



Boiler & Power

Machines for Power Plants

Bending to perfection.



Technical Advances

We set standards in power plant construction

The future of the global energy supply depends critically on innovations in power plant construction. The fluctuations in renewable energy performance which need to be balanced out, the increasing demand for energy internationally and tightened statutory regulations: Power plant construction is currently a balancing act of growing, supply-relevant, economic and ecological requirements. As such, the requirements of built-in piping systems and pipe materials increase as these noticeably contribute to improved efficiency.

Efficiency necessitates innovative technology

The efficiency of the combustion chamber depends, among other things, on the tubes used forming as large an area as possible for the transfer of heat by using particularly narrow bending radii. The bending challenge of this is enormous in respect to the high-strength of the materials. On the one hand, the materials react sensitively; on the other, large bending forces are required to reshape the harder tubes. We meet these challenges with innovative booster bending procedures, which even exceed international tolerance regulations in regard to wall thinning and ovality thanks to their high levels of precision. This offers a noticeable cost benefit especially when it comes to using high-strength materials.

Experience and industry expertise

For a number of decades now we have been developing and manufacturing cold tube bending machines which are specially designed for the specific requirements of power plant construction. We are just as familiar with bending high-strength and heat-resistant steel as with thick-walled high-pressure tubes up to 16". The cold-bending of tubes with a bending radius of $1 \times D$ and lower is part of our day to day work.

Further optimum bending procedures for your requirements

Alongside our booster bending machines, our heavy duty machine line offers another optimum solution for various bending tasks in power plant construction. Equipped with special tools, these machines bend thin and thick-walled tubes with a maximum diameter of 426×22 mm.



Creating small bending radii

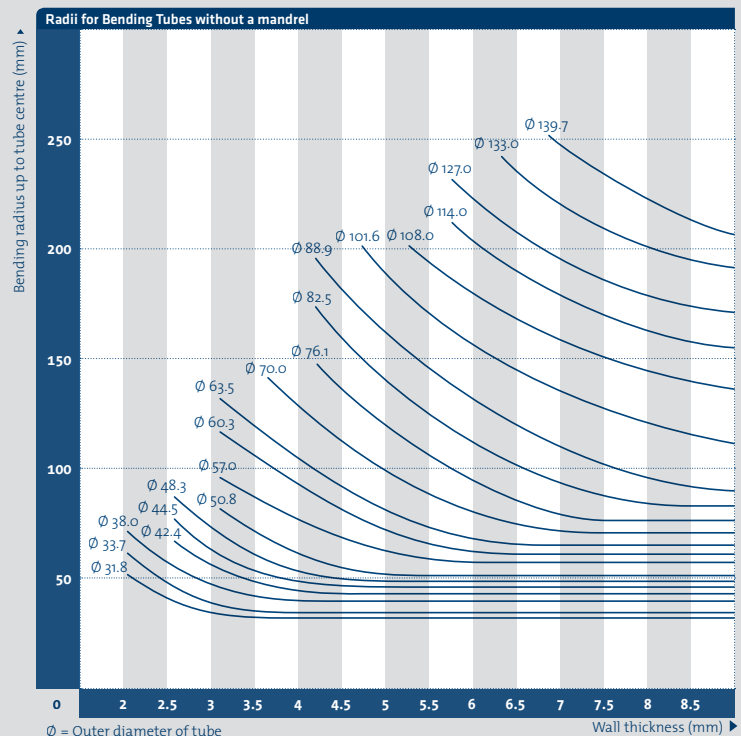
For bending thick-walled tubes without using a mandrel, the booster bending method makes it possible to create very small bending radii (depending on the tube diameter, the minimum radius is less than $1 \times D$). This makes it possible to, for example, produce smaller boilers with greater capacities. Furthermore, when using a mandrel, thin-walled tubes can be bent to a small radius as the booster device relieves the pressure on the tube's outer wall.

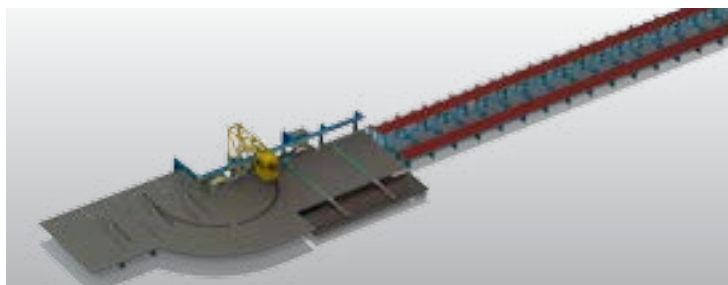
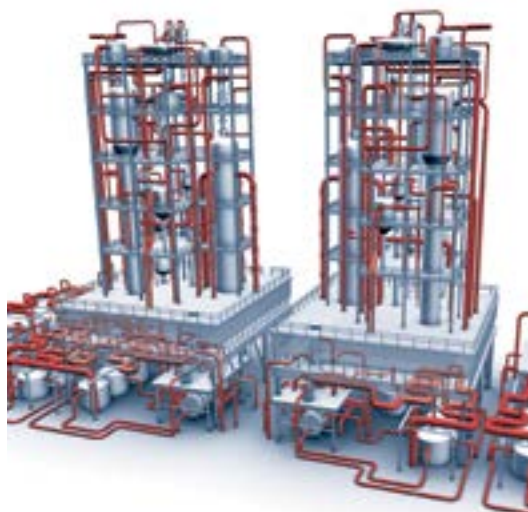
Determining the smallest bending radius

Example

Outer diameter of tube \varnothing	50.8 mm
Wall thickness	4.5 mm
Min. bending radius up to centre line*	54 mm

*acc. to diagram





Precise and Economical

Our bending technology for modern power plants

For the particular requirements of power plant construction, we offer special booster bending machines with and without mandrels for single-item and batch production. All in all, you have the choice of four different product lines in this area: Semi-automatic and automatic CNC booster bending machines, CNC Twin booster bending machines with two bend heads and the membrane wall bending machines of the FL line.

The greatest precision – without any post-processing

Benefit from our unique mandrel-free bending technique: Reduced production costs thanks to precise results, without any post-processing. Our machines for mandrel-free bending make it possible to machine boiler tubes up to a radius of $1 \times D$ with minimum wall thickness reduction and optimum ovality. This means you can considerably reduce material usage. Of course, this also applies to the latest high heat-resistant steels. Another bonus point: Our method better meets the tolerance specifications for wall thinning and ovality, e.g. in European standards EN 12952, the American Society of Mechanical Engineers ASME B31.1 and all other international standards. The result: With a bending radius of $1 \times D$, the maximum wall thinning is around 12%, with maximum ovality less than 10%.

Efficient production, even with small bending radii

Production requirements for boiler tubing and tube serpentine are high. The manufacture of smaller boilers specifically with greater capacities necessitates the use of extremely narrowly bent tubing. It is not rare that the minimum bending radius needs to be $1 \times D$. The semi-automatic booster

bending machines and automatic CNC booster bending machines are designed precisely with these requirements in mind.

The right solution to every requirement

Our semi-automatic systems from the SR line are the right choice when it comes to manufacturing single bends and smaller batches. The automatic, CNC-controlled machines also bend complex tubing systems with multiple bends or large batch sizes. We have developed the CNC Twin machines with two bend heads specifically for the efficient processing of large and complex tube serpentine: With this machine line, two vertically and horizontally traversable bend heads are used to bend tubes alternating in a clockwise and counter clockwise direction. This means that the tube serpentine does not have to be turned after every bend, thus enabling the swift and economical production and creation of large section lengths. The system can also be supplemented with a terminal end bender. We have developed the FL machine line for the purpose of precisely machining full membrane walls. Our modified compression bending procedure makes it possible to bend membrane tube walls to angles up to 135° . Thanks to the optimum swivel device, the entire system can be swivelled up to 25° in both directions. This enables the diagonal bending of the membrane wall without the need for any extra space. The system thereby ensures an enormous boost in productivity as it allows for the particularly simple and time-saving prefabrication of larger membrane tube walls.

We manufacture our systems in Germany according to your individual demands and production data. We'll be happy to help you make the right choice.



1D/3D System



Mandrel Retraction Device



Cutting Saw Device



Lower mounted Booster System



Upper mounted Booster System



Flip-over Table

Optimally Customized to Your Needs

Our modularly configurable machine and accessories range offers you maximum flexibility. A tube bending machine which is tailored precisely to your specific production requirements noticeably contributes to maximizing your productivity and plays a decisive role in your competitive ability. We begin each new project with a comprehensive consultative meeting in order to find the bending solution which best corresponds to your job definition. Whether mandrel retraction device, 1D/3D system, cutting saw device or flip-over table, we assist you when it comes to selecting the equipment you need. Take advantage of our decades of experience in developing and manufacturing customer-specific tube cold bending machines for boilers and power plant construction.

Your Optional Extras

Tube systems with two bending radii

With our 1D/3D system, you can create two bending radii of different sizes within one tube serpentine without having to change the tool.

Bend-in-bend Systems

Our clamp jaw changing system enables the bending of tube systems without or with very short straight lengths between bends. The clamp jaw changing system is used frequently, e.g. in tubes for burner ports.

Cutting Saw Device

The numerically controlled cutting saw separates the machined tube from the remaining section while still on the bending machine. This allows for the efficient manufacture of short bending sections from one length of tubing.

Flip-over Table

For the efficient and safe turning of flat tube serpentine, the option of an integrated flip-over table is available. In this configuration, several arm pairs are used whose rotational point lies exactly in the tube axis. The tube flipping is done synchronously to the movement of the index head.

Mandrel Retraction Device

During the bending process, the mandrel retraction device positions the optional mandrel in the bending area and, among other things, offers crucial advantages when it comes to machining thin-walled tubes.

Tube Loading

For automated and thus particularly efficient machine loading, we can offer you different handling systems for tube lengths of up to 150 m.

Precise, mandrel free cold bending of the smallest radii

Alongside the special Schwarze-Robitec control procedure, an important quality feature of our booster bending machines is the compactly constructed module of tube boost and integrated tube clamp. This enables, among other things, mandrel-free cold bending of very small radii: If the ratio of the outer diameter to the wall thickness is 1:10 or lower, bending radii of $1 \times D$ are possible without any difficulty. Here, the clamping element transfers the boost force safely to the tube.



SR 60 DB



Strong in Performance and Precision

The SR DB semi-automatic, electro-hydraulic booster bending machines are true experts when it comes to manufacturing boiler tubes. They efficiently and precisely produce small to medium-sized series and individual bends, if necessary, at the smallest bending radii. Of course, this also applies to tubing from new high-strength and heat-resistant materials. These machines are equipped, among other features, with the intuitively operable CNC single-axis control system, a hydraulically powered bending table and a hydraulic vertical/horizontal tool clamp with knee-lever activation.

CNC 100 DB



Performance up, Costs down

When it comes to the batch production of boiler tubing and tube serpentines, you need a powerful tube cold bending machine. With our CNC DB machine line you can depend on a real all-rounder - reliable even after years of continuous multi-level operation. The CNC DB series is optimized for automatic production processes and offers proof of its full efficiency. In this regard, we have fitted it with numerous technical features: starting with the CNC multi-axis control unit, continuing with the integrated tube positioning device and the smart booster with its programmable boost factor.

Technical Data

Illustrations may include optional equipment. Special versions by request. Subject to technical modification. Further optional equipment is available on request.

		SR 60 DB	SR 80 DB	SR 100 DB	SR 165 DB	CNC 60 DB	CNC 80 DB	CNC 100/80 DB	CNC 100 DB	CNC 165 DB	CNC 60 DB Twin	CNC 80 DB Twin
Max. Ø tube x wall thickness: (Tensile strength: 700 N/mm ²)	mm	63,5 x 5	88,9 x 8	114,3 x 7,1	168,3 x 7,1	63,5 x 5	88,9 x 8	88,9 x 11	114,3 x 7,1	168,3 x 7,1	63,5 x 5	88,9 x 8
Max. section modulus	cm ³	12,5	37,8	60,4	139,1	12,5	37,8	46,9	60,4	139,1	12,2	37,8
Max. centerline bending radius (CLR)	mm	300	400	450	500	200	250	350	350	425	200	250
Min. centerline bending radius (CLR)	mm	20	30	50	70	20	30	30	50	70	30	35
Transport carriage (extension possible)	mm							6,000				6,000
Max. bending angle												
▶ using split bend former	Degree		200°					200°				200°
▶ using solid bend former	Degree		180°					180°				180°
Max. bending speed												
▶ forward, steplessly adjustable	RPM	3	1,8	1,5	1,2	6	3	1,6	1,6	1,4	6,5	3
▶ return, constant	RPM	10	5	2,5	2	10	6	2,8	2,8	1,8	10	6
Power requirement	kW	22	22	25	35	50	50	50	50	55	35	50
Bending direction		Clockwise - on request counter clockwise				Clockwise - on request counter clockwise					Clockwise & Counter	
Weight of machine approx.	kg	5,250	6,300	11,200	16,500	10,000	11,500	15,800	18,000	23,500	depending on techn	
Positioning device												
▶ Max. orientation angle	Degree							Unlimited				Unlimited
▶ Max. orientation speed	RPM					40	30	30	20	15	40	30
▶ Max. transport speed	m/min					50	50	50	50	40	50	35

CNC 100 DB Twin



Terminal End Bender



FL 3600



Equipped for complex Tasks

We have developed our DB-Twin CNC tube bending machine series specifically for the increasingly complex requirements of boiler plant manufacturing. These tube bending machines can be used in any combination and for bending applications either in clockwise or counter-clockwise directions. Large-scale coiled piping configurations can be bent even when using counter-clockwise bending directions without having to turn the coiled pipe after every tube bend. The advantage of an arrangement of two parallel bending heads is that different bending radii can be bent within one system. The system's high degree of automation means that an optional terminal end bender can be used which is capable of forming bends easily in both bending directions at the back end of a coiled piping configuration or a piping system.

Bending Membrane Walls with millimeter precision

Modern-day boiler and power plant construction is inconceivable without the use of welded membrane walls. In order to fit perfectly into the boiler design and adjacent supply line segments, the membrane walls first need to be precisely bent with millimeter precision. We have optimized the FL machine series to meet these requirements exactly. It machines full membrane walls with a width of up to 3,600 mm reliably and in one operation. The consequences, and your results, are cost savings and shortened production times thanks to reduced assembly effort on the construction site.

CNC 100 DB Twin
88.9 x 11
46.9
350
35
2.7
3.8
50
Clockwise
ical version
20
35

		FL 1000	FL 2000	FL 3000	FL 3600
Max. Ø tube x wall thickness (Tensile strength: 700 N/mm ²)	mm	70 x 5			
Number of tubes with max. Ø	pc	8	16	32	40
Through-width	mm	1,000	2,000	3,000	3,600
Through-width (at max. diagonal bending 25°) approx.	mm	880	1,600	2,400	2,800
Max. section modulus	cm ³	124	248	496	620
Max. centerline bending radius (CLR)	mm	400			
Min. centerline bending radius (over plain roller)	mm	150			
Max. bending angle	Degree	135			
Max. bending speed	RPM	1.5	0.4	0.3	0.3
Power Requirement 1500 RPM	kW	15	20	35	35
Weight of machine approx.	kg	11,000	30,000	58,000	62,500

Optional Extras

- ▶ Machines SR DB, CNC DB and CNC DB Twin:
 - Wiper die holder and lubrication
 - Main block lubrication
 - Air oil cooler
- ▶ Machines SR and CNC DB with mandrel
 - Hydraulic mandrel retraction device
 - Automatic mandrel lubrication
- ▶ Machines SR DB
 - Boost synchronisation

- ▶ Machines CNC DB
 - 1D/3D bending
 - Bending of bend-in-bend systems
 - Cutting saw device
 - Pressure die replacement device
- ▶ Machines FL
 - Machine pivoting device, diagonal bending ± 25°
 - Membrane wall transport rolls with electric drive and power lift
 - Hydraulically adjustable membrane wall stop (distance + angle)



Modern and Powerful



Bending tools and drive technology

Whether machine body, bend head, bending tool or drive technology, all of the components of our booster bending machines fit perfectly into each other like a well-oiled gearbox and let you perform particularly fast, precise and efficient manufacturing jobs.

Demanding bending tasks require a stable base which can absorb all bending and torsion forces without difficulty. And it is precisely for this reason that the machine bed of our systems is designed as a welded box construction and reinforced optimally with multiple fins.

Winning speed

The proven design of our developed bending heads makes any additional support of the middle axis unnecessary in most cases. You benefit from even shorter tool change times and accelerated bending processes, even with complicated geometrics.

Maximum productivity trumps

You can flexibly modify the bending speed of our machines and thereby set your individual requirements with precision accuracy.

Automatic, efficient, powerful

With all CNC booster bending machines, servo-electrical drives position the tube accurately in the machine.

Safe manufacturing processes

Clamping bending tools and the pressure die boost is done in many cases using the knee lever. This means the tubes are fitted perfectly even under the most difficult conditions.

The greatest flexibility in the machining process enables the use of multi-piece bend formers which can be clamped both vertically and horizontally. They guarantee smooth production and easy removal of tubing with a bending angle of over 180°. When manufacturing extremely small bending radii of up to less than 1 x D, we also offer you one-piece bend formers with which you can also efficiently machine the new, high-strength materials.

Reducing costs intelligently

We only use controlled hydraulic pumps and power units. If the machine is not in operation, the pumps will switch to idle mode using the regulators. This means noticeable energy cost reductions for you.

Operational reliability – sustained!

Even under high pressure, our machines keep a cool head: The batch-produced water cooling (air oil cooling optionally available) of the hydraulic system create optimum operating conditions. In tropical climate conditions, our machines can be fitted with an active oil climate control. Constant oil temperatures and a comparably low pressure level ensure that your machine runs fault-free continuously.





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