolling mill, in relation to product initial quality initial and final quality obtained, mechanical properties, "new" qualities and how to act on them. This module aims for the participant to understand steel as a material with variable properties according to its temperature deformation condition, its evolution and composition, as a summary of the effects of thermomechanical treatments. We also will explain different methods to calculate, like whole magnitude, finite elements (FEA) and individual points.

In the third module a review of the theoretical basis of the design and calibrations and roll pass design for long products is carried out, including specific aspects of different sections, and providing a series of methods, calculations and parameters with the objective that the participant can assess and develop new roll pass design and pass schedules, and will be able to review existing pass programs. All the parameters (temperature, shaping, the guiding system, etc.) and their influence will be explained.

In the fourth module, the key aspects of the facilities of a rolling mill are exposed, the productivity and the overall efficiency of the process from the continuous casting to the final product warehouse and the product certification, including the revision of problems, quality and how to manage them both from an overview and through specific improvements. It also describes what an ISO 9001: 2015 quality system looks like in a steel-rolling company.

No book has been developed, so the attendee should take notes or contents.

### 3.- General data about this training action

#### 3.1.- Course name

Hot Rolling of Steel Sections

#### 3.2.- Duration

120 hours during two months, with 24/7 access to the platform.

#### 3.3.- Objectives

The purpose of the course is for the participant to become knowledgeable about the technical and technological processes of a rolling mill, as well as to recognize all the parts of a rolling process from continuous casting to product completion, and even with autonomy to be able to enter into the reality of a rolling mill.

#### 3.4.- Methodology

You can take the course from anywhere, organizing the time according to each person and without fixed schedules.

The didactic manual contains the development of the topics that make up the course and has the appropriate content for the specific pedagogical objectives and the degrees or levels of knowledge that are intended to be acquired.

The information, updated content to the advances of the sector, is sequenced in a logical and orderly way in a way that allows you to easily expand your knowledge.

The course delivery model through the platform requires a monitoring system in which you can maintain continuous contact with the course tutor, benefiting from a personalized tutoring and communication system.

You must remember that the evaluation of the course will be carried out by the Tutor based on the results of the evaluation tests and the tasks handled.

### 3.4.- Virtual platform URL

<https://aula.atecid.com>

### 3.5.- Recommendations for taking the course and tutorials

The following recommendations seek that the participant can advance through the course in a continuous way, taking advantage of its contents and transforming said contents into their knowledge:

- try not to accumulate matter for the last days
- try to spend a certain time each day, or each week
- participate in forums and tutorials
- raise your doubts or questions so that the tutor can identify the content to which the student refers
- make sure you do all the assessment exercises

## 4.- Follow-up of the course. Tutoring service

During the expected duration of the course, you will have a tutor to answer your questions or concerns, for which it is necessary to use the platform's messaging system. There are not fixed day-hour for tutorials, so anyone anywhere can place his question, and we will answer in a flexible way, as soon as we can.

In case a videoconference webinar or tutorial is offered, for any reason, or because you need it, a specific time will be agreed.

The person in charge of this course is Javier Aseguinolaza Iriondo, whose qualification and experience can be checked in [his LinkedIn profile](#).

## 5.- External Collaborators

We make use of contents developed by other companies or individuals, specially pictures and videos. If you want to collaborate, please tell us. Here is our collaborators table.

**Hot Rolling of Long Products**

We appreciate the permissions of access and use to material  
From companies and individuals we consider our **collaborators**:

- Cambridge University 
- Danieli 
- Viktor Mácha – Photographer [www.viktormacha.com](http://www.viktormacha.com)
- Sist. de Engrase y Lubricación [www.sistemasdeengrasylubricacion.es](http://www.sistemasdeengrasylubricacion.es)
- World Steel Association [worldsteel.org](http://worldsteel.org) 
- NORD drive systems
- SMS Group 
- KANTHAL 
- MWE GmbH 
- Ingersoll Rand – CompAir  
- CONECBAND 
- UNESID 
- British Steel 
- Harald Finster, Photographer <http://www.hfinster.de/>
- ATOMAT <https://www.automat.com/>
- Montanstahl 

• And some internet portals like Pixabay, Dafeul, Videezy y Shutterstock

## ANEXO I. SYLLABUS

### Module 1: General Iron & Steel sector general vision and hot rolling processes

- Productions, Capacities, Prices and trends.
- Hot rolling processes, general vision

### Module 2: Metallurgical Vision of the Steel Hot Rolling Process

1. Steel structure and transformations
2. Metallurgical temperatures and the rolling mill
3. Grain structure and distribution
4. Chemical composition and alloying elements
5. Metallurgical Strategies and chemical composition
6. Steel composition and final steel quality

### **Module 3: Roll Pass Design (grooves and passes)**

1. Constant volume and material flow
2. Pass filling and not filling
3. Rolling conditions
4. Start of the rolling case of flat passes and bar sections (cases of theory-practice)
5. application will be presented constantly throughout the course)
6. Types of rolls
7. Plastic yield stress and influencing factors
8. Temperature, profiles and round
9. Roll groove dimensions
10. Workshop – Product trace development for bar, from billet
11. Force, Moment, Power & Motors
12. Roll Pass design for Profiles
13. Roll Pass design for bar
14. Initial sections, number of stands and passes
15. Rolling Defects and how to avoid them

### **Module 4: Rolling mill productivity and efficiency**

1. Reheating furnace, types and strategy
2. Rolling mill production capacity
3. Initial sections definition
4. Layout influence in quality
5. Finishing mill
  - Cooling
  - Cutting
  - Straightening
  - Stacking & Labelling
6. ISO 9001:2015 in a minimill – hot rolling

