*ENGINEERING*
*YOUR SPRAY SOLUTION*

# SCALEMASTER® – the Standard in Descaling Technology

SCALEMASTER®

# OPTIMAL DESCALING FOR HIGHER PRODUCT QUALITY AND LOW MAINTENANCE COSTS

**Primary and secondary scale ruin considerably the surface quality of ingots, slabs, blooms, plate bars, sheet metals, strips, profiles and pipes. Not only is the rolling stock surface affected but scale also causes high wear to the rolls.**

Give scale a hard time – with the SCALEMASTER® descaling nozzles from Lechler. They don't give scale any chance at all by delivering razor-sharp, powerful and uniform jets. The water is focused to create extremely high jet pressure, thereby guaranteeing optimum descaling results.

And optimal descaling provides:

- perfect surface quality
- high product quality
- low maintenance costs
- low roll wear

For many years Lechler has been a leader in the design and development of descaling nozzles. By working closely with renowned rolling mills Lechler has consistently achieved many improvements to descaling, always tailored to the exact needs of the users.

**May we help you? Our technical services group is committed to providing not only the best products but also the finest service to you.**

# NOZZLE DATA

**When a descaling system is being designed the following nozzle performance parameters must be known:**

- The water flow rate at a given pressure
- The spray width at a given vertical spray height (this defines the spray angle)
- The spray impact and its distribution across the spray width

The impact (also called impact pressure) is the momentum or force distribution over the spray foot print area.
Therefore the impact can be defined as I = F/A

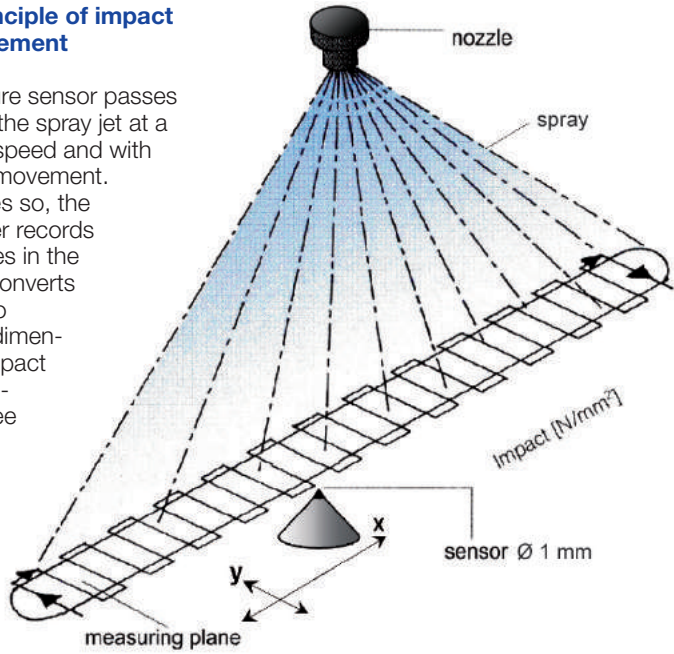
I = Impact [N/mm²]
F = Force [N]
A = Area [mm²]

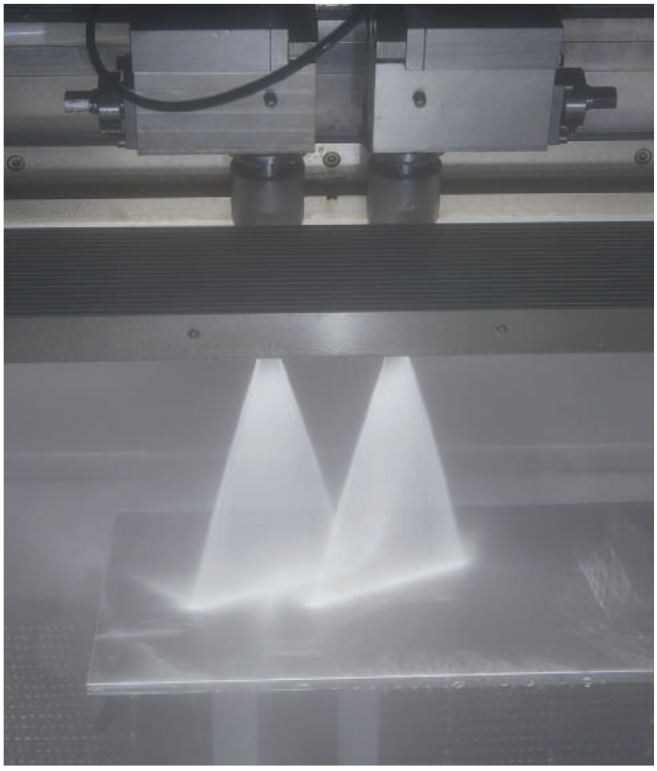
When modern descaling nozzles such as the Lechler SCALEMASTER® and lower spray heights are being combined, spray foot print thicknesses of only 3 mm become a challenge for the impact measurement facilities. Spray overlaps below 10 mm also require a much higher precision of the spray width data.

Only the new Lechler 3D impact measurement technology utilizing a sensor with only 1.0 mm diameter provides the resolution required for the design of an optimal nozzle arrangement. The impact distribution is measured and documented 3-dimensionally throughout the entire spray in one sensor scan.

**The principle of impact measurement**

A pressure sensor passes through the spray jet at a defined speed and with defined movement. As it does so, the computer records the pulses in the jet and converts them into a three-dimensional impact representation (see below).

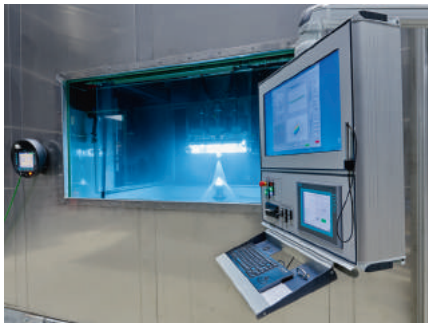


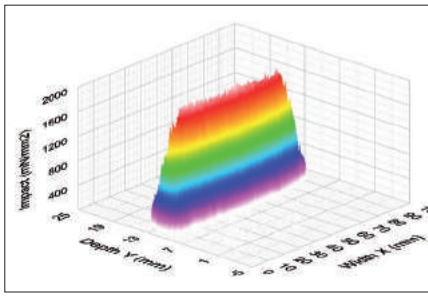
Impact measurement with twin nozzle arrangement

**Lechler high pressure spray lab**

Impact measurements under real installation conditions in terms of nozzle inclination and offset angles can now be performed with the new Lechler high pressure spray lab. Additionally the well proven sensor technology (1 mm diameter) has been integrated into a plate, allowing the measurement of two adjacent sprays. With such a descaling nozzle arrangement Lechler can now investigate the effect on various spray overlap situations in order to fight surface striping especially on rolled plates. Impact measurements up to 500 bars water pressure can be performed.



Lechler high pressure spray lab



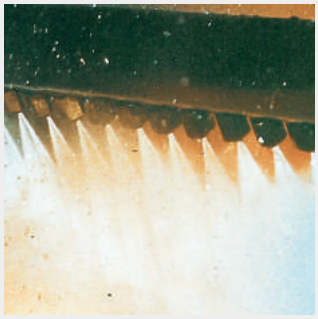

3D measurement protocol, impact measurement

# SCALEMASTER® – THE ECONOMIC DESCALING NOZZLE

**Improved product quality, plant efficiency and reduction of energy and water are vital prerequisites of modern rolling mills. The answer to those needs for your descalers is the SCALEMASTER®.**

With the development of the SCALEMASTER® Lechler once again lives up its innovative reputation in descaling and provides a major advancement in gaining worldclass surface finish.

The SCALEMASTER® combines the advantages of many nozzle designs in a single package. It is based on the experience gained over a hundred years of nozzle design, combined with the latest research in nozzle technology.



## Better Surface Quality

The razor sharp SCALEMASTER® slices through primary and secondary scale faster and more thoroughly than ever. The high impact jet is uniformly distributed eliminating surface streaks. This results in an absolutely clean, smooth surface over the entire width of the strip.

## Lower Energy and Water Consumption

Compared to traditional nozzles, the SCALEMASTER® uses up to 30 % less water and can operate at lower pressures. Consequently, the required pump capacity is considerably reduced. This translates into both lower operating costs for energy and lower capital outlays for pumps. Furthermore, with the built-in filter available on the SCALEMASTER®, you may save preliminary filtering costs.

## Long Life and Easy Handling

The SCALEMASTER® is built to stand up the harshest mill conditions. The tungsten carbide tip can withstand the highest pressures, poor water quality and abrasive particles. When a nozzle must be changed, the SCALEMASTER® is designed to make it both fast and foolproof. The tip, stabilizer and filter can be preassembled and then assembled to the header as one unit.

By assembling this single unit rather than separate parts, the installation can be performed with one hand and helps maintenance personnel install the nozzles quickly in the most difficult locations.

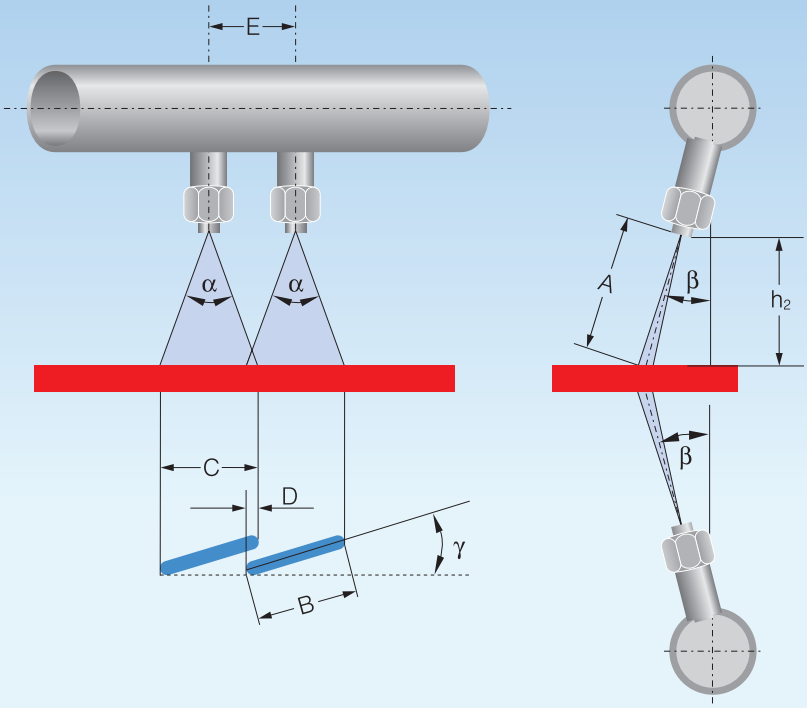
The self alignment feature of the nozzle ensures that the cap can be tightened only when alignment is achieved.

# NOZZLE ARRANGEMENT ON THE SPRAY HEADER

**The following apply to the arrangement on the spray header:**

E = C - D
C = cos γ · B
β = 5°, 10° or 15°

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



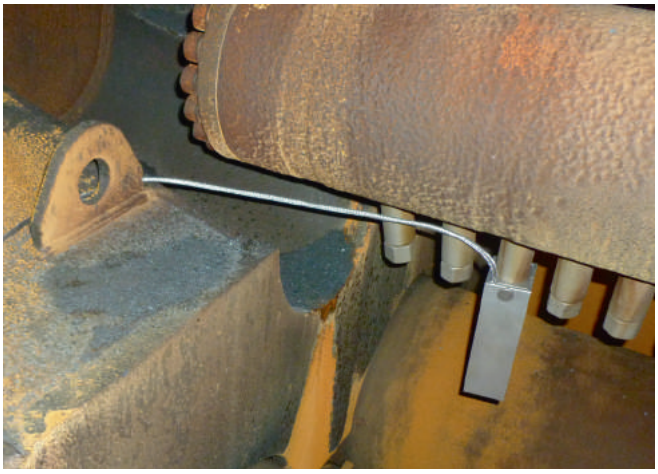

**Spray length (A), Spray width (B, C), Overlap (D), Nozzle distance (E) at vertical spray height ($h_2$), Nozzle spray angle (α) and Angle of inclination (β)**

| Vertical spraying height $h_2$ [mm] | Angle of inclination β = 15° A [mm] | Nominal nozzle spray angle α at p = 150 bar | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | α = 22° | | | | α = 26° | | | | α = 30° | | | | α = 34° | | | | α = 40° | | | |
| | | 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[1] |
| 75 | 78 | 36 | 35 | - | - | 43 | 42 | 5 | 37[1] | 49 | 47 | 5 | 42[1] | 55 | 53 | 6 | 47[2] | 67 | 65 | 7 | 58[2] |
| 100 | 104 | 47 | 45 | 7 | 38[1] | 56 | 54 | 5 | 49[2] | 64 | 62 | 5 | 57[3] | 71 | 69 | 7 | 62[3] | 88 | 85 | 8 | 77 |
| 125 | 129 | 57 | 55 | 7 | 48[2] | 68 | 66 | 7 | 59[3] | 78 | 75 | 7 | 68 | 87 | 84 | 9 | 75 | 108 | 104 | 10 | 94 |
| 150 | 155 | 68 | 66 | 8 | 58[3] | 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 |

[1] only **MiniSCALEMASTER®** with hexagon socket nut [2] only **MiniSCALEMASTER®** [3] only with hexagon socket nut

# DESCALING PRESSURE GAUGE

Hand held pressure reading



Installation example: pressure sensor with spray protection mounted on spray header

## 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 putting the pressure sensor instead.

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

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

## Sensor details

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

## Complete Descaling Pressure Gauge

(Ordering No 06P.M00.00.00.00.0) Sensor adaptors for 644 (MiniSCALEMASTER®) and 694 (SCALEMASTER®) nozzle tips included.

# NOZZLE DATA
# CORRECT NOZZLE ARRANGEMENT

| Order No. for nozzle tip | | | | | | | A ø [mm] | Water flow rate (V̇) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Type | | | | | | Material code | | p = 100 bar (1450 psi) | | p = 200 bar (2900 psi) | | p = 400 bar (5800 psi) | |
| Series | Code | | | | | | | [l/min] | [US Gall./min] | [l/min] | [US Gall./min] | [l/min] | [US Gall./min] |
| | Nominal spray angle | | | | | | | | | | | | |
| | 22° | 26° | 30° | 34° | 40° | | | | | | | | |
| 694 | 495 | 496 | 497 | 491 | 498 | 27 | 1.50 | 12.00 | 3.17 | 16.97 | 4.50 | 24.00 | 6.34 |
| 694 | 535 | 536 | 537 | 531 | 538 | 27 | 1.75 | 15.00 | 3.96 | 21.21 | 5.60 | 30.00 | 7.92 |
| 694 | 565 | 566 | 567 | 561 | 568 | 27 | 2.00 | 18.00 | 4.76 | 25.46 | 6.73 | 36.00 | 9.52 |
| 694 | 605 | 606 | 607 | 601 | 608 | 27 | 2.10 | 23.00 | 6.08 | 32.53 | 8.59 | 46.00 | 12.16 |
| 694 | 645 | 646 | 647 | 641 | 648 | 27 | 2.50 | 28.00 | 7.40 | 39.60 | 10.46 | 56.00 | 14.80 |
| 694 | 685 | 686 | 687 | 681 | 688 | 27 | 2.80 | 36.00 | 9.51 | 50.91 | 13.45 | 72.00 | 19.02 |
| 694 | 725 | 726 | 727 | 721 | 728 | 27 | 3.00 | 45.00 | 11.89 | 63.64 | 16.81 | 90.00 | 23.78 |
| 694 | 765 | 766 | 767 | 761 | 768 | 27 | 3.50 | 58.00 | 15.32 | 82.02 | 21.67 | 116.00 | 30.64 |
| 694 | 805 | 806 | 807 | 801 | 808 | 27 | 3.80 | 72.00 | 19.02 | 101.82 | 26.90 | 144.00 | 38.04 |
| 694 | 845 | 846 | 847 | 841 | 848 | 27 | 4.30 | 89.00 | 23.51 | 125.87 | 33.25 | 178.00 | 47.02 |
| 694 | 885 | 886 | 887 | 881 | 888 | 27 | 4.70 | 112.00 | 29.59 | 158.39 | 41.85 | 224.00 | 59.18 |
| 694 | - | 906 | 907 | 901 | 908 | 27 | 5.00 | 125.00 | 33.03 | 176.78 | 46.70 | 250.00 | 66.06 |
| 694 | - | 916 | 917 | 911 | 918 | 27 | 5.20 | 134.00 | 35.40 | 189.50 | 50.07 | 268.00 | 70.80 |

**Ordering example:** Series **694** + Code **495** + Mat.-Code **27** = Order no. **694.495.27**

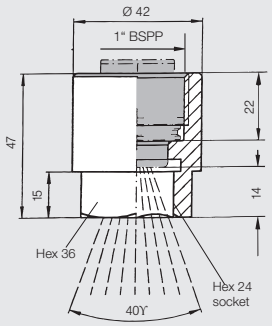
A ø = equivalent bore diameter

Material code 27: Stainless steel nozzle tip with tungsten carbide insert

**Flow rate conversion for table**

$$\dot{V}_2 = \sqrt{\frac{p_2}{p_1}} * \dot{V}_1 \text{ [l/min]}$$

$$p_2 = \left(\frac{\dot{V}_2}{\dot{V}_1}\right)^2 * p_1 \text{ [bar]}$$




Special nut with hexagon socket for very narrow distances between nozzles
**Order no.: 069.402.11**

## Nozzle spray positions

1. All nozzle jets turned parallel in one direction.

2. Nozzle jets, half of them turned outwards in opposite directions. This directs the spray water to both sides (see Fig. 1).

## Nipple installation

So that the correct alignment of the nozzle mouthpiece (15° offset angle to the header's longitudinal axis–see Fig. 1) is guaranteed, the welding nipple on the spray header must be positioned so that its flat inner surfaces are parallel to the header's longitudinal axis. This is best achieved with the alignment aid supplied as an accessory (Fig. 2, Order No. 069.490.01).

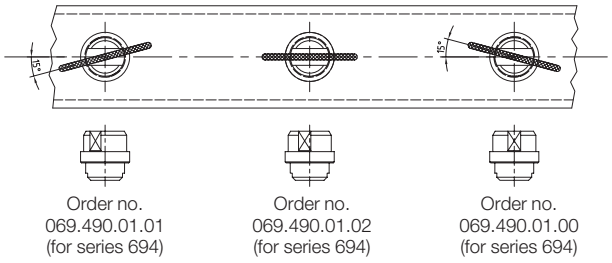
To do this, it is inserted into the flat nipple opening. A rule (or similar) can now be used to easily bring the nipple into the correct parallel position where it can be welded in place (see Fig. 3).

## Alignment tip

The installation aid (Fig. 2, Order No. 069.490.01) is also used as a dummy part to shut off nozzle connections or for hydrostatic pressure testing.

Fig. 2: Alignment tip / dummy part

Fig. 1 Alignment tips




Order no. 069.490.01.01 (for series 694)

Order no. 069.490.01.02 (for series 694)

Order no. 069.490.01.00 (for series 694)

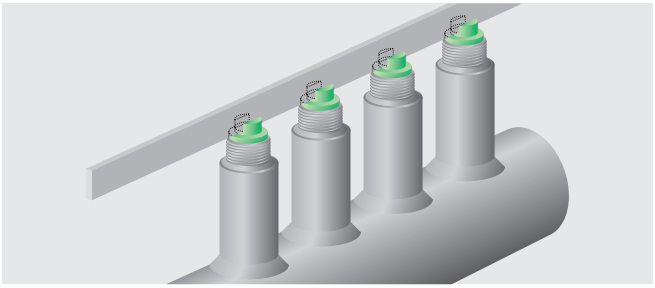
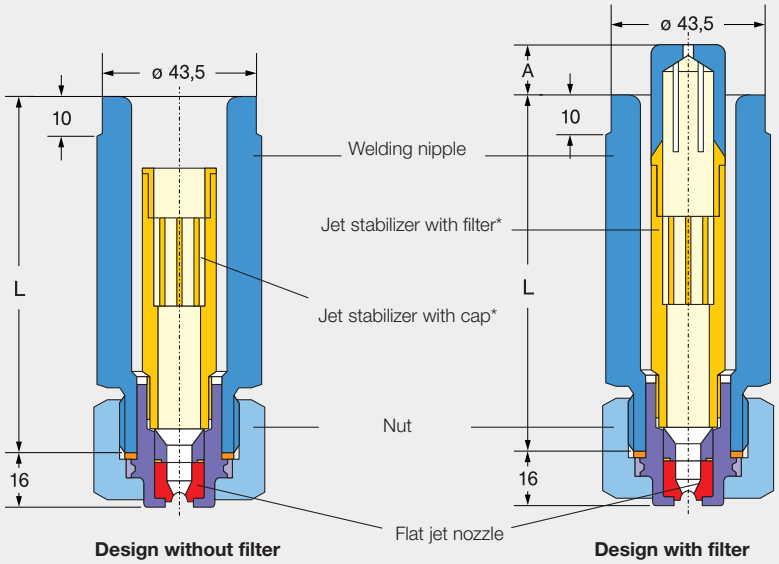


Fig. 3: Installation example for welding nipple

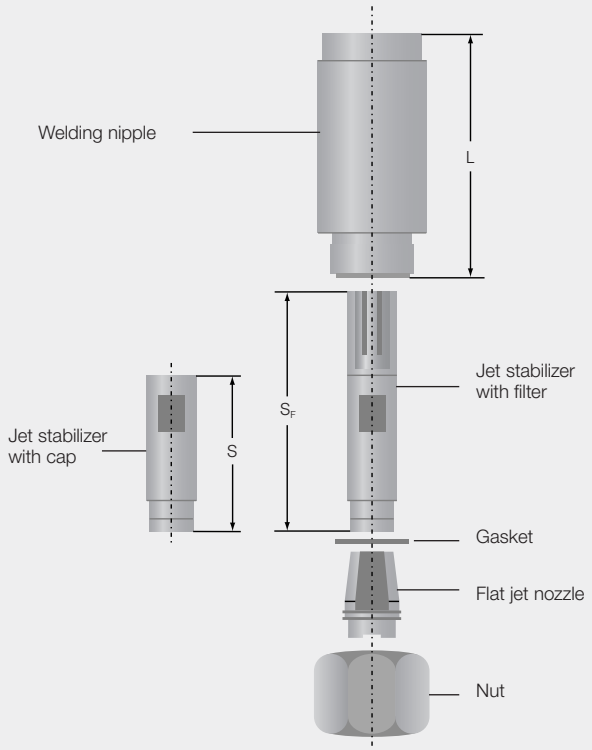
# TECHNICAL DATA, INDIVIDUAL COMPONENTS, ORDERING NUMBERS




* max. torque: 30 Nm (22 ft.lbs.)

| L | A with jet stabilizer 069.455.16 | A with jet stabilizer 069.454.16 |
|---|---|---|
| 120 | 16 | - |
| 100 | 36 | 16 |
| 73 | 63 | 43 |

(all dimensions in mm)




| Component | Model | Ordering No. | Weight (kg) |
|---|---|---|---|
| Welding Nipple<br>Material:<br>AISI 304 | Length L = 120 mm<br>L = 100 mm<br>L = 73 mm | 069.411.1C.00<br>069.410.1C.00<br>069.410.1C.73 | 0.83<br>0.69<br>0.48 |
| Jet Stabilizer<br>Material: Brass | without Filter with kap<br>S = 74 mm<br>with Filter<br>$S_F$ = 130 mm<br>$S_F$ = 110 mm | <br>069.431.16<br><br>069.455.16<br>069.454.16 | <br>0.11<br><br>0.22<br>0.19 |
| Gasket<br>Material: Copper | | 095.015.34.04.02.0 | 0.004 |
| Nozzle | | 694.XXX.XX<br>see table page 7 | 0.085 |
| Nut (Hex 41)<br>Material: AISI 430 F | | 069.400.11 | 0.153 |
| Alignment Tip<br>Blank Tip<br>Material: Mild Steel | | 069.490.01 | 0.072 |
| Tip extractor<br>Material:<br>Stainless steel | Data sheet on request | 069.492.12.00.10.0 | 0.250 |
| Extraction tool | Data sheet on request | 095.009.00.12.56.0 | 0.95 |

Max. permissible operating pressure: 450 bar

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