ENGINEERING
YOUR SPRAY SOLUTION

LECHLER

Precision Nozzles and Systems for Roll Cooling Solutions in Rolling Mills

Roll Cooling

HENNLICH - ŽIJEME TECHNIKOU

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COMPETENCE IN THE METALLURGICAL INDUSTRY

Lechler nozzles have been setting standards in quality, performance and design for over 135 years.

A wide range of specially developed and proven nozzles of many different designs and in a range of materials is available for applications throughout the processes of metal smelting, refining, casting, rolling and processing. You can also select from over 20.000 other Lechler nozzles for a very wide range of other applications — with new ones being added to the range daily!

A dynamic market with high expectations

Global steel production will increase dramatically in the years ahead. The globalisation of the steel industry is not yet complete.

Every year, new steel-making companies are being newly formed, with production plants on every continent. The trend is similar in the case of the aluminium industry and the producers of non-ferrous metals.

The metallurgical industry places stringent demands on its suppliers

Most metallurgical plant and machine builders are already organised and active globally. Process optimisations, along with new technologies, enable production capacities to be permanently increased and the product quality of the metals produced to be further improved.
Nozzles and nozzle systems play an important role here in all production stages.
The following basic requirements must be met for a successful partnership:

Great innovative strength in order to realise new technologies.

High problem-solving competence for ensuring plant availability.

Global organisation as a guarantee of customer proximity and worldwide service.

Lechler meets these requirements in full.

Wherever you are in the world, Lechler is close by and employs over 680 people

With production facilities in Germany, the USA, England, Hungary, India and China, sales offices in France, Spain, the BENELUX countries, Sweden and Finland, and representatives in over 25 countries, Lechler has a global network of service stations. This guarantees technical support for plant operators, a supply of spare parts and ongoing training of maintenance staff throughout the world.


Headquarters, Germany


Lechler Ltd., United Kingdom


Lechler Inc., USA

FUNDAMENTALS IN ROLL COOLING

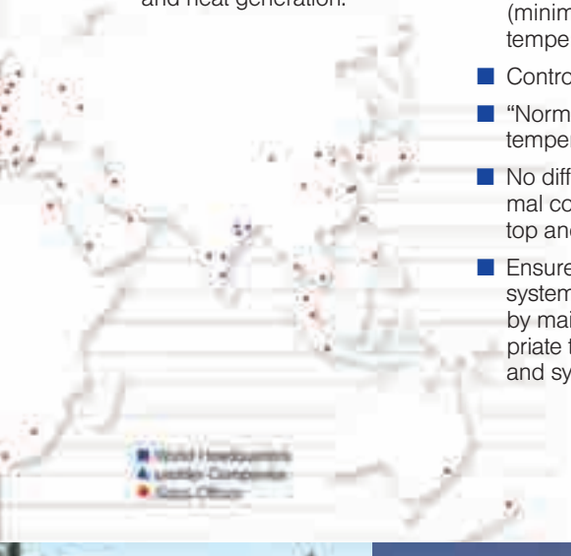
In the process of rolling the most significant aspect is the generation of heat through friction and deformation in the roll bite.The most important aspects are:

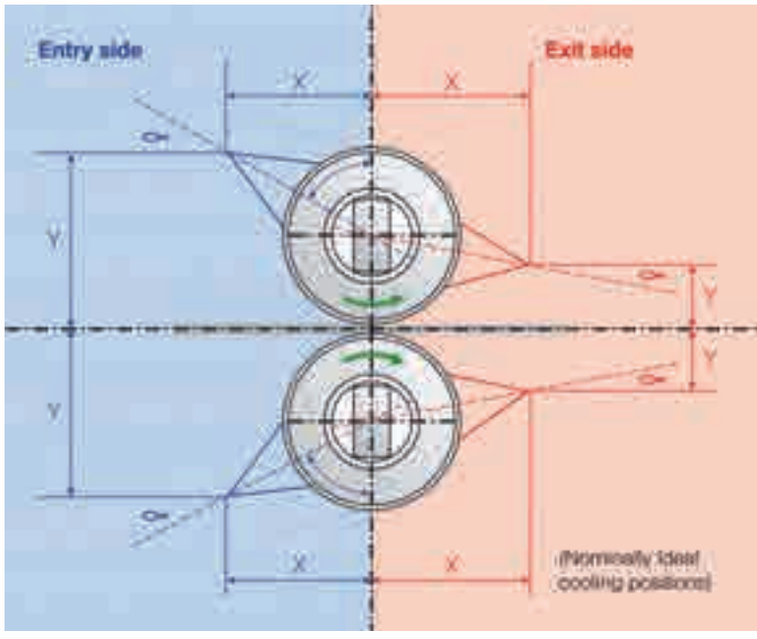
- Maintaining uniform, stable roll temperatures, circumferentially around the roll and transversely across the roll with
- Creating optimum thermal crowns and minimum differential in temperature in the upper and lower work rolls with optimum heat extraction

Because of the current demands on mills to process much lighter exit gages from increased incoming hot strip thickness, much larger reductions are necessary on individual mill stands, such high reductions at a nominal width result in a larger area of contact with corresponding higher rolling force, friction and heat generation.

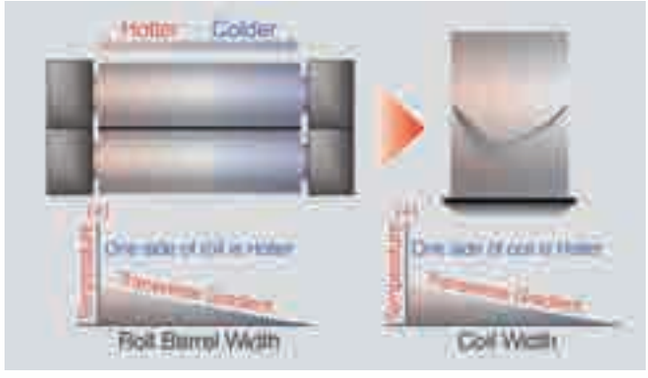
These high reduction schedules combined with the requirement to produce widening range of material cross-sections with a more diverse range of softer and harder materials also result in increasingly greater challenges in the control of roll temperature and the effective transfer / extraction of heat.
Establishing a uniform homogenous cooling across the rolling width with a uniform and acceptable thermal distribution (no gradients) is the ultimate goal as regards cooling and assures that the universal problem of post cooled shape after recoil is minimized.
A well designed, cooling system in good operating condition will achieve several important objectives

- Maximum heat extraction at minimal coolant consumption
- Symmetrical thermal profiles on the work rolls (minimum gradient in temperature)
- Controlled thermal crowns
- “Normal” steady state roll temperatures
- No differentials in the thermal conditions between the top and bottom work roll
- Ensure that the roll bending system is kept within range by maintaining the appropriate thermal crown height and symmetry

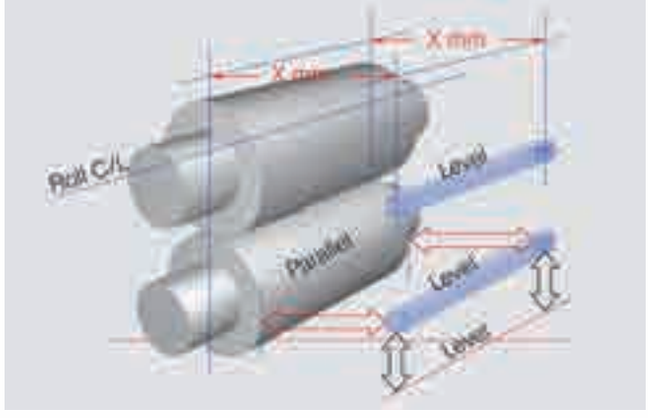




Symetrical top and bottom roll cooling arrangements



Roll and coil transverse temperature gradients



Top and bottom spray header in line (parallel) to center lines of work rolls

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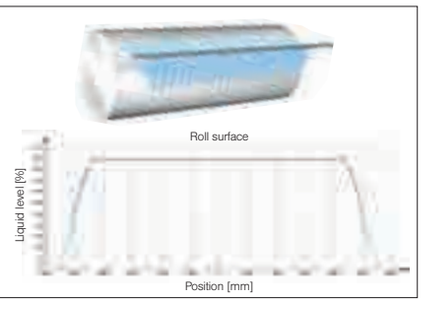
THERMAL ROLL COOLING STUDIES

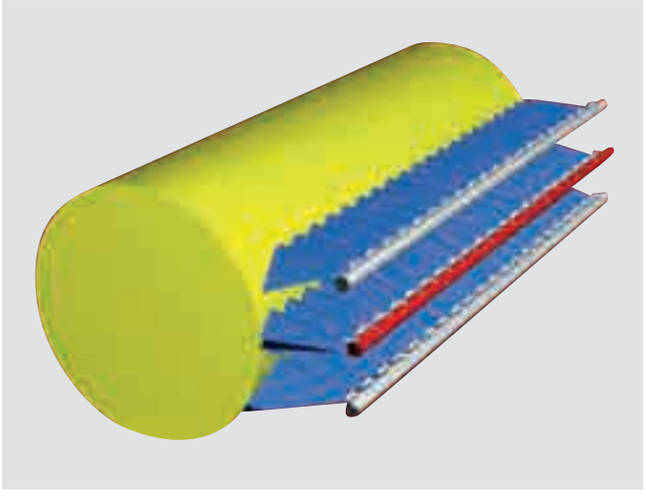
Over the life span of a rolling mill the requirements in terms of product quality and the range of steel grades may change significantly. In particular the capability of the installed roll cooling systems needs to be investigated as one of the key technology area when it comes to process modifications aiming for a higher productivity.

Having engineered and installed more than 350 selective cooling systems in steel, aluminium and non-ferrous rolling mills and having revamped a large number of conventional roll cooling systems in hot and cold rolling mills Lechler has the competence and experience to also help you to optimize your roll cooling system performance.

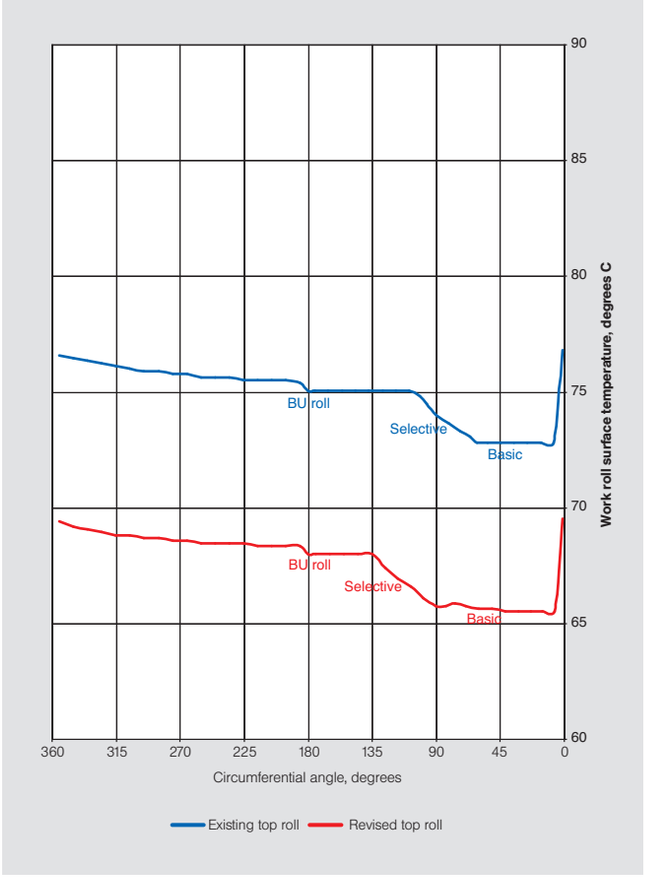


Optimum strip flatness thanks to simulation of the nozzle arrangement

Where the capability of Lechler was limited to the investigation of the coolant volume distribution characteristic Lechler can now also simulate the **thermal cooling effect** of the existing work roll sprays with a computer model.



Roll cooling nozzle arrangement



Circumferential work roll temperature profile before (blue) and after (red) optimization

Thermal roll cooling studies help to:

- Improve product quality
- Increase mill speed and productivity
- Experience of 350 Roll cooling systems installed
- Optimized roll cooling headers and nozzles from one source

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SAFE COSTS AND ENERGY

OPTIMIZE YOUR PROCESS

A roll cooling study is a systematic and structured approach and delivers a wide range of benefits by determining the improvements that can be obtained by an upgraded cooling system with improved operation and maintenance practices. The thoroughly documented final report, containing collected and analysed data and a proposal for future improvements through a system upgrade, forms a comprehensive and indispensable tool for decision making.

A study also identifies problems and causes which were previously not recognised. The time, efforts and cost of such work is insignificant in comparison with the potential benefits of a properly executed study which results in an optimised roll cooling system and the subsequent improvements in product quality, productivity and reduced operation costs.

Roll Cooling Study Phase 1

A typical roll cooling study would be carried out in two phases:

In Phase 1 a site visit could be the start during which data would be collected.

Benchmarking

Also included in Phase 1 would be the benchmarking of the cooling effect of the existing header and nozzle arrangement.
Based on the cooling effect and the heat input data the top and bottom work roll temperature can be calculated.
Spray cooling asymmetries and any other problematic areas would be highlighted in the final report f phase 1.
Speed and work roll diameter differences are being considered.

Roll Cooling Study Phase 2

There can be a number of reasons for conducting a study. The most common are:

- Identify strip shape defects and to eliminate them
- Extend work roll life time
- Increase rolling speed and productivity
- Improve maintenance friendliness and reduce costs
- Optimize coolant flow and hence save energy and coolant treatment costs
- Change of product formats and steel grades (product mix)

Objectives

In most cases it is a combination of all six reasons that determines the objectives for a revamp of the roll cooling system. It is important that these objectives are clearly defined so as to provide the study with a clear focus when preparing the final study report.

Based on the result of the benchmarking and the objectives the required cooling effect and the new heat input into the work rolls would be calculated. With these as an input a recommendation for an optimized nozzle and header arrangement would be worked out for every stand.

Mill Types

Roll cooling studies can be performed for the following flat rolling mills:

- Steel hot strip mills
- Tandem steel cold rolling mills
- Reversing steel cold rolling mills
- Steel plate rolling mills
- Every type of aluminum hot, cold and foil rolling mill
- Every type of NF-rolling mill (copper, brass etc.)

Lechler scope of supply

Phase 1 - Existing

- Performance of the entire site survey including the roll temperature measurements
- Presentation of the final report of Phase 1 (benchmarking)

Phase 2 - Optimization

- Calculation of the newly set cooling parameters which includes total coolant flow rates and pressures
- Complete basic and detailed engineering for new nozzle and header arrangement
- Manufacturing and supply of the new set of nozzles and accessories
- Fabrication and supply of the new set of roll cooling headers

Optimized spray header designed and fabricated by Lechler

Please contact Lechler for a first discussion regarding the optimization of your roll cooling system.

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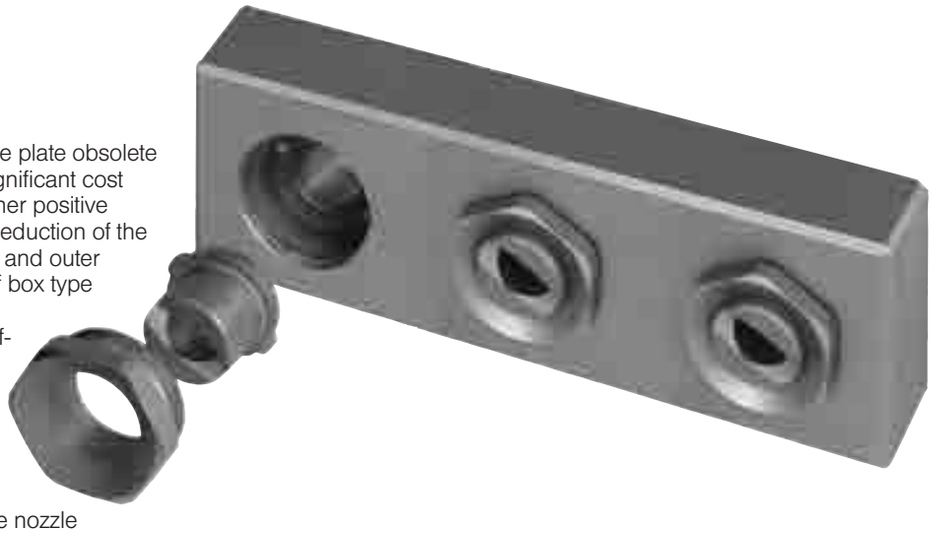
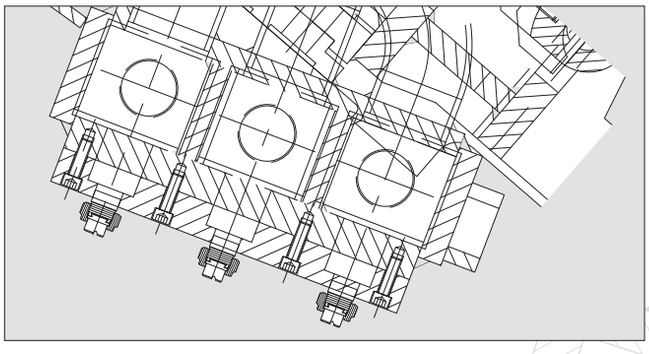
ROLL COOLING FLAT JET NOZZLE

NEW !
Patent Pending

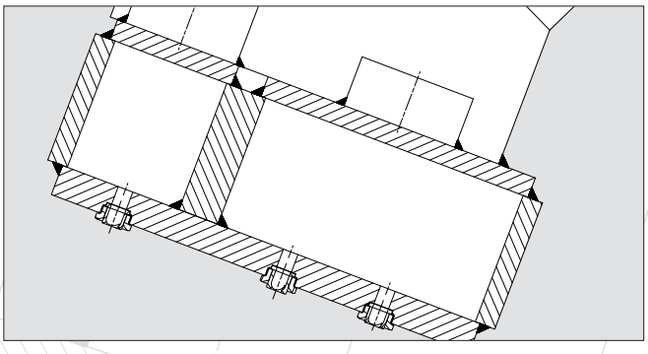


The correct alignment of the roll cooling nozzles on the spray header is essential for optimal roll cooling. Flat jets are the preferred spray pattern for roll cooling, therefore only a self aligning nozzle design provides the operation safety required in a modern rolling mill.
All flat jet nozzles of the Lechler series 6E4 and 6E5 come with an automatic self aligning feature which ensures that every nozzle will always be installed under the correct spray offset angle towards the roll center line.

mediate nozzle plate obsolete resulting in significant cost savings. Another positive aspect is the reduction of the overall weight and outer dimensions of box type headers.
The correct offset angle is machined directly into the header front plate and does not depend on the nozzle tip. The two keys on the nozzle tip are always in line with the flat jet spray axis.



Example of conventional box type header



Example of new box type header with 6E series nozzle

No welding nipple is required for the 6E nozzle series because the tip geometry can be machined directly into a front plate of a box type spray header. A hollow nozzle nut holds the nozzle tip in place. This simple but innovative design does make all the welding nipples and the inter-

This prevents wrong fabrication caused by design mistakes.

The nozzle tip seals metallically against the bottom of the header plate machined surface.

The Spray has a parabolic liquid distribution which is ideal for a multi nozzle header arrangement

- Parabolic liquid distribution
- Automatic nozzle alignment
- High operation safety
- No welding nipples required
- Simplifies the design of boxtype headers because:
  - No welding nipples required
  - Reduces header weight
  - Reduces outer header dimension
  - Reduces header costs significantly

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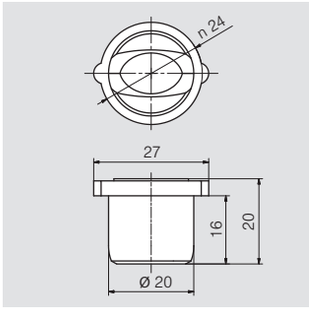
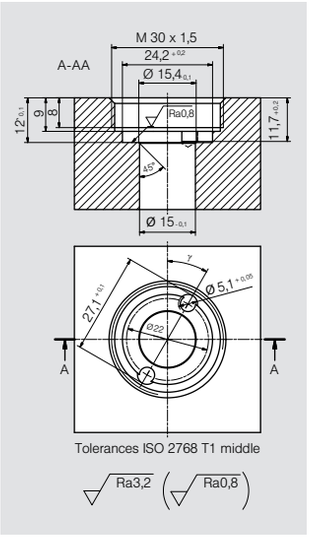
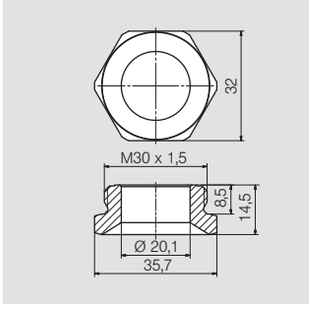
Nozzle series 6E4/6E5
Weight: 28 g



Spray width [B] at p=3 bar		
H / B	H 250 mm	H 500 mm
6E4.721 - 6E4.921	100	200
6E4.941 - 6E5.201	115	210
6E4.722 - 6E4.962	150	300
6E4.982 - 6E5.202	160	310
6E4.723 - 6E4.963	220	440
6E4.983 - 6E5.203	250	490
6E4.724 - 6E4.964	330	630
6E5.984 - 6E5.204	340	640



Hollow-core screw
Weight: 41 g



Hollow-core screw

Ordering-no.
06E. 400. 11 (AISI 430 F)
06E. 400. 17 (316 SS)
06E. 400. 30 (brass)

Material AISI 430 F:
Non austenitic stainless steel

Blind tip for pressure testing

Ordering-no. **06E.490.1Y**

Ordering no. Type				Mat. no.		E Ø [mm]	V̇ [l/min] p [bar]							
				17 316 SS	30 Brass		0,5	1,0	2,0	40* psi	3,0	5,0	7,0	10,0
20°	30°	45°	60°											
6E4. 721	6E4. 722	6E4. 723	6E4. 724	○	○	2,1 - 2,5	3,15	4,45	6,30	1,95	7,72	9,96	11,79	14,09
6E4. 761	6E4. 762	6E4. 763	6E4. 764	○	○	2,3 - 2,8	4,00	5,66	8,00	2,48	9,80	12,65	14,97	17,89
6E4. 801	6E4. 802	6E4. 803	6E4. 804	○	○	2,6 - 3,2	5,00	7,07	10,00	3,10	12,25	15,81	18,71	22,36
6E4. 841	6E4. 842	6E4. 843	6E4. 844	○	○	3,0 - 3,6	6,25	8,84	12,50	3,88	15,31	19,67	23,39	27,95
6E4. 881	6E4. 882	6E4. 883	6E4. 884	○	○	3,4 - 4,0	8,00	11,31	16,00	4,96	19,60	25,30	29,93	35,78
6E4. 921	6E4. 922	6E4. 923	6E4. 924	○	○	4,1 - 4,4	10,00	14,14	20,00	6,20	24,49	31,62	37,42	44,72
6E4. 941	6E4. 942	6E4. 943	6E4. 944	○	○	4,6 - 5,0	11,20	15,84	22,40	6,94	27,44	35,42	41,91	50,09
6E4. 961	6E4. 962	6E4. 963	6E4. 964	○	○	4,2 - 5,3	12,50	17,68	25,00	7,75	30,62	39,53	46,77	55,90
6E4. 981	6E4. 982	6E4. 983	6E4. 984	○	○	4,2 - 5,1	14,00	19,80	28,00	8,68	34,29	44,27	52,38	62,61
6E5. 001	6E5. 002	6E5. 003	6E5. 004	○	○	4,8 - 5,6	15,75	22,27	31,50	9,76	38,57	49,80	58,92	70,43
6E5. 011	6E5. 012	6E5. 013	6E5. 014	○	○	4,9 - 5,8	16,75	23,69	33,50	10,40	41,03	52,97	62,67	74,91
6E5. 041	6E5. 042	6E5. 043	6E5. 044	○	○	5,5 - 6,6	20,00	28,28	40,00	12,41	48,99	63,25	74,83	89,44
6E5. 061	6E5. 062	6E5. 063	6E5. 064	○	○	5,8 - 6,7	22,50	31,84	45,00	13,96	55,15	71,20	84,24	100,69
6E5. 081	6E5. 082	6E5. 083	6E5. 084	○	○	6,6 - 7,4	25,00	35,36	50,00	15,50	61,24	79,06	93,54	111,80
6E5. 121	6E5. 122	6E5. 123	6E5. 124	○	○	7,4 - 8,3	31,50	44,55	63,00	19,56	77,16	99,61	117,86	140,87
6E5. 161	6E5. 162	6E5. 163	6E5. 164	○	○	8,3 - 8,4	40,00	56,57	80,00	24,80	97,99	126,50	149,68	178,90
6E5. 181	6E5. 182	6E5. 183	6E5. 184	○	○	8,9 - 10,3	28,50	63,64	90,00	27,90	110,23	142,30	168,37	201,24
6E5. 201	6E5. 202	6E5. 203	6E5. 204	○	○	9,6 - 10,5	50,00	70,71	100,00	31,04	127,47	158,11	187,08	223,61

E = Narrowest free cross section. * US gal/min.

Subject to technical modifications.

Example for Ordering: **Type** 6E4. 721 + **Material-no.** 17 = **Ordering no.** 6E4. 721. 17

Conversional formula for the above series:

$$\dot{V}_2 = \dot{V}_1 * \sqrt{\frac{p_2}{p_1}}$$

ROLL COOLING FLAT JET NOZZLE

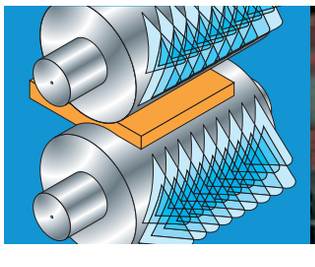
NEW !
Patent Pending

The correct alignment of the roll cooling nozzles on the spray header is essential for optimal roll cooling. Flat jets are the preferred spray pattern for roll cooling, therefore only a self aligning nozzle design provides the operation safety required in a modern rolling mill.
All flat jet nozzles of the Lechler series 6F4 and 6F5 come with an automatic self aligning feature which ensures that every nozzle will always be installed under the correct spray offset angle towards the roll center line. The nozzle tip has two locating lugs for self alignment and seals metallically with a circular surface against the welding nipple when the nut is tightened. No torque is applied on the lugs themselve preventing mechanical damage due to over tightening of the nut. The 6F nozzle series are ideal for mounting when space is limited.

Unlike the dove tail assemblies the tip is put in in axial direction of the welding nipple.
Safe and one-handed nozzle tip mounting is guaranteed because thread engagement does not take place before the two location lugs have been correctly positioned on the opposite nipple side.
The 6F nozzle series is available with a wide variety of standard offset angles which simplifies spray header fabrication significantly. It also helps to prevent wrong fabrication of headers.

The spray has a parabolic liquid distribution which is ideal for a multi nozzle header arrangement

- Parabolic liquid distribution
- Automatic nozzle alignment
- High operation safety
- Secure one-handed axial mounting
- Mechanical damage prevented
- Variety of standard offset angles
- Design and fabrication errors prevented



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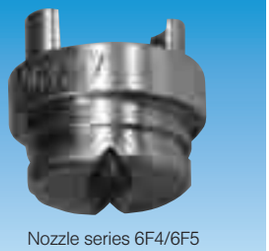
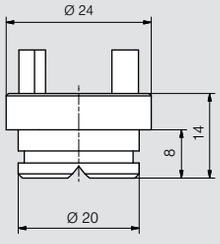


Nozzle series 6F4/6F5
Weight: 38 g



Spray width [B] at p=3 bar

H / B	H 250 mm	H 500 mm
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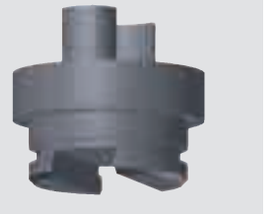
6F4.941 - 6F5.201	115	210
6F4.722 - 6F4.962	150	300
6F4.982 - 6F5.202	160	310
6F4.723 - 6F4.963	220	440
6F4.983 - 6F5.203	250	490
6F4.724 - 6F4.964	330	630
6F5.984 - 6F5.204	340	640



Alignment tip for welding alignment and pressure testing

Ordering-no. **06F.490.1Y**

Orderin no. Type ∢ 20°	∢ 30°	∢ 45°	∢ 60°	Mat. no. 17 316 SS	30 Brass	γ Offset angle	E Ø [mm	V̇ [l/min] p [bar] 0,5	1,0	2,0	40* psi	3,0	5,0	7,0	10,0
6F4. 721	**6F4. 722**	**6F4. 723**	**6F4. 724**	○	○	Code for offset angle see separate table below	2,1 - 2,5	3,15	4,45	6,30	1,95	7,72	9,96	11,79	14,09
6F4. 761	**6F4. 762**	**6F4. 763**	**6F4. 764**	○	○		2,3 - 2,8	4,00	5,66	8,00	2,48	9,80	12,65	14,97	17,89
6F4. 801	**6F4. 802**	**6F4. 803**	**6F4. 804**	○	○		2,6 - 3,2	5,00	7,07	10,00	3,10	12,25	15,81	18,71	22,36
6F4. 841	**6F4. 842**	**6F4. 843**	**6F4. 844**	○	○		3,0 - 3,6	6,25	8,84	12,50	3,88	15,31	19,67	23,39	27,95
6F4. 881	**6F4. 882**	**6F4. 883**	**6F4. 884**	○	○		3,4 - 4,0	8,00	11,31	16,00	4,96	19,60	25,30	29,93	35,78
6F4. 921	**6F4. 922**	**6F4. 923**	**6F4. 924**	○	○		4,1 - 4,4	10,00	14,14	20,00	6,20	24,49	31,62	37,42	44,72
6F4. 941	**6F4. 942**	**6F4. 943**	**6F4. 944**	○	○		4,6 - 5,0	11,20	15,84	22,40	6,94	27,44	35,42	41,91	50,09
6F4. 961	**6F4. 962**	**6F4. 963**	**6F4. 964**	○	○		4,2 - 5,3	12,50	17,68	25,00	7,75	30,62	39,53	46,77	55,90
6F4. 981	**6F4. 982**	**6F4. 983**	**6F4. 984**	○	○		4,2 - 5,1	14,00	19,80	28,00	8,68	34,29	44,27	52,38	62,61
6F5. 001	**6F5. 002**	**6F5. 003**	**6F5. 004**	○	○		4,8 - 5,6	15,75	22,27	31,50	9,76	38,57	49,80	58,92	70,43
6F5. 011	**6F5. 012**	**6F5. 013**	**6F5. 014**	○	○		4,9 - 5,8	16,75	23,69	33,50	10,40	41,03	52,97	62,67	74,91
6F5. 041	**6F5. 042**	**6F5. 043**	**6F5. 044**	○	○		5,5 - 6,6	20,00	28,28	40,00	12,41	48,99	63,25	74,83	89,44
6F5. 061	**6F5. 062**	**6F5. 063**	**6F5. 064**	○	○		5,8 - 6,7	22,50	31,84	45,00	13,96	55,15	71,20	84,24	100,69
6F5. 081	**6F5. 082**	**6F5. 083**	**6F5. 084**	○	○		6,6 - 7,4	25,00	35,36	50,00	15,50	61,24	79,06	93,54	111,80
6F5. 121	**6F5. 122**	**6F5. 123**	**6F5. 124**	○	○		7,4 - 8,3	31,50	44,55	63,00	19,56	77,16	99,61	117,86	140,87
6F5. 161	**6F5. 162**	**6F5. 163**	**6F5. 164**	○	○		8,3 - 8,4	40,00	56,57	80,00	24,80	97,99	126,50	149,68	178,90
6F5. 181	**6F5. 182**	**6F5. 183**	**6F5. 184**	○	○		8,9 - 10,3	28,50	63,64	90,00	27,90	110,23	142,30	168,37	201,24
6F5. 201	**6F5. 202**	**6F5. 203**	**6F5. 204**	○	○		9,6 - 10,5	50,00	70,71	100,00	31,04	127,47	158,11	187,08	223,61

E = Narrowest free cross section. * US gal/min

Subject to technical modifications

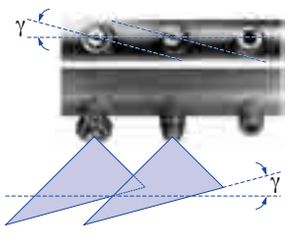
Accessories

Welding nipple

Retaining nut

Example for Ordering: **Type** 6F4. 721 + **Material-no.** 17 + **Offset angle** 15 = **Ordering no.** 6F4. 721. 17. 15

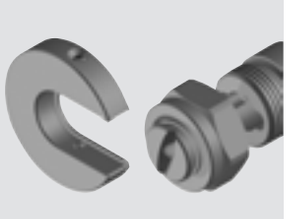
Ordering code for offset angle	
Offset angle γ	Ordering code
15°	**15**
20°	**20**
25°	**25**
30°	**30**
35°	**35**
40°	**40**
45°	**45**
50°	**50**
60°	**60**
70°	**70**



Offset angles see table

Conversional formula for the above series:

$$\dot{V}_2 = \dot{V}_1 * \sqrt{\frac{p_2}{p_1}}$$



Removal tool
Ordering no. **06S. 491. 1C**

Technical data and ordering data for accessories see page 13.

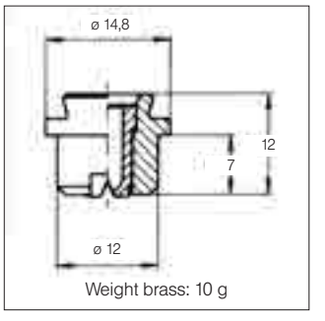
FLAT FAN DOVETAIL NOZZLES

The 660 series nozzles come with the conventional, automatic self aligning dovetail connection which ensures that every nozzle will always be installed under the correct spray offset angle towards the roll center line.

The small tip dimensions make this nozzle series ideal for roll cooling and strip cooling headers when space is limited especially in small rolling mills for non ferrous metals.

All tips have an automatically built in 5° offset angle if the welding nipple is welded in line with the centre line of the spray header. Any other offset angle has to be compensated for by welding the nipple under a different angle (minus the 5° inbuilt offset angle).

The spray has a parabolic liquid distribution which is ideal for a multi nozzle header arrangement.



Weight brass: 10 g

Spray width [B] at p=3 bar

B \ H	H 250 mm	H 500 mm
600. 301 - 331	70	125
600. 361 - 761	90	175
600. 801 - 881	100	200
600. 302 - 332	110	210
600. 362 - 402	135	260
600. 442 - 882	150	300
660. 303 - 333	175	350
660. 363 - 403	200	400
660. 443 - 923	220	440
660. 304 - 334	250	470
660. 364 - 404	315	600
660. 444 - 924	330	630

Ordering no. Type ∢ 20°	∢ 30°	∢ 45°	∢ 60°	Mat. no. 16 303 SS	17 316 SS	30 Brass	E Ø [mm]	V̇ [l/min] p [bar] 0,5	1,0	2,0	40* psi	3,0	5,0	7,0	10,0
660. 301	660. 302	660. 303	660. 304	○	-	○	0,4 - 0,6	0,16	0,23	0,32	0,10	0,39	0,50	0,59	0,71
660. 331	660. 332	660. 333	660. 334	○	-	○	0,5 - 0,7	0,22	0,32	0,45	0,14	0,55	0,71	0,84	1,00
660. 361	660. 362	660. 363	660. 364	○	○	○	0,6 - 0,8	0,31	0,44	0,63	0,20	0,77	0,99	1,17	1,40
660. 401	660. 402	660. 403	660. 404	○	○	○	0,8 - 1,0	0,50	0,70	1,00	0,31	1,22	1,58	1,87	2,23
660. 441	660. 442	660. 443	660. 444	○	○	○	0,9 - 1,1	0,62	0,88	1,25	0,39	1,53	1,97	2,33	2,79
660. 481	660. 482	660. 483	660. 484	○	○	○	1,0 - 1,2	0,80	1,13	1,60	0,50	1,96	2,53	2,99	3,57
660. 511	660. 512	660. 513	660. 514	○	○	○	1,1 - 1,4	0,95	1,34	1,90	0,59	2,32	3,00	3,55	4,24
660. 561	660. 562	660. 563	660. 564	○	○	○	1,3 - 1,5	1,25	1,76	2,50	0,78	3,06	3,95	4,67	5,59
660. 601	660. 602	660. 603	660. 604	○	○	○	1,5 - 1,7	1,57	2,22	3,15	0,98	3,85	4,98	5,89	7,04
660. 641	660. 642	660. 643	660. 644	○	○	○	1,6 - 1,9	2,00	2,82	4,00	1,24	4,89	6,32	7,48	8,94
660. 671	660. 672	660. 673	660. 674	○	○	○	1,8 - 2,2	2,37	3,35	4,75	1,47	5,81	7,51	8,88	10,62
660. 721	660. 722	660. 723	660. 724	○	○	○	2,1 - 2,5	3,15	4,45	6,30	1,95	7,71	9,96	11,78	14,08
660. 761	660. 762	660. 763	660. 764	○	○	○	2,3 - 2,8	4,00	5,65	8,00	2,48	9,79	12,64	14,96	17,88
660. 801	660. 802	660. 803	660. 804	○	○	○	2,6 - 3,2	5,00	7,07	10,00	3,10	12,24	15,81	18,70	22,36
660. 841	660. 842	660. 843	660. 844	○	○	○	3,0 - 3,6	6,25	8,83	12,50	3,88	15,30	19,76	23,38	27,95
660. 881	660. 882	660. 883	660. 884	○	○	○	3,4 - 4,0	8,00	11,31	16,00	4,96	19,53	25,29	29,93	35,77
-	-	660. 923	660. 924	○	○	○	4,1 - 4,4	10,00	14,14	20,00	6,21	24,49	31,26	37,42	44,72

E = Narrowest free cross section. * US gal/min

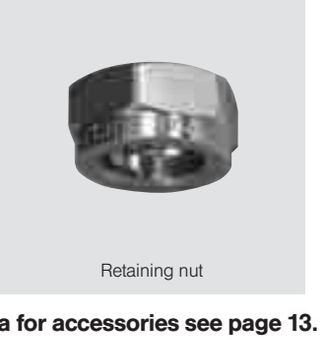
Subject to technical modifications

Example for Ordering: **Type** 660. 301 + **Material-no.** 17 = **Ordering no.** 660. 301. 17

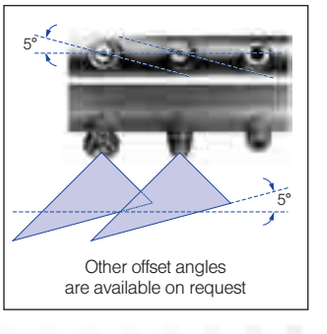
Conversional formula for the above series: $\dot{V}_2 = \dot{V}_1 * \sqrt{\frac{p_2}{p_1}}$

Accessories

Welding nipple



Retaining nut



Other offset angles are available on request

Technical data and ordering data for accessories see page 13.

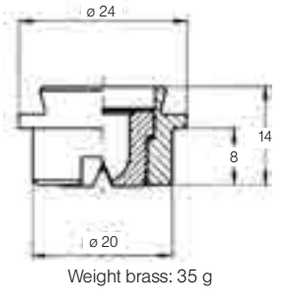
FLAT FAN DOVETAIL NOZZLES

The 664 and 665 series nozzles come with the conventional, automatic self aligning dovetail connection which ensures that every nozzle will always be installed under the correct spray offset angle towards the roll center line.

This nozzle family has become an industrial standard solution for roll cooling applications.

All tips have an automatically built in 15° offset angle if the welding nipple is welded in line with the centre line of the spray header. Any other offset angle has to be compensated for by welding the nipple under a different angle (minus the 15° inbuilt offset angle).

The spray has a parabolic liquid distribution which is ideal for a multi nozzle header arrangement.



Weight brass: 35 g

Spray width [B] at p=3 bar

B \ H	H 250 mm	H 500 mm
664.721 - 664.921	100	200
664.941 - 665.201	115	210
664.722 - 664.962	150	300
664.982 - 665.202	160	310
664.723 - 664.963	220	440
664.983 - 665.203	250	490
664.724 - 664.964	330	630
665.984 - 665.204	340	640

Ordering no. Type				Mat. no.			E Ø [mm]	V̇ [l/min] p [bar]							
∢ 20°	∢ 30°	∢ 45°	∢ 60°	16 303 SS	17 316 SS	30 Brass		0,5	1,0	2,0	40* psi	3,0	5,0	7,0	10,0
664. 721	664. 722	664. 723	664. 724	○	○	○	2,1 - 2,5	3,15	4,45	6,30	1,95	7,72	9,96	11,79	14,09
664. 761	664. 762	664. 763	664. 764	○	○	○	2,3 - 2,8	4,00	5,66	8,00	2,48	9,80	12,65	14,97	17,89
664. 801	664. 802	664. 803	664. 804	○	○	○	2,6 - 3,2	5,00	7,07	10,00	3,10	12,25	15,81	18,71	22,36
664. 841	664. 842	664. 843	664. 844	○	○	○	3,0 - 3,6	6,25	8,84	12,50	3,88	15,31	19,67	23,39	27,95
664. 881	664. 882	664. 883	664. 884	○	○	○	3,4 - 4,0	8,00	11,31	16,00	4,96	19,60	25,30	29,93	35,78
664. 921	664. 922	664. 923	664. 924	○	○	○	4,1 - 4,4	10,00	14,14	20,00	6,20	24,49	31,62	37,42	44,72
664. 941	664. 942	664. 943	664. 944	○	○	○	4,6 - 5,0	11,20	15,84	22,40	6,94	27,44	35,42	41,91	50,09
664. 961	664. 962	664. 963	664. 964	○	○	○	4,2 - 5,3	12,50	17,68	25,00	7,75	30,62	39,53	46,77	55,90
664. 981	664. 982	664. 983	664. 984	○	○	○	4,2 - 5,1	14,00	19,80	28,00	8,68	34,29	44,27	52,38	62,61
665. 001	665. 002	665. 003	665. 004	○	○	○	4,8 - 5,6	15,75	22,27	31,50	9,76	38,57	49,80	58,92	70,43
665. 011	665. 012	665. 013	665. 014	○	○	○	4,9 - 5,8	16,75	23,69	33,50	10,40	41,03	52,97	62,67	74,91
665. 041	665. 042	665. 043	665. 044	○	○	○	5,5 - 6,6	20,00	28,28	40,00	12,41	48,99	63,25	74,83	89,44
665. 061	665. 062	665. 063	665. 064	○	○	○	5,8 - 6,7	22,50	31,84	45,00	13,96	55,15	71,20	84,24	100,69
665. 081	665. 082	665. 083	665. 084	○	○	○	6,6 - 7,4	25,00	35,36	50,00	15,50	61,24	79,06	93,54	111,80
665. 121	665. 122	665. 123	665. 124	○	○	○	7,4 - 8,3	31,50	44,55	63,00	19,56	77,16	99,61	117,86	140,87
665. 161	665. 162	665. 163	665. 164	○	○	○	8,3 - 8,4	40,00	56,57	80,00	24,80	97,99	126,50	149,68	178,90
665. 181	665. 182	665. 183	665. 184	○	○	○	8,9 - 10,3	28,50	63,64	90,00	27,90	110,23	142,30	168,37	201,24
665. 201	665. 202	665. 203	665. 204	○	○	○	9,6 - 10,5	50,00	70,71	100,00	31,04	122,47	158,11	187,08	223,61

E = Narrowest free cross section. * US gal/min

Subject to technical modifications

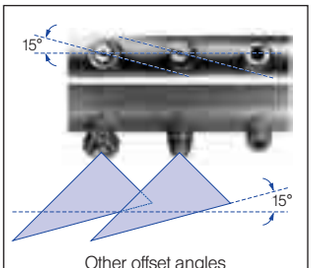
Example for Ordering: Type 664. 721 + Material-no. 17 = Ordering no. 664. 721. 17

Conversional formula for the above series: $\dot{V}_2 = \dot{V}_1 * \sqrt{\frac{p_2}{p_1}}$

Accessories

Welding nipple

Retaining nut



Other offset angles are available on request

Technical data and ordering data for accessories see page 13.

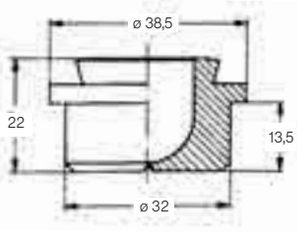
FLAT FAN DOVETAIL NOZZLES

The 669 series nozzles come with the conventional, automatic self aligning dovetail connection which ensures that every nozzle will always be installed under the correct spray offset angle towards the roll center line.

This nozzle family allow very large flow rates for roughing mill, plate mill and strip cooling applications.

All tips have an automatically built in 15° offset angle if the welding nipple is welded in line with the centre line of the spray header. Any other offset angle has to be compensated for by welding the nipple under a different angle (minus the 15° inbuilt offset angle).

The spray has a parabolic liquid distribution which is ideal for a multi nozzle header arrangement.



Weight brass: 135 g

Spray width [B] at p=3 bar

	H 250 mm	H 500 mm
669.041 - 664.281	115	210
669.042 - 669.282	160	310
669.043 - 669.283	250	490
665.042 - 665.202	340	640

Ordering no. Type 20°	30°	45°	60°	Mat. no. 16 303 SS	30 Brass	E Ø [mm]	V̇ [l/min] p [bar] 0,5	1,0	2,0	40* psi	3,0	5,0	7,0	10,0
669. 041	669. 042	669. 043	669. 044	○	○	5,5 - 6,5	20,00	28,28	40,00	12,41	48,99	63,25	74,83	89,44
669. 121	669. 122	669. 123	669. 124	○	○	7,3 - 8,3	31,50	44,55	63,00	15,50	77,16	99,61	117,86	140,87
669. 201	669. 202	669. 203	669. 204	○	○	9,5 - 10,6	50,00	71,00	100,00	31,00	122,00	158,00	187,00	224,00
669. 281	669. 282	669. 283	669. 284	○	○	9,4 - 13	80,00	113,00	160,00	49,60	196,00	253,00	299,00	358,00

E = Narrowest free cross section. * US gal/min

Subject to technical modifications

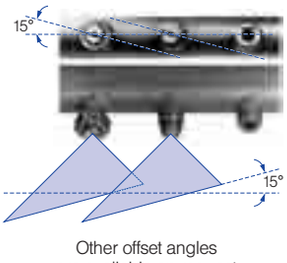
Example for Ordering: Type **669. 041** + Material-no. **16** = Ordering no. **669. 041. 16**

Conversional formula for the above series: $\dot{V}_2 = \dot{V}_1 * \sqrt{\frac{p_2}{p_1}}$

Accessories

Welding nipple

Retaining nut

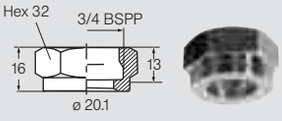


Other offset angles are available on request

Technical data and ordering data for accessories see page 13.

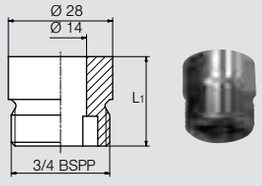
ACCESSORIES

Series 6F



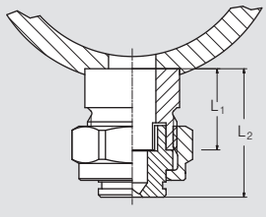
Weight brass 60 g

Retaining nut: **065.600.11** (AISI 430 F)
065.600.16 (303 SS)
065.600.17 (316 SS)
065.600.30 (brass)



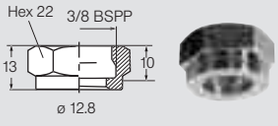
Weight 82 g

Welding nipple: **06F.410.17.xx** (316 SS)
06F.411.17.xx (316 SS)



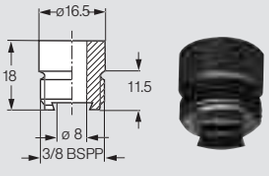
$L_2 = L_1 + 14$ mm

Series 660



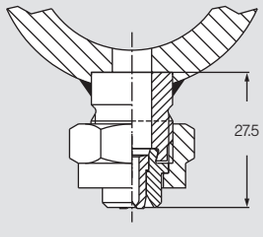
Weight 25 g

Retaining nut: **065.200.16** (303 SS)
065.200.17 (316 SS)
065.200.30 (brass)

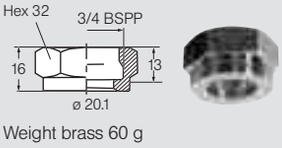


Weight 21 g

Welding nipple: **066.011.17** (316 SS)

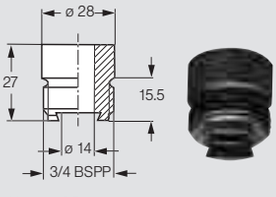


Series 664/665



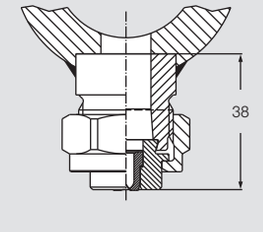
Weight brass 60 g

Retaining nut: **065.600.11** (AISI 430 F)
065.600.16 (303 SS)
065.600.17 (316 SS)
065.600.30 (brass)

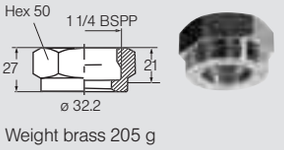


Weight 65 g

Welding nipple: **066.410.17** (316 SS)
066.410.03 (1.0570)

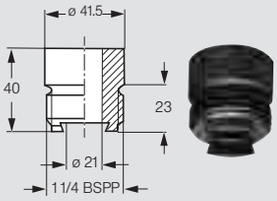


Series 669



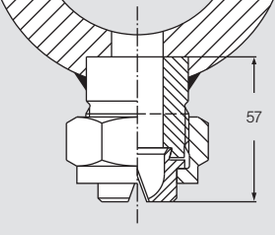
Weight brass 205 g

Retaining nut: **066.900.16** (303 SS)
066.900.17 (316 SS)
066.900.30 (Brass)



Weight 280 g

Welding nipple: **066.910.17** (316 SS)
066.910.02 (1.0159)



Series 6F

Nipple length 20 - 99 mm in steps of 1 mm	
Basic type number	Length L_1
06F. 410. 17	**xx**
xx = nipple length [mm]	
Example for nipple length 35 mm **06F. 410. 17.**	**35**

Nipple length 100 - 199 mm in steps of 1 mm	
Basic type number	Length L_1
06F. 411. 17	**xx**
xx = nipple length [mm]	
Example for nipple length 35 mm **06F. 411. 17.**	**35**

Other nipple lengths for all nozzle series on request.

Alignment tips

Series 6E: **06E.490.1Y**
Series 6F: **06F.490.1Y**

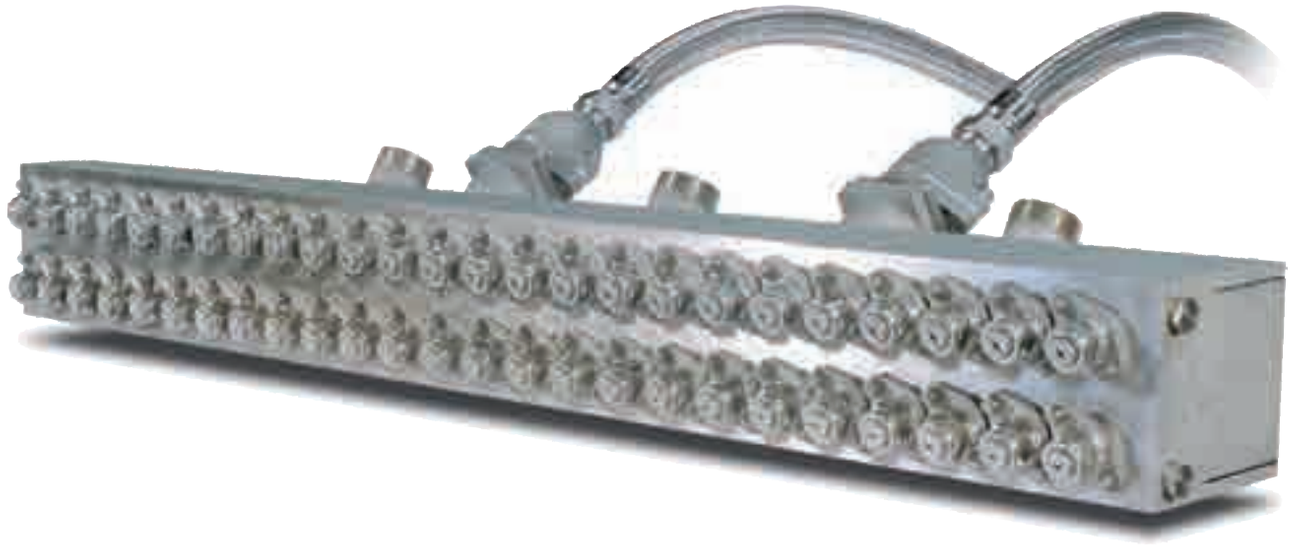
Series 660: **066.090.16** offset angle 5°

Series 664/665: **066.490.16** offset angle 15°

Series 669: **066.990.16** offset angle 15°

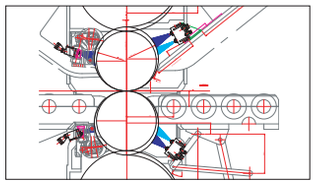
(other offset angles on request)

SELECTOSPRAY® ROLL COOLING SYST



SELECTOSPRAY® – an indispensable actuator for shape control. It corrects reliably asymetrical strip shape defects and supports work roll bending

To date, more than 300 Lechler SELECTOSPRAY® roll cooling systems have been installed globally in cold rolling mills for steel, aluminium and non-ferrous metals, as well as in aluminium hot rolling mills and foil mills. Profit from our comprehensive know-how in this specialist area.



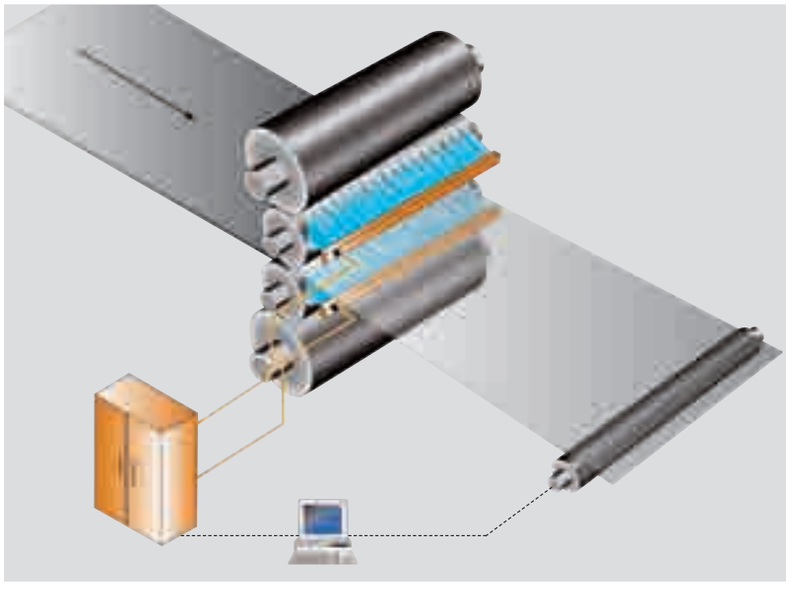
Selective roll cooling system, individually designed

The principle

To achieve precise cooling control, the roll barrel is 'divided' into zones, each of which has coolant precisely applied to it by MODULAX valve controlled spray nozzles. Each of the zonal sprays can be operated independently of the others either manually, by push button control, semi automatically by a PLC, or automatically in connection with a shape control system.

The SELECTOSPRAY® system can be used in conjunction with any of the shape control systems currently available, the roll zoning being dimensionend to exactly match that of the shape metering roll involved. Zone widths for both automated and manually controlled systems are available, widths in general use being between 25 mm and 100 mm.

The SELECTOSPRAY® system includes complete headers, air hoses and control cabinet.



Electrically controlled SELECTOSPRAY® system with EVA valve technology (25 mm/1", 50 mm/2")

Control cabinet

Air and cable hoses

EM FOR STRIP SHAPE CONTROL

Lechler competence and expertise

Of paramount importance for any roll cooling application is how the sprays impinge on the roll surface. An effective and precise footprint geometry is the fundamental requirement to establish a uniform cooling from top to bottom work rolls and transversely across the cooling area resulting in an optimal heat extraction across the spray cooling area on the roll.

When designing a spray header Lechler arranges the sprays without interference or creating hot and cool bands in adjacent cooling zones.
The nozzle flow rates and spray angles are taken into account besides the positions of the spray headers in the mill for the design of the optimal nozzle offset and impingement angles in order to obtain the best heat transfer.

Lechler SELECTOSPRAY® valves

The proven Modulax valve design is available in three different versions:

- Pneumatically controlled with the solenoid in the control cabinet outside of the mill
- Electro-pneumatically with the solenoid directly attached (DSA)
- Purely electrically controlled (EVA)

All valve versions have very large coolant entry ports, are easily removable from the header front and are protected by the header itself. All valves carry self aligning flat jet nozzles.

Lechler SELECTOSPRAY® valves (MODULAX)

- Liquid to air pressure ratio 2:1
- Very large internal free passages
- Uses standard shop air
- Simple design, only one moving part which is the piston

Electro-pneumatic valve actuation (DSA)

- Each valve has its own dedicated solenoid directly attached
- Shorter response time
- Air for the pilot operation is fed by a single tube directly into the header and instantly available when the electrical solenoid is activated
- Solenoids can be supplied in either normally open or normally closed

Electric valve actuation (EVA)

- Especially in rolling mills where inflammable rolling oil or kerosene is used as a coolant and without the need for compressed air
- Large orifices for a laminar flow and a stable spray

ENGINEERING
YOUR SPRAY SOLUTION

Yes, I want to get detailed information on Lechler products

Please send me the special information:

- ☐ Catalogue »Precision Spray Nozzles and Accessories«
- ☐ Brochure »Nozzles and Systems for the Metallurgical Industry«
- ☐ Brochure »Continuous Casting«
- ☐ Brochure »SELECTOSPRAY® Roll Cooling Systems«
- ☐ Brochure »SCALEMASTER HPS®«
- ☐ Brochure »SCALEMASTER® HP«
- ☐ Brochure »MicroSCALEMASTER®«
- ☐ Brochure »VarioCool® Gas Conditioning Systems«
- ☐ Special interests:

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