Five Technologies - One System Supplier: Loeser, Speyer Germany

Loeser GmbH, located in Speyer Germany, is a global leader and major innovator in the field of grinding and polishing systems. Loeser’s product line has been recently expanded to include complete continuous through feed chrome plating systems. This new addition combined with Loeser continuous through feed induction hardening systems makes Loeser the only producer of surface technology systems for bars and pipes able to offer all of the following solutions:

1) Through feed induction hardening  
2) Through feed belt grinding pre chrome  
3) Through feed continuous chrome plating  
4) Through feed polishing post chrome  
5) Through feed application of special wax for added corrosion resistance

Loeser has produced several such complete systems that are currently in production.

Producing machines and complete systems for the industry for over 75 years, Loeser has persistently continued to further develop and refine the existing fundamental technologies. Based on reliable machine technology, Loeser is well respected globally for its ability to develop new and efficient systems that can be installed in a customers plant and running in a remarkable short amount of time.

Components not manufactured by Loeser are purchased from well established high quality global suppliers with parts and service worldwide

Next we can show the complete process step by step from raw material to finished product using Loesers advanced technology
1. Through Feed Induction Hardening

CIH RPS 376 Continuous Through Feed Induction Hardening line

Hardening of the surface is necessary for work pieces exposed to severe work conditions such as hydraulic cylinder rods on earth moving equipment. This process makes the surface much more resistant to scraping, gouging, and denting caused by hard objects striking the outside diameter.

This process is mainly used on hydraulic cylinders; other applications include ball screws to increase the wear resistance in the ball track and other round parts.

The technology is based on the induction hardening process. Induction hardening uses eddy currents to produce heat on the surface of the work piece. Eddy currents are evoked by one or more induction coils with high frequency alternating current.

Picture 1: Induction coil and water quencher
The number of induction coils used, is determined by the required through feed speed, depth of hardness and the diameter of the bars or pipes.

A continuously running transport system feeds the steel bars through the induction coils at a consistent speed.

Specifically engineered transport system, controlled by the PLC, is designed for maximum efficiency and production. The extremely accurate and repeatable spiral movement insures consistent hardness and hardening depth throughout the complete bar.

The outer surface heats up to the required hardening temperature. Deeper layers will not reach this temperature during the short heating period and therefore will not be hardened.

Immediately after heating, the bar or tube is quenched with an emulsion or with water. The quenching medium is applied by an automatically operating quencher.
Picture 3: Inductive heating and cooling with automatic quencher

Steam vapor can be extracted with a mist collector

A quantity of bars is initially loaded onto a load table equipped with an automatic operating magazine loader. The magazine loader picks up the bar and places it onto the in feed transport conveyor where it then travels through the hardener and exits the machine on the exit transport conveyor. The bar is then automatically lifted off the exit transport conveyor and placed onto the unload table. The process automatically repeats leaving the minimum amount of distance between bars for maximum efficiency.

Pictures 4 and 5: Infeed magazine and outfeed magazine

After quenching, the residual cooling agent is removed from the bars using an air blow off device.

The guide roll system moves the bars to an ejector. The bars are retained in an outfeed magazine.

The effective hardening depths depend on the required operating conditions. It is possible to reach a depth of approx. 2mm. Hardening results also depend on the material.

Additional induction coils allow further hardening depth
Depending on the hardening temperature it is possible to vary the surface hardness. Throughput speed varies depending on the diameter of the part. Smaller diameters feed faster than larger diameters proportionally.

Loeser designs and builds each system based on specific customer requirements. From the smallest to the largest diameter, hardening is possible with standard machines. The length of the workpiece may range from a few decimeter to several meters.

Pictures 6 and 7: Induction coil and quencher

Once process parameters are determined that produce the required hardness, hardness depth and production requirements for each bar, all parameters are then stored on the PLC and can be easily retrieved the next time this bar is processed.

Picture 8: Control unit of the automatic hardening machine

Pictures 9 and 10: Bars before and after hardening
The work pieces can be moved manually or automatically to the next production machine, which is usually a straightener.

After the straightening process (if required) bars are polished to the required surface finish parameters using a multiple station abrasive belt polisher. A bonded wheel (stone wheel) grinder is in most cases not capable of producing adequate surface finish parameters required for chrome plating ultimately effecting the life of the piston rod seals on a hydraulic cylinder rod.

2. Through Type Belt Grinding Before Chrome

Sketch 2: Belt Grinding Machine

This production step prepares the surface of the work piece for chrome plating.

Belt polishing brings the bar surface to the required measurable surface finish parameters which vary depending on the customers quality level. Final surface finish roughness is determined by the number of abrasive belt polishing stations and abrasive belt grit sequence. Belt grinding is used when the surface-finish requirement is very high.

Pictures 11 and 12: Surface before chrome plating, left: after stone grinding; right: after belt grinding
Loeser is a global leader in the technology required to produce super high quality surface finishes with many years of process development and innovative thinking. Working very closely with all abrasive belt manufacturers and their newest technology keeps Loeser far ahead of the competition.

Careful and accurate evaluation of customer specific needs is the reason Loeser can construct large complex systems.

Centerless grinding machines are usually configured as follows:

1) Infeed magazine for the bars that are to be processed
2) Automatic loading unit to the roller guide
3) Roller guide with pinch roll system for loading the bars into the grinding station
4) Belt grinding stations of varying capacity and number
5) Roller guide with pinch roll system to transport the ground material
6) Automatic system to unload the work pieces into the outfeed magazine
7) Magazine for the finished work pieces

The machines include additional support devices such as paper bed type coolant filtration units, magnetic separators for removing steel swarf, mist collectors for extracting humidity vapor from inside the cabinet.

Pictures 13 and 14: Paper filter system with magnetic separator

The machine enclosure provides a dry floor condition and noise isolation.
Loeser produces machines that finish tubes/bars in a vast size:
Diameter range from as small as 6mm up to 500mm
Length range from a few centimeters up to 30 meters

Loeser belt grinding machines can grind or polish a very wide variety of materials form stainless steel, special alloys, zirconium, titanium, non ferrous materials, hardened steel, chrome plated bars and many more. The product line includes all types of configurations from single station manually operated machines to completely automated multiple station machines with up to 12 grinding stations.
The patented designs of the machines include pressure controlled grinding. This precision method controls grinding pressure with extreme sensitivity and accuracy. This assures grinding consistency and process repeatability at high production rates.

High quality surface finish, process repeatability and high production are the result of this technology.

Loeser works very closely with all of the abrasive belt manufacturers worldwide and is always looking for the latest advancements in abrasive belt technology. This keeps Loeser on the cutting edge of developing process advancements. Our customers greatly benefit from Loeser’s decades of experience in developing thousands of grinding processes. This allows Loeser to offer much more than just the construction of a machine. Customers are assured a reliable machine and process.

When customers require new process development with special requirements such as special materials, surface finish parameters, high stock removal etc; Loeser works closely with the customer to develop the necessary process parameters to meet the customers needs.

A tremendous amount of Loeser’s success in meeting customers process requirements is due to advanced technology controlling the operation of the machines. This ever advancing technology has an estimated 50 man years of development work and is incorporated into the controls of the machines demands.
The control station of the machine contains an operator interface (HMI) this is a very self explanatory easy to learn touch screen system with all the necessary screens to operate the machine. Programs, once created and optimized, can be saved and recalled as required in the future.

Pictures 20 and 21: User interface belt grinding

In order to produce the highest quality chrome plated bars or tubes, the surface finish must also be of the highest quality before the plating process.

The better the surface quality before plating, the higher the quality of the finished chrome plated part and the more efficient the plating process.

A high surface quality raises the throughput speed and helps to reduce the thickness of the chromium coating, significantly reducing the consumption of chromic acid.
3. Through Type Chrome Plating

Developing the chrome plating technology and designing a process reliable chrome plating machine was an important step for Loeser on the road to becoming a supplier of complete systems in the market of surface optimization of bars and pipes.

Through type chrome plating is used to seal with a galvanic chrome layer on the surface of parts that are produced for mechanically demanding applications. Many mechanical parts, like cylinders, mechanical guides or press punches can be produced simply and economically.

Chromium plating is an electrochemical process, used to seal the surface of a metal with a coat of chrome. For mechanical use or respectively for protection, the thickness of the chromium coating ranges between a few hundredths and a few tenths of a millimeter.
In the past the work pieces were dipped into a tank filled with chromium acid.

The tank was equipped with lead anodes, attached to the positive pole of a rectifier. The work piece had to be attached to the negative pole of the rectifier. However this procedure poses several major problems.

1.) While the bars leave the chromium bath, some of the chromium acid liquid can drop to the floor.

2.) Large tanks are filled with many thousand liters of chromium acid.

3.) The guidelines for appropriate handling of chromium acid are kept very strictly all over the world.

4.) Strict official approval proceedings are required. The reduction of the amount of chrome bath solution in regard to reducing pollution is an absolute necessity.

5.) The thickness of the chromium layer is hard to control. The position of the anodes is radially asymmetrical with respect to the bars. Therefore the chromium layer is not consistent.

A: anodes  B: bars  C: chromium acid tank  D: chrome layer

Sketch 3: Chromium plating bath, lateral view
Due to the distribution of the lines of force the chromium layer increases in areas that experience a stronger flow of the electric current.

The procedure generates a product of lesser quality that consumes a large amount of chromium and entails environmental damage.

Loeser developed a through type chrome plating machine, which solves these problems elegantly.

The work pieces are continuously moved through the chromium tank. During this process the work piece (A) is connected to the negative pole of the rectifier while the anodes (G) situated inside the chromium tank are connected to the positive pole of the rectifier.

The uniform movement through the chromium bath causes the formation of an evenly thick layer of chromium, which can be adjusted by the size of the chromium tank (length) and by controlling the throughput speed.
The speed of the plating process can be adjusted depending on the size of the tank and the thickness of the chromium layer.

The following diagram explains this relation.

Diagram 1: Speed of through type chrome plating

The advantages of the through type chrome plating system developed by Loeser must be regarded as a breakthrough in the implementation of this technology. The work pieces are coated homogeneously and completely and there is no waste.

The drive system is dimensioned and designed precisely so, that the electrical contacts rest securely during the transport process and the infeed parameters can be optimally adjusted.
The chromium layer is homogeneous and the quality of the plating is very high. Additionally chromium consumption is low and the product quality, after the system parameters have been set, is first rate and reproducible. Production costs are optimized and environmental impact is low. The process parameters can be saved in the control system and uploaded from memory as required.

![User interface control](image)

Pictures 23 and 24: User interface control

The machine is designed in such a way that several work pieces of the same diameter can be plated in parallel by one through type plating system. The system can be designed for different diameter ranges.

Standard machines work within the diameter ranges of 20mm to 70mm and 70mm to 150mm. Usually the thickness of the chromium layer ranges between 10 and 50 micrometers.

The layer has to contain miniscule fissures in order to prevent the chromium layer to break. The chromium layer is of a harder consistency than the steel it surrounds. Without the fissures the layer can break open due to climate conditions or the elasticity of the steel core.

Large cracks allow oxygen to reach the steel core which causes corrosion there. Micro fissure offer the best protection against inadmissibly large cracks.

Before plating the surface of the work piece must be finely polished. The quality of the plating depends largely on the surface quality of the starting material.

After plating the surface must be polished to reach a high surface quality and to relieve the tension in the chromium layer.

Additionally the chromium layer can be sealed with wax.
4. Through Type Belt Grinding after Plating

Belt grinding machines after plating differ from the machines traditionally used for the pure grinding of bars and pipes.

These machines contain two separate working areas: a wet area for grinding and a dry area with polishing wheels and waxing stations.

Sketch 7: Finishing line for chrome plated bars with 4 polishing stations and 4 waxing stations

The design of the belt grinding machines for this process is comparable to the one of grinding machines used before plating.

After plating the work pieces travel through a pressure controlled super finish and polishing process in order to enhance corrosion resistance. The roughness values reached here vary between 0.2µm and under 0.1 µm depending on the customer’s requirements.

After super finishing, any remaining coolant fluid is removed from the work pieces by use of an air blow off.

The work piece is then automatically transported to the waxing stations.
5. Through type sealing procedure with wax

Depending on the diameter of the work piece and the through feed speed, it can be optimal to reheat the work piece by use of an induction coil.

Pictures 26 and 27: Polishing head and wax injection

The waxing station contains several polishing wheels. Their purpose is to dry, then re-polish and to heat the work piece.

The wax is applied and polished into the micro fissures of the chrome layer to seal them. This procedure crucially increases the corrosion resistance of the work piece.

Loeser has sold, installed and commissioned several of the described systems on the national as well as on the international market. The reference customers are among the premium suppliers of the hydraulic and automotive industries.

Trailer:

Loeser is the global market leader in the processes of surface optimization on metal, wood, plastic and paper through feed grinding, polishing and deburring. The company was founded in 1934 by the grandfather of the author Michael Loeser. Many Loeser machines are in production worldwide. The company maintains sales and service centers in USA, China, Mexico, Spain, Turkey, Russia, France, Poland, Japan, Korea, Taiwan and in Egypt.