



HOT STRIP MILL WORK ROLL LUBRICATION

DESCRIPTION

The Purpose and Advantages of Use

This simplified description explains how the Work Roll Lubrication System for hot strip mills. The work roll lubrication system is delivered to steelworks and used in the finishing rolls.

The equipment is designed to be used especially with the biodegradable rolling oil PiniRol. It is characteristic for the oil that it is as safe as possible for the staff of the rolling mill to use and handle. In addition, the environmental load of PiniRol oil is minimal.

Benefits

By using the work roll lubrication system steelworks can achieve, among others, the following financial benefits in hot strip rolling:

- the required energy is decreased
- roll force is decreased
- the wear and tear of the rolls is decreased
- the need for repairing the rolls is decreased and their service life becomes longer
- the surface quality of the rolled coils is

improved and more first-rate coils can be produced

- the productivity of the rolling line is increased

How the System Works

The following description of operations details the different systems that make up the parts of the work roll lubrication system.

Each part formed of the different systems is manufactured, assembled and tested at the manufacturing factory into a ready-made unit in order to make the installation as quick and easy as possible, so that normal production on the rolling line is affected as little as possible.

I. Oil Aggregate

The oil pumping aggregate next to the oil tank transfers the rolling oil through the oil pipelines specifically installed for this purpose to component boxes mounted near each rolling stand.

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Pict. 1

2. Oil Tank

The oil used in the work roll lubrication system is stored in a stainless steel oil tank called a production tank (gross volume circa 25 m³). In addition to the production tank, also a separate storage tank is needed to equalise possible delays in transporting the oil (e.g. customs formalities) and to secure constant availability of oil for the rolling process. The required rolling oil is transported to the storage tank in a stainless steel tank either by car, railway or a standardised container tank (see attached image 1).

3. Component Boxes

During the design phase, the customer and supplier together choose on which rolling stands (usually 4-6 stands) of the finishing rolls the work roll lubrication system is installed. A component box is mounted in the immediate vicinity of each rolling stand. The oil and water used is conducted through separate pipelines into each component box. The necessary equipment (check valves, adjustment valves, blenders, oil measuring equipment) is installed in each component box to produce the desired oil and water mixture. The desired amount of oil can be adjusted separately for the upper and lower rolls in each component box. In addition, the quantities of oil for each rolling stand can be adjusted separately. All of these functions can be automatically controlled. From the component boxes the oil and water mixture is channelled through pipelines to the nozzle pipes near the top and bottom work rolls.

The nozzle pipes are connected to the oiling equipment which is located in the rolling stands (see section 5 below). If strips of different width are rolled on the line (e.g. normal and wide strips), the width of the strip is chosen either automatically or by an operator. Whatever width is chosen, the necessary number of nozzles attached to the nozzle pipe will be activated to suit the width of the rolled strip.

Each component box is connected to a separate electricity and automation box. Through an automated system, this box controls the valve functions for the oil and water mixture in the component box (see attached image 2 of the component box).



Pict. 2

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Pict. 3

4. Water Treatment Unit

Depending on the qualities of the process water available at the rolling mill, the water needed for the oil spray system can be processed in a separate water treatment unit. In this case, the process water line is connected with the water treatment unit, which is constructed on a common platform. The water treatment unit is usually composed of the following functions, among others: active carbon filtering, water softening and pressurising.

5. Oil Spray Devices and Scrapers

Two separate and moveable nozzle pipe attachment systems are built on the entry side of each rolling stand (e.g. 5 stands). These attachment systems enable the oil and water mixture to be sprayed through the nozzles onto the top and bottom work rolls.

In addition to the nozzle pipes, also scrapers are connected to the attachment structures. The scrapers are designed to mechanically clean the surfaces of the work rolls of water and impurities. This makes the sprayed oil adhere better to the surface of the roll and impurities (scale) cannot get into the roll gap (see attached image 3, the body of an oil spray device in production).

6. Motor Control Centre (MCC)

The motor control centre contains electric switch appliances which are used to join the oil spray devices to the rolling mill's power-distribution

network. The control centre consists of the required electrical feed system for different motors (valves, pumps) and electric cables. In addition, the control centre includes the necessary electronics units needed to connect the oil spray equipment into the automation system.

7. Central Processing Unit (CPU)

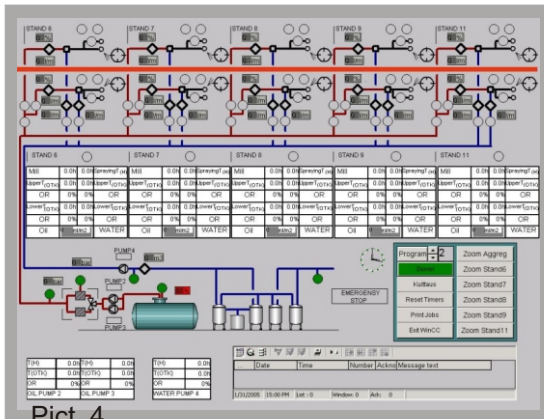
The central processing unit controlling the entire automation system is placed in a cabinet with the necessary data transmission connections to all the different systems connected to the automation system (e.g. control room, the mill's own basic and higher automation system).

8. Programmable Logic Controller (PLC)

PC equipment used to control the automation system of the work roll lubrication system is installed in the control room of the hot strip mill. The operator can use this equipment to control and operate all the functions of roll lubrication. The control room operator can choose different display views from the PC screen that represent different parts of the oil spray process and thus follow the process through each phase. Each view contains information such as the status of the equipment involved in the process, different notifications, measurements, set values, alarms, etc. In practise, when the automatic control is in use, the task of the operator is to supervise the functioning of the work roll lubrication system (see attached image 4, an example of the main image of the system).



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Pict. 4

The data transmission connects the control room's PC equipment to all the units involved in controlling the system: the central processing unit, the distributed sub-stations (in each rolling stand), the motor control centre and the control panel. In addition, the basic automation system and so-called higher level automation system that are a part of the central automation system of the rolling mill will be connected to the data transmission system mentioned above.

9. Control Panel

A control panel for manual use operates with push buttons and switches is positioned in the control room for the operator. The operator can use a switch to choose, for example, the way the control system is running (manual/automation). If the data transmission connection to the higher automation system of the rolling mill is connected, information

about the width of the rolled strip (normal/wide) comes from the higher level automation. Otherwise the operator can choose the width of the lubricated strip from the manual control panel. The oil spray system usually functions completely automated without the operator needing to control anything from the control panel or computer.

10. Oil Pipelines

The oil pipelines that start from the oil tank form a closed system in which the oil flows through each rolling stand before returning to the oil tank. There is a separate branch in the closed oil circuit for each component box near each rolling stand.

11. Water Pipelines

The process water, or the cleaned, sufficiently soft water that has been run through the water treatment unit, is transferred through the pipelines to each component box near each rolling stand.

12. Compressed Air Pipelines

The compressed air cylinders that move the nozzle pipes need clean compressed air. This air can be obtained from the mill's compressed air system. If needed, an automatically guided pressure reduction station can be connected to the system. This pressure reduction station will provide higher pressure for the pressurised air cylinders when lubrication devices and scrapers need to be moved to a different position.



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Scope of Delivery:

Pinifer is ready to negotiate with the customer on different options for scope of delivery. We can provide, for example, the following kind of turnkey delivery:

1. Pinifer will design and deliver, for example, sections 1-10 of the equipment and devices mentioned above. They will be prefabricated and assembled units from Finland.
2. The steelworks in question will manufacture the oil tank (section 2) (e.g. based on Pinifer's design) as well as planning the pipelines (sections 10, 11 and 12) to suit the process, purchasing the pipeline material and installing them into a complete system together with the equipment supplied by Pinifer.
3. The steelworks will install the equipment together with Pinifer's installation supervisors. Pinifer will be in charge of supervising the installation and implementation of the equipment.
4. The equipment will be commissioned and tested by both Pinifer's and the customer's experts together.
5. Pinifer's experts will provide the rolling mill's staff with user training.

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