



## Hydromechanical Descaling Nozzles



SCALEMASTER APS<sup>®</sup>  
SUPERIOR

# SCALEMASTER APS®

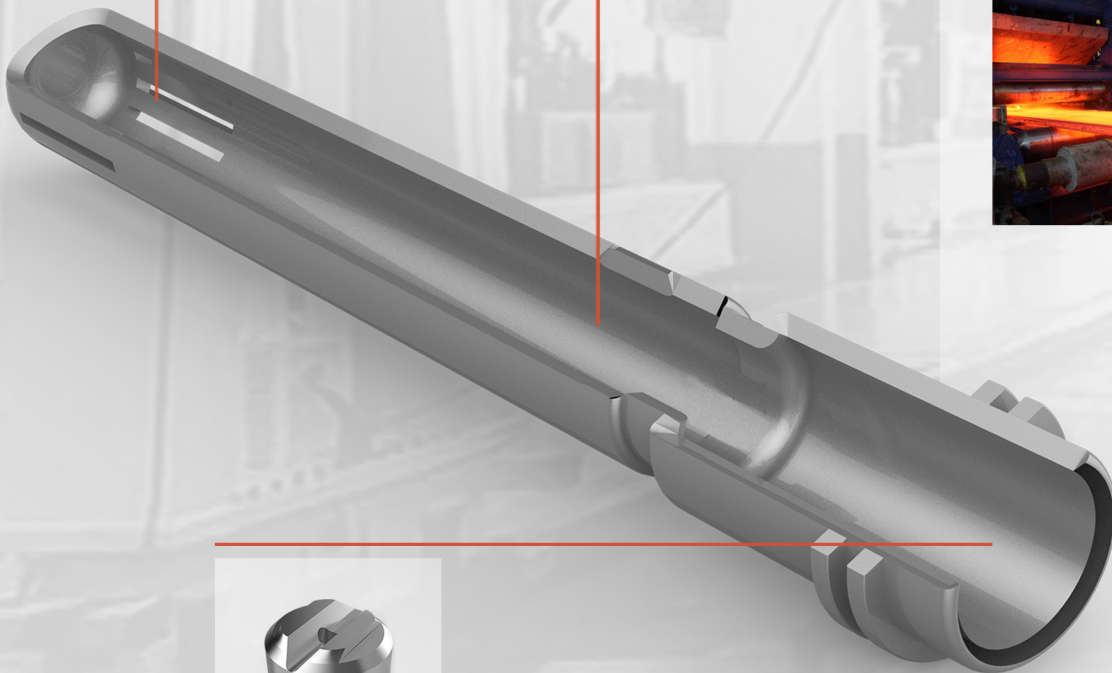
SUPERIOR



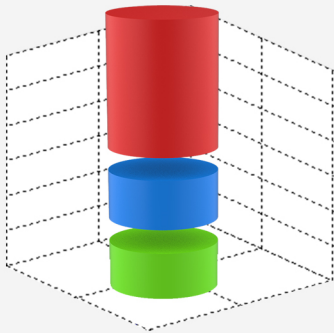
SCALEMASTER APS is consonant with all other SCALEMASTER AP types. It is designed to be used without headings change.

An increased spray effect enables to get great surface quality without extra energy consumption.

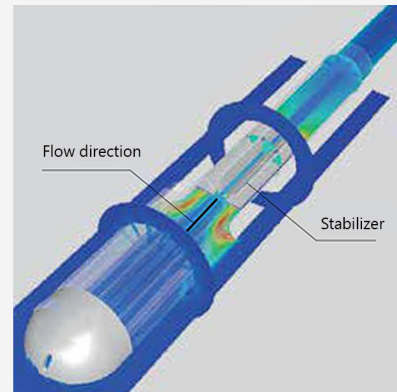
This nozzle type enables to get high impact with smaller nozzle size which lead to use of lower water flow and decrease in energy consumption.



- SCALEMASTER
- SCALEMASTER AP
- SCALEMASTER APS



Mitsuda SCALEMASTER nozzles impact according to nozzle sizes.



CFD turbulence simulation of the Scalemaster AP showing optimal non-turbulent inflow conditions (dark blue area) right to the tip.

Focus on the highest spray performance at constant water pressure and flow.  
Check the working nozzle types.  
Check the nozzle settlement.

↓

- | Maximize efficiency.
- | Stable water pressure
- | Keep nozzle size.

+

- | Increase impact through decreasing the vertical spray height.

✓

Focus on the highest spray performance at constant water pressure and flow.  
Check the working nozzle types.  
Check the nozzle settlement.

↓

- | Keep impact values same.
- | Reduce water flow through using smaller size nozzle.
- | Keep nozzle size same and reduce water pressure.

+

- | Increase impact through decreasing the vertical spray height.

✓

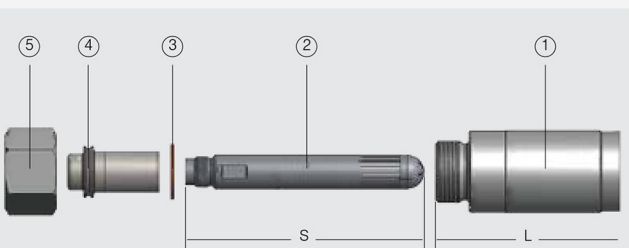
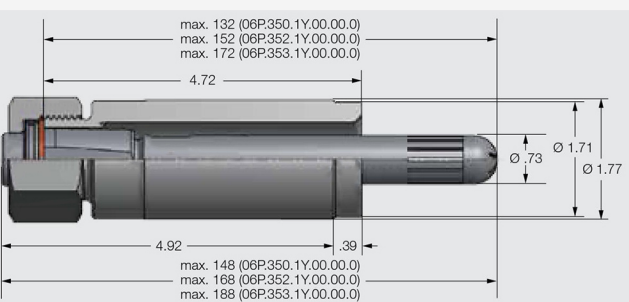
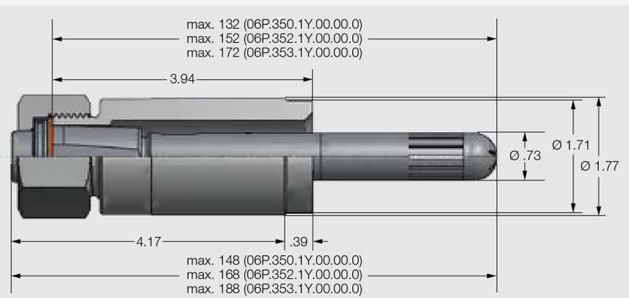
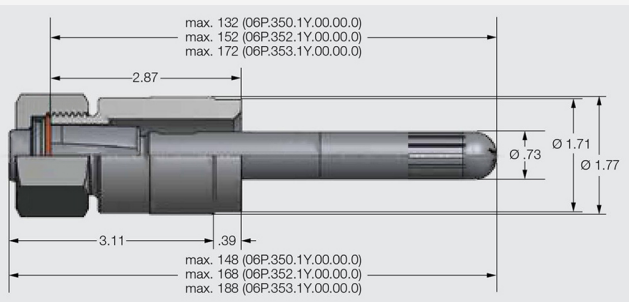
- Enhanced descaled material surface quality
- Increased pump energy saving
- Decreased splash water amount



Through the new designed headings together with new stabilizing filter unit, the SCALEMASTER AP provides benefits as below:

Since the vertical spray is not under height 150mm, SCALEMASTER AP is the most appropriate descaling nozzle for all traditional hot strip mills.

- Improved descaling through increased impact.
- Higher surface quality in result of increased impact.
- Use of decreased water flow rate in descaling
- Increased energy saving
- Longer mechanical strength due to decreased water flow.
- Replaceable with all other SCALEMASTER nozzles.



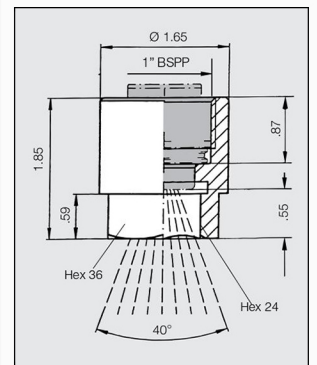
No:	Component	Order no.	Weight
1	Welding nipple material: AISI 304	Length: L = 2.87 in L = 3.94 in L = 4.72 in order length on request.	M6.69.410.1C.73 0.08 lbs M6.69.410.1C.00 0.57 kg M6.69.411.1C.00 0.83 lbs
2	Filter stabilizer Unit Material: Stainless steel	filtered S = 110 filtered S = 130 filtered S = 150	M6.6P350.1Y.00.00.0 0.22 lbs M6.6P352.1Y.00.00.0 0.29 lbs M6.6P353.1Y.00.00.0 0.34 lbs
3	Gasket Material: Copper		M6.95.015.34.04.02.0 0.11lbs
4	Nozzle tip		M6.6P4.XXX.XX see order table 0.31 lbs
5	Nut (Standard) Material: AISI 430F	Hex 32 Max .tork 250 Nm	M6.69.400.11 0.31 lbs

Order no. For nozzle.						Material Code	Aø[mm]	Water flow rate (V)					
Type					Aø[mm]			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°								
M6.P4	495	496	497	491	498	27	1.50	12.00	3.17	16.97	4.50	24.00	6.34
M6.P4	535	536	537	531	538	27	1.75	15.00	3.96	21.21	5.60	30.00	7.92
M6.P4	565	566	567	561	568	27	2.00	18.00	4.76	25.46	6.73	36.00	9.52
M6.P4	605	606	607	601	608	27	2.10	23.00	6.08	32.53	8.59	46.00	12.16
M6.P4	645	646	647	641	648	27	2.50	28.00	7.40	39.60	10.46	56.00	14.80
M6.P4	685	686	687	681	688	27	2.80	36.00	9.51	50.91	13.45	72.00	19.02
M6.P4	725	726	727	721	728	27	3.00	45.00	11.89	63.64	16.81	90.00	23.78
M6.P4	765	766	767	761	768	27	3.50	58.00	15.32	82.02	21.67	116.00	30.64
M6.P4	805	806	807	801	808	27	3.80	72.00	19.02	101.82	26.90	144.00	38.04
M6.P4	845	846	847	841	848	27	4.30	89.00	23.51	125.87	33.25	178.00	47.02
M6.P4	885	886	887	881	888	27	4.70	112.00	29.59	158.39	41.85	224.00	59.18
M6.P4	-	906	907	901	908	27	5.00	125.00	33.03	176.78	46.70	250.00	66.06
M6.P4	-	916	917	911	918	27	5.20	134.00	35.40	189.50	50.07	268.00	70.80

Flow rate conversion for table

$$V_2 = \sqrt{\frac{p_2}{p_1}} * V_1 \text{ [l/min]}$$

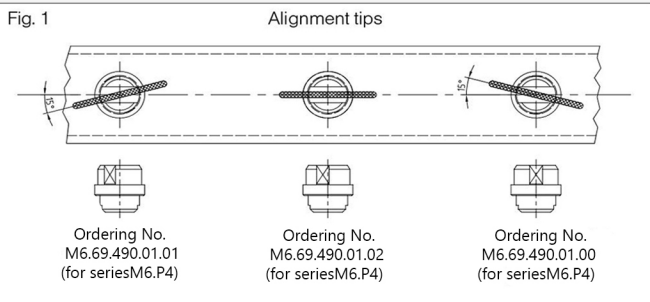
$$p_2 = \left(\frac{V_2}{V_1}\right)^2 * p_1 \text{ [bar]}$$



Special nut with hexagon socket for very narrow distances between nozzles  
Order no: M6.69.402.11

Ordering Series + Code + Mat.Code = Order No.  
example: M6.P4 + 495 + 27 = M6.P4. 495. 27

A ø = equivalent bore diameter  
Material Code 27: Stainless steel nozzle tip with tungsten carbide insert



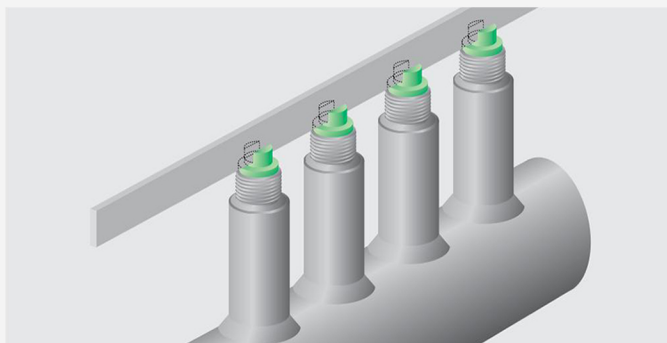
### Spraying Positions

1. Place all nozzle tips in one direction and position in parallel
2. Place nozzle tips in opposite directions for running water to both sides.

(Fig. 2. Order no M6.69.490.01) Please check Fig.3 to see the installation example for welding nipple.

### Alignment Tip

Alignment Tip is also used for closing nozzle connections or as a device for hydrostatic pressure test.



### Nipple installation

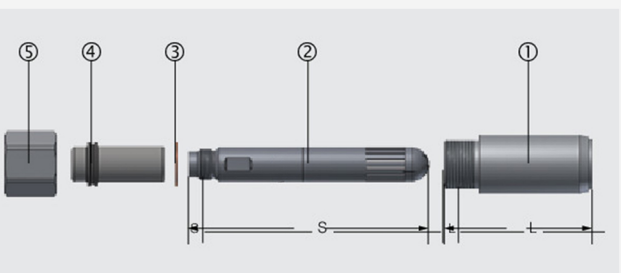
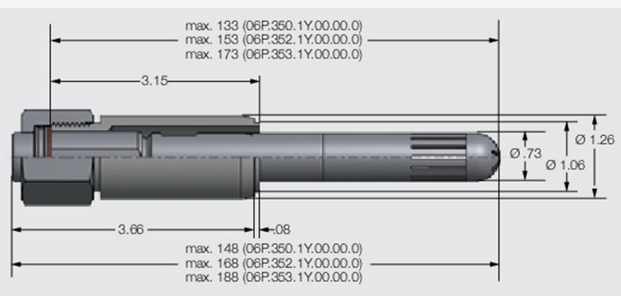
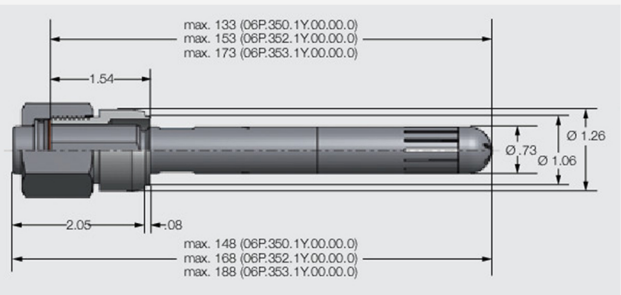
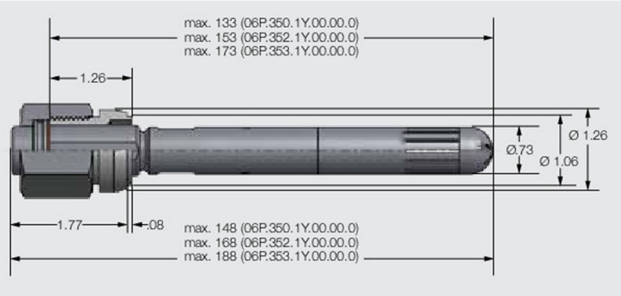
Once the nozzle mouthpieces are correctly aligned (with 15 offset angles to the longitudinal axis of the head), placed the welding nipple on the spray header; thus its flat inner surface is being positioned longitudinally parallel to the head.



# ShortSCALEMASTER AP SUPERIOR®



- | Decreased spray height
- | Enhanced descaled material surface quality
- | Increased pump energy saving
- | Decreased water flow rate
- | Less colling of descaled product



Which also provides benefits as below:

- | Improved descaling through increased impact.
- | Higher surface quality in result of increased impact.
- | Use of decreased water flow rate in descaling
- | Increased energy saving because of less colling need of the descaled product
- | Longer mechanical end strength due to decreased water flow.
- | Replaceable with all other SCALEMASTER nozzles.

Since the vertical spray is under height 150mm, shortSCALEMASTER AP is the most appropriate descaling nozzle for all traditional hot strip mills that working with smaller size nozzles.

No:	Component	Order no:	Weight
1	Welding nipple material: AISI 304	Length: L = 1.26 in L = 1.54 in L = 3.15 in order length on request.	M6.60.020.1C.01 M6.60.020.1C.00 M6.60.020.1C.02 0.132 lbs 0.176 kg 0.419 lbs
2	Filter stabilizer Unit Material: Stainless steel	Filtreli S = 110 Filtreli S = 130 Filtreli S = 150	M6.6P350.1Y.00.00.0 M6.6P352.1Y.00.00.0 M6.6P353.1Y.00.00.0 0.220 lbs 0.287 lbs 0.342 lbs
3	Gasket Material: Copper		M6.95.015.34.02.07.0 0.002 lbs
4	Nozzle tip		M6.6P3.XXX.XX see order table 0.309 lbs
5	Nut (Standard) Material: AISI 430F	Hex 32 Max .tork 200 Nm	M6.64.400.11 0.187 lbs

Order no. For nozzle.							A $\phi$ [mm]	Water flow rate (V)					
Type								p = 100 bar (1450 psi)		p = 200 bar (2900 psi)		p = 400 bar (5800 psi)	
Series	Code					Material Code		[l/min]	[US Gall./min]	[l/min]	[US Gall./min]	[l/min]	[US Gall./min]
	Nominal spray angle												
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M6.P3	685	686	687	681	688	27	2.80	36.00	9.51	50.91	13.45	72.00	19.02
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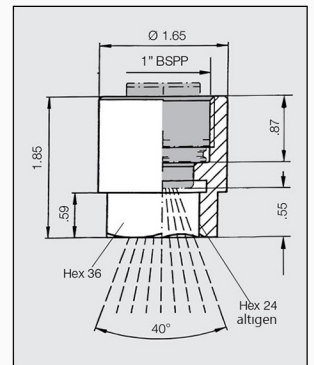
Ordering Series + Code + Mat.Code = Order No.  
 example: M6.P4 + 495 + 27 = M6.P3. 495. 27

A  $\phi$  = equivalent bore diameter  
 Material Code 27: Stainless steel nozzle tip with tungsten carbide insert

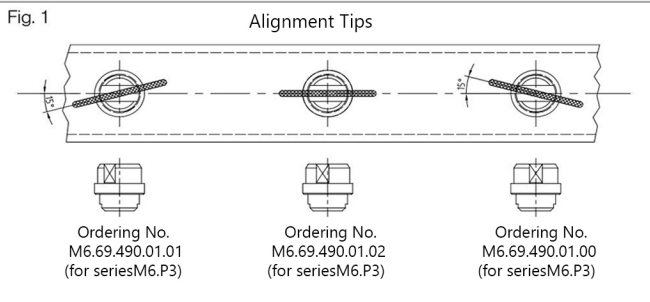
Flow rate conversion for table

$$V_2 = \sqrt{\frac{p_2}{p_1}} * V_1 \text{ [l/min]}$$

$$p_2 = \left(\frac{V_2}{V_1}\right)^2 * p_1 \text{ [bar]}$$



Special nut with hexagon socket for very narrow distances between nozzles  
 Order no: M6.64.401.11



### Spraying Positions

1. Place all nozzle tips in one direction and position in parallel
2. Place nozzle tips in opposite directions for running water to both sides.

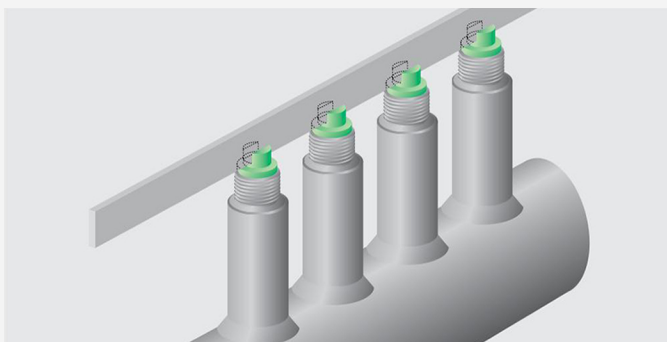
This can be easily work through alignment tip (Fig. 2). Order no M6.64.490.01) Please check Fig.3 to see the installation example for welding nipple.

### Alignment Tip

Alignment Tip is also used for closing nozzle connections or as a device for hydrostatic pressure test.

### Nipple installation

Once the nozzle mouthpieces are correctly aligned (with 15 offset angles to the longitudinal axis of the head), placed the welding nipple on the spray header; thus its flat inner surface is being positioned longitudinally parallel to the head.



# WCV Water Control Valve for Series

Water Control Valve contains a stabilizer which enables it to work as a check valve

All Water Control Valves include filter

Water Control Valves are made of stainless steel

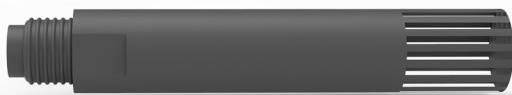
High performance in metallic sealing with hardened piston



WCV for 6P4 series



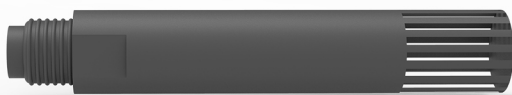
WCV with 6P4 nozzle



WCV (for 6P4 series) without nozzle



6P3 nozzle WCV



WCV (for 6P3 series) without nozzle



WCV for 6P3 series

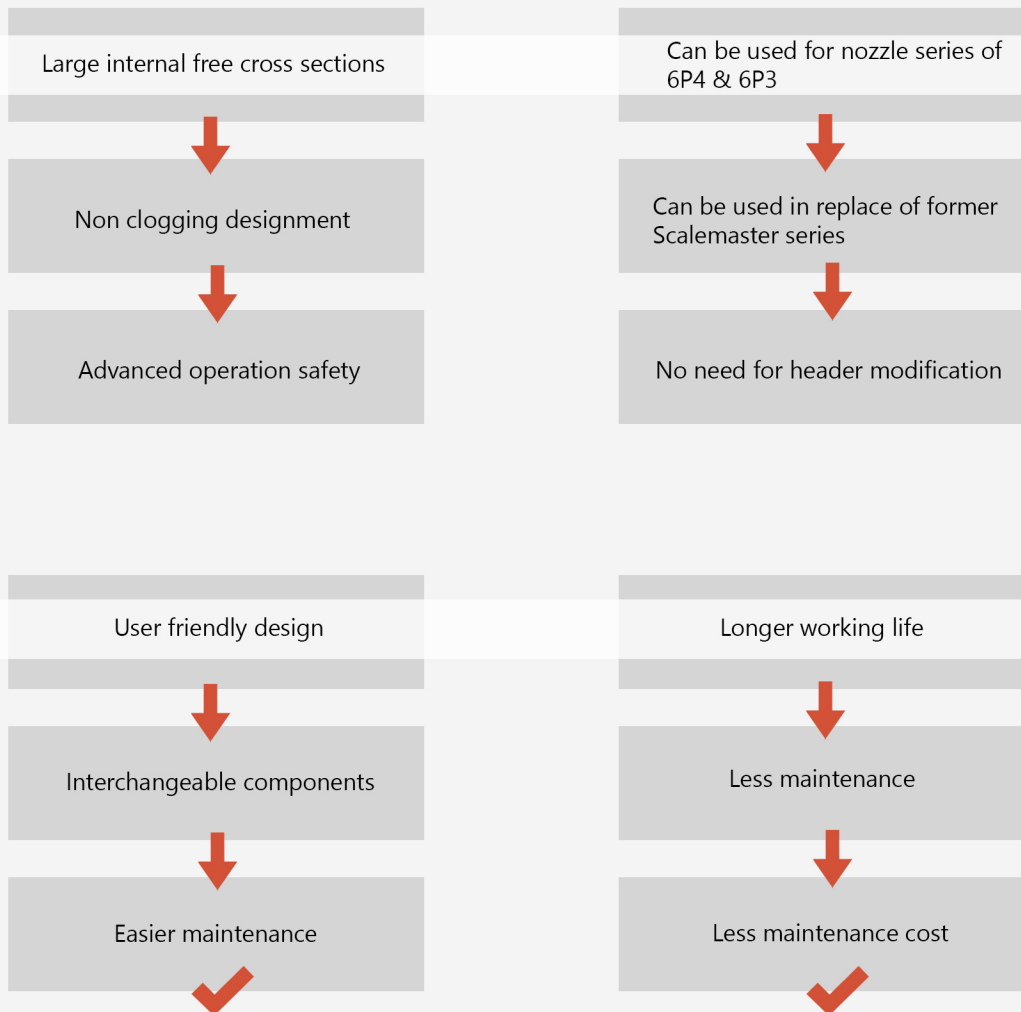




# Advantages of Water Control Valve

While, descaling of steel plates and stainless-steel strips is processing, descaling is not performed for all passing rolls. On this point, nozzle check valves help to prevent unnecessary surface cooling that happens during the system's water prefilling.

Series	Ordering No.	Opening Pressure [psi]	Closing Pressure [psi]	Material
SCALEMASTER APS (6P4)	M6.6P.470.16.00.00	203	145	Stainless steel
shortSCALEMASTER APS (6P3)	M6.6P.370.16.00.00	203	145	Stainless steel



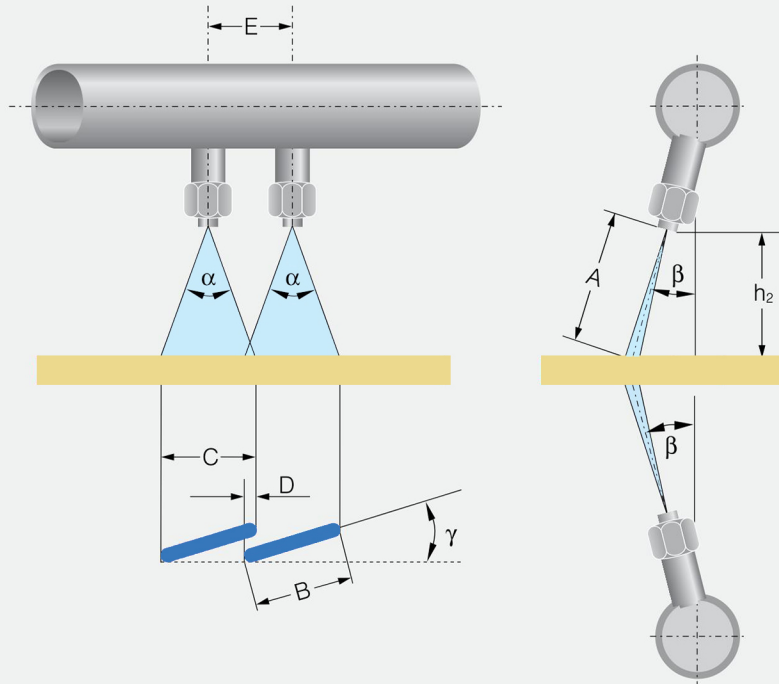
The below nozzle arrangement is applied on the spray header:

$$E = C - D$$

$$C = \cos \gamma \cdot B$$

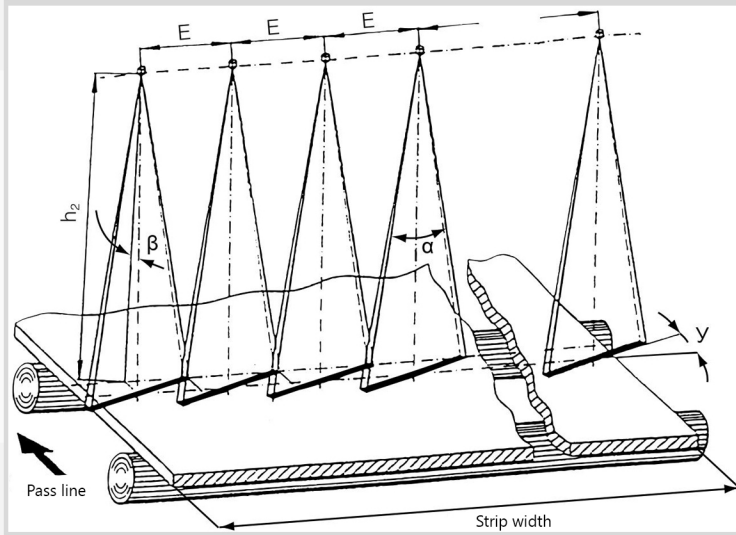
$$\beta = 5^\circ, 10^\circ \text{ or } 15^\circ$$

- A = Spray length
- B = Spray
- C = Spray in rolling direction
- D = Overlap
- E = Nozzle distance
- $h_2$  = Vertical spray height
- $\alpha$  = Nozzle spray angle
- $\beta$  = Angle of inclination
- $\gamma$  = Offset angle of the nozzle with respect to the pipe roll axis



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

Vertical spray height $h_2$ [in]	Angle of inclination $\beta = 15^\circ$ A [in]	Nominal nozzle spray angle at $p = 150$ bar															
		$\alpha = 22^\circ$				$\alpha = 26^\circ$				$\alpha = 30^\circ$				$\alpha = 40^\circ$			
		B [in]	C [in]	D [in]	E [in]	B [in]	C [in]	D [in]	E [in]	B [in]	C [in]	D [in]	E [in]	B [in]	C [in]	D [in]	E [in]
1.97	2.05	1.02	0.98	-	-	1.18	1.14	-	-	1.38	1.34	-	-	1.85	1.77	0.20	1.57 <sup>1)</sup>
2.95	3.07	1.42	1.38	-	-	1.69	1.65	0.20	1.46 <sup>1)</sup>	1.93	1.85	0.20	1.85 <sup>1)</sup>	2.64	2.56	0.28	2.28 <sup>2)</sup>
3.94	4.09	1.85	1.77	0.28	1.5 <sup>1)</sup>	2.20	2.13	0.20	1.93 <sup>2)</sup>	2.52	2.44	0.20	2.24 <sup>3)</sup>	3.46	3.35	0.31	3.03
4.92	5.08	2.24	2.17	0.28	1.89 <sup>2)</sup>	2.68	2.60	0.28	2.32 <sup>3)</sup>	3.07	2.95	0.28	2.68	4.25	4.09	0.39	3.70
5.91	6.10	2.68	2.60	0.31	2.28 <sup>3)</sup>	3.19	3.07	0.28	2.80	3.66	3.54	0.31	3.23	5.04	4.88	0.39	4.49
7.87	8.15	3.50	3.39	0.35	3.03	4.17	4.02	0.39	3.62	4.80	4.65	0.39	4.25	6.61	6.38	0.59	5.79
9.84	10.20	4.37	4.21	0.43	3.78	5.20	5.04	0.39	4.65	5.94	5.75	0.59	5.16	8.23	7.95	0.59	7.36



Company \_\_\_\_\_

Responsible \_\_\_\_\_

Address \_\_\_\_\_

Phone \_\_\_\_\_

Fax \_\_\_\_\_

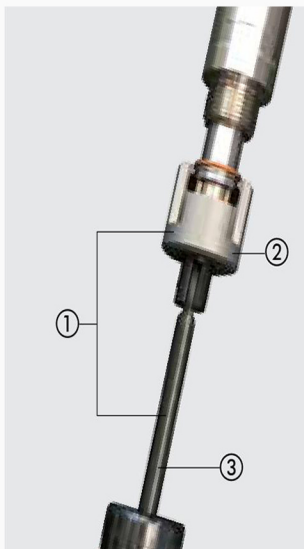
E-mail \_\_\_\_\_

## Questionnaire about existing Nozzle Arrangement

Name	Tarih	Bölüm			
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 [inç]	Nozzle Data			
Strip			top	bottom	
Slab		Number of headers			
Plate		Nozzle type			
Bloom		Horizontal distance (E)	in	in	
Billet		Number of nozzles			
Rounds		Vertical spray height ( $h_2$ )	in	in	
Material speed	m/s	Spray angle ( $\alpha$ )	°	°	
Pressure at header	psi	Offset angle ( $\gamma$ )	°	°	
Available max. water flow	gal/min	Impingement angle ( $\beta$ )	°	°	
	l/h				
Room for sketch:					

## Disassembly Set

The disassembly set is pushed into the recess on the nozzle mouthpiece. Then the complete nozzle can be pulled out when the union nut is dismantled.



## Spray Headers

Mitsuda is offering complete spray headers or rings besides the great range of descaling nozzles.



### For SCALEMASTER APS

#### Disassembly set

Ordering no. M6.69.492.12.00.00.0

#### Tip extractor

Ordering no. M6.69.492.12.00.10.0

#### Extraction tool

Ordering no. M6.95.009.00.12.56.0

### For shortSCALEMASTER APS

#### Disassembly set

Ordering no. M6.64.492.12.00.00.0

#### Tip extractor

Ordering no. M6.64.492.12.00.10.0

#### Extraction tool

Ordering no. M6.95.009.00.12.56.0

