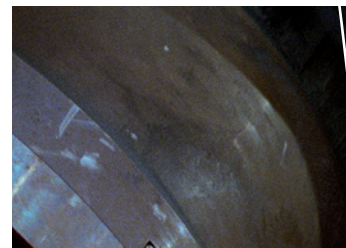




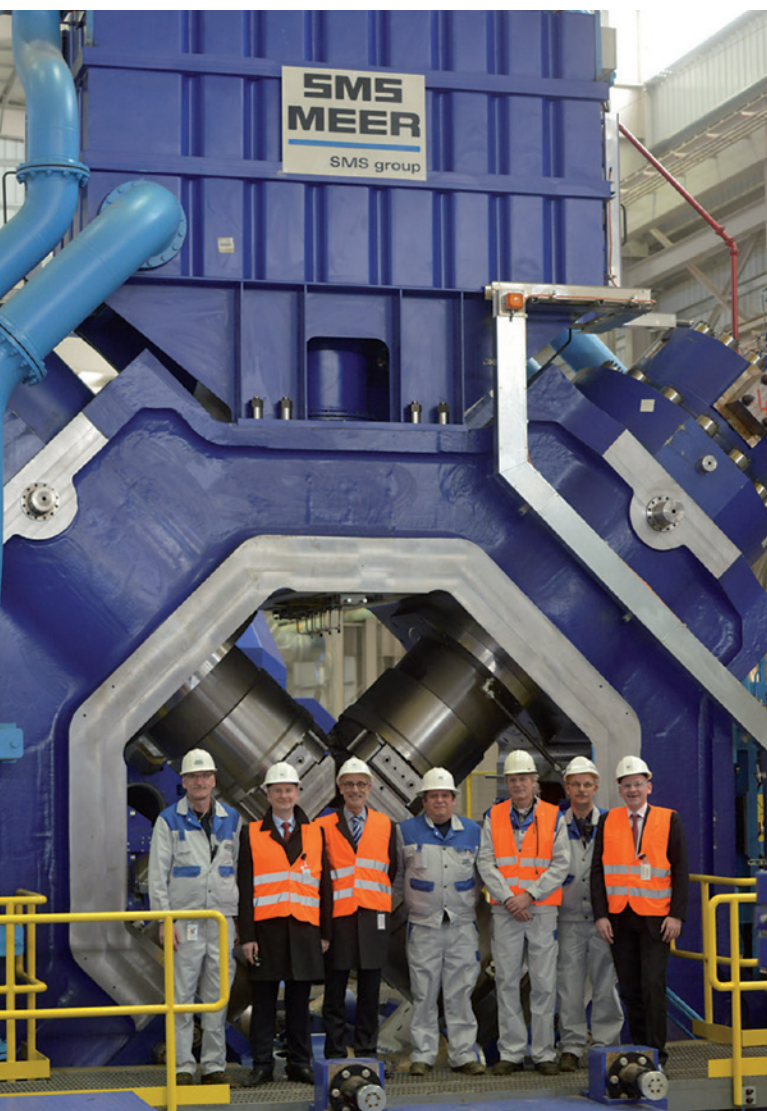
SMX Radial forging machines

All-round pioneers

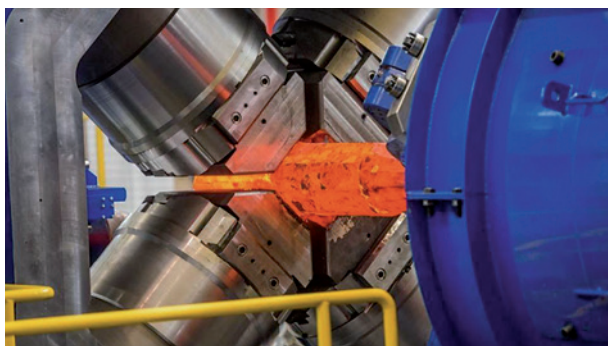


Radial forging machines

Our strengths – your advantage on the market



SMX 1100 in the USA



Greater competitive edge

The requirements of the forging industry are simple: high precision and productivity, perfect microstructure properties and flexibility in terms of use, batch size and unit production. The SMS group not only meets the demands of today, but also ensures that plant owners have a greater competitive edge to safeguard their future. With their innovative concept, high performance and intelligent technology, the SMX hydraulic radial forging machines are global leaders. The main advantage of radial forging machines is that the workpiece is enclosed by four forging dies and is therefore only able to yield axially, thereby avoiding lateral spread. All types and sizes of ingot, round and rectangular slabs and hollow components of different sizes can be used as starting material.

Broad material spectrum

In terms of the range of materials, the SMX radial forging machines from the SMS group impress with their sheer versatility. Suitable materials include:

- Carbon steels
- Structural steels
- Tool steels
- High-speed steels
- Stainless steels
- Non-magnetic steels
- Nickel-based alloys
- Titanium alloys
- Zirconium, tungsten, molybdenum and other special alloys



Semi-finished products for rolling mills

The results

Thanks to the hydraulic drive concept, the starting material is turned into high-precision products of outstanding metallurgical quality with perfect compaction through the core and fine grain over the whole cross-section.

Listed below are some of the possible forging long products:

- Bars – round, square and flat
- Multi-cranked shafts, for example axles and drive spindles
- Thick-walled tubes with outside diameters from 150 mm to 500 mm and wall thicknesses from 27 mm to 125 mm



Double railway axles



Forged thick-walled tubes

Integrated plant concept

One-stop shop

Harmonised interfaces

The SMS group offers everything from the mechanical plant components through the hydraulics and electrics right up to the control and automation systems from a single source. Customers therefore receive perfectly harmonised technologies to ensure a highly productive forging line.

The main components

A typical plant configuration comprises:

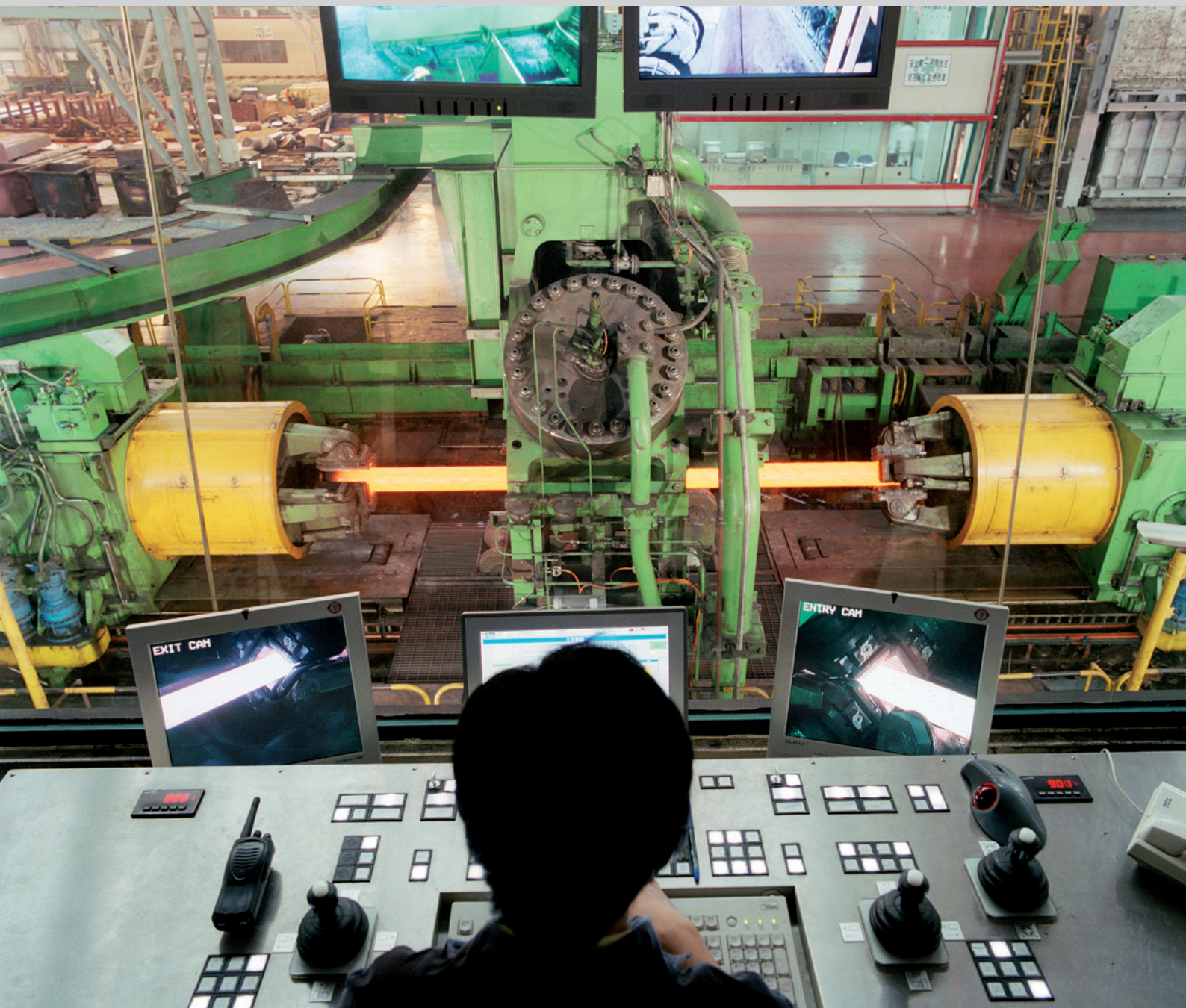
- 1 Heating furnace
- 2 Loading, unloading and transport facilities
- 3 SMX radial forging machine, press frame with four hydraulic cylinders and tools arranged in an x-shape
- 4 Two fully synchronised manipulators
- 5 Cutting and marking machine
- 6 Control panel with control equipment and ComForge® technology package for calculating the pass schedule
- 7 Tool changing facility

Hydraulics and electrics



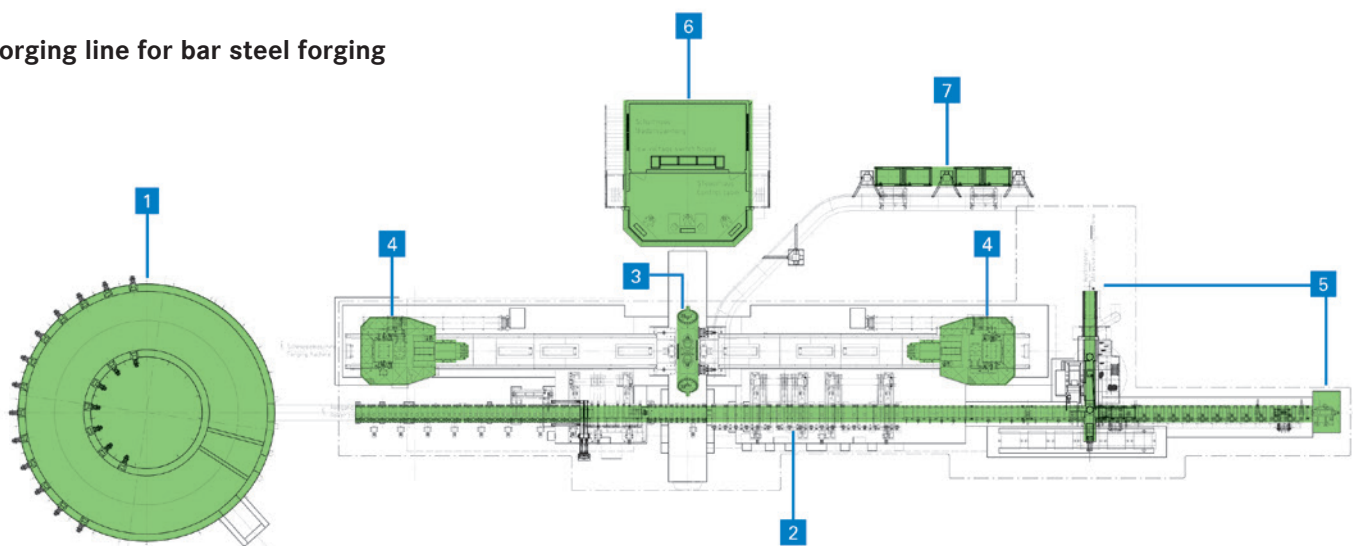
SMX 600 in Russia





SMX 700 in China

Forging line for bar steel forging



Pioneering technology

Better fully hydraulic

Cutting-edge engineering

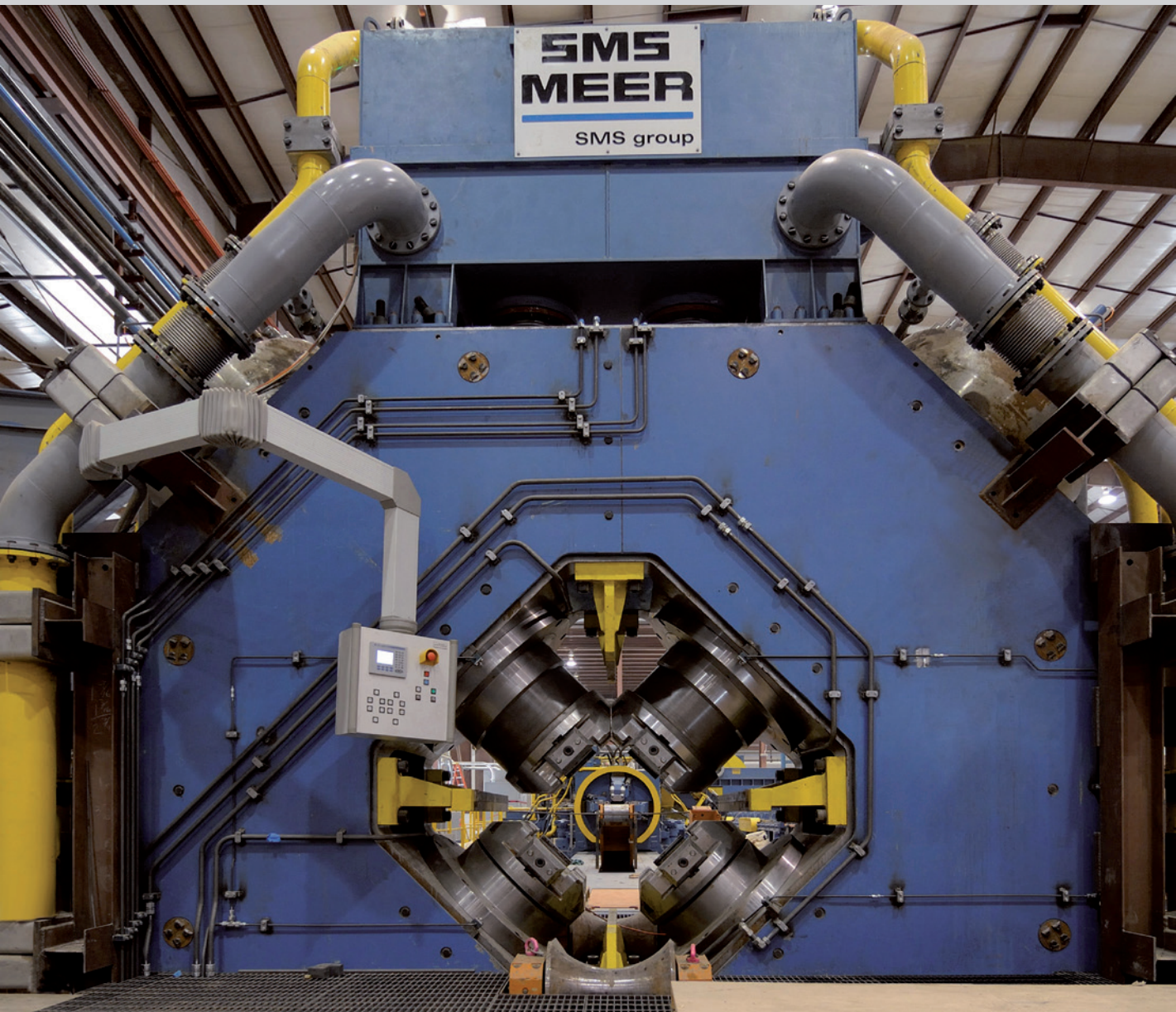
The heart of the SMX radial forging machine consists of a highly rigid press frame in which four hydraulic cylinders with corresponding tools are arranged in an “X” shape. The SMS group’s solution impresses with its clear, simple and easily accessible design.

Long stroke

The long stroke characteristic of all hydraulic radial forging machines allows the charge material to be forged into finished products with a wide diameter variance, normally with three sets of tools.

Tool changing is quick and easy thanks to the maintenance-friendly design. The enclosure of the workpiece together with the high stroke rate of the hydraulic cylinders ensures a high degree of deformation and freely adjustable rate of deformation that can be adapted to suit the material. The high degree of enclosure of the tools significantly enhances the forming capacity.





SMX 700 in the USA

Universal and fast

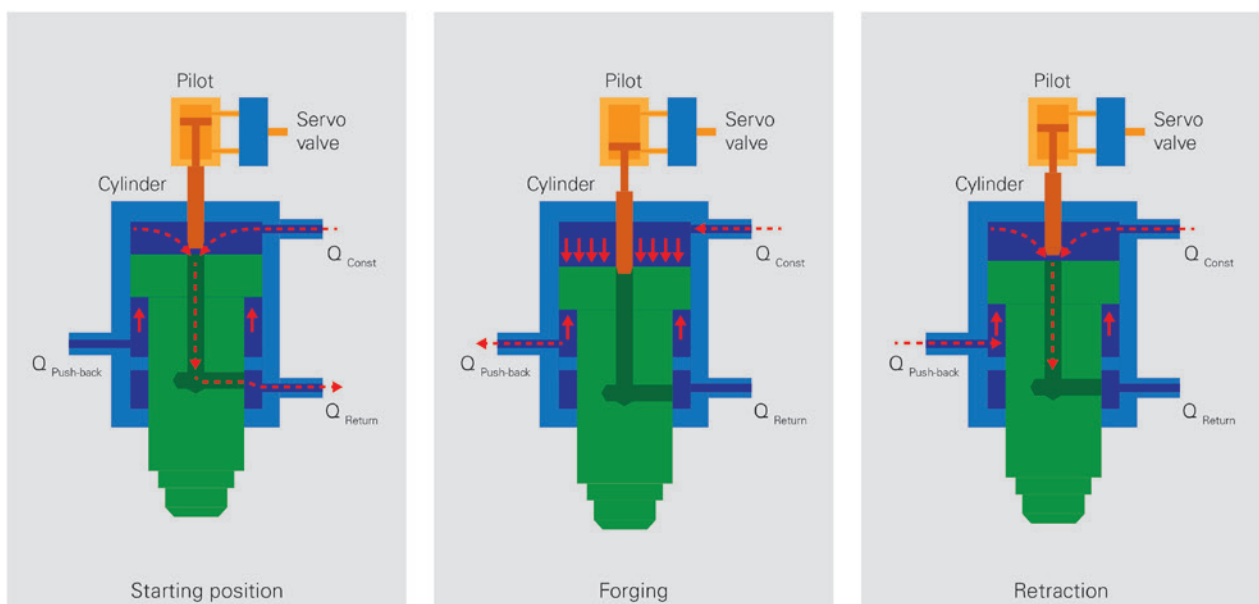
During forging, the four cylinders with the dies move synchronously to the centre of the press, thereby shaping the ingot. The high forging accuracy is achieved by precise and highly dynamic control of the hydraulic cylinders. Depending on the desired final geometry, the four forging dies can also be used in sequence – in other words, one pair after the other.

Benefits at a glance

- High productivity
- Energy-efficient thanks to forging in just one heat (normal case)
- Variable positioning of the tools
- Forming through to the core thanks to hydraulic drive concept with long stroke
- Fine, uniform microstructure over the whole cross-section
- High surface quality
- No risk of core fusion
- No tool changing for cross-section reductions from 6.25 to 11.0
- Short retooling times thanks to tool changing system
- Low wear and low-maintenance design heat

Innovative hydraulic cylinders

Maximum performance with stroke sequences



The practically maintenance-free press cylinders incorporate the patented technology from the SMS group. The basic principle: a servo-controlled pilot cylinder that is followed by the working piston. The forming rate, return stroke and high forging accuracy of each forming stroke are controlled by the pilot cylinder. The high-pressure oil flows constantly in one direction – from the pumps through the pipes and then into working cylinder which performs the stroke movement in the press direction. During the return stroke movement, the working cylinder is moved by retraction accumulators, while the oil flows through the internal forging valve and cools the cylinder shaft and tool. This uniform flow of oil results in low-vibration operation with small compression volume and up to 300 strokes/min.

Benefits at a glance

- Vibration-free operation, low noise level
- Up to 300 strokes/min., depending on the machine size
- Extremely long maintenance intervals

SMX 700 in the USA

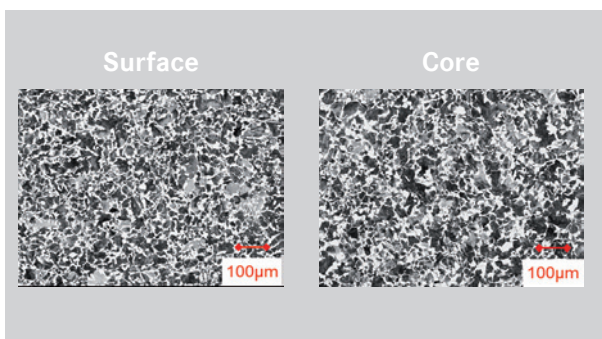


Forging of railway axles

Uniform forming through to the core

Benefits at a glance

- Forging of single, double or multiple axles from one ingot in just one heat
- High productivity thanks to short cycle times and large height reductions per pass
- Through-forging right to the ingot core for a homogeneous microstructure over the whole cross-section



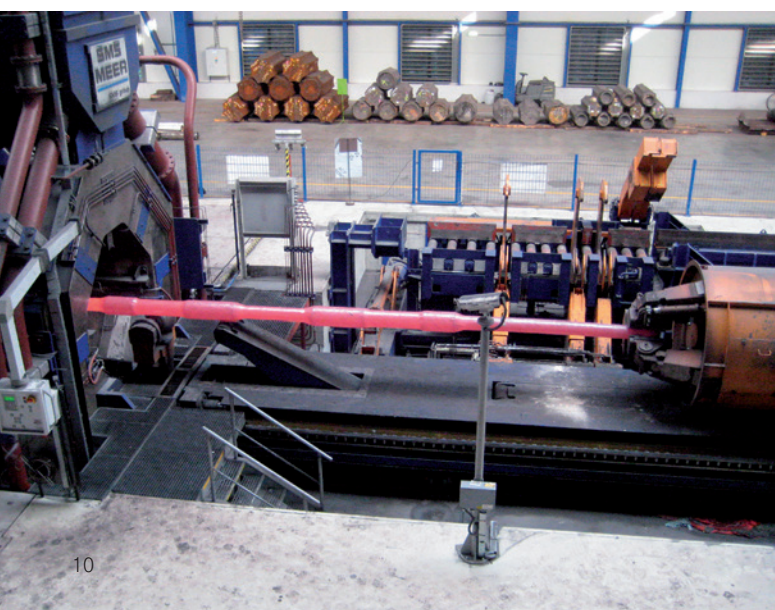
Homogeneous microstructure of a forged axle

SMX 800 in Czech Republic

For the forging of railway axles, the SMS group offers plant layouts tailored exactly to the special demands of axle production. The hydraulic radial forging machines with fully synchronised manipulators forge the workpieces through to the core over the whole length. Plant operators thus achieve a homogeneous microstructure over the whole crosssection, irrespective of the charge material. The machines process ingot cast, continuous cast or preformed material.

Energy-efficient and time-saving

With the hydraulic radial forging machines, axle producers can forge up to three or more axles from a single ingot. Only one heat is required for this – the forging process does not have to be interrupted for intermediate heating. This ensures high productivity and at the same time reduces the energy consumption. The machine design boosts productivity by allowing simultaneous loading and unloading of the machine: While the finished forged ingot is removed on the unloading side, a new ingot can already be clamped on the loading side.



Forging of thick-walled tubes

High straightness, minimum eccentricity

Above a certain wall thickness, tubes can no longer be produced conventionally such as by welding or rolling. The SMS group has therefore developed a special layout for radial forging plants that permits the production of particularly heavy-walled tubes of high-strength materials.

High surface quality and straightness

For the forging of tubes, the SMS group has modified and expanded the proven SMX concept: the plant layout has been expanded to include a third manipulator that holds a mandrel bar. Special conically shaped tools ensure high-quality tube surface finishes, the infeed movement and the turn angle of the manipulator are designed for an optimum material flow. During forging, flaws in the starting material are compensated in just one pass: even if extremely eccentric mothertubes are used, finished tubes can be produced with low eccentricity and high straightness.

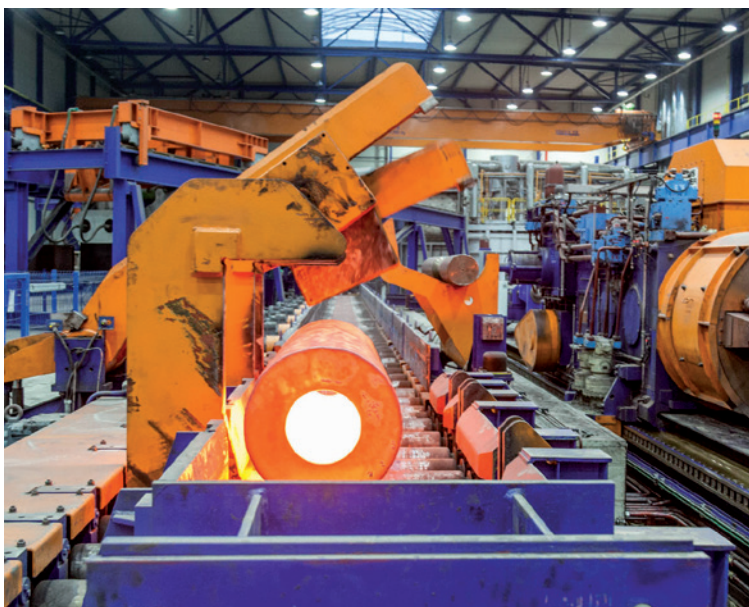
Benefits at a glance

- Production of cranked tubes possible
- Reduction of the eccentricity, for example from ± 15 mm in the mothertube to max. ± 2.6 mm in the finished tube.
- High straightness: max. 5 mm deviation over 4 m length

Processable materials

- Carbon steels
- Tool steels
- Austenitic steels
- Ferritic chrome steels
- Duplex steel grades
- High-temperature steels
- Nickel-based alloys
- Titanium alloys

SMX 800 in Czech Republic



Precise Manipulators

Forging quickly and uniformly

Computer-controlled movements

In addition to the high load-bearing capacity, the precise interaction between the manipulators and the forging machine is crucial for ensuring a perfect forging result. This is only possible with a sophisticated, computer-controlled system.

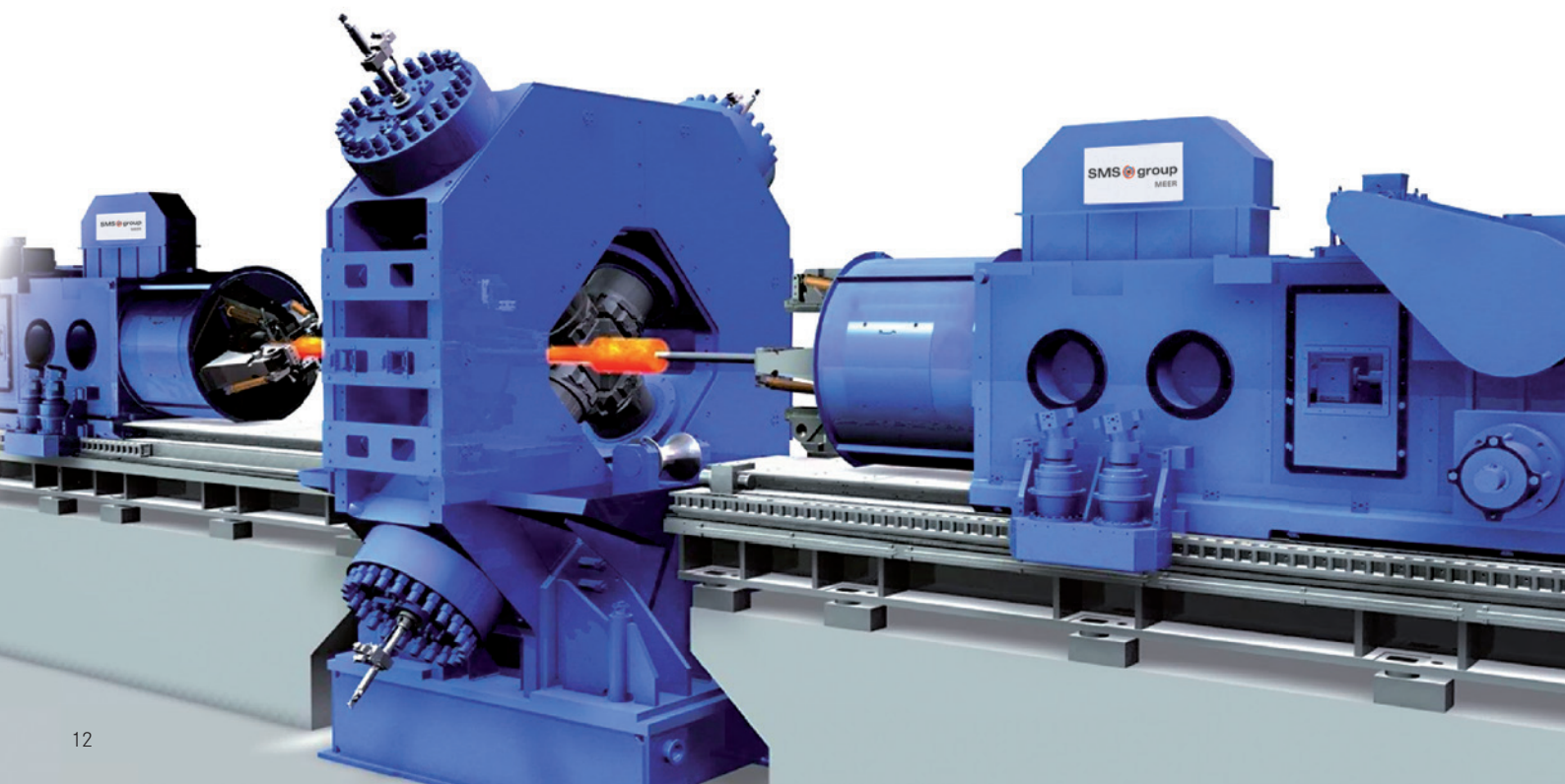
Working in harmony

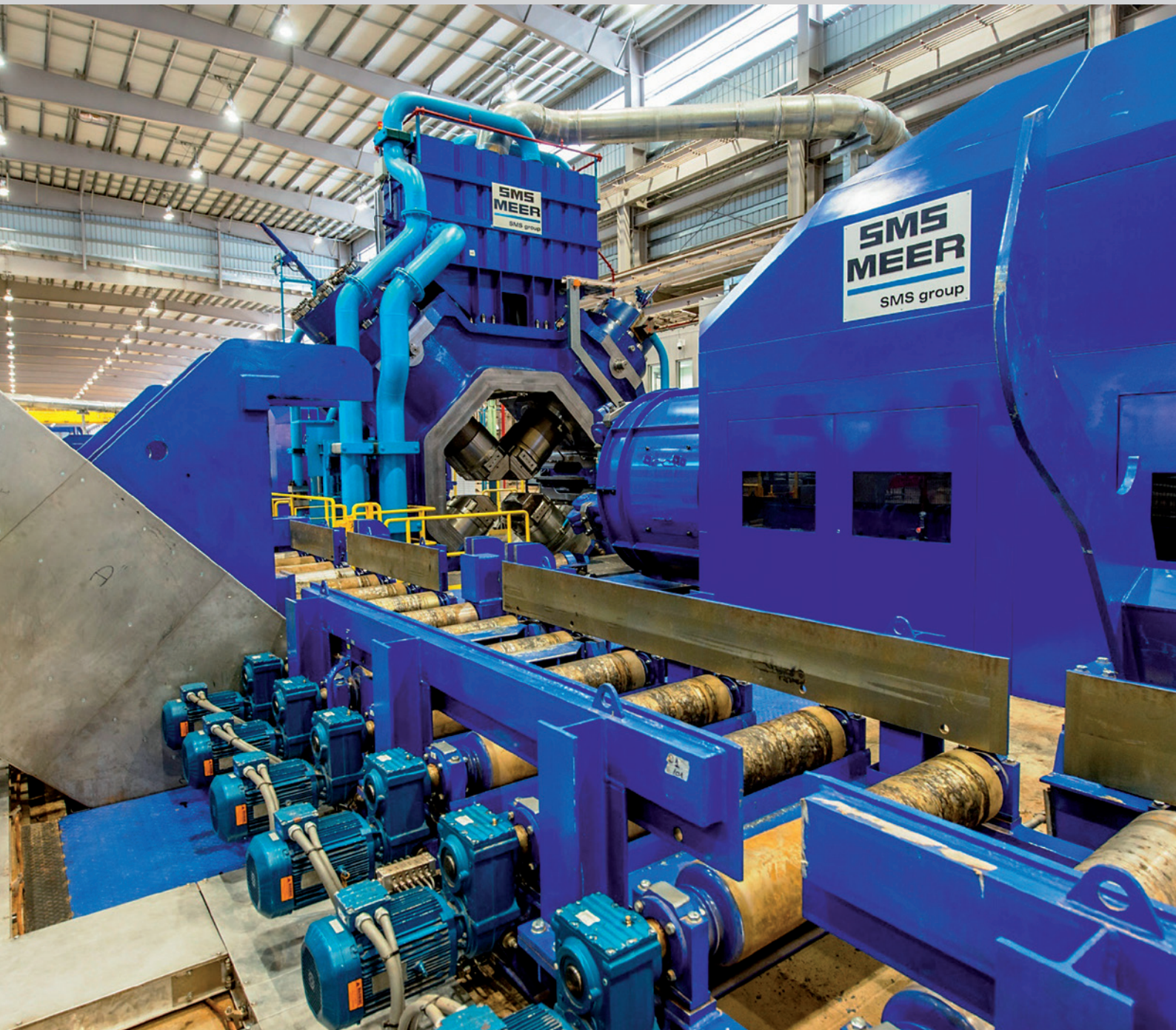
The SMS group has synchronised and automated the sequences of movements of the manipulators for a fast and smooth forging process. After receiving the workpiece, the first manipulator carriage moves continuously forward and guides the workpiece precisely into position in the machine. During the steady forward motion of the carriage, a mechanism ensures that the tongs unit remains synchronised with

the strokes of the forging tools. The rotation of the tongs is also very precisely matched to the forging strokes. As soon as the second manipulator grips the workpiece, the manipulators are synchronised under computer control and the workpiece is transferred “on the fly”. The two manipulators can exert a slight tensile force on the workpiece as it is contacted by the forging tools.

For solid and hollow workpieces

The tongs are hydraulically actuated and the desired clamping force, depending on the workpiece, can be selected from three levels. The tong peel is designed as a hollow shaft construction, thus enabling the use of a mandrel forging device, e.g. for tubes.

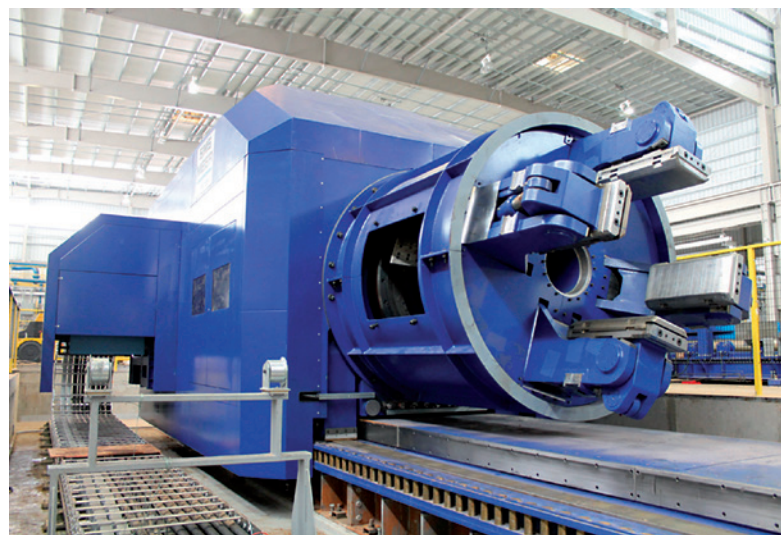




SMX 1100 in the USA

Benefits at a glance

- Computer-controlled manipulator movements
- Synchronised with forging strokes
- High load-carrying capacity
- Compact design
- Maintenance-friendly designs



Comforge®

Intelligent technology package

Large diameter database

With data on over 400 materials, the SMS group's ComForge® technology package has everything required for calculating relevant forging schedules for all customers. Should a customer's alloy not correspond with any of the existing material families, new flow curves are compiled in close collaboration with the Technical University of Aachen (RWTH). This provides plant owners with a comprehensive database for trouble-free and technologically proven forging processes.

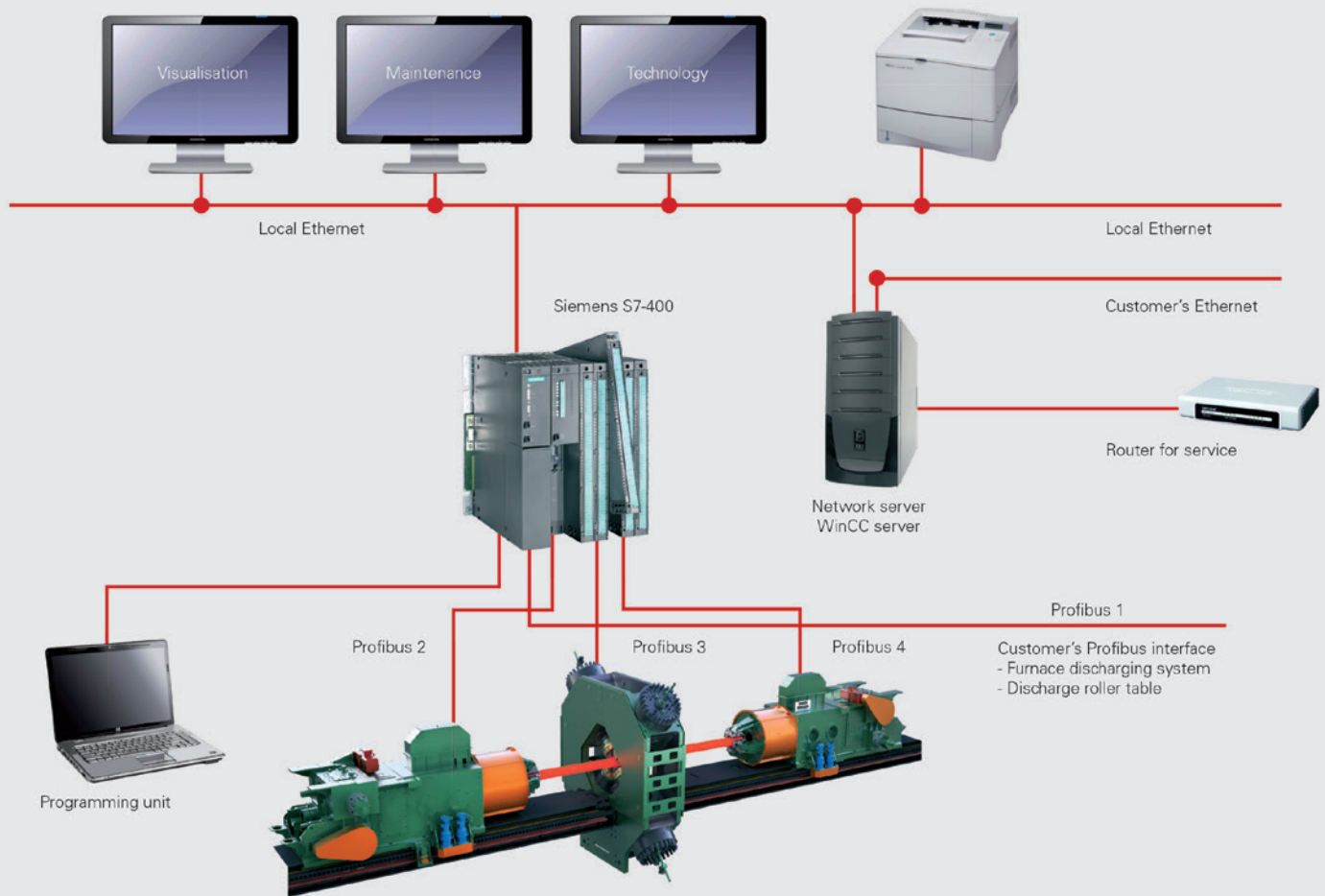
Calculating, controlling, checking

ComForge® is the technology package developed by the SMS group for the calculation of pass schedules in which cross-sectional forms, forging processes and customers' specific wishes (e.g. fine grain structure) are taken into consideration. An intuitive user interface allows all the desired parameters to be easily input:

- Geometry of the initial and final dimensions
- Material quality of the forging
- Tool and machine parameters
- Deformation parameters
- Furnace temperature



Automation concept of the forging lines

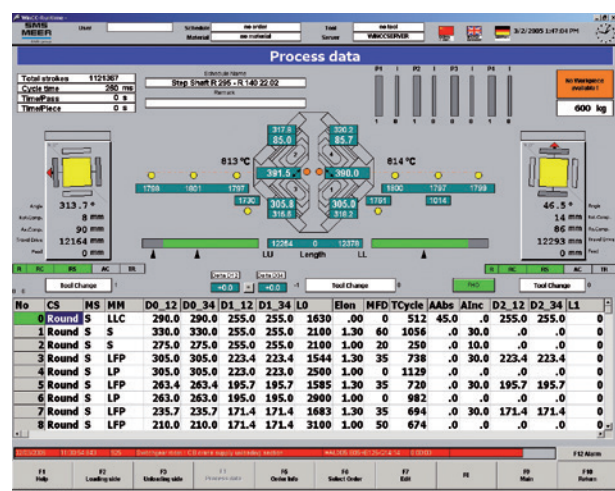


Once the parameters have been set, the pass schedules using the SMS group's comprehensive database. They are then transferred to the automation system which monitors and controls all the plant components, control devices and sensors.

These include, for example:

- Forging sequence from start to finish
- Geometry of the deformation
- Forces and temperatures
- Time for each pass and the total forging process

The pass schedule can be optimised and saved by the plant owner so that all the data on the forging process are immediately available for repeat orders.



User interface of the control software

All series

Flexible and successful

A worldwide success

Since the introduction of the hydraulic forging machine, the SMS group has won satisfied customers on practically every continent. The productive benefits, the high product quality and the low life-cycle operating costs of the SMX radial forging machines are the

key arguments for plant owners to decide in favour of the SMS group. Furthermore, the SMS group with its more than 20 years of experience in the field of radial forging machines is your competent partner for all process and material questions.



SMX 800 in Czech Republic



SMX 600 in Taiwan



SMX 700 in the USA



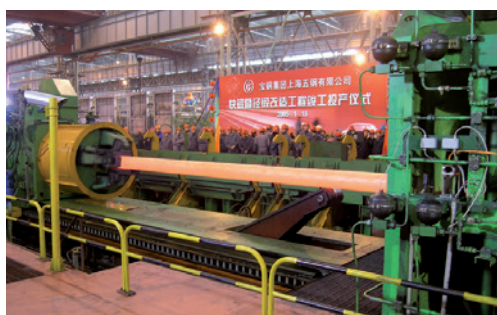
RUMX 800 in Italy



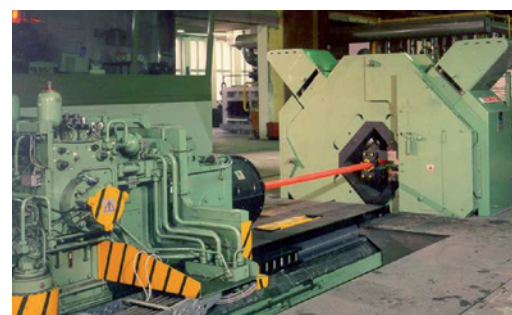
SMX 700 in China



SMX 500 in France



SMX 700 in China



SMX 200 in Germany

SMX radial forging machines

Series	200 / 3	350 / 6	450 / 13	650 / 15	800 / 18	1100 / 22
Max. initial pass (round) in mm	200	350	450	650	800	1100
Smallest finished product in mm	40	60	70	80	100	120
Max. bar length of finished product in m	6	10	12	14	18	18
Max. ingot weight in t	1	1.4	4	6	8	10
Max. forging force in MN	3	6	13	15	18	22
Max. stroke per tool in mm	85	120	180	220	280	350
Stroke rate when planishing in strokes /min.	300	260	240	240	220	200

Manipulators

Series	7 / 14	25 / 50	35 / 70	60 / 120	80 / 160	100 / 200
Max. load-carrying force in kN	7	25	35	60	80	100
Max. clamping torque in kNm	14	50	70	120	160	200

Customised designs

Customer, city / country	Machine type	Max. press force in MN	Max. ingot weight in t	Max. tool opening in mm
Carpenter Technology Corporation, Tanner / USA	SMX	22	10.00	1100
Electrostal, Electrostal / Russia	SMX	12	2.50	600
No information / Japan	SMI*	8	n / a	430
Hubei Xinyegang Steel Co., Huangshi / China	SMX	16	8.00	800
Vitkovice Hammering, Ostrava / Czech Republic	SMX	18	8.00	800
Wuhu XinXing Ductile Iron Pipes, Wuhu / China	SMX	13	6.00	700
Dongbei Special Steel Group, Dalian / China	SMX	16	8.00	800
Universal Stainless, North Jackson / USA	SMX	13	6.00	700
Jiangsu Tiangong, Danyang City / China	SMX	13	6.00	700
S-Tech Corp., Sinying City / Taiwan	SMX	12	6.00	600
Top Eastern, Dalian / China	SMX	2.75	0.75	200
Baosteel Group, Shanghai No. 5, Shanghai / China	SMX	13	6.00	700
Aubert et Duval, Les Ancizes / France	SMX	13	3.50	500
Hitachi Metals, Yasugi / Japan	SMX	13	3.50	500
Timet, Birmingham / United Kingdom	RUMX**	8	3.50	700
Schmidt + Clemens, Lindlar / Germany	SMX	2.75	0.75	200
Acciaierie Foroni Spa, Gorla Minore / Italy	RUMX	10	3.50	800

* Horizontal forging machine with tools in an I-shaped arrangement

** Radial forging machine with tools shifting device



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Open-die Forging

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