

WF

FORMING EXCELLENCE



OUR MACHINES
FOR HIGH-PRECISION TUBES AND GAS CYLINDERS

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Three good reasons for working with us

We are individual.

In addition to enormous experience gathered over many years in the flow forming of standard cylindrical components, WF Maschinenbau also offers a large range of unconventional and innovative solutions that expand the previously known applications for flow forming and necking-in machines, such as, for example, the combination of a number of forming processes, such as flow forming and spinning, in a single machine.

Over and above the standard range of machines, the WF design team provides every customer with the opportunity of generating a solution tailor-made for him or her. Workpiece diameters of above 750 mm and lengths of over 4,000 mm can, for example, be implemented.

We deliver quality.

Our machines are manufactured at Sendenhorst with the highest possible degree of WF production input. We cooperate only with high-quality German suppliers, enabling us to be sure that all components installed meet our demanding standards.

We provide service.

We will accompany you throughout the entire purchase process, and we have the right contact for every question. After commissioning, our comprehensive service assures regular maintenance and the guaranteed availability of spare parts that ensure long, trouble-free years of operation of your machine.

Our SMART FORMING tools additionally provide you with a broad range of Industry 4.0 applications.



Our range of machines – an overview

End products

High-precision tubes

End products in detail

Cylindrical tubes, rotationally symmetrical high-precision hollow elements with a constant or variable wall-thickness profile, rotationally symmetrical tapered, concave or convex hollow bodies

Applications

Automotive, energy plants, street lighting, aerospace, energy and environmental technology, defence

Materials

Aluminium, steel, special steels, corrosion-resistant nickel-based and nickel-molybdenum alloys, etc.

Intermediate products

Seamless tubes, rounds, preforms, turned blanks

Technology

Flow forming

Benefits

Individual wall-thickness contours, enhanced strength and hardness with lower wall thickness, optimum homogeneity

Designation

Horizontal/
vertical flow forming machine

Series

HSTR/VSTR



End products

Gas cylinders

with neck and bottom

End products in detail

High-pressure gas cylinders, all-steel cylinders, steel cylinders with reduced wall thickness for CNG, hydrogen and various other gases, airbag cartridges, thin-walled liners for high-pressure composite gas cylinders

Applications

Breathing-protection technology, fire-extinguishing technology, gas transportation, beverages, mechanical engineering, automotive industry, aerospace, general industry, domestic-appliance industry, environmental echnology

Materials

Steel, aluminium, stainless steel

Intermediate products

Seamless tubes, cylindrical preforms, impact extruded, deep-drawn and flow formed blanks

Technology

Necking-in / closure

Benefits

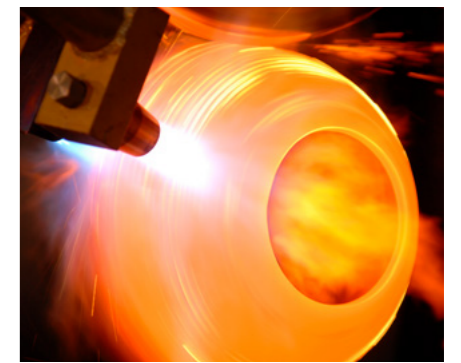
Individual neck and bottom geometries, wall-thickness increases up to a factor of 5 in the shoulder and bottom area

Designation

Necking-in machine

Series

SFM



Gas cylinders

with both side necks

Exceptionally long gas cylinders for transportation of CNG or hydrogen, jumbo cylinders

Gas transportation, automotive industry, aerospace, environmental technology

Steel, aluminium

Seamless tubes, cylindrical preforms, impact extruded, deep-drawn and flow formed blanks

Necking-in / closure

Individual neck and bottom geometries, wall-thickness increases up to a factor of 5 in the shoulder area

Tube necking-in/closure machine

RVM

Our series of machines for high-precision tubes



Our HSTR and VSTR series have been specially conceived for the production of thin-walled high-precision tubes. They produce long, thin-walled tubes from short, thick-walled hollow bodies. Tube sizes not commercially available can be produced easily using these machines.

Benefits for you using our high-precision tube machines

- Improved material microstructure
- Enhanced workpiece strength data for smaller wall thicknesses
- Higher stability with smaller wall thicknesses
- Production of tubes with maximum accuracy for wall thickness and straightness
- Wall-thickness reductions of up to 90% possible
- Enormous bandwidth of materials can be processed
- Only simple rounds needed for production
- Machines suitable for extremely long continuous operation

Highlights of our machines

- Available in horizontal (HSTR) and vertical (VSTR) models
- Suitable for forward/reverse flow forming and shear forming of cones
- High-strength stiff basic machine components in a stress-relieving annealed steel/welded structure
- If required, machine bed of cast-steel design
- Constant spindle speed even under fluctuating load

Machine description

- Two robust guide/connecting rods between headstock and tailstock column (HSTR) or: two robust guide/connecting columns between machine table and head plate (VSTR) assuring balanced, vibration-free production
- Guidance of three-roller flow forming support by means of four extremely robust linear guides within the machine frame
- Main spindle and tailstock designed as CNC axis
- Optional: manual or semi-automatic shiftable gearbox for spindle drive

HSTR

The horizontal design permits easy manual feed and discharge of workpieces. This concept also provides a low machine height, permitting its use even in low-rise factory buildings. Each radial unit can be equipped optionally with a separate axial axis.

Special equipment, HSTR series

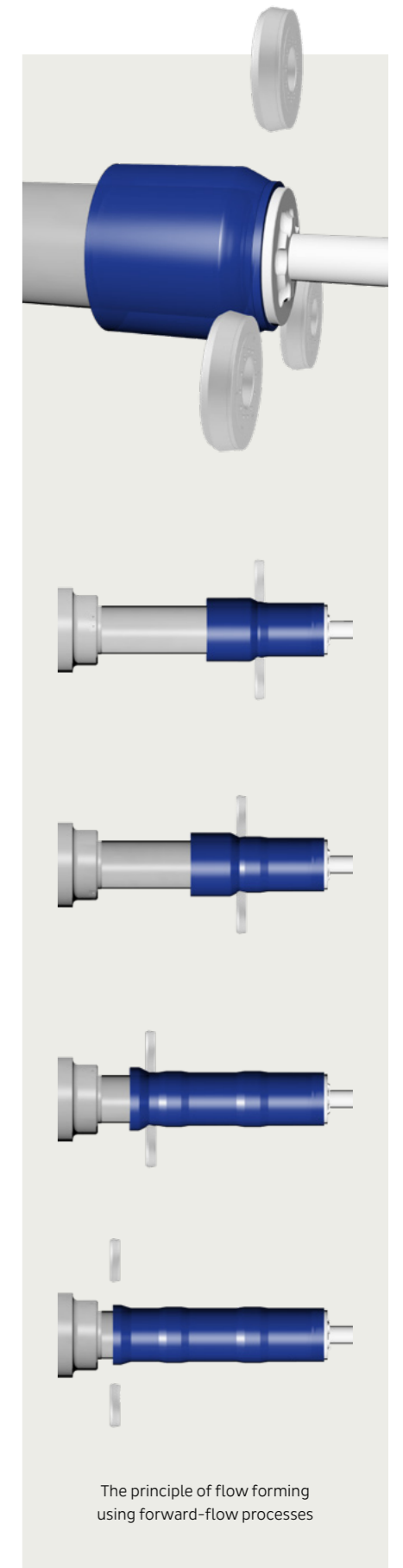
- Tailstock cylinder radially moveable to extend maximum workpiece length
- Radially and axially moveable centring system/part-storage rack, can also be optionally positioned via the CNC control system
- Path length evaluation system for continuous monitoring of effectively reached part length
- Measurement of effective forming forces for optimisation of force distribution and roller wear
- Position display for axial roller displacement
- Automatic calculation of roller-drive speed and incorporation into CNC program
- Three different stripper and ejector variants available
- Manual or automatic two-stage gearbox for adjustment of spindle torque to current forming task
- Special roller-bearing housing for special applications (shear-forming, spinning)
- Loading and unloading by robot

VSTR

Thanks to the vertical design, the disadvantages of horizontal-type machines caused by gravity are eliminated. The sagging of both tools and workpieces of small diameter and great lengths is prevented. The vertical design is, in addition, compact and space-saving, facilitates setting-up and operation of the machine. Every radial unit can, if required, perform with a separate longitudinal axis.

Special equipment, VSTR series

- Tailstock cylinder radially moveable to expand maximum workpiece length for reverse flow processes
- Path length evaluation system for continuous monitoring of path length effectively reached
- Internal mandrel cooling for constant tool temperature during forming
- Measurement of effective forming forces for optimisation of force distribution and roller wear
- Position display for axial roller misalignment
- Automatic calculation of roller-drive speed and incorporation into CNC program
- Manual or automatic two-stage gearbox for adjustment of spindle torque to current forming task
- Special roller-bearing housing for special applications (shear-forming, spinning)
- Loading and unloading by robot or by integrated feed/discharge system
- VSTR 250-3 and 500-3: three different stripper and ejector variants

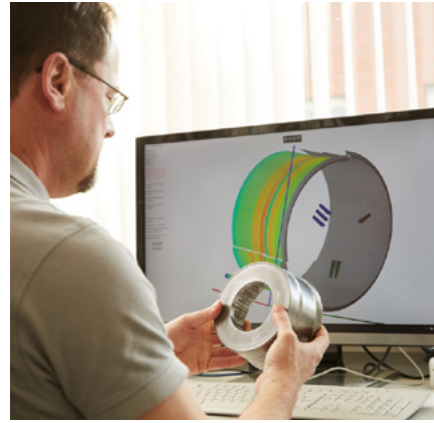


The principle of flow forming using forward-flow processes

Our series of machines for high-precision tubes

HSTR 250-3

Horizontal flow forming machine (HSTR)
for cold forming of tubes and hollow bodies of diameters up to 250 mm



Evaluation using SMART FORMING viewer



| | | |
|--|-----------|--|
| Workpiece diameter | min. | 50 mm |
| Workpiece diameter | max. | 250 mm |
| Workpiece length (forward-flow processes) | max. | 1,000 mm / 2,000 mm / 3,000 mm |
| Workpiece mounting | DIN 55027 | Size 11 |
| Number of forming rollers | fix | 3 |
| Drive rating, main spindle | approx. | 125 kW |
| Main-spindle speed | max. | 400/800* rpm |
| Support stroke | axial | 1 x 1,200 mm oder 1 x 2,200 mm oder 1 x 3,200 mm |
| Support stroke | radial | 3 x 150 kN |
| Support force | axial | 1 x 1,200 kN |
| Support force | radial | 3 x 150 kN |
| Tailstock thrust force | max. | 120 kN |

*If machine equipped with optional shift gearbox

Optional:

- Headstock optionally with or without shift gearbox

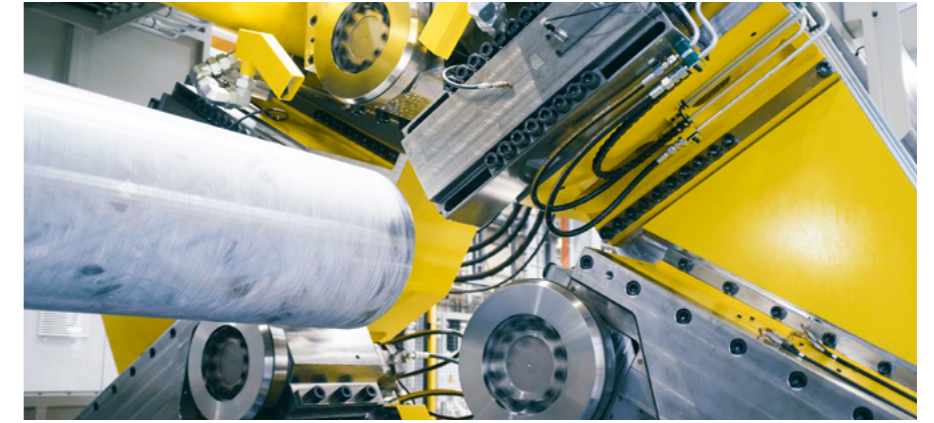


HSTR 500-3

Horizontal flow forming machine (HSTR)
for cold forming of tubes and hollow bodies of diameters up to 500 mm



Radial run-out measurement on an HSTR main spindle



Working area of an HSTR 500-3

| | | |
|--|-----------|--------------------------------|
| Workpiece diameter | min. | 100 mm |
| Workpiece diameter | max. | 500 mm |
| Workpiece length (forward-flow processes) | max. | 1,000 mm / 2,000 mm / 3,000 mm |
| Workpiece mounting | DIN 55027 | Size 15 |
| Number of forming rollers | fix | 3 |
| Drive rating, main spindle | approx. | 175 kW |
| Main-spindle speed | max. | 350/700* rpm |
| Support stroke | axial | 1 x 2,200 mm oder 1 x 3,200 mm |
| Support stroke | radial | 3 x 275 mm |
| Support force | axial | 1 x 350 kN |
| Support force | radial | 3 x 250 kN |
| Tailstock thrust force | max. | 150 kN |

*If machine equipped with optional shift gearbox

Optional:

- Headstock optionally with or without shift gearbox
- Internal mandrel cooling for constant tool temperature during forming



Our series of machines for high-precision tubes

HSTR 750-3

Horizontal flow forming machine (HSTR)
for cold forming of tubes and hollow bodies of diameters up to 750 mm



Working area of an HSTR 750-4 (special variant)

| | | |
|--|-----------|---|
| Workpiece diameter | min. | 150 mm |
| Workpiece diameter | max. | 750 mm |
| Workpiece length (forward-flow processes) | max. | 2,000 mm / 3,000 mm or individual |
| Workpiece mounting | DIN 55027 | Size 20 |
| Number of forming rollers | | Standard 3 / optional 4 |
| Drive rating, main spindle | approx. | 300 kW |
| Main-spindle speed | max. | 250/500* rpm |
| Support stroke | axial | max. 1 x 2,200 mm oder 1 x 3,200 mm or individual |
| Support stroke | radial | 3 x 400 mm |
| Support force | axial | 1 x 600 kN |
| Support force | radial | Standard 3 x 400 kN / optional 4 x 400 kN |
| Tailstock thrust force | max. | 260 kN |

*If machine equipped with optional shift gearbox

Optional:

- Internal mandrel cooling for constant tool temperature during forming

Special solution:

The HSTR 750 can also be supplied with four radial axes and with separately moveable axial axes (= 4 x cross supports).



VSTR 250-3

Vertical flow forming machine (VSTR)
for cold forming of tubes and hollow bodies of diameters up to 250 mm



Working area of VSTR 250-3

| | | |
|--|-----------|----------------------------|
| Workpiece diameter | min. | 50 mm |
| Workpiece diameter | max. | 250 mm |
| Workpiece length (forward-flow processes) | max. | 500/1,000 mm or individual |
| Workpiece mounting | DIN 55027 | Size 11 |
| Number of forming rollers | fix | 3 |
| Drive rating, main spindle | approx. | 125 kW |
| Main-spindle speed | max. | 400/800* rpm or individual |
| Support stroke | axial | 1 x 600 mm |
| Support stroke | radial | 3 x 150 mm |
| Support force | axial | 1 x 200 kN |
| Support force | radial | 3 x 150 kN |
| Tailstock thrust force | max. | 120 kN |

*If machine equipped with optional shift gearbox

Optional:

- Three different stripper and ejector variants available



Our series of machines for high-precision tubes

VSTR 500-3

Vertical flow forming machine (VSTR)
for cold forming of tubes and hollow bodies of diameters up to 500 mm



Typical applications of the VSTR 500-3

| | | |
|--|-----------|----------------------------|
| Workpiece diameter | min. | 100 mm |
| Workpiece diameter | max. | 500 mm |
| Workpiece length (forward-flow processes) | max. | 1,000 mm or individual |
| Workpiece mounting | DIN 55027 | Size 15 |
| Number of forming rollers | fix | 3 |
| Drive rating, main spindle | approx. | 175 kW |
| Main-spindle speed | max. | 350/700* rpm or individual |
| Support stroke | axial | 1 x 1,100 mm |
| Support stroke | radial | 3 x 275 mm |
| Support force | axial | 1 x 350 kN |
| Support force | radial | 3 x 250 kN |
| Tailstock thrust force | max. | 150 kN |

*If machine equipped with optional shift gearbox

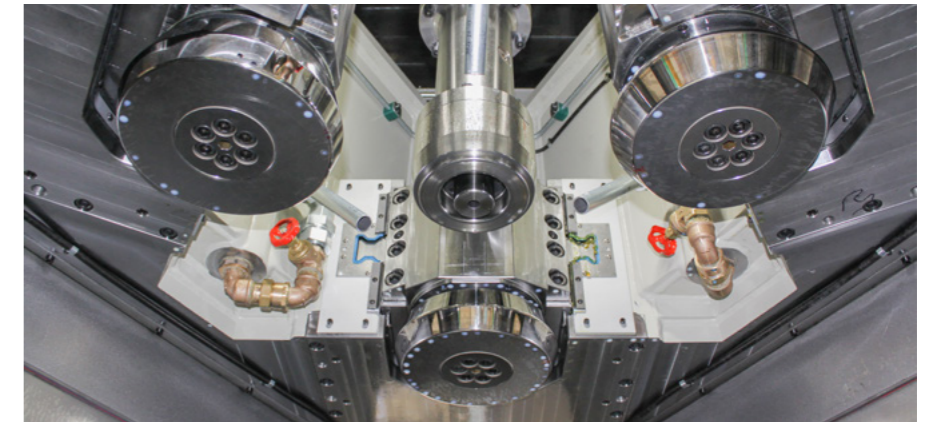
Optional:

- Three different stripper and ejector variants available



VSTR 750-3

Vertical flow forming machine (VSTR)
for cold forming of tubes and hollow bodies of diameters up to 750 mm



Working area of VSTR 750-3

| | | |
|--|-----------|---|
| Workpiece diameter | min. | 150 mm |
| Workpiece diameter | max. | 750 mm |
| Workpiece length (forward-flow processes) | max. | 1,500 mm or individual |
| Workpiece mounting | DIN 55027 | Size 20 |
| Number of forming rollers | | Standard 3 / optional 4 |
| Drive rating, main spindle | approx. | 300 kW |
| Main-spindle speed | max. | 250/500* rpm |
| Support stroke | axial | 1 x 1,600 mm or individual |
| Support stroke | radial | Standard 3 x 400 mm / optional 4 x 400 mm |
| Support force | axial | 1 x 600 kN |
| Support force | radial | Standard 3 x 400 kN / optional 4 x 400 kN |
| Tailstock thrust force | max. | 260 kN |

*If machine equipped with optional shift gearbox

Special solution:

The VSTR 750-3 can also be supplied with four radial axes and with separate axial axes (= 4 x transverse supports).

Our series of machines for gas cylinders with neck and bottom



Our SFM series has been specially conceived for forming of bottoms and bottle necks on tubes or cylindrical preforms. The diameter of the tube is reduced in this process and the tube end is closed totally gas-tight. Practically any contours can be generated in the shoulder/neck area of a gas cylinder using an SFM machine, thanks to the unique WF necking-in support.

Benefits for you using our gas-cylinder machines

- Series production of bottle bottoms and necks on a single machine
- Production of extremely shallow bottoms (as preform for a concave-bottom press)
- Attainment of gas tightness in the bottom with only one cutting-torch operation
- Increase of wall thickness in the shoulder area up to 5-fold of initial wall thickness
- Flexible design of contour profiles for the bottom, shoulder and neck, thanks to special support
- Integrated loading/unloading to protect the operator against extremely hot components

Highlights of our machines

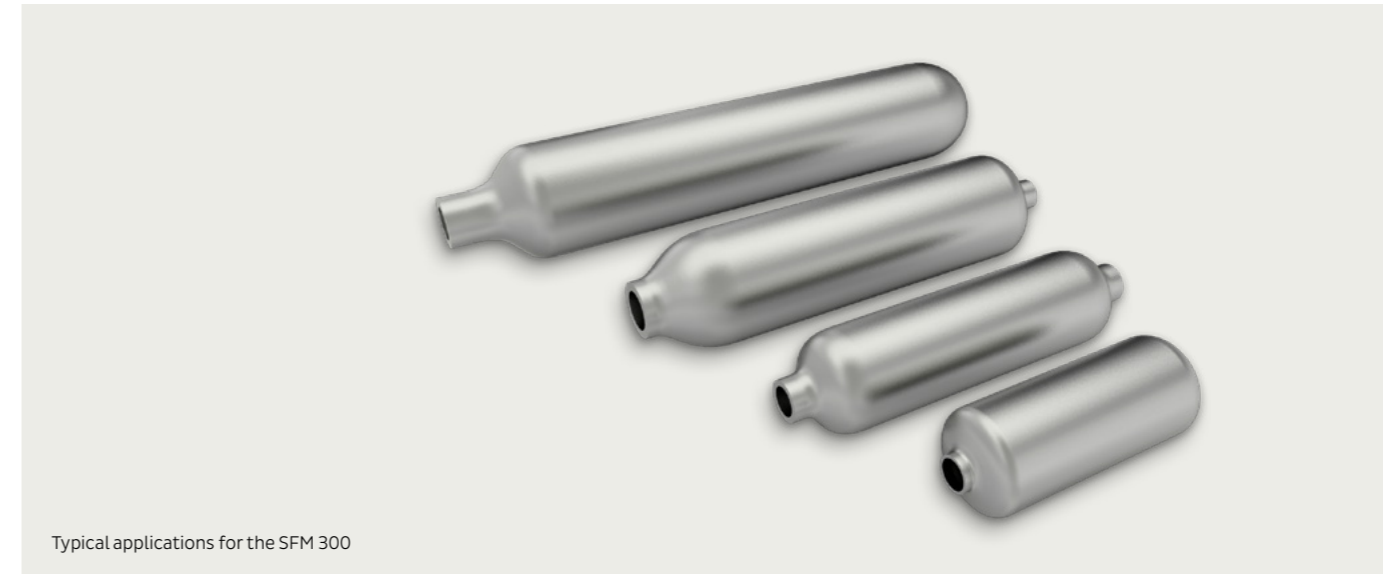
- Unhindered access to the working area, optimum for tool changing and maintenance
- Programmable stop adjustment in the interior of the main spindle acts simultaneously as the ejector for finished components
- Hydraulic clamping chuck of enormous clamping force
- Special guard plates protect operators against fly ash and slag
- Integrated slag collection tray, accessible with fork-lift truck for emptying

Machine description

- High-torque main-spindle motor driving hollow spindle
- Stop adjustment, ejector, draw tube for clamping chuck and guide tube for small bottle diameters all completely integrated into the main spindle
- Special necking-in support for simultaneous interpolation of movement of forming roller in three coordinates
- Load/unload system included in all cases
- Carried double heating burner to maintain the forming temperature throughout the forming process
- Consistent water-cooling of all hot-area bearings
- Screening and protection by means of heat deflectors throughout the working area
- Machine prepared for integration of an inductive heating system for tube ends and a three-axis handling portal



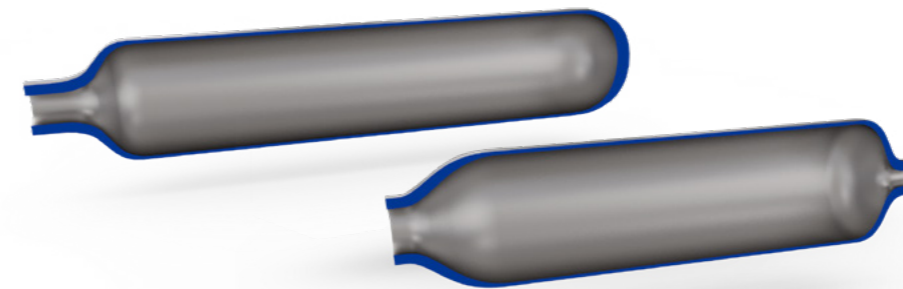
Typical application for an SFM 450



Typical applications for the SFM 300

Special equipment, SFM series

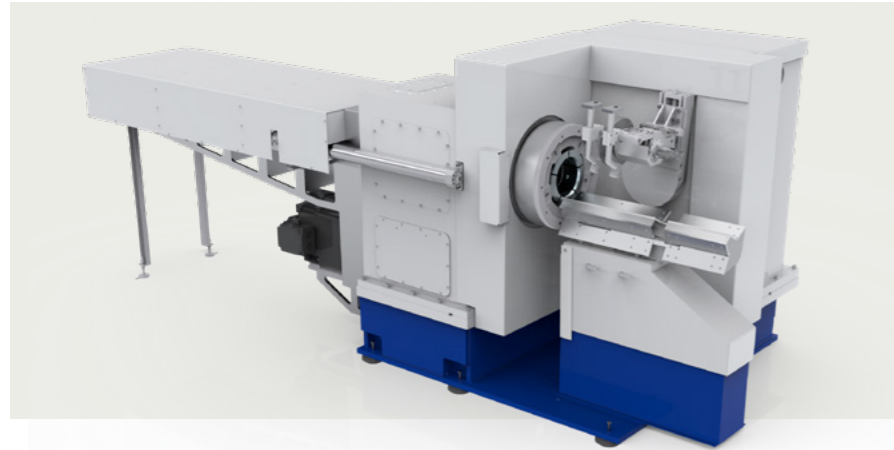
- Induction system for inductive heating of tube ends in just seconds
- Rotation system for slow rotation of the tubes during heating
- Loading portal, 3-axis portal, CNC controlled for handling of tubes between induction system and SFM
- Special loading system for loading of tubes through the main spindle
- Pole zone burner with pilot flame for slag-combustion and final gas-tight closure of pole zone during the bottle-bottom production
- Slag conveyor to transfer slag immediately into a container (container must be supplied by customer)
- Thermal camera for monitoring of plot of temperature in the tube
- Customer-specific safety-technology to protect against heat and flying slag particles
- Conveying technology (diabolo-roller conveyors/inclined planes/turntables, etc.)
- Flame detector for heating burner
- Roller-changing crane



Our series of machines for gas cylinders with neck and bottom

SFM 300

Necking-in machine (SFM)
for necking-in of tube ends of diameters up to 300 mm (hot forming)



SFM pivot support in action

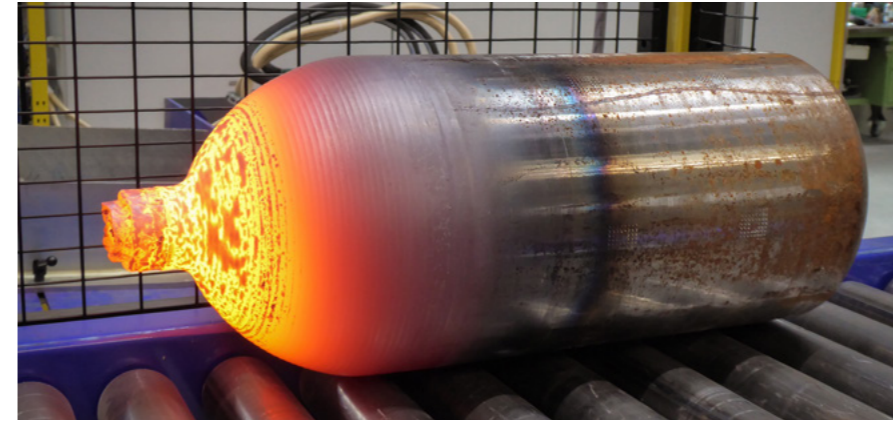
| | | |
|--|---------|-----------|
| Workpiece diameter | min. | 100 mm |
| Workpiece diameter | max. | 300 mm |
| Workpiece length (cylindrical section) | min. | 400 mm |
| Workpiece length (total) | max. | 1,800 mm |
| Drive rating, main spindle | approx. | 165 kW |
| Main-spindle speed | max. | 1,100 rpm |
| Support stroke | axial | 400 mm |
| Support stroke | radial | +/- 90 mm |
| Angular swivel stroke | | 120° |
| Support force | axial | 125 kN |
| Support force | radial | 125 kN |
| Angular swivel torque | max. | 15 kNm |

The SFM 300 is a top-grade all-round machine featuring WF's patented necking-in support. This system reduces the mechanical adjustments necessary during set-up works to a minimum and also permits the generation of ogive contours.



SFM 450

Necking-in machine (SFM)
for necking-in of tube ends of diameters up to 450 mm (hot forming)



Stainless-steel gas cylinder immediately after forming of neck

| | | |
|--|---------|------------|
| Workpiece diameter | min. | 200 mm |
| Workpiece diameter | max. | 450 mm |
| Workpiece length (cylindrical section) | min. | 650 mm |
| Workpiece length (total) | max. | 2,500 mm |
| Drive rating, main spindle | approx. | 225 kW |
| Main-spindle speed | max. | 900 rpm |
| Support stroke | axial | 600 mm |
| Support stroke | radial | +/- 125 mm |
| Angular swivel stroke | | 120° |
| Support force | axial | 250 kN |
| Support force | radial | 250 kN |
| Angular swivel torque | max. | 45 kNm |



Bottleneck after final machining

Special solution:

Our SFM machine is also optionally available for customer-specific tube diameters. We manufacture machines for the production of ultra-small cylinders (e.g. CO₂ cylinders, beverage industry), just as much as large-scale cylinders (e.g. for jumbo cylinders, natural-gas transport cylinders).

The critical inspection of our professional



Our series of machines for gas cylinders with both side necks

Our RVM series has also been specially developed for the closure/forming of tube ends. The SFM series works on the rotating workpiece, whereas the machines of the RVM series work on stationary tubes. Both, tubes with large imbalances and tubes with bent or curved geometries, can be closed.

Benefits for you using our RVM machines

- No rotating workpieces, assuring maximum safety
- Highly flexible forming of the tube closure area
- Adaptation to various tube diameters can be easily programmed

Highlights of our machines

- Production of any cylinder length required, since the tube does not rotate
- End processing also possible on bent / curved tubes
- Operation irrespective of tube length
- Cycle time might be halved, while simultaneous end working at both ends of the tube is optionally possible

Machine description

- Rotating roller head carrying one or two forming rollers
- Forming rollers circle the tube end and neck-in the tube diameter
- CNC-controlled radial unit moves the forming rollers in the radial direction
- CNC-controlled axial unit moves the rotating head (RVM 60) or the stationary tube (RVM 600) in the axial direction
- Secure clamping of the tube on the machine table thanks to hydraulic clamping shoes

Special equipment, RVM series

- Second forming head for simultaneous working of both tube ends at a time
- Robot load/unload
- Induction heating system for heating of the tube ends prior to forming
- Safety technology tailored specifically to the customer
- Monitoring technology
- Noise reduction for hydraulics
- Handling and conveying technology



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Typical application: CNG transportation

Our series of machines for gas cylinders with both sides necks

RVM 60

Tube necking-in and closure machine (RVM)
for neck forming on tube ends of diameters up to 60 mm (hot forming)



AWF expert setting up an RVM machine.

| | | |
|--------------------|------|--------|
| Workpiece diameter | min. | 15 mm |
| Workpiece diameter | max. | 60 mm |
| Workpiece length | min. | 150 mm |
| Workpiece length | max. | 500 mm |

The RVM 60 closes tube ends quickly and without complication, even if the tube is of a pre-bent or pre-curved geometry.

Special solution:

Cycle times can be halved by upgrading with a second forming head!



Bent tube end necked-in on an RVM 60

RVM 600

Tube necking-in and closure machine (RVM)
for shoulder/neck forming on tube ends of diameters up to 600 mm (hot forming)



Typical jumbo cylinders produced on an RVM 600

| | | |
|--------------------|------|-----------|
| Workpiece diameter | min. | 200 mm |
| Workpiece diameter | max. | 600 mm |
| Workpiece length | min. | 850 mm |
| Workpiece length | max. | 16,500 mm |

Optional:

- Second forming head for simultaneous working of both tube ends at a time
- Load/unload by two synchronised robots
- Induction heating system for heating of tube ends prior to forming
- Safety technology tailored to the specific customer
- Monitoring technology
- Noise reduction for hydraulics
- Handling and conveying technology

The RVM 600 is especially suitable for production of extremely large, extremely long and extremely heavy gas cylinders, so-called jumbo cylinders, which are used specifically in gas transportation.

Special solution:

Halving of cycle times is possible by upgrading with a second forming head!

Our service packages

| | Includes | ★ Basic | ★★ Advanced | ★★★ Excellence |
|------------------------------------|--|------------|----------------|-------------------|
| Troubleshooting | WF helpdesk: Service portal linked with digital lifecycle record for trouble-free service processes | ● | ● | ● |
| | Personal contact | | ● | ● |
| | Remote support: For identification of cause(s) of problems with the machine via on-line link | | ● | ● |
| | SMART glasses support: Determination of causes of problem(s) using augmented-reality goggles | | | ● |
| | On-site support: For identification of cause(s) of problems on the actual machine | | | ● |
| Training online and offline | General operation: General instruction in the operation of the machine during pre-commissioning at WF | ● | ● | ● |
| | Machine operation: User knowledge on setting machine up, tool changing, programming and safe handling and use of operating equipment | | ● | ● |
| | Machine maintenance: Know-how on machine mechanics and hydraulics, fault diagnosis and troubleshooting | | ● | ● |
| | Programming and forming process: Detail knowledge on programming and technologies | | | ● |
| | Follow-up: Individual practical training for advanced practitioners, around four months after commissioning, for optimisation of operation | | | ● |
| Maintenance | Spares package 4000: Recommended spare parts for the first 4,000 hours of operation | | ● | |
| | Spares package 8000: Recommended spare parts for the first 8,000 hours of operation | | | ● |
| | Remote maintenance: Remote inspection for ascertainment of machine condition, including recommendations for action | | ● | ● |
| | SMART glasses maintenance: Inspection using AR goggles and remote access for ascertainment of machine condition, including recommendations for action | | | ● |
| | On-site maintenance agreement: Entire on-site maintenance of the machine at specified maintenance intervals | | | ● |

Further services

SMART FORMING tools – WF Maschinenbau's Industry 4.0 solutions

SMART FORMING assistant for graphical programming support for NC programs

SMART FORMING viewer for visual display and evaluation of forming forces on the product

SMART FORMING cam for video supervision of the machine's working area

SMART FORMING inspector for quality assurance of the forming process

SMART FORMING diagnostics for support of preventative maintenance and continuous self-diagnosis

Automation

Set-up of load/unload systems, robots and transfer systems

Innovation engineering

Product developments, feasibility studies and fundamental tests in our R&D Center

Small production runs to bridge shortages of machine capacity or peak orders, performance of small runs

“WF Future Zone” workshop – What else is possible? YOU shape the future of your industry!

Machine set-up for optimised start of a new production line

Retrofitting and uprating

General overhaul for minimisation of risk of failures and/or **retrofitting** to assure regular production operation

You can book additional services as you need them.

Please contact us directly for more information, we'll be pleased to help you!

With our service packages, we ensure long and reliable operation of your machine. The “Basic” package is included in the purchase price of your machine. Please contact us for customised packages or to book individual services!

FORMING EXCELLENCE

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of WF Maschinenbau, its
machines and activities
on our new website!

