Descaling systems
More surface quality in rolling and forging plants
Tradition as basis – high-pressure as motivation

As specialists for sophisticated solutions SCHÄFER & URBACH have become renowned in the following areas.

- **Pump Units**
  - High-pressure pumps HDP
  - Process pumps PPK
  - Mud pumps BT
  - Slurry-Pumps SPL
  - Steam- and Duplex pumps
  - Special pumps

- **High-pressure technology**
  - Tank- and industrial cleaning systems
  - HP Cleaning systems
  - HP Cleaning accessories

- **Water hydraulics**
  - Descaling systems
  - Drive systems for presses

- **Service / After Sales**
  - Engineering
  - Welding technology
  - Commissioning

For more than 80 years SCHÄFER & URBACH have developed and supplied equipment and components for systems and high-pressure plants to customers throughout the world. All of the supplied equipment is manufactured at the SCHÄFER & URBACH workshop. The company assumes responsibility, as it supplies complete high-pressure and systems solutions made up of components which all fit together seamlessly – forming a perfect match and being ... all from one source.

Water-hydraulic systems solutions

Services provided by SCHÄFER & URBACH comprise planning, design, assembly and commissioning of water-hydraulic plant and equipment as well as after sales service and spare part delivery for plants in operation. SCHÄFER & URBACH offers all services on a turn-key basis and from a single source. SCHÄFER & URBACH sees itself as a supplier of high-pressure systems without interfaces.

SCHÄFER & URBACH designs and realizes water-hydraulic systems solutions for:

- **Descaling systems** – More surface quality in rolling and forging plants
- **Press drives** – Customized solutions for the replacement and modernization of forging press drives
Descaling systems

We do not remain at the surface!
SCHÄFER & URBACH designs, supplies and assembles both individual components for descaling systems as well as complete descaling units for the removal of primary and secondary scale. The equipment is designed according to the latest state of the art in descaling technology using Lechler descaling software. Numerous rolling mills throughout the world have benefited from the reliability of the systems in terms of surface quality improvements and marked savings in energy costs and/or spray water.

Systeme / Plants
SCHÄFER & URBACH provides technical advice, and designs and supplies descaling systems for:
- Continuous casting lines / slabs
- Plates
- Forged and shaped parts
- Hot strip
- Bars / rods
- Sections

Components
SCHÄFER & URBACH naturally also handles modernization projects for existing plants and/or delivers individual components, such as:
- Descaling boxes
- Descaling valves
- Spray headers and rings
- Descaling pumps
- Resonators
- Pre-filling at low pressure
- Shut-off valves
- Check valves
- Accumulator emergency stop valves

Introduction

(Functional description of a descaling unit)
The below described descaling units serve to remove the primary scale forming on metallic surfaces during furnace treatment. The scale layer is removed by water being sprayed onto the metal surface at high pressure while the material is passing through a dedicated descaling cabin. Primary scale is removed essentially by three physical processes. The individual contribution of each of these processes to the descaling result depends on the type of scale forming in the furnace, which in turn is determined by the type of material heated in the furnace.

The following three physical mechanisms can be distinguished:
1. Generation of heat stress in the scale layer due to cooling
2. Explosive energy as a result of the increasing volume of water when it evaporates
3. Mechanical forces caused by the impact of the water jet

Materials tending to form a relatively thick and porous scale mainly benefit from the first two physical mechanisms. By contrast, the third mechanism is more effective with materials forming a thin, coherent and adhesive layer of scale. The latter type of scale is called sticky scale and it is much more difficult to remove than scale of the first category. SCHÄFER & URBACH designs and supplies individual components for descaling systems as well as complete descaling units for unalloyed, low-alloy and high-alloy steels, including assembly and commissioning.
General description of plunger pumps

Plunger pump S&U HPP 180-3

The use of plunger pumps is recommended wherever relatively high pressures and relatively small pumping rates are needed. The flow volume depends on the plunger diameter, plunger stroke and the speed of the drive shaft. Combining several plunger units into one pump unit with overlapping strokes reduces the surges which occur whenever a stroke takes place. In each case the conditions at the infeed side of the pump deserve special attention, as they are dependent on the routing of the pipes, the primary pressure, the temperature of the fluid and other factors. The design and manufacture of SCHÄFER & URBACH products comply with the EU pressure equipment directive (RL97/23/EC).
Comparison of plunger and rotary pumps in descaling plants

<table>
<thead>
<tr>
<th>Plunger pumps</th>
<th>Rotary pumps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressurization through line resistance after geometric displacement</td>
<td>Dynamical pressure increase of the pumping medium (water) through speed increase</td>
</tr>
<tr>
<td>Pressures up to 5,000 bar, no limits for strength reasons</td>
<td>Pressures of up to 250 bar for rotary pumps in descaling units. Strength limitations imposed by impeller diameter and speed</td>
</tr>
<tr>
<td>No special design even at ultra-high pressures</td>
<td>To accommodate different pumping rates high-pressure rotary pumps must be designed as multi-stage pumps and equipped with corresponding axial balancing equipment</td>
</tr>
<tr>
<td>Extremely high overall efficiencies up to about 95%</td>
<td>Extremely high overall efficiencies up to about 75%</td>
</tr>
<tr>
<td>Low speeds up to about 375 rpm</td>
<td>Very high speeds up to about 5,000 rpm</td>
</tr>
<tr>
<td>Gear reduction using single-stage standard cylindrical gears, low costs</td>
<td>Possibility of gearing only by means of special turbo-gears; high costs, few qualified manufacturers</td>
</tr>
<tr>
<td>At constant speed pumping rate is virtually independent of operating pressure; flow rate is proportional to speed</td>
<td>Pumping rate at constant speed dependent on counter-pressure; operation constantly at Q-H curve</td>
</tr>
<tr>
<td>In intermittent mode, simple switching from pressure mode to pressureless circulation by lifting the suction valve, at the same time reducing power input to about 3% of the engine rating</td>
<td>During intermittent operation with the consumer locked about 50-70% of the drive power is converted into heat. In order to prevent overheating a bypass is arranged near the pressure joint, releasing some 20% of the volume. This avoids evaporation of the rotary pump. Power input amounts to some 60% of the engine rating</td>
</tr>
<tr>
<td>Plunger pumps are used in virtually all industrial sectors, e.g. in descaling, rolling and metallurgical technology</td>
<td>There are no HPP rotary pumps specifically designed for descaling; all HPP pumps are modified boiler feeding pumps. In rolling mill and steel works applications as well as in power plants with clean boiler feedwater, boiler feeding pumps usually operate at optimal efficiencies. However, HPP rotary pumps used in descaling applications constantly operate in throttle mode, with Qmax amounting to about 1.3 x Qn and Qmin being determined by the required bypass volume. This mode of operation means that the blades are subjected to high-speed water flows coming from constantly changing directions. Especially at the discharge side of the impeller high stresses may occur. If the number of stages is high, the remaining radial forces under partial load may cause localized collision in the narrow sealing gaps.</td>
</tr>
</tbody>
</table>
Descaling unit for different-sized forging ingots

INA SCHAEFFLER, Romania S.R.L

Complete descaling cabin

Dimensions and weight

<table>
<thead>
<tr>
<th>Description</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length approx.</td>
<td>2,800 mm</td>
</tr>
<tr>
<td>Width approx.</td>
<td>2,700 mm</td>
</tr>
<tr>
<td>Height approx.</td>
<td>3,500 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>9,750 kg</td>
</tr>
</tbody>
</table>
Complete descaling unit
INA SCHAEFFLER, RUMÄNIEN S.R.L

Descaling box

Inside of box

Inside of box

Valve engineering
### Descaling unit for different-sized forging ingots in a wheel rolling plant

Nizhniy Tagil, Russia

#### Technical specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type number</td>
<td>642.607</td>
</tr>
<tr>
<td>Jet width ($B$)</td>
<td>72 mm</td>
</tr>
<tr>
<td>Spray jet angle ($a$)</td>
<td>30°</td>
</tr>
<tr>
<td>Jet depth</td>
<td>3.64 mm</td>
</tr>
<tr>
<td>Spraying pressure</td>
<td>325 bar</td>
</tr>
<tr>
<td>Total force</td>
<td>176 N</td>
</tr>
<tr>
<td>Flow rate</td>
<td>41.46 l/min</td>
</tr>
<tr>
<td>Max. impact</td>
<td>0.94 N/mm²</td>
</tr>
<tr>
<td>Adjustment angle ($b$)</td>
<td>15°</td>
</tr>
<tr>
<td>Flow rate, total</td>
<td>165.9 l/min</td>
</tr>
<tr>
<td>Swivelling angle ($y$)</td>
<td>15°</td>
</tr>
<tr>
<td>Overlap ($D$)</td>
<td>6.2 mm</td>
</tr>
<tr>
<td>Spraying height ($h_2$)</td>
<td>100 mm</td>
</tr>
</tbody>
</table>

Cabin with turntable and nozzles

Close-up of the nozzles – 325 bar

Upper site
Result after descaling
Nizhniy Tagil, Russia

Data of the forging ingots

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter:</td>
<td>Ø 430 mm</td>
</tr>
<tr>
<td>Length:</td>
<td>200 – 1000 mm</td>
</tr>
<tr>
<td>Temperature:</td>
<td>approx. 1,200 °C</td>
</tr>
</tbody>
</table>
Descaling solution for a continuous casting plant with four individual strands
HKM, Germany

Complete descaling unit for a continuous casting plant with four individual strands

Main sections of the descaling plant
The descaling plant consists of three main sections. The first one comprises all components next to the casting strands, the second one the components located in the area of the high-pressure water pumps and the third one the components making up the filter station on the low-pressure side.
Components of the descaling system
HKM, Germany

Complete descaling unit

Slabs after descaling

Plunger pump station
The descaling unit includes four plunger pumps, two each belonging to one slab line. Each pump has its own PLC control for exchanging data with the higher-level control system.

The function of the plunger pumps is to pressurize the water up to a level high enough press the total flow rate through the nozzles of the spray header. However, for the actual descaling operation only one pump each is required. The second plunger pump serves as a stand-by unit. This provides the possibility of servicing or repairing a pump during running operation.

The pumps are driven by frequency-controlled electric engines which adjust the required spraying pressure to the different materials to be descaled.

Filter station
The water drawn from the operator’s water supply system is guided - by means of a manual shut-off valve - to one of two backflush filters arranged in parallel. The degree of contamination of the filters is monitored by differential pressure switches. The two automatic reversible flow filters feature an autonomous control.

Reverse flushing is triggered when a differential pressure of 0.8 bar is reached. Upon attainment of this differential pressure level, the information that reverse flushing has been initiated is sent to the high-level control system.

Additionally, data about the operating status of the automatic backflush filters is transmitted to the high-level control.
Primary scale removal plant for slabs and ingots
SEVERSTAL, St. Petersburg, Russia

Primary scale removal in a wide hot strip mill. Due to the specific material grades and the resulting difficult-to-remove scale layers, this descaling unit has an impact of I = 2.67 N/mm². This impact is achieved by an operating pressure of p = 320 bar.
Components of the descaling system
SEVERSTAL, St. Petersburg – Russia

Water pump S&U PPW 200
The industrial pump of the S&U PPW 200 type is a compact high-capacity pump for the medium pressure range of up to 500 bar operating pressure.

- Drive power: up to 600 kW
- Piston force: up to 200,000 N
- Engine speed (rpm): 995 - 1788 U/min.
- Crankshaft speed (rpm): 221 - 252
- Transmission ratio: 4.54 - 7.5
- Pressure: 100 - 500 bar
- Pumping rate: 300 - 2,500 Liter/min.
- Stroke: 180 mm
Descaling of steel rods
YARTSEVO, Russia

The descaling unit includes two plunger pumps. The function of the plunger pumps is to pressurize the water up to a level high enough press the total flow rate through the nozzles of the spray ring. However, for the descaling operation only one pump is required.

The second plunger pump serves as a stand-by unit. (See also at “Descaling plant at HKM, Germany”)
Descaling unit for a hot rolling mill
Hyundai Steel, South Korea

Positions of the descaling units within the roll mill

Primary descaling
Secondary descaling
Descaling unit for a wide hot strip mill
Hyundai Steel, South Korea

The pumping station (see layout) with its 8 high-pressure piston pumps forms the heart of the plant. Each pump has a power rating of 470 kW. The total pumping capacity of the plant is 230 m³/h at an operating pressure of 450 bar.

The unit includes one descaler each downstream of the furnace and upstream of the finishing mill. As slabs of different thicknesses are descaled, the top spray headers must be lifted and lowered by hydraulic cylinders in order to maintain a constant distance of 100 mm between the nozzles and the slab surface. The equipment is laid out for a maximum stroke length of 110 mm (the thinnest slab is only 150 mm thick, the thickest one 260 mm).

The descaler upstream of the finishing train works the same way. Likewise, the material to be descaled varies in thickness. Therefore the headers are also liftable by means of hydraulic cylinders and position transducers. The maximum stroke length is only 15 mm (the thinnest strip gauge is 35 mm, the thickest one 50 mm).

As a provider of systems solutions SCHÄFER &URBACH supplied the detail engineering including electrical controls, the complete mechanical equipment and all of the electrical systems.
Descaling unit for wide hot strip mill
Salzgitter, Germany

Project scope:
Engineering, manufacture, delivery, assembly and commissioning of all components of a complete, continuously operative descaling unit installed in a wide hot strip mill. The following equipment was installed (while the rolling mill was running): three new rotary pumps with 2,300 kW drive power each, two continuously operating water filters (900 m³/h) and three oil pump units for hydrostatic engine and pump shaft lubrication.

All project work was performed by SCHÄFER &URBACH’s own personnel. Four days were available to integrate the pre-tested pump lines.
Reference list of supplied descaling units

1. GEBr. BÖHLER & CO., KAPFENBERG
   1 primary descaling unit for ingots and bars

2. GEBr. BÖHLER & CO., DÜSSELDORF
   1 primary descaling unit for billets

3. ÖSTERREICHISCH-ALPINE-MONTAGEGESELLSCHAFT, JUDENBURG
   1 primary descaling unit for billets, 3 secondary descaling units for rods

4. GEBr. BENTELER, SCHLOSS-NEUHAUS, PADERBORN
   1 primary descaling unit for the jacket surface and both end faces of ingots for the fabrication of pipes on steel extruders

5. TECHSTRANG, BULGARIA, VIA SCHLOEMANN AG, DÜSSELDORF
   1 primary descaling unit for the jacket surface and both end faces of ingots for the fabrication of steel sections on steel extruders

6. CHISTAL I, PEKING, VIA SCHLOEMANN AG, DÜSSELDORF
   1 primary descaling unit for the jacket surface and both end faces of ingots as well as the holes on ingots with holes for the fabrication of pipes on steel extruders

7. CHISTAL II, PEKING, VIA SCHLOEMANN AG, DÜSSELDORF
   1 primary descaling unit for the jacket surface and both end faces of ingots for the fabrication of pipes on steel extruders

8. INDURAD, RUMANIA, VIA SCHLOEMANN AG, DÜSSELDORF
   1 primary descaling unit for the jacket surface and both end faces of blooms for drop forging presses

9. UNITED STATES STEEL, USA, VIA SCHLOEMANN AG, DÜSSELDORF
   1 primary descaling unit for the jacket surface and both end faces of blooms for drop forging presses

10. TUBOS FORJADOS, SPAIN, VIA DEMAG AG, DUISBURG
    11 primary descaling unit for the jacket surface on ingots for pipe fabrication on pipe rolling mills
    1 secondary descaling unit for rough-pierced pipe blanks

11. ROHRWALZWERK KOMOTAU, CZECHOSLOVAKIA, VIA DEMAG AG, DUISBURG
    1 primary descaling unit for the jacket surface and both end faces on ingots for pipe fabrication on pipe rolling mills
    3 secondary descaling units for rough-pierced pipe blanks and mandrel rods

12. GEBr. BÖHLER & CO., KAPFENBERG
    3 primary descaling units for billets, 4 secondary descaling units for rods

13. STAHLWERKE-BRÜNINGHAUS, WERDOHL
    10 primary descaling units for swaging hammers and forging machines
Reference list of supplied descaling units

14. VOEST-ALPINE, VIENNA
   1 primary descaling unit for billets

15. SHARIAR PIPE MILLS, IRAN, VIA DEMAG AG, DUISBURG
   1 primary descaling unit for the jacket surface and both end faces on ingots for pipe fabrication on pipe rolling mills
   3 secondary descaling units for rough-pierced pipe blanks and mandrel rods

16. BARZIEH, INDIA, VIA SCHLOEMANN-SIEMAG AG, DÜSSELDORF
   1 secondary descaling unit for square ingots

17. STANKO-IMPORT, MOSKAU, VIA THYSSEN-RHEINSTAHL, ESSEN
   2 secondary descaling units for 44 different shaped parts

18. MANNESMANNRÖHREN-WERKE AG, DÜSSELDORF
   1 primary descaling unit for the jacket surface and both end faces on round blooms

19. DUNAFERR, LÖRINCI HENGERMÜ KFT, HUNGARY
   1 primary descaling unit for cogged ingots in sheet-rolling mills

20. SMS DEMAG AG, DÜSSELDORF
   1 descaling unit for IPB-profiles with turnable nozzle holder

21. SMS DEMAG AG, DÜSSELDORF
   1 descaling unit for various profiles

22. SMS EUMUCO GMBH FOR MANSCHAN, CHINA
   1 set of components for primary descaling system for blocks with 2 different dimensions

23. SEVERSTAL S.A., CHEREPHOVETS
   1 primary descaling unit for ingots and slabs

24. SMS EUMUCO GMBH FOR NIZHNIY TAGIL, RUSSIA
   1 primary descaling unit for blocks with 2 different dimensions

25. HKM HÜTTEWERKE KRUPP MANNESMANN GMBH, DUISBURG
   1 descaling unit for continuous casting system consisting of 4 single lines

26. YARTSEVO, RUSSIA
   1 descaling unit for square slabs

27. HYUNDAI - STEEL, SOUTH KOREA
   1 descaling unit for micro-alloyed sheets in a hot rolling mill

28. INA SCHAFFLER, ROMANIA S.R.L
   1 primary descaling box for end surface and lateral areas for forged blocks with different dimensions
Tradition as basis – high-pressure as motivation

SCHÄFER & URBACH · Descaling systems · Errors excepted. Technical changes possible.

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DIN EN ISO 9001:2008
EU Guidelines: 97/23/EG pressure equipment
EU Guidelines: 94/9/EG ATEX for cleaning lances and high-pressure equipment
EU Guidelines: ZH 1/406 for liquid jets
Qualification according to DIN 18800 Part 7
Certificate according to DIN EN 3834-2 for welded structures
Certificate according to AD Guidelines HP 0 (TRB 200), TRD and TRR 100
Specialist firm according to §19 WHG