

ENGINEERING
YOUR SPRAY SOLUTION



➤➤ SCALEMASTER ECO⁺

One step ahead in
the evolution of descaling

METALLURGY





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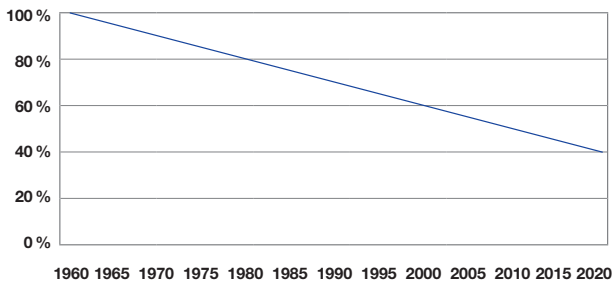
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WHY GREEN STEEL NEEDS GREY MATTER ...

Emission trading systems in various parts of the world will lead to higher prices for CO₂ emission allowances and rising energy costs. In addition to this, more stringent emission reduction targets can be expected, highlighting growing environmental awareness and the pressure governments are exerting on steel producers to step up their efforts in reducing CO₂ emissions by improving their energy efficiency in every process.

Energy consumption % reduction 1960–2020



Indexed global energy consumption/tonne of crude steel production

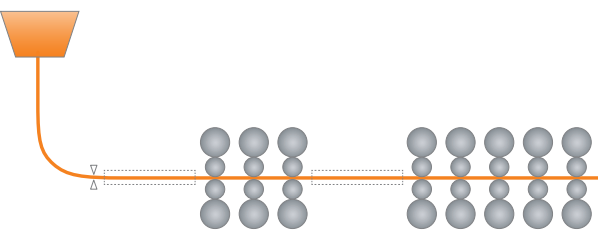
Iron and steel production is very energy-intensive. According to the World Steel Association, the joint efforts of steel producers and the plant suppliers have led to reductions of about 60 % in the energy required to produce a tonne of crude steel since 1960. Subsequently greenhouse gas emissions per tonne of steel have also been reduced.

The future use of green hydrogen by integrated steel mills to replace carbon in their ironmaking reduction process will make a major contribution to reducing CO₂ emissions further. Nevertheless, downstream processors have to continue improving their energy efficiency.

Innovation in reduction of CO₂ emissions in existing processes

- Engineering
- Consulting
- System studies
- Implementation of reduction technologies

Amongst the downstream processes, one of the most energy-intensive processes in flat steel production is in hot strip and plate mills, where up to 15 % of total energy is consumed by the descaling system's high pressure pumps. Cutting energy bills and the subsequent CO₂ emissions will definitely be on the agenda sooner rather than later. It is crucial to have a holistic approach because of the third factor, which is the consumption of plant water. In fact, monitoring and managing the ecological plant water footprint will appear on the same agenda in the near future.



The modern, uninterrupted processes, known also as CSP, DUE, ESP or QSP, represent a very energy-efficient method of producing hot rolled steel coils. Avoiding heat losses of the relatively thin transfer bar from strand to strip, much less high pressure water for descaling is used in these plants. However, due to the significantly higher water pressures and the very low spray heights, special descaling nozzles providing very high impact values and very precise sprays are required.



Challenge

Green steel requires large amounts of energy for the production of hydrogen and the operation of EAFs. All downstream processes must intensify their efforts in increasing their energy efficiency in parallel.



AND WHAT LECHLER CAN DO ABOUT IT

Lechler set a new standard when it introduced the first generation of SCALEMASTER descaling nozzles in 1992 together with the world's first and widely applied DESCALE nozzle configuration software.

The Lechler MiniSCALEMASTER's role in the success of first generation thin slab rolling plants – known as compact strip production – was not insignificant because of its contribution to minimizing the cooling of the transfer bar by reducing the volume of descaling water. The smaller physical size of the MiniSCALEMASTER was instrumental in the reduction of the spray height, a key parameter for increasing the impact.

Today, the company's latest addition, the SCALEMASTER ECO+, continues the good work, especially for the modern versions of compact or endless strip production plants. This innovative new product with its new application concept offers additional options and solutions for surface quality improve-

ments and unlocks further potential of energy efficiency and cost optimizations, as well as helping to reduce greenhouse gas emissions.

The Lechler claim of "Engineering your spray solution" has been adopted and extended to "Engineering your DESCALING solution" and goes far beyond simply offering a new series of nozzles. With the addition of the MillConfig.Descale simulation package a very sophisticated tool for decision-making is now available when it comes to the investigating potentials for increasing the energy efficiency and for improving surface quality.

The new SCALEMASTER ECO+ with its innovative Booster design is setting new impact records for descaling nozzles. Offering additional standard offset angle options when battling surface striping, Lechler is once again the leader in high pressure descaling.



Enhancing sustainability



MORE EFFICIENCY
MORE QUALITY
LESS CO₂
LESS COSTS

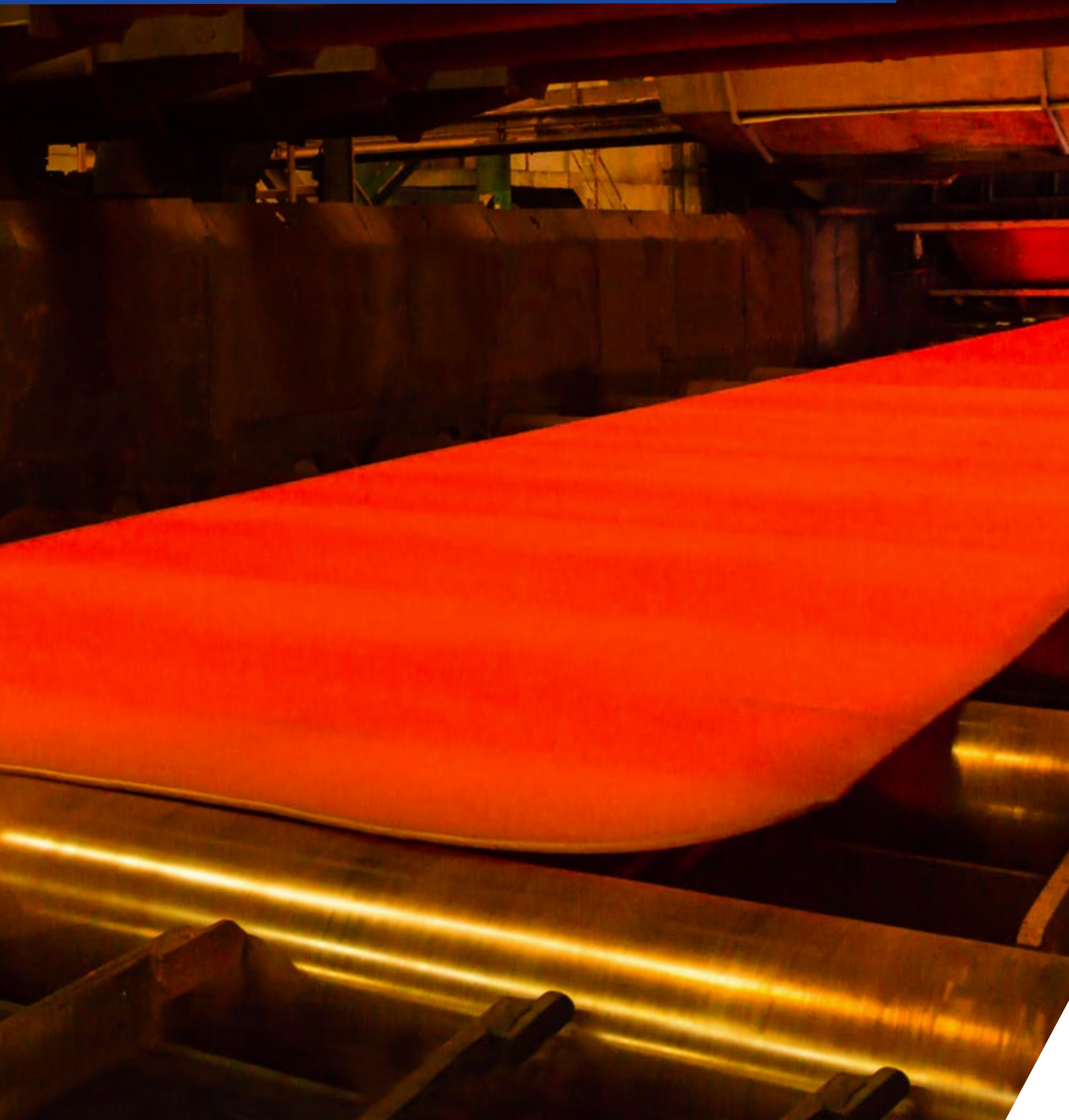


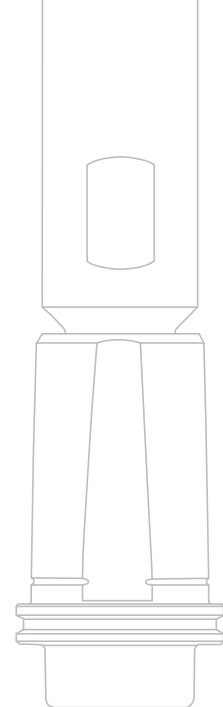
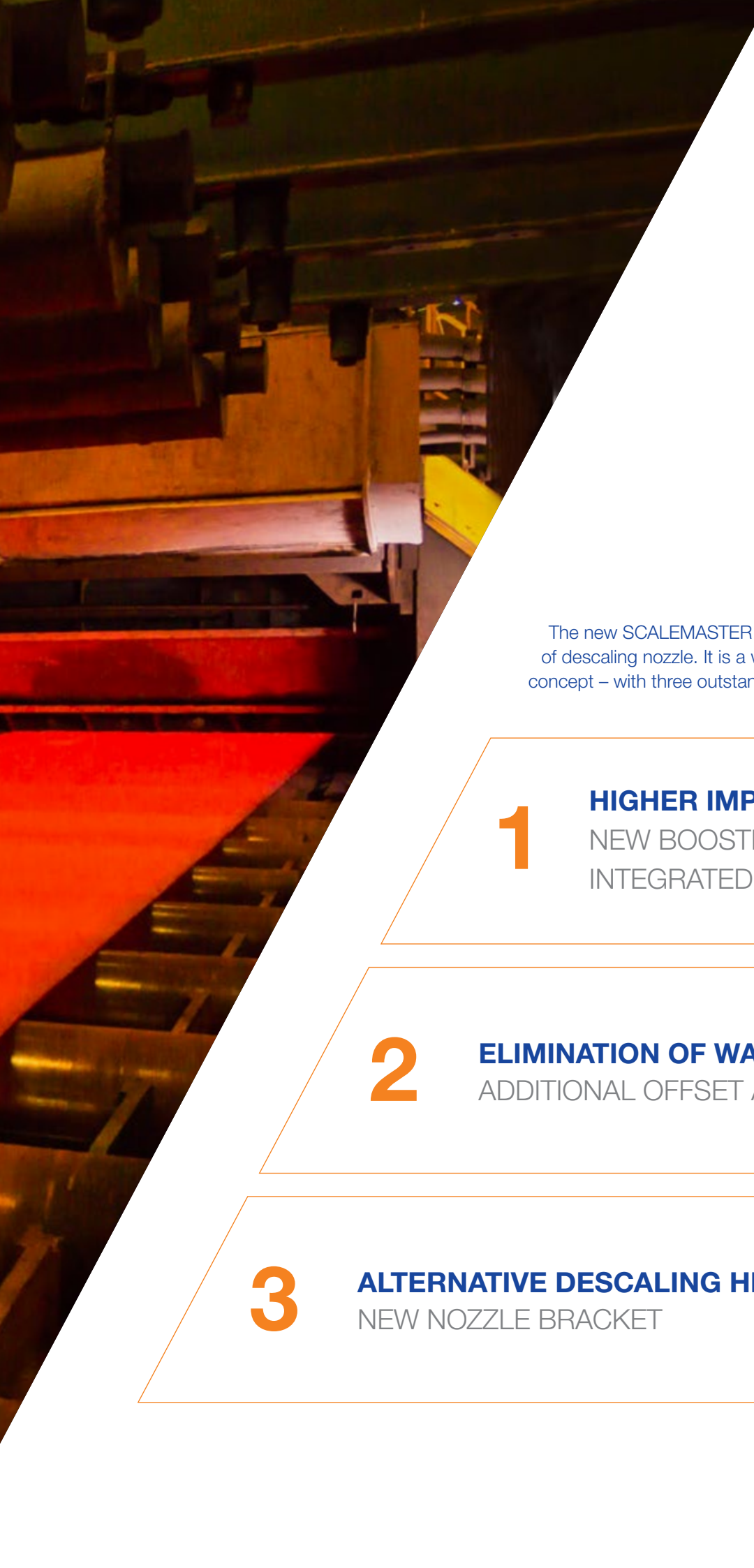
Contribution

The new Lechler SCALEMASTER ECO+ descaling nozzle concept offers additional options and solutions for surface quality improvements and unlocks further potential of energy efficiency and cost optimizations, as well as helping to reduce greenhouse gas emissions.



**SCALEMASTER ECO+
THE NEW DESCALING NOZZLE CONCEPT
COMBINES THREE USER BENEFITS**





The new SCALEMASTER ECO+ isn't just a new kind of descaling nozzle. It is a whole new descaling nozzle concept – with three outstanding user benefits.

1

HIGHER IMPACT

NEW BOOSTER WITH INTEGRATED FILTER

2

ELIMINATION OF WASH-OUT EFFECT

ADDITIONAL OFFSET ANGLE OPTIONS

3

ALTERNATIVE DESCALING HEADER DESIGNS

NEW NOZZLE BRACKET

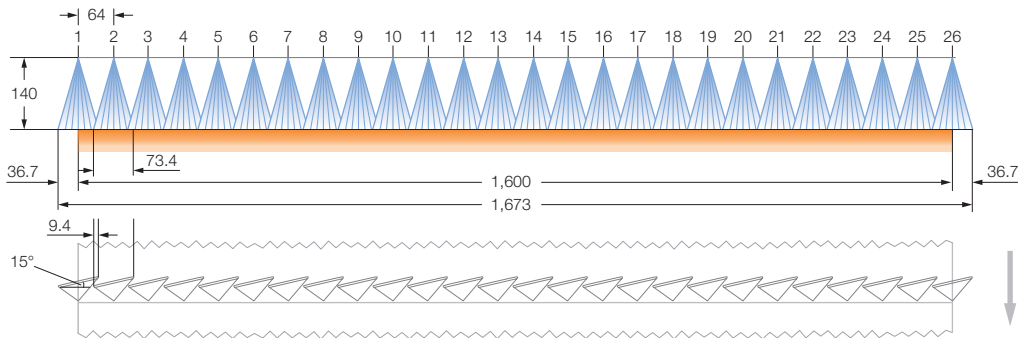


PERFECT SYSTEM DESIGN LECHLER DESCALE SOFTWARE

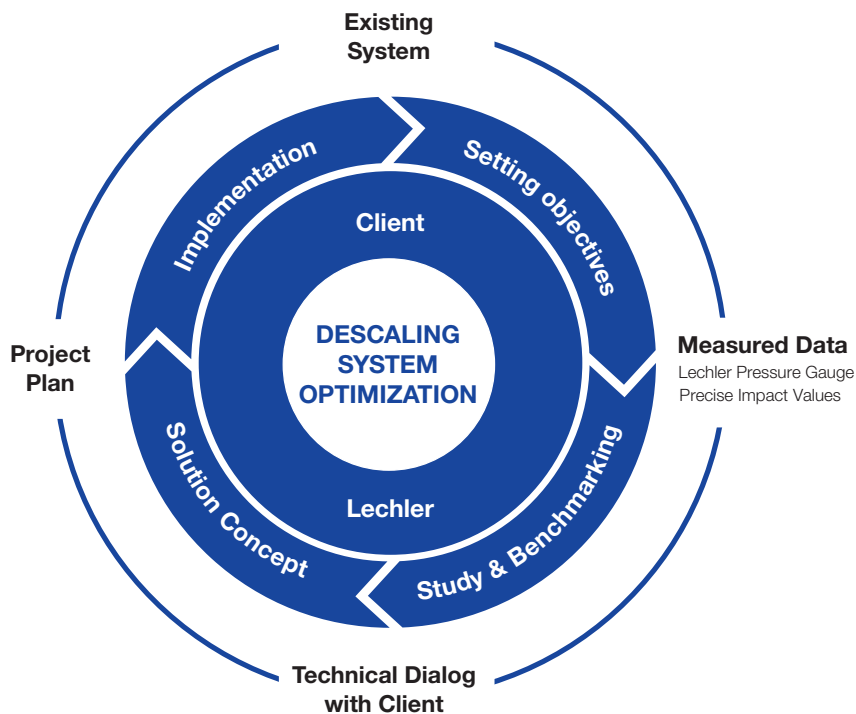
Benefit from the SCALEMASTER ECO+ when designing or optimizing a descaling system

Choose the experts. Since 1992 thousands of descaling systems have been designed using the Lechler DESCALE software and were equipped with Lechler SCALEMASTER nozzles.

- Let Lechler help you with the latest release of the Lechler DESCALE configuration software
- Scan and download, print, fill in and return the DESCALE questionnaire with the QR code below to Lechler
- Lechler will send you a proposal for an optimized nozzle configuration



Example of optimization with Lechler DESCALE software. (Dimensions in mm)



Optimize your descaling system

Increasing your descaling efficiency and quality is easy. Just scan the QR code and complete a questionnaire. Lechler will calculate your optimized nozzle configuration and notify you immediately.
<https://lechler-event.de/r/nozzlearrangement>



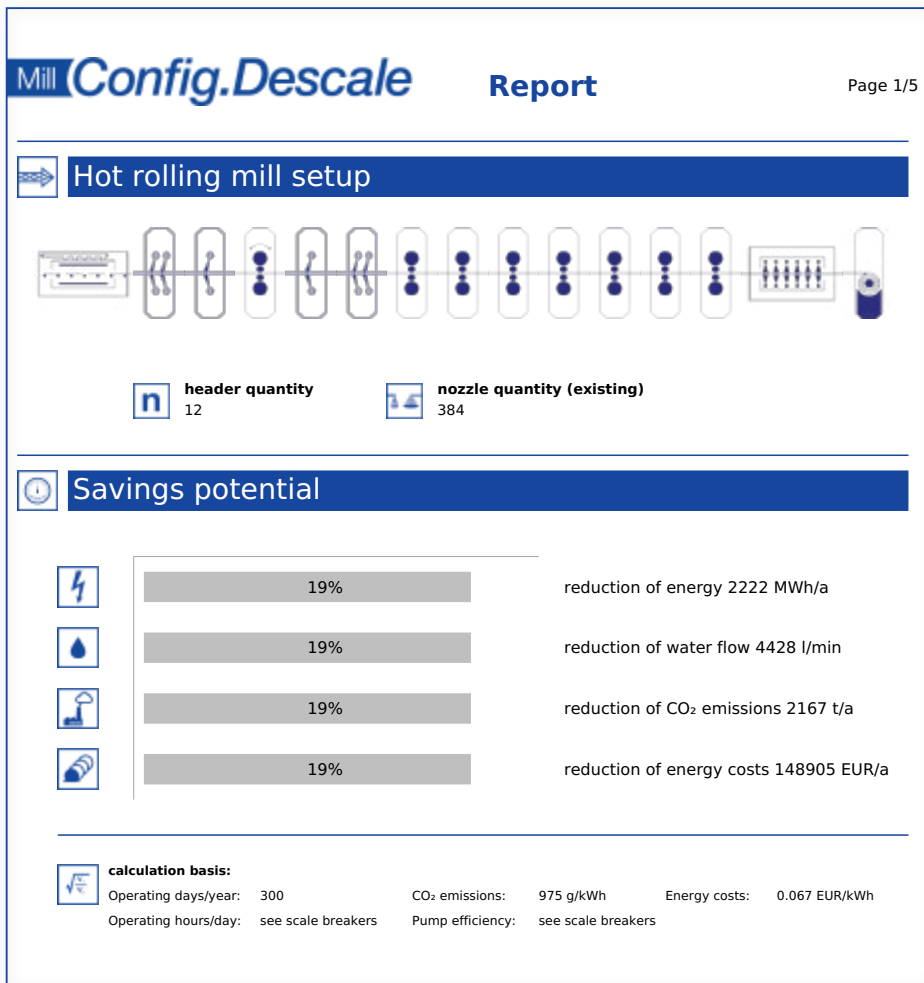


STUDY YOUR FULL POTENTIAL MILLCONFIG.DESCALE

Get a system study to benefit from SCALEMASTER ECO⁺

A descaling system study is a systematic and structured procedure for defining how an existing system nozzle arrangement and header configuration performs regarding **surface quality and energy efficiency**.

- Scan and download, print, fill in and return the MillConfig.Descale questionnaire with the QR code below to Lechler
- Lechler will investigate the potentials for increasing the energy efficiency and for improving the surface quality by performing a detailed study of the descaling system of the entire rolling mill



Management summary of a MillConfig.Descale study report

How much can you save?

Identify your savings potential now. Simply scan the QR code and complete the questionnaire. Lechler will investigate your potentials and provide you with a proposal on how to achieve them.

<https://lechler-event.de/r/millconfigdescale>





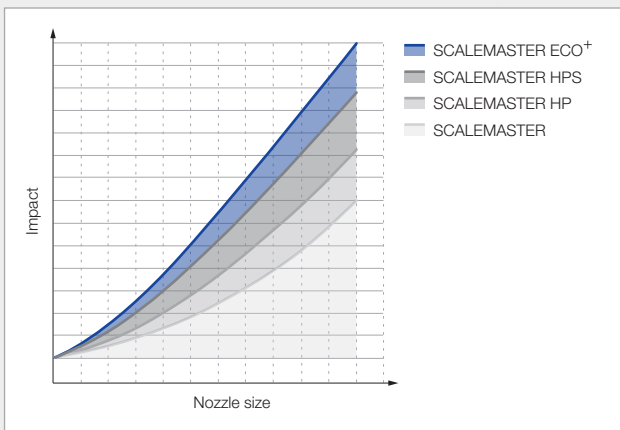
SCALEMASTER ECO⁺ THE NEW BOOSTER

SCALEMASTER ECO⁺

Impact equals steel quality. Availability equals profitability. That's why we designed SCALEMASTER ECO⁺ to deliver even more impact while protecting its long-term functionality. We achieved this by developing a new Booster.

The new Booster from the nozzle innovators

- Patented multi channel design for highest impact
- Rigid mechanical design for roughest system conditions
- Made from stainless steel for long service life
- Integrated fine filter protects Booster and nozzle for clogging-free and safe operation



Booster



Nozzle tip



BOOST YOUR IMPACT SAVE ENERGY COSTS



By further reducing the spray depth, the Booster concentrates the high pressure water on a smaller footprint, thereby increasing the impact and hence the descaling performance

- **SCALEMASTER ECO⁺** is fully compatible with all other SCALEMASTER nozzles (check overall length) – no header modifications necessary
- Optimized Booster design reduces the spray footprint area resulting in a higher impact
- An increased spray impact can lead to an improvement in the surface quality with no additional energy input
- A nozzle family providing higher impacts allows the use of a smaller nozzle size so that the impact can be maintained with a lower water flow and reduced energy consumption

MAXIMIZE IMPACT

Change to SCALEMASTER ECO⁺

- Maximize impact
- Keep water pressure
- Keep nozzle size



Additional option

- Reduce vertical spray height and increase impact even further



SAVE ENERGY

Change to SCALEMASTER ECO⁺

- Maintain impact values
- Install smaller nozzle size and reduce water flow
- Keep nozzle size and reduce water pressure



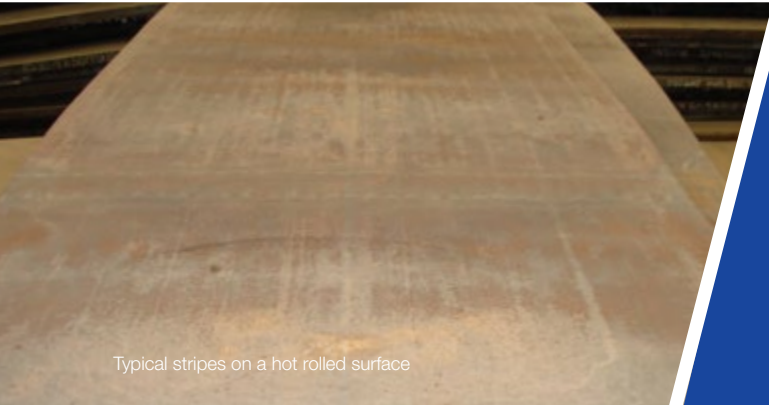
Additional option

- Reduce vertical spray height allowing a further reduction in the water flow





ELIMINATION OF WASH-OUT EFFECT STRIPE-FREE DESCALING



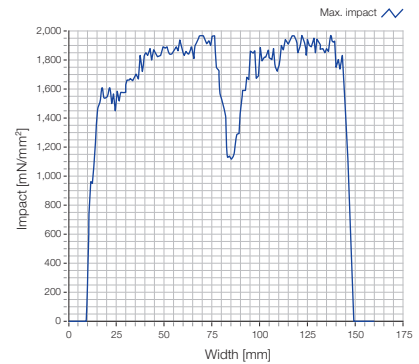
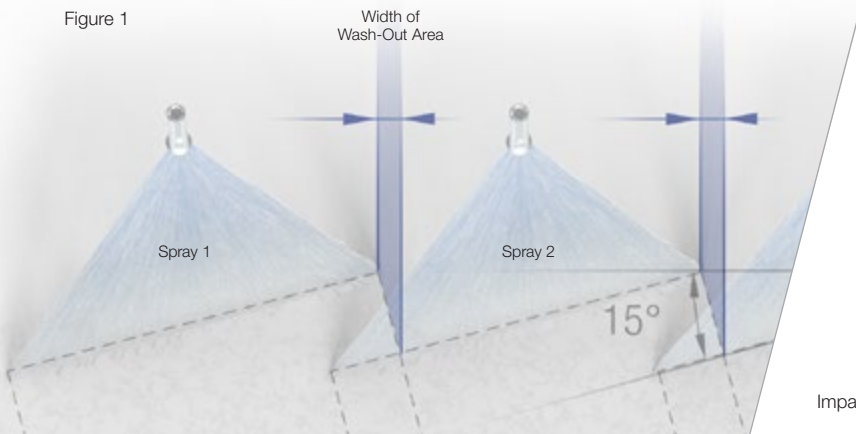
Typical stripes on a hot rolled surface

THE CHALLENGE

Stripe patterns due to non-uniform descaling compromising surface quality.



Figure 1



Impact measurement protocol 1, nozzles arranged at 15° offset angle

The phenomenon

Striping on the surface can be caused in the spray overlap area and is known as the "Wash-Out Effect", which appears when two sprays do not overlap correctly.

The Wash-Out Area

This phenomenon occurs when the partially undercut width of the spray in front is not fully compensated by the effective impact width of the spray behind.

Offset angle

When descaling nozzles are arranged at an offset angle and an inclination angle with the sprays overlapping each other, the side of the spray (Spray 1), tilted further towards the center line of the pipe, partially undercuts the spray in front (Spray 2), thereby reducing the impact in that area. The wide band of the Wash-Out Area is shown in Figure 1. If this is the case, a reduction of the offset angle could improve the situation.

The result with an offset angle reduced to 0° is shown in Figure 2, where the direct Wash-Out Area has been eliminated. This effect can be simulated and measured on the Lechler test bench. Impact measurement protocol 1 was conducted at an offset angle of 15° showing a significant drop of the impact in the overlap area. This is where the Wash-Out Effect occurs. At both measurements the inclination angle is maintained at 15°.

The high impact peak visible in the impact measurement protocol 2 does not affect the surface result.



ADDITIONAL OFFSET ANGLE OPTIONS

SURFACE QUALITY IMPROVEMENTS

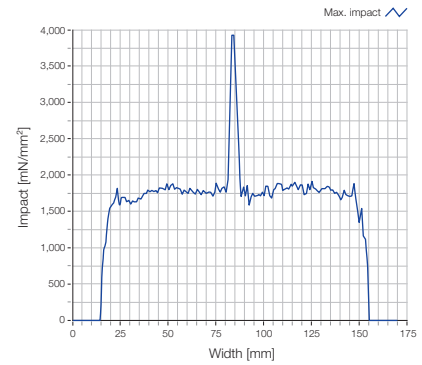
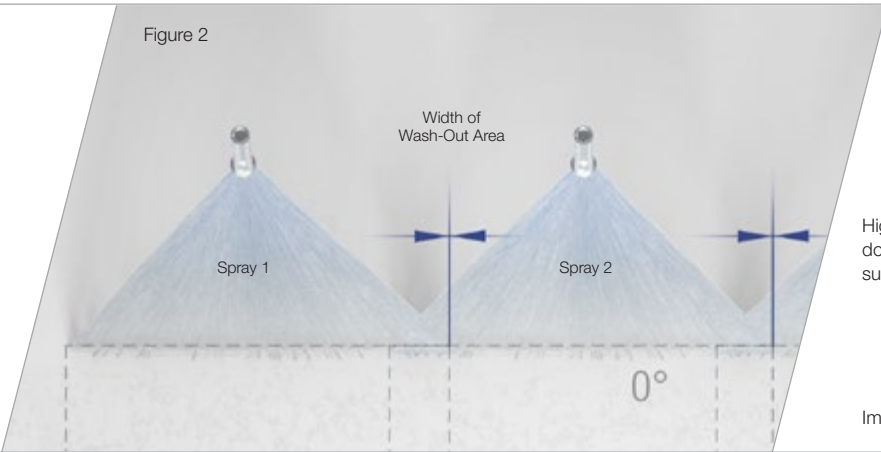
MAXIMUM FLEXIBILITY

THE SOLUTION

Adjustment of the nozzle offset angle.



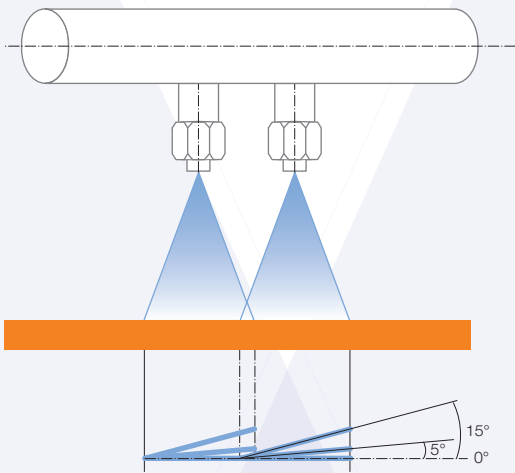
Figure 2



High impact peak does not affect surface result

Impact measurement protocol 2, nozzles arranged at 0° offset angle

New degrees of quality



Additional standard offset angles provide rolling mill operators with additional options for surface quality optimizations

The objective

Stripe-free descaling across the entire width must be ensured.

High pressure spray lab

With the impact sensor integrated into a plate, a wide variety of overlap situations of two adjacent nozzles sprays have been investigated on the test bench in the Lechler spray lab.

The optimization

Many measurements have shown that changing from a traditional 15° offset angle arrangement to either a 5° or a 0° offset angle can reduce or eliminate surface striping.

Exclusivity

The SCALEMASTER ECO+ is the only descaling nozzle family available with standardized offset angles of 0°, 5° and 15°, allowing a low cost offset angle modification by simply changing the nozzle tips. Please see pages 15,17 and 19.

Way forward

Contact Lechler and ask for an overlap study.



MiniSCALEMASTER ECO+

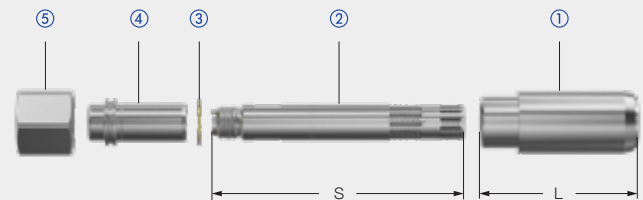
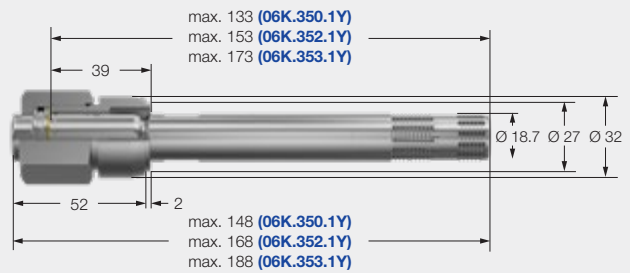
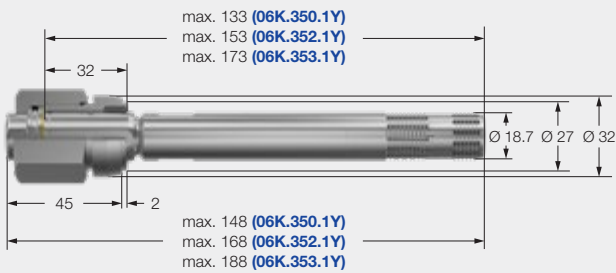
More clearance in confined settings

- Spray height reduction
- Improved rolled material surface quality
- Saves on pump energy
- Water flow rate reduced
- Less cooling of rolled product

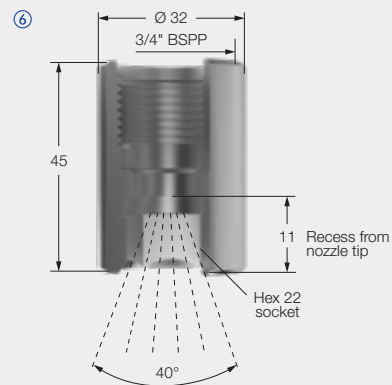
All dimensions in technical drawings and tables are in millimetres (unless stated otherwise).



MiniSCALEMASTER ECO+



The new SCALEMASTER ECO+ with the innovative Booster combined with the additional offset angle options form the next step in the evolution of the SCALEMASTER family of descaling nozzles. It is interchangeable with all other SCALEMASTER nozzles of an equivalent overall length.



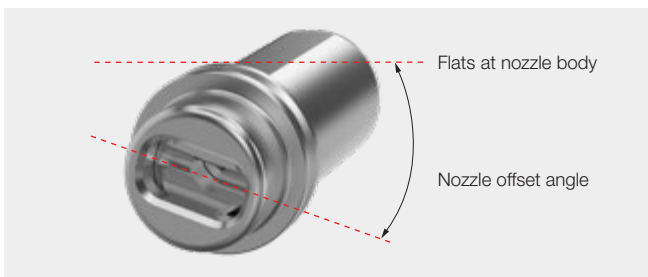
Special nut with hexagon socket for very narrow distances between nozzles

Designation	Order No.	Material	Dimensions	Weight [kg]
	Type			
① Welding nipple	060.020.1C.01 060.020.1C.00 060.020.1C.02	AISI 304	Length [mm]	0.060 0.080 0.190
			L = 32 L = 39 L = 80 Other length on request	
② Booster	06K.350.1Y 06K.352.1Y 06K.353.1Y	Stainless steel	With filter [mm]	0.117 0.145 0.174
			S = 110 S = 130 S = 150	
③ Gasket	095.015.34.02.07	Copper	–	0.001
④ Nozzle tip	6K3.XXX.XX.XX <small>See order table</small>	–	–	0.140
⑤ Nut (standard)	064.400.11	AISI 430 F	Hex 32 Max. torque 180 Nm	0.085
⑥ Special nut with hexagon socket	064.401.11	–	Hex 22 socket	0.120

Max. permissible operating pressure: 450 bar

Series	Order No. for nozzle tip					Material No. ¹	Offset angle			Equivalent bore diameter A [mm]	Water flow rate (V̇)					
	Code						0°	5°	15°		p = 100 bar (1,450 psi)		p = 200 bar (2,900 psi)		p = 400 bar (5,800 psi)	
	Nominal spray angle										[l/min]	[US gal/min]	[l/min]	[US gal/min]	[l/min]	[US gal/min]
	22°	26°	30°	34°	40°											
6K3	495	496	497	491	498	27	00	05	15	1.50	12.00	3.17	16.97	4.50	24.00	6.34
6K3	535	536	537	531	538	27	00	05	15	1.75	15.00	3.96	21.21	5.60	30.00	7.92
6K3	565	566	567	561	568	27	00	05	15	2.00	18.00	4.76	25.46	6.73	36.00	9.52
6K3	605	606	607	601	608	27	00	05	15	2.10	23.00	6.08	32.53	8.59	46.00	12.16
6K3	645	646	647	641	648	27	00	05	15	2.50	28.00	7.40	39.60	10.46	56.00	14.80
6K3	685	686	687	681	688	27	00	05	15	2.80	36.00	9.51	50.91	13.45	72.00	19.02
6K3	725	726	727	721	728	27	00	05	15	3.00	45.00	11.89	63.64	16.81	90.00	23.78
6K3	765	766	767	761	768	27	00	05	15	3.50	58.00	15.32	82.02	21.67	116.00	30.64
6K3	805	806	807	801	808	27	00	05	15	3.80	72.00	19.02	101.82	26.90	144.00	38.04
6K3	845	846	847	841	848	27	00	05	15	4.30	89.00	23.51	125.87	33.25	178.00	47.02
6K3	885	886	887	881	888	27	00	05	15	4.70	112.00	29.59	158.39	41.85	224.00	59.18
6K3		906	907	901	908	27	00	05	15	5.00	125.00	33.03	176.78	46.70	250.00	66.06
6K3		916	917	911	918	27	00	05	15	5.20	134.00	35.40	189.50	50.07	268.00	70.80

¹ Material No. 27: Stainless steel nozzle tip with tungsten carbide insert.



Please be aware that digits 9 and 10 indicate the integrated nozzle offset angle! Conversion of former series 6P3/642/644.XXX.27.00 ► **6K3.XXX.27.15**

Flow rate conversion for table:

$$\dot{V}_2 = \dot{V}_1 \cdot \sqrt{\frac{p_2}{p_1}} \quad [\text{l/min}] \quad p_2 = p_1 \cdot \left(\frac{\dot{V}_2}{\dot{V}_1}\right)^2 \quad [\text{bar}]$$

Ordering	Series	+	Code	+	Material No.	+	Offset angle	=	Order No.
example:	6K3	+	495	+	27	+	15	=	6K3.495.27.15



SCALEMASTER ECO⁺

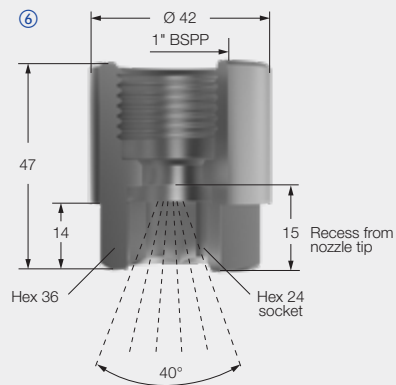
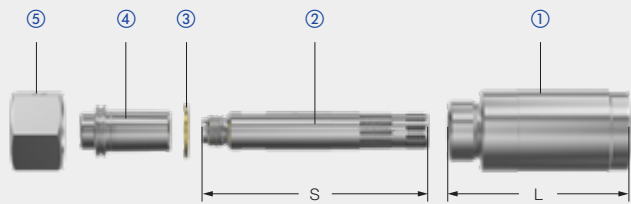
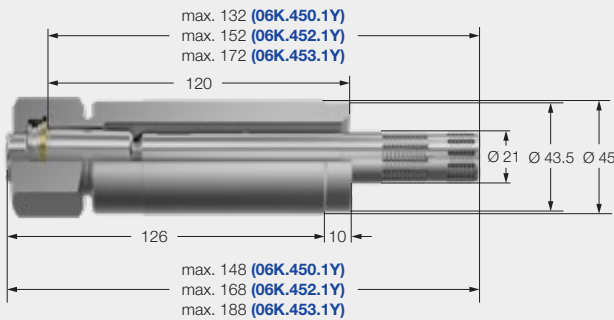
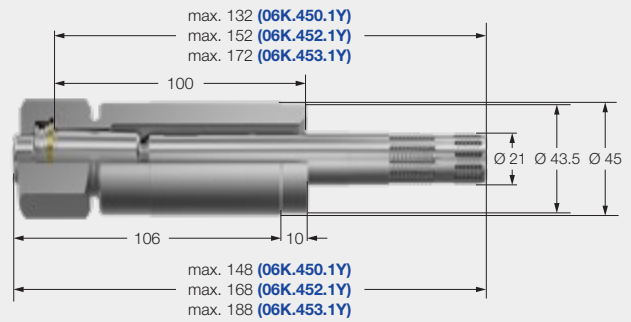
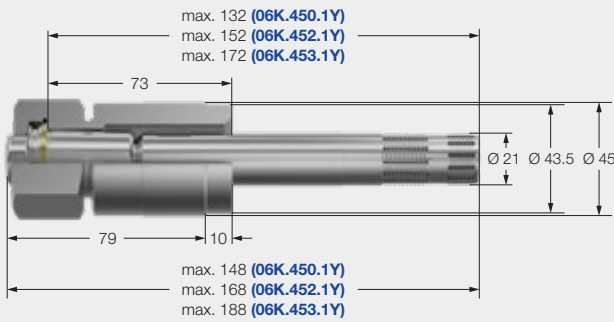
The optimum descaling solution for conventional hot strip and plate mills

- Improved rolled material surface
- Saves on pump energy
- Splash water quantity reduced

All dimensions in technical drawings and tables are in millimetres (unless stated otherwise).



SCALEMASTER ECO⁺



Special nut with hexagon socket for very narrow distances between nozzles

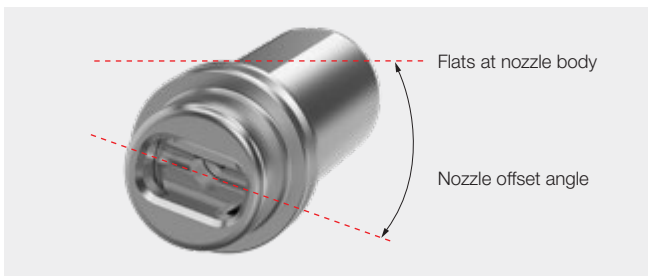
The new SCALEMASTER ECO+ with the innovative Booster combined with the additional offset angle options form the next step in the evolution of the SCALEMASTER family of descaling nozzles. It is interchangeable with all other SCALEMASTER nozzles of an equivalent overall length.

Designation	Order No.	Material	Dimensions	Weight [kg]
	Type			
① Welding nipple	069.410.1C.73 069.410.1C.00 069.411.1C.00	AISI 304	Length [mm]	0.490 0.710 0.830
			L = 73	
			L = 100 L = 120 Other length on request	
② Booster	06K.450.1Y 06K.452.1Y 06K.453.1Y	Stainless steel	With filter [mm]	0.142 0.182 0.222
			S = 110	
			S = 130 S = 150	
③ Gasket	095.015.34.04.02	Copper	-	0.005
④ Nozzle tip	6K4.XXX.XX.XX <small>See order table</small>	-	-	0.140
⑤ Nut (standard)	069.400.11	AISI 430 F	Hex 41 Max. torque 200 Nm	0.150
⑥ Special nut with hexagon socket	069.402.11	-	Hex 24 socket	0.251

Max. permissible operating pressure: 450 bar

Series	Order No. for nozzle tip					Material No. ¹	Offset angle			Equivalent bore diameter A [mm]	Water flow rate (V̇)					
	Code						0°	5°	15°		p = 100 bar (1,450 psi)		p = 200 bar (2,900 psi)		p = 400 bar (5,800 psi)	
	Nominal spray angle										[l/min]	[US gal/min]	[l/min]	[US gal/min]	[l/min]	[US gal/min]
	22°	26°	30°	34°	40°											
6K4	495	496	497	491	498	27	00	05	15	1.50	12.00	3.17	16.97	4.50	24.00	6.34
6K4	535	536	537	531	538	27	00	05	15	1.75	15.00	3.96	21.21	5.60	30.00	7.92
6K4	565	566	567	561	568	27	00	05	15	2.00	18.00	4.76	25.46	6.73	36.00	9.52
6K4	605	606	607	601	608	27	00	05	15	2.10	23.00	6.08	32.53	8.59	46.00	12.16
6K4	645	646	647	641	648	27	00	05	15	2.50	28.00	7.40	39.60	10.46	56.00	14.80
6K4	685	686	687	681	688	27	00	05	15	2.80	36.00	9.51	50.91	13.45	72.00	19.02
6K4	725	726	727	721	728	27	00	05	15	3.00	45.00	11.89	63.64	16.81	90.00	23.78
6K4	765	766	767	761	768	27	00	05	15	3.50	58.00	15.32	82.02	21.67	116.00	30.64
6K4	805	806	807	801	808	27	00	05	15	3.80	72.00	19.02	101.82	26.90	144.00	38.04
6K4	845	846	847	841	848	27	00	05	15	4.30	89.00	23.51	125.87	33.25	178.00	47.02
6K4	885	886	887	881	888	27	00	05	15	4.70	112.00	29.59	158.39	41.85	224.00	59.18
6K4		906	907	901	908	27	00	05	15	5.00	125.00	33.03	176.78	46.70	250.00	66.06
6K4		916	917	911	918	27	00	05	15	5.20	134.00	35.40	189.50	50.07	268.00	70.80

¹ Material No. 27: Stainless steel nozzle tip with tungsten carbide insert.



Please be aware that digits 9 and 10 indicate the integrated nozzle offset angle! Conversion of former series 6P4/682/694.XXX.27.00 ► **6K4.XXX.27.15**

Flow rate conversion for table:

$$\dot{V}_2 = \dot{V}_1 \cdot \sqrt{\frac{p_2}{p_1}} \quad [\text{l/min}] \quad p_2 = p_1 \cdot \left(\frac{\dot{V}_2}{\dot{V}_1}\right)^2 \quad [\text{bar}]$$

Ordering	Series	+	Code	+	Material No.	+	Offset angle	=	Order No.
example:	6K4	+	495	+	27	+	15	=	6K4.495.27.15



J-Type SCALEMASTER ECO⁺

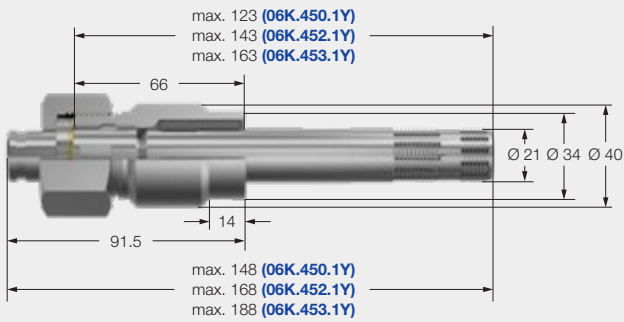
The energy-efficient alternative with two alignment tabs at the nozzle tips

- Saves on pump energy
- Water flow rate reduced
- Less cooling of rolled product

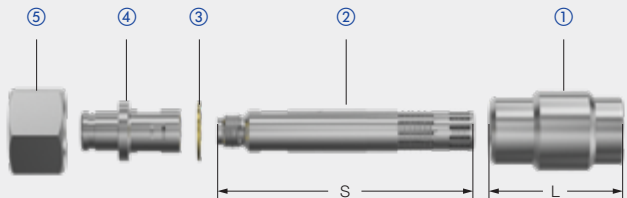
Dimensions in mm.



J-Type SCALEMASTER ECO⁺



The new SCALEMASTER ECO⁺ with the innovative Booster is now also available for installations with two alignment tabs. It is interchangeable with all other SCALEMASTER nozzles of an equivalent overall length.

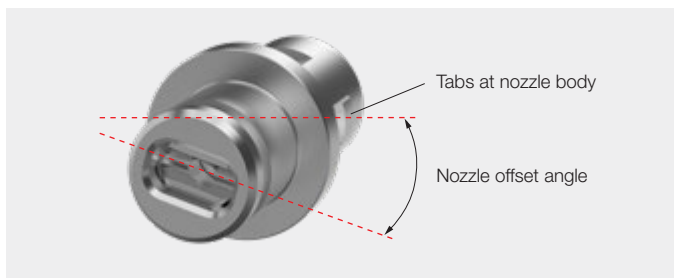


Designation	Order No.	Material	Dimensions	Weight [kg]
	Type			
① Welding nipple	06S.J10.1C.00	AISI 304	Length [mm]	0.830
			L = 66	
② Booster	06K.450.1Y 06K.452.1Y 06K.453.1Y	Stainless steel	With filter [mm]	0.142 0.182 0.222
			S = 110	
			S = 130 S = 150	
③ Gasket	095.015.34.09.31	Copper	–	0.005
④ Nozzle tip	6KJ.XXX.XX.XX <small>See order table</small>	–	–	0.140
⑤ Nut (standard)	06S.J00.11	AISI 431	Hex 41	0.150

Max. permissible operating pressure: 450 bar

Series	Order No. for nozzle tip					Material No. ¹	Offset angle			Equivalent bore diameter A [mm]	Water flow rate (V̇)					
	Code						0°	5°	15°		p = 100 bar (1,450 psi)		p = 200 bar (2,900 psi)		p = 400 bar (5,800 psi)	
	Nominal spray angle										[l/min]	[US gal/min]	[l/min]	[US gal/min]	[l/min]	[US gal/min]
	22°	26°	30°	34°	40°											
6KJ	495	496	497	491	498	27	00	05	15	1.50	12.00	3.17	16.97	4.50	24.00	6.34
6KJ	535	536	537	531	538	27	00	05	15	1.75	15.00	3.96	21.21	5.60	30.00	7.92
6KJ	565	566	567	561	568	27	00	05	15	2.00	18.00	4.76	25.46	6.73	36.00	9.52
6KJ	605	606	607	601	608	27	00	05	15	2.10	23.00	6.08	32.53	8.59	46.00	12.16
6KJ	645	646	647	641	648	27	00	05	15	2.50	28.00	7.40	39.60	10.46	56.00	14.80
6KJ	685	686	687	681	688	27	00	05	15	2.80	36.00	9.51	50.91	13.45	72.00	19.02
6KJ	725	726	727	721	728	27	00	05	15	3.00	45.00	11.89	63.64	16.81	90.00	23.78
6KJ	765	766	767	761	768	27	00	05	15	3.50	58.00	15.32	82.02	21.67	116.00	30.64
6KJ	805	806	807	801	808	27	00	05	15	3.80	72.00	19.02	101.82	26.90	144.00	38.04
6KJ	845	846	847	841	848	27	00	05	15	4.30	89.00	23.51	125.87	33.25	178.00	47.02
6KJ	885	886	887	881	888	27	00	05	15	4.70	112.00	29.59	158.39	41.85	224.00	59.18
6KJ		906	907	901	908	27	00	05	15	5.00	125.00	33.03	176.78	46.70	250.00	66.06
6KJ		916	917	911	918	27	00	05	15	5.20	134.00	35.40	189.50	50.07	268.00	70.80

¹ Material No. 27: Stainless steel nozzle tip with tungsten carbide insert.



Please be aware that digits 9 and 10 indicate the integrated nozzle offset angle! Nozzle with 15° offset
▶ 6KJ.XXX.27.15

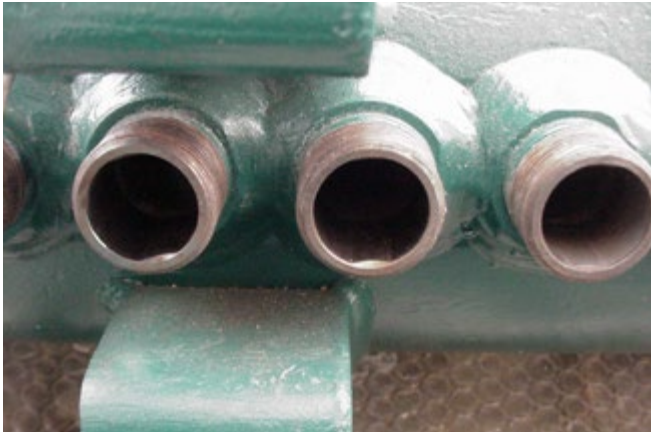
Flow rate conversion for table:

$$\dot{V}_2 = \dot{V}_1 \cdot \sqrt{\frac{p_2}{p_1}} \quad [\text{l/min}] \quad p_2 = p_1 \cdot \left(\frac{\dot{V}_2}{\dot{V}_1}\right)^2 \quad [\text{bar}]$$

Ordering	Series	+	Code	+	Material No.	+	Offset angle	=	Order No.
example:	6KJ	+	495	+	27	+	15	=	6KJ.495.27.15



ALTERNATIVE NOZZLE MOUNTING WHEN NOZZLES GET TOO CLOSE



MiniSCALEMASTER nipples at very narrow pitches with overlapping weld seams

Welding nipples have accommodated the descaling nozzle tips for decades. Those welding nipples, representing the number of nozzles, are welded on to pre-fabricated and pre-drilled header pipe.

When nozzle pitches become less than approximately 50 mm, the weld seams of the nipples overlap, which can lead to a triaxial state of stress that can form cracks. Welding difficulties in these narrow gaps can be an additional burden.

Lechler is well aware of the problems associated with cracked headers. As a result, Lechler offers a standard design solution for alternative header configurations, especially for new types of compact or uninterrupted strip production lines and plate mills, where the trend for lower spray heights continues.



THE NEW NOZZLE BRACKET FOR BETTER HEADERS

FEATURES

- Standardized and proven design
- Minimum nozzle pitch for MiniSCALEMASTER nozzles can now be realized without problems (40 mm with special nut, 43 mm with standard nut)
- Bracket is bolted to a flat surface
- Lechler precision-made, self-aligning bracket
- Available in any tailored length between 55 and 300 mm in 1.0 mm increments
- Each bracket can be replaced individually
- Available also for chevron header designs



THE NEW NOZZLE BRACKET

Lechler's new SCALEMASTER ECO⁺ bracket offers alternatives in both header design and nozzle mounting. It allows for alternative header configurations, especially for new types of compact or endless strip production lines and plate mills, where the trend for lower spray heights continues. Since the nipples are no longer welded on, all associated problems are also eliminated. Additionally, the nozzle offset angle against the centre axis of the header pipe is already built into the nozzle tips. The perfect alignment of the nozzles on the spray header ensures that the sprays hit the surface at an identical offset angle and distance, resulting in optimum descaling.



ADVANTAGES

- Interfacing dimensions can be downloaded
- Lowest spray heights for maximization of impact can be realized
- Welding of nipples eliminated
- Perfect nozzle positioning and alignment on header
- All kinds of headers possible
- Any type of special header can be designed
- Fast and cost effective repair of header

USER BENEFITS

- Greatest design flexibility
- Header designer does not have to design this crucial element of the header and saves time
- Single source for all relevant nozzle components
- The full potential of energy efficiency and surface quality optimizations can be utilized
- Costly cracked header failures avoided
- Increased operation safety and improved surface quality
- "Plug and spray" solution with all nozzle components from a single source
- Reduced downtime, maintenance cost savings



Nozzle bracket for MiniSCALEMASTER nozzles

All details

- The SCALEMASTER ECO+ bracket can be bolted directly to a pipe thus enabling the machining of a flat surface
- The SCALEMASTER ECO+ bracket is an ideal “bolt-on” interface between the header and the descaling nozzle. Welding of a large number of welding nipples with all the negative thermal consequences is no longer necessary
- When descaling headers are made from forged hollow shafts and the surface subsequently machined, the SCALEMASTER ECO+ bracket can be an ideal substitute for welding nipples

All dimensions in technical drawings and tables are in millimetres (unless stated otherwise).



Nozzle bracket

Part number: **06 B . XXX . MM . YY . ZZ**

Length of bracket [mm]

055-300

Material of screws

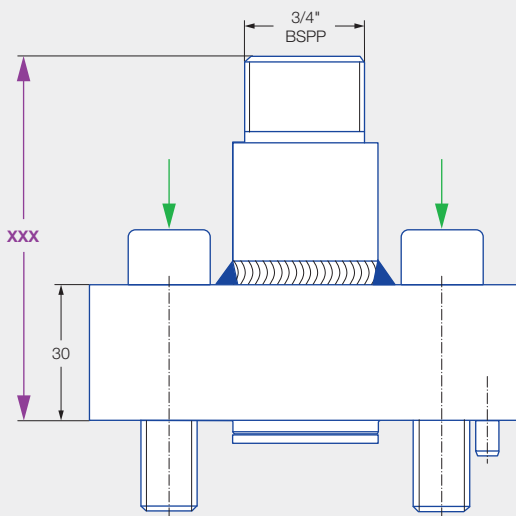
00 = steel
1C = 304 SS

Direction of offset angle

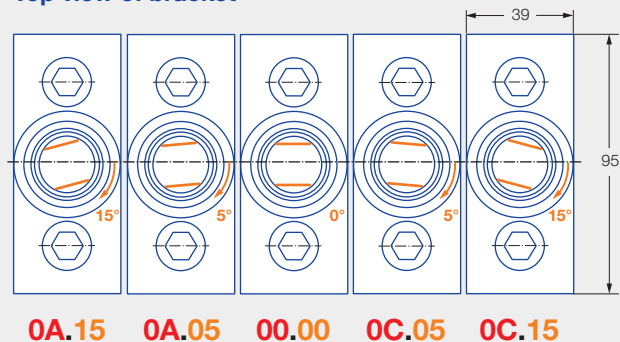
0C = clockwise
0A = anti-clockwise
00 = 0°

Nominal offset angle [°]

00
05
15



Top view of bracket



In combination with nozzle offset angle 0° (nozzle type **6K3.XXX.27.00.00**) ZZ is the final offset angle of the spray pattern.

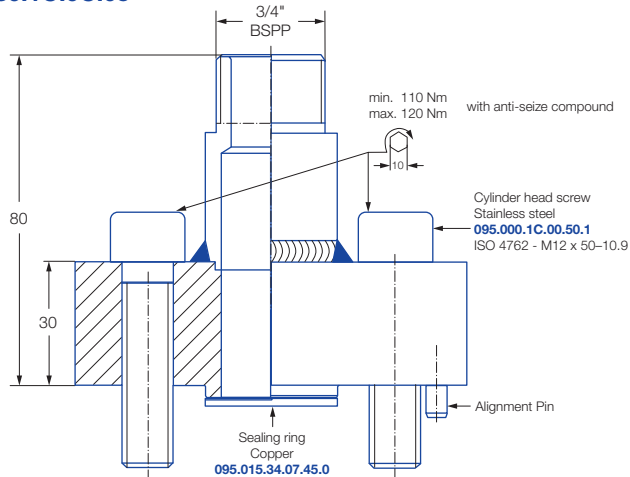
In order to compensate for the slight nozzle tip rotation during tightening of the nut, the as-built angle is 3° anti-clockwise rotated to the nominal offset. This helps to get the precise offset angle.

Max. pressure 450 bar
Nozzle bracket itself is made from stainless steel 304

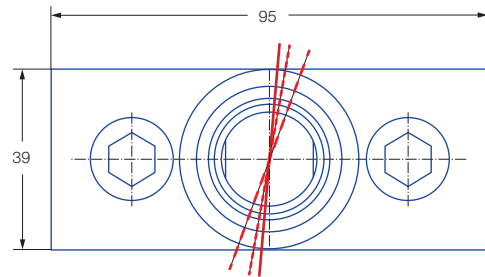
Example:

06B.080.1C.0C.05

Dimensions in mm.



80 mm length,
5° clockwise offset angle

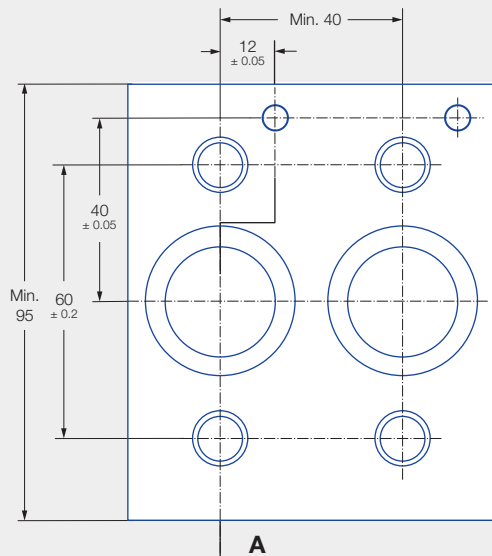
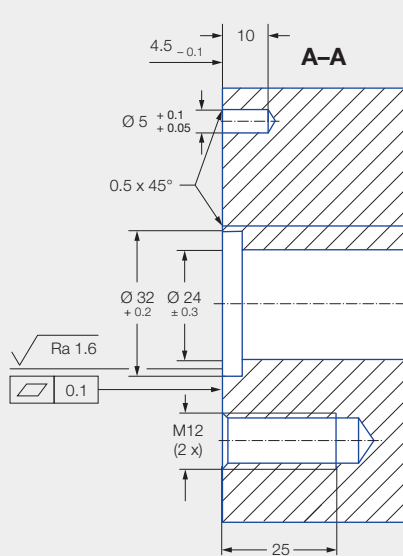


Orientation of nozzle spray in combination with nozzle:

- 6K3.XXX.27.00.00 -> spray offset angle = 5° (clockwise)
- - - 6K3.XXX.27.05.00 -> spray offset angle = 10° (clockwise)
- · - 6K3.XXX.27.15.00 -> spray offset angle = 20° (clockwise)

Bore pattern on spray header

Dimensions in mm.



Accessories

Component	Order No.
Special nut with hexagon socket (material: stainless steel) (recommended for pitches less than 43 mm)	064.401.11.00.00
Nut (standard) (material: stainless steel)	064.400.11.00.00
Nozzle	6K3.XXX.27.00.00
Cylinder head screw (material: steel)	095.000.00.00.50.1
Cylinder head screw (material: stainless steel)	095.000.1C.00.50.1
Sealing ring (material: copper)	095.015.34.07.45



LECHLER DESCALING HEADERS HOW TO GET SPRAYS IN LINE

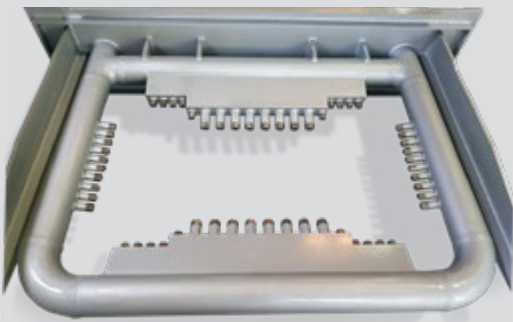


Seamless pipe mills

Descaling header for a seamless pipe mill. Configuration with Lechler DESCALE application software.

The optimal nozzle arrangement on spray headers is as important as the selection of the correct nozzle. That's why Lechler also offers engineering and production of spray headers. With this service, the circle is now complete, starting from the development of the spray nozzle and measuring the spray performance through to application engineering and finally the spray header.

With transparent processes, audited and certified by world leading plant engineering companies, Lechler spray headers undergo dedicated QA procedures from production planning to dimensional control prior and during production. Quality control also includes nondestructive testing of the material, welds and the final header. Either performed according to a customer's special QA specifications or according to the internal Lechler NDT standards. No header leaves a Lechler factory without its test certificate.



Beam blank rolling mills

Special descaling header design for a beam blank with identical spray height at flanges, tips and web.

YOUR BENEFITS

Header and nozzles from one source

- Reduced number of suppliers
- Fewer project interfaces to coordinate

Optimized spray header design from the nozzle experts due to

- Process know-how
- Nozzle application know-how

Guaranteed overall spray performance

- Welding nipples and bases welded correctly
- Perfect nozzle alignment

Product quality and plant availability

- Approved and certified NDT and QA procedures
- Longer lifetime, less downtime



Plate and hot strip mills

Bottom descaling header for a 5,000 mm plate mill descaler.

- Headers engineered and manufactured by Lechler

- Header manufactured according to customer drawings

NOZZLE ARRANGEMENT ON THE SPRAY HEADER

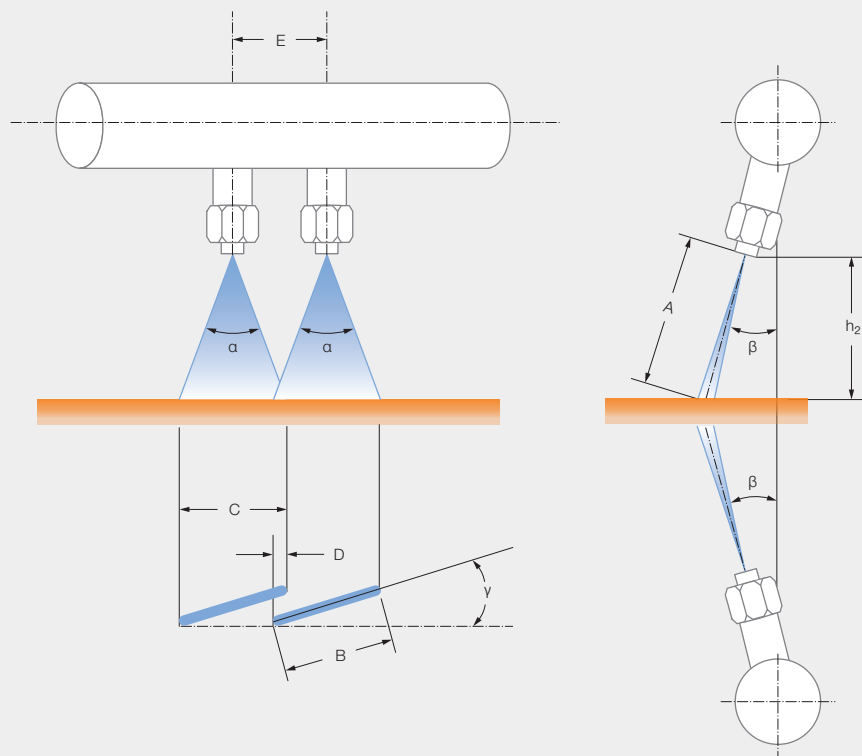


Data and terminology

$E = C - D$
 $C = \cos \gamma \cdot B$
 $\beta = 5^\circ, 10^\circ \text{ or } 15^\circ$

- A = Spray length
- B = Spray width
- C = Spray width in rolling direction
- D = Overlap
- E = Nozzle distance

- h_2 = Vertical spray height
- α = Nozzle spray angle
- β = Angle of inclination
- γ = Offset angle of the nozzle against pipe roll axis
- Standard: $0^\circ, 5^\circ$ and 15°



Vertical spraying height h_2 [mm]	Angle of inclination $\beta = 15^\circ$ A [mm]	Nominal nozzle spray angle α at $p = 150$ bar																			
		$\alpha = 22^\circ$				$\alpha = 26^\circ$				$\alpha = 30^\circ$				$\alpha = 34^\circ$				$\alpha = 40^\circ$			
		B [mm]	C [mm]	D [mm]	E [mm]	B [mm]	C [mm]	D [mm]	E [mm]	B [mm]	C [mm]	D [mm]	E [mm]	B [mm]	C [mm]	D [mm]	E [mm]	B [mm]	C [mm]	D [mm]	E [mm]
50	52	26	25	–	–	30	29	–	–	35	34	–	–	39	38	–	–	47	45	5	40*
75	78	36	35	–	–	43	42	5	37*	49	47	5	42*	55	53	6	47**	67	65	7	58**
100	104	47	45	7	38*	56	54	5	49**	64	62	5	57***	71	69	7	62***	55	85	8	77
125	129	57	55	7	48**	68	66	7	59***	78	75	7	68	87	84	9	75	108	104	10	94
150	155	68	66	8	58***	81	78	7	71	93	90	8	82	103	99	9	90	128	124	10	114
200	207	89	86	9	77	106	102	10	92	122	118	10	108	134	129	13	116	168	162	15	147
250	259	111	107	11	96	132	128	10	118	151	146	15	131	166	160	15	145	209	202	15	187

* Only **MiniSCALEMASTER ECO+** with hexagon socket nut.

** Only **MiniSCALEMASTER ECO+**.

*** Only with hexagon socket nut.

Dimensions in table apply for 15° offset angle only.

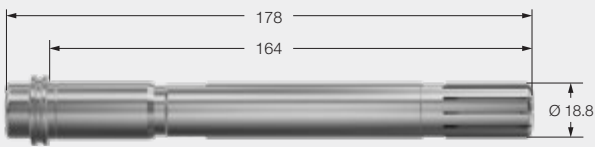
WSV Water Stop Valve For thermomechanical rolling

- The WSV is a check valve which includes the stabilizer
- Every WSV comes with a filter
- Material completely made of stainless steel
- Metallic sealing
- Piston hardened

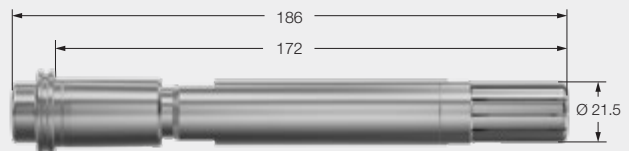
Dimensions in mm.

MiniSCALEMASTER ECO+

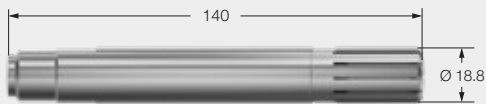
SCALEMASTER ECO+



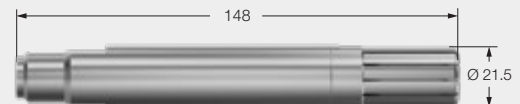
WSV with nozzle 6K3



WSV with nozzle 6K4



WSV (for series 6K3) without nozzle



WSV (for series 6K4) without nozzle

Advantages for users

During the thermomechanical rolling of steel plate and when rolling stainless steel strip, descaling is not performed for every roll pass. Nozzle check valves are used here to prevent undesired surface cooling of the rolling stock caused by the system prefilling water, which would otherwise flow unrestricted through the nozzle tip.

For series	Order No.	Opening pressure [bar]	Closing pressure [bar]	Material
SCALEMASTER ECO+ (6K4)	06K.470.16	14	10	Stainless steel
MiniSCALEMASTER ECO+ (6K3)	06K.370.16	14	10	Stainless steel

Very large internal free cross sections

Non-clogging design

High operating safety

Simple design

Components can be replaced

Easy maintenance

Extended service life

Less maintenance

Low maintenance costs

Accessories

That keep your rolling rolling

Descaling pressure gauge

Hand held pressure reading

With the new Lechler descaling pressure gauge the water pressure can be measured directly at the spray header in front of a descaling nozzle by simply taking one nozzle out and fitting the pressure sensor instead.

For detailed information please ask for the special product data sheet.

- Simple and user-friendly key operation
- Two sensor inputs, automatic sensor recognition

Sensor details

- Measuring range: 0–600 bar
- Burst pressure: 2,000 bar
- Accuracy of sensor: $\pm 0.25\%$ of full scale (± 1.5 bar)
- Protection class: IP67

Complete descaling pressure gauge

Sensor adaptors for 6K3 (Mini SM ECO+) and 6K4 (SM ECO+) nozzle tips included.

Order No. 06P.M00.00.00.00



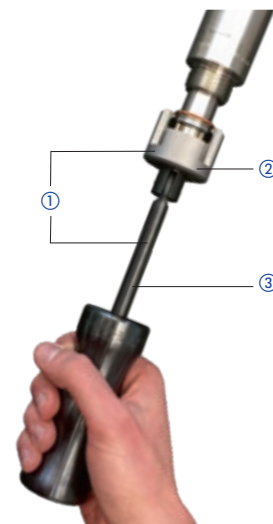
Hand held pressure reading



Disassembly set

The disassembly set is pushed onto the recess on the mouthpiece. The entire nozzle unit can be pulled out when the union nut is unscrewed.

Designation	Order No.	
	SCALEMASTER ECO+	MiniSCALEMASTER ECO+
① Disassembly set	069.492.12.00.00	064.492.12.00.00
② Tip extractor	069.492.12.00.10	064.492.12.00.10
③ Extraction tool	095.009.00.12.56	095.009.00.12.56



Anti-seize compound

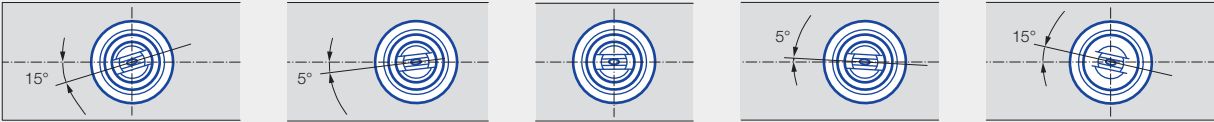
Application of the anti-seize compound on the thread of the welding nipples is recommended and ensures easy removal of the nut. **Order No. 9ET.048.29.00.00**; 80 g

Correct nozzle alignment Accessories

Nozzle spray positions

1. All nozzle jets turned parallel in one direction.
2. Half of the nozzle jets turned outwards in opposite directions. This directs the spray water to both sides (see Fig. 1).

Fig. 1



Nipple installation

For the standard installation with all nozzle jets turned parallel in one direction, the welding nipples on the spray header must be positioned so that the flat inner surfaces are parallel to the header's longitudinal axis. The required jet offset angle can be achieved by using the nozzle tips with the corresponding offset angle, e.g. **6K4.XXX.27.15** for 15° offset.

Order numbers for alignment tips

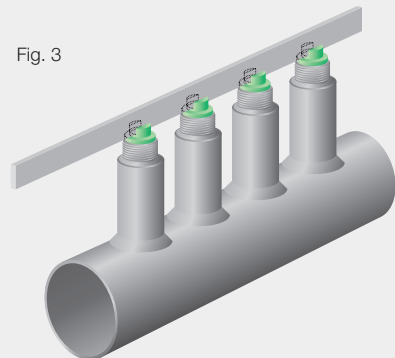
	Mini SCALEMASTER ECO ⁺			SCALEMASTER ECO ⁺		
	0° Offset angle	5° Offset angle	15° Offset angle	0° Offset angle	5° Offset angle	15° Offset angle
In-line installation (all sprays in one line)	064.490.01.00 in combination with nozzle 6K3.XXX.27.00	-	-	069.490.01.00 in combination with nozzle 6K4.XXX.27.00	-	-
Standard installation (all sprays turned parallel in one direction)	-	064.490.01.00 in combination with nozzle 6K3.XXX.27.05	064.490.01.00 in combination with nozzle 6K3.XXX.27.15	-	069.490.01.00 in combination with nozzle 6K4.XXX.27.05	069.490.01.00 in combination with nozzle 6K4.XXX.27.15
Chevron design (half of the sprays turned outwards in opposite directions, center perpendicular)	-	one half: 064.490.01.00 other half: 064.490.01.08 center: 064.490.01.05 in combination with nozzle 6K3.XXX.27.05	one half: 064.490.01.00 other half: 064.490.01.01 center: 064.490.01.02 in combination with nozzle 6K3.XXX.27.15	-	one half: 069.490.01.00 other half: 069.490.01.08 center: 069.490.01.05 in combination with nozzle 6K4.XXX.27.05	one half: 069.490.01.00 other half: 069.490.01.01 center: 069.490.01.02 in combination with nozzle 6K4.XXX.27.15

The alignment tip is inserted into the flat nipple opening. A ruler (or similar) can now be used to easily bring the nipples into the correct parallel positions where they can be tack welded in place (see Fig. 3). The alignment tips (see Fig. 2) can also be used as a dummy part for hydrostatic pressure testing.

Fig. 2



Fig. 3





QUESTIONNAIRE FOR NOZZLE ARRANGEMENT

We will be happy to advise you on how to achieve the best descaling results with minimum energy input. Simply fill out the form and send it to the relevant email address on the last page.

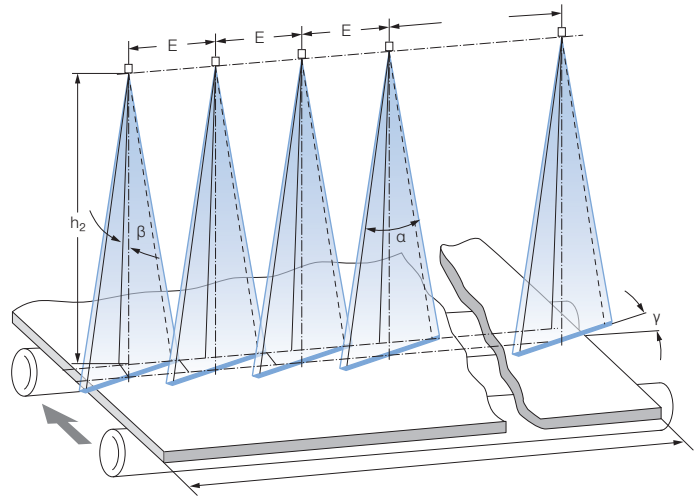
Company

Responsible

Address

Phone

Email



Questionnaire on existing descaling nozzle arrangement

Name:		Date:	Department:		
Location of descaling installation:		<input type="checkbox"/> Behind the furnace	<input type="checkbox"/> RSB	<input type="checkbox"/> FSB	<input type="checkbox"/> Interstand descaling
Format	Dimensions [mm]	Nozzle data	top	bottom	
Strip		Number of headers			
Slab		Nozzle type			
Plate		Horizontal distance (E)	[mm]	[mm]	
Bloom		Number of nozzles			
Billet		Vertical spray height (h_2)	[mm]	[mm]	
Rounds		Spray angle (α)	[°]	[°]	
Material speed		[m/s]			
Pressure at header		[bar]			
Available max. water flow		[l/min]	[°]	[°]	
		[l/h]	[°]	[°]	
Space for sketch:					

Good to know

You can also enter the required data online – either via the QR code on the right.
<https://lechler-event.de/r/nozzlearrangement>





METALLURGICAL SPRAY APPLICATIONS WE HAVE THE WORLD COVERED





 **Headquarters**

 **Production**

 **Sales**



Germany

Lechler GmbH
Ulmer Strasse 128
72555 Metzingen
Phone +49 7123 962-0
info@lechler.de



China

Lechler Nozzle Systems
(Changzhou) Co., Ltd.
No.99 Decheng Rd, Jintan
Changzhou, JS 213200, P.R.C
Phone +86 519-6822 8088
info@lechler.com.cn



India

Lechler (India) Pvt. Ltd.
Plot B-2
Main Road
Wagle Industrial Estate Thane
400604 Maharashtra
Phone +91 22 40634444
lechler@lechlerindia.com



USA

Lechler Inc.
445 Kautz Road
St. Charles, IL 60174
Phone +1 630 3776611
info@lechlerusa.com



ASEAN

Lechler Spray Technology
Sdn. Bhd.
No. 22, Jalan Astaka 4B/KU2
Bandar Bukit Raja
41050 Klang, Selangor
Malaysia
Phone +603 3359 1118
info@lechler.com.my



Belgium

Lechler S.A./N.V.
Avenue Newton 4
1300 Wavre
Phone +32 10 225022
info@lechler.be



Finland

Lechler Oy
Ansatie 6 a C 3 krs
01740 Vantaa
Phone +358 207 856880
info@lechler.fi



France

Lechler France SAS
Bât. CAP2
66-72 Rue Marceau
93100 Montreuil
Phone +33 1 49882600
info@lechler.fr



Great Britain

Lechler Ltd.
1 Fell Street, Newhall
Sheffield, S9 2TP
Phone +44 114 2492020
info@lechler.com



Italy

Lechler Spray Technology S.r.l.
Via Don Dossetti, 2
20080 Carpiano (Mi)
Phone +39 2 98859027
info@lechleritalia.com



Spain

Lechler, S.A.
C / Isla de Hierro, 7 –
Oficina 1.3
28703 San Sebastián de
los Reyes (Madrid)
Phone +34 91 6586346
info@lechler.es



Sweden

Lechler AB
Kungsängsvägen 31B
753 23 Uppsala
Phone +46 18 167030
info@lechler.se

- Subsidiary
- Sales office/sales representative

Full range from one source

Precise spray applications play a crucial part in many areas of steel production and non-ferrous metallurgy: from cooling in continuous casting processes and roller cooling through to descaling and strip treatment. Lechler offers special nozzles made of a wide range of different materials to cover all applications. The focus is always on achieving the optimum result with the lowest possible consumption of energy and spray media – thus also significantly reducing the overall carbon footprint.

Global representation

We are at home right at the heart of Europe. In Metzingen, Germany, we have developed unique expertise in planning, calculation and realization of metallurgical spray applications. From here, we support you with our highly qualified experts and sales partners all over the world.

We do not just see ourselves as a supplier, however. Because we also support you in process optimization on-site. Thanks to our international network of production locations, subsidiaries and sales offices/sales representatives, we can always guarantee fast part availability and short distances for service work. Contact us and experience this for yourself. We look forward to hearing from you.

**ENGINEERING
YOUR SPRAY SOLUTION**



Lechler GmbH · Precision Nozzles · Nozzle Systems

Ulmer Strasse 128 · 72555 Metzingen, Germany · Phone +49 7123 962-0 · info@lechler.de · www.lechler.com

ASEAN: Lechler Spray Technology Sdn. Bhd. · 22, Jln. Astaka 4B/KU2 · Bdr. Bukit Raja · 41050 Klang · Malaysia · Phone +603 3359 1118 · info@lechler.com.my

Belgium: Lechler S.A./N.V. · Avenue Newton 4 · 1300 Wavre · Phone +32 10 225022 · info@lechler.be

China: Lechler Nozzle Systems (Changzhou) Co., Ltd. · No.99 Decheng Rd, Jintan, Changzhou, JS 213200, P.R.C · Phone +86 519-6822 8088 · info@lechler.com.cn

Finland: Lechler Oy · Ansatie 6 a C 3 krs · 01740 Vantaa · Phone +358 207 856880 · info@lechler.fi

France: Lechler France SAS · Bât. CAP2 · 66-72 Rue Marceau · 93100 Montreuil · Phone +33 1 49882600 · info@lechler.fr

Great Britain: Lechler Ltd. · 1 Fell Street, Newhall · Sheffield, S9 2TP · Phone +44 114 2492020 · info@lechler.com

India: Lechler (India) Pvt. Ltd. · Plot B-2 · Main Road · Wagle Industrial Estate Thane · 400604 Maharashtra · Phone +91 22 40634444 · lechler@lechlerindia.com

Italy: Lechler Spray Technology S.r.l. · Via Don Dossetti, 2 · 20080 Carpiano (Mi) · Phone +39 2 98859027 · info@lechleritalia.com

Spain: Lechler, S.A. · C / Isla de Hierro, 7 – Oficina 1.3 · 28703 San Sebastián de los Reyes (Madrid) · Phone +34 91 6586346 · info@lechler.es

Sweden: Lechler AB · Kungsängsvägen 31B · 753 23 Uppsala · Phone +46 18 167030 · info@lechler.se

USA: Lechler Inc. · 445 Kautz Road · St. Charles, IL 60174 · Phone +1 630 3776611 · info@lechlerusa.com



Edition 07/22 · EN · 1,000 · www.dgm-kommunikation.de
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