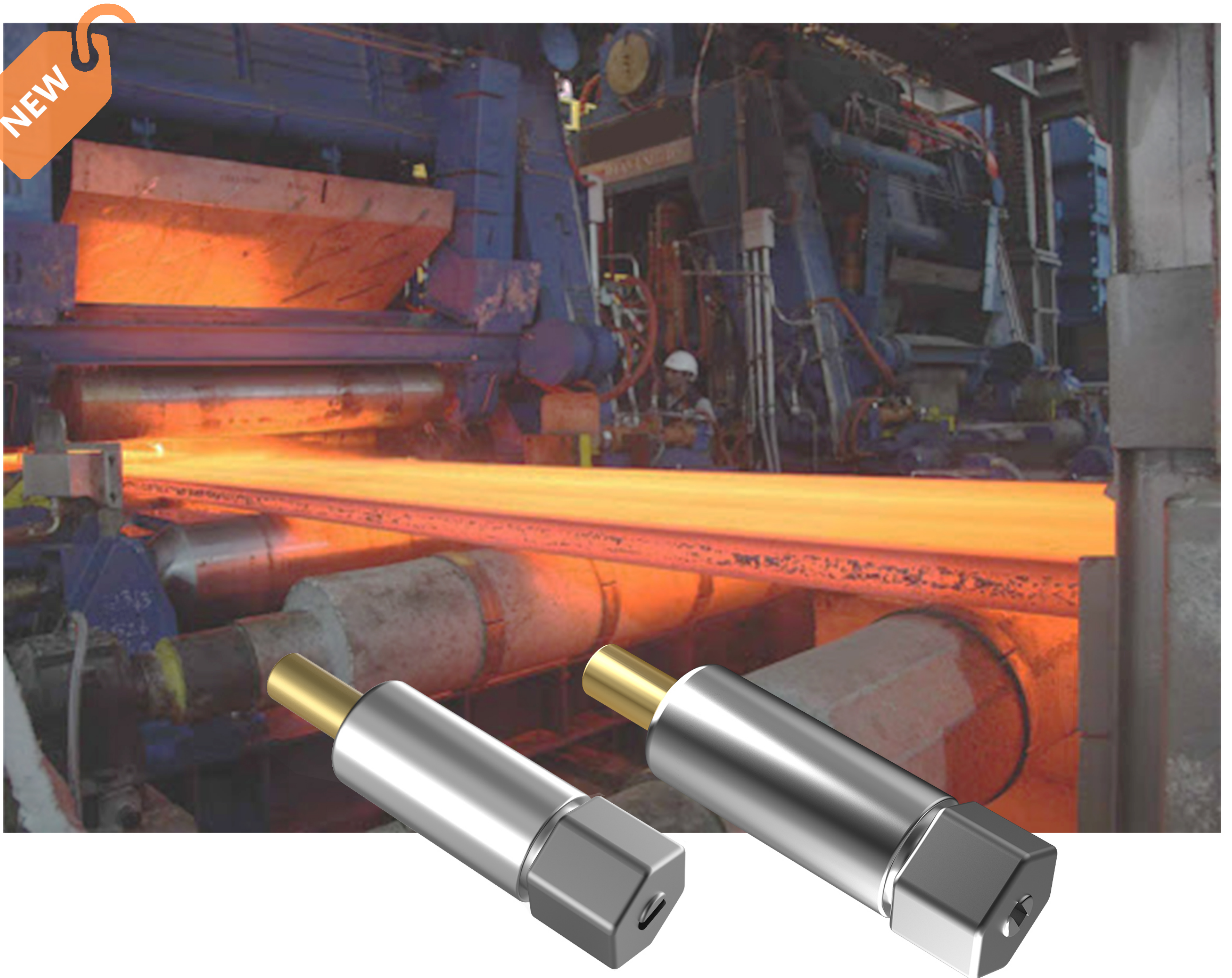


SCALEMASTER AP<sup>®</sup>  
**Advanced Performance**





Upon increasing need for improved product quality and more energy saving, descaling system is redesigned to work more efficiently than in the past.

An improved descaling system is through related with the spray and nozzle quality that redesigned based on following points:

- | Improved product quality
- | Decrease in operating costs
- | Decrease in pump energy consumption
- | Decrease cooling of product through sprays

This redesigned ScaleMaster enables top to get maximum impact and water pressure through minimum energy consumption.

The basic points in design of new Scalemaster are as follows:

- | Smooth impact distribution of individual sprays on target surfaces
- | Spray angle
- | Spray thickness
- | Flow rate

Scalemaster system have been installed in more than 100 facility worldwide and working efficiently and successfully in descaling. As a result of this high success, the Scalemaster AP is developed with more developed features.

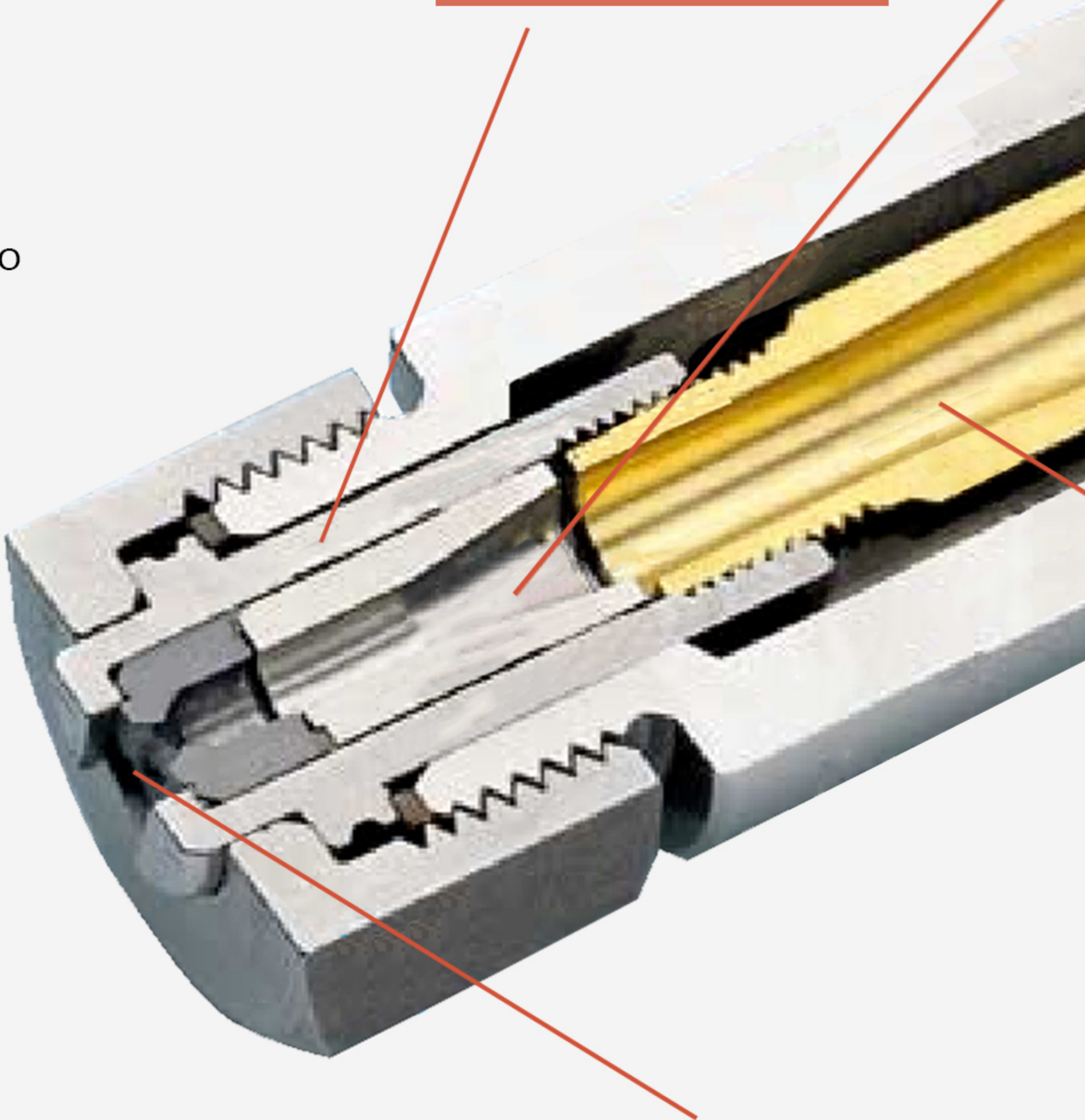
The most significant feature of ScaleMaster AP is the increased spray impact density that provides better descaling and surface quality.

In addition to all these features, the new SCALAMASTER AP is created within high tolerances to work efficiently in all operating conditions.

**Mitsuda is one of a few spray nozzle manufacturers in the world that uses computer-based 3D and 5D modelling techniques which support to get best results through optimizing nozzle and header arrangements.**

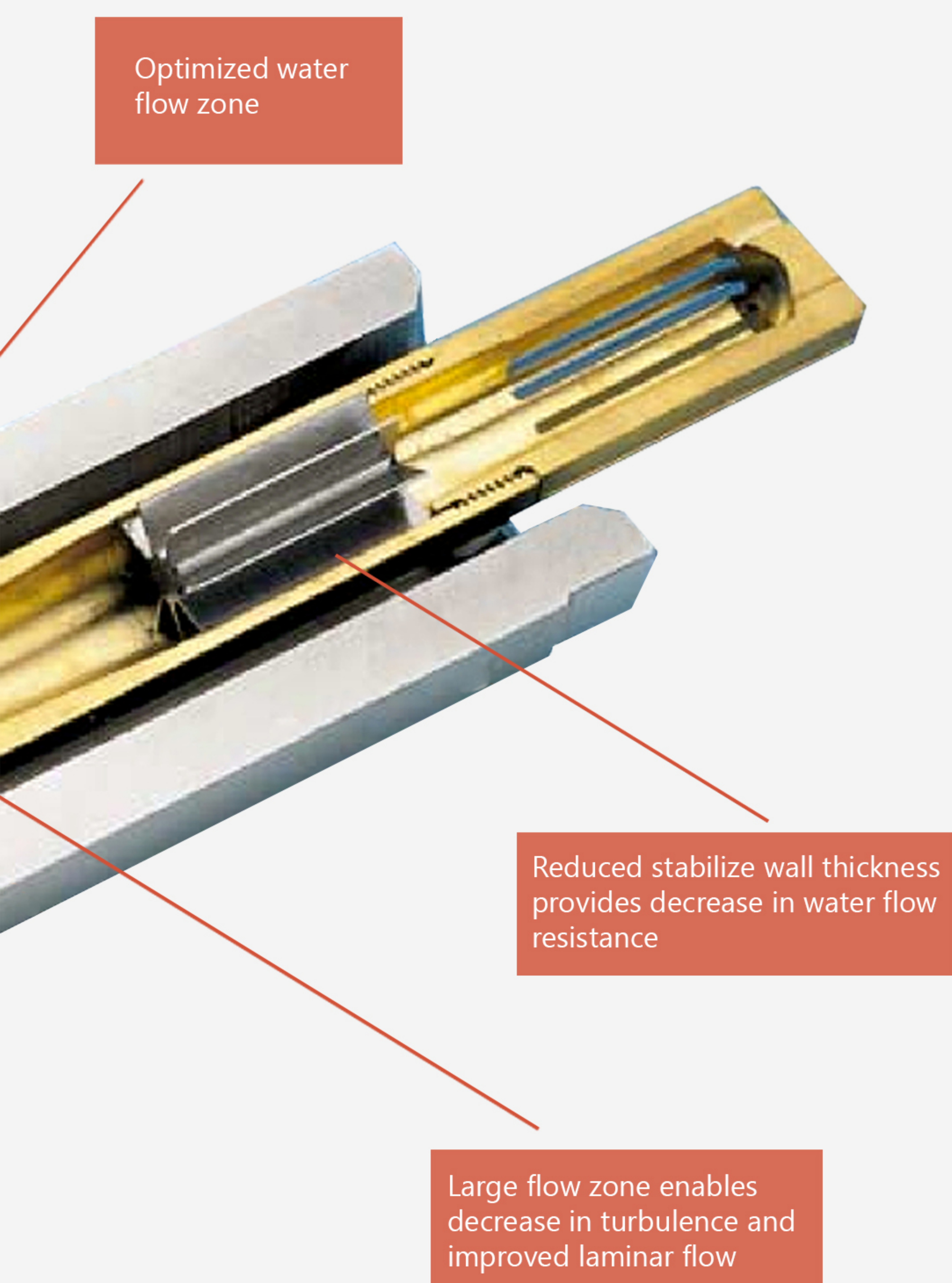
Computer based modelling also enables to many rolling mills to decrease operating costs while improving product quality

Ust -The nozzle tips of SCALAMASTER AP and ShortSCALEMASTER AP also changeable with all other SCALAMASTER AP tips.



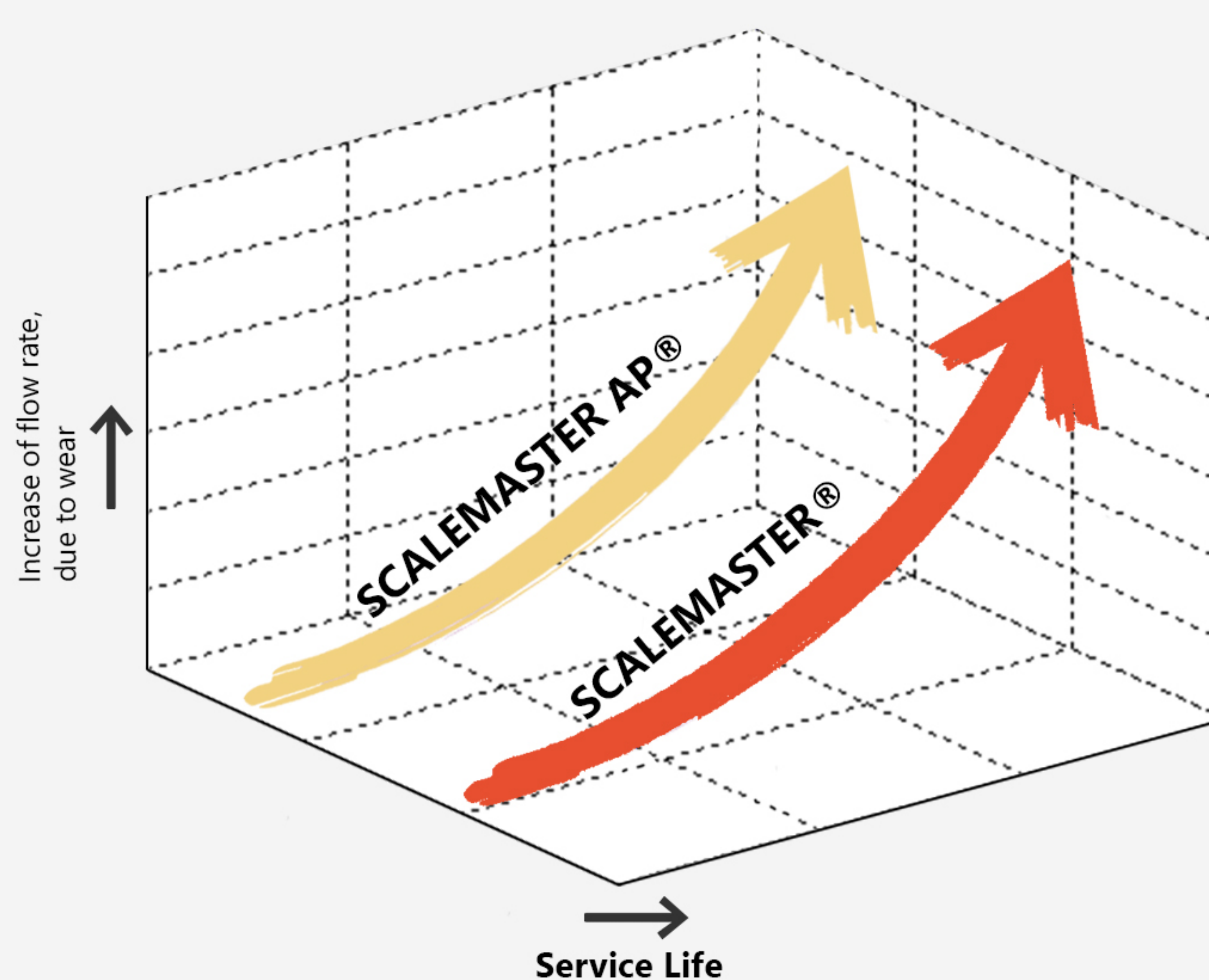
Alt- Advanced nozzle designs within the orifice and flow zone help to reduce wearing and increase jet quality.





## SCALEMASTER AP®

SCALEMASTER AP long life is designed to be used in the areas where high spray pressures lead to more wearing of nozzle orifice. Advanced nozzle designs within the orifice and flow zone help to reduce wearing and extended the service life of the nozzle.



## Service Life Diagram

SCALEMASTER AP Long Life offers 3 to 4 times longer service life than standard SCALEMASTER AP.

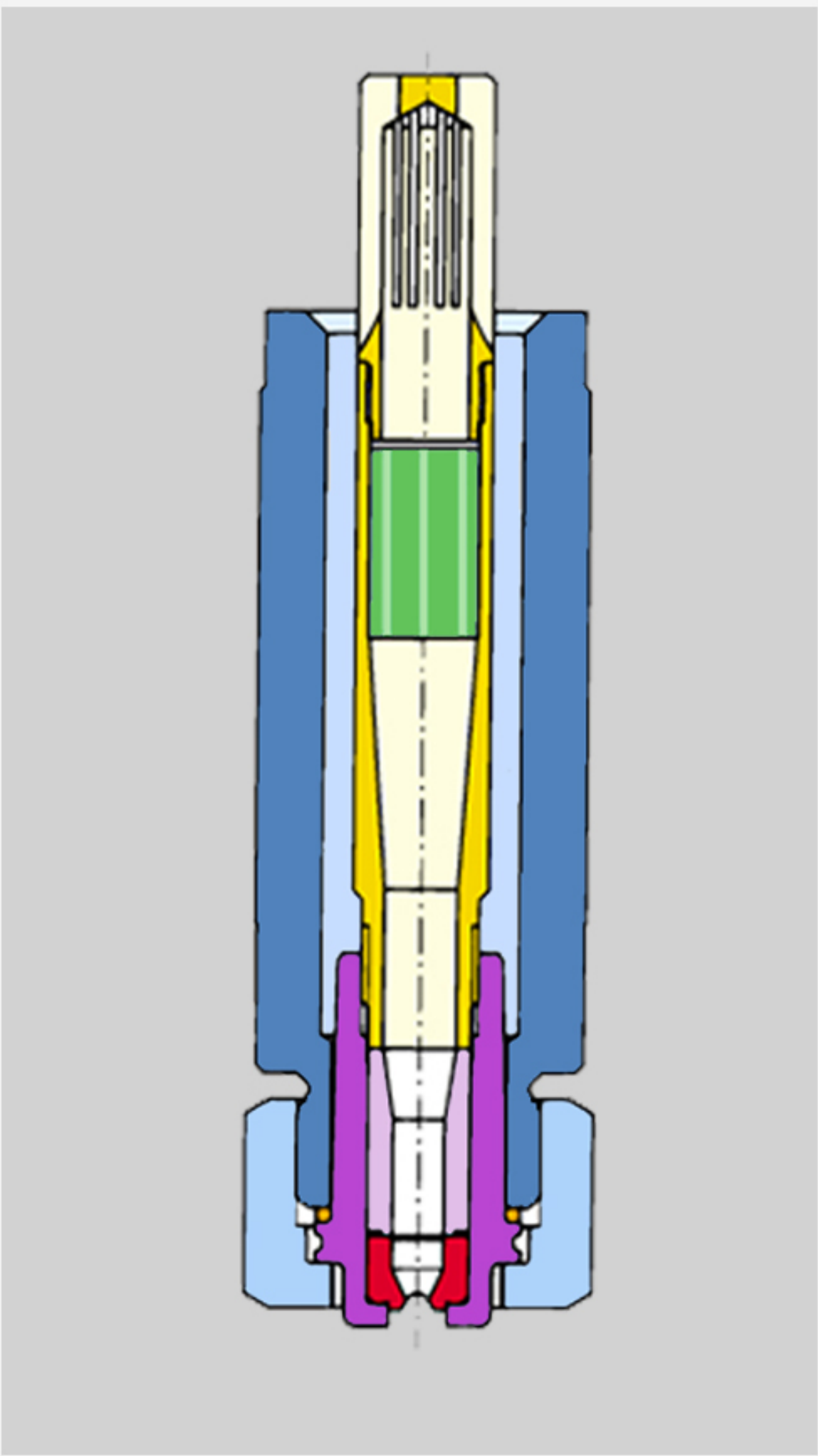
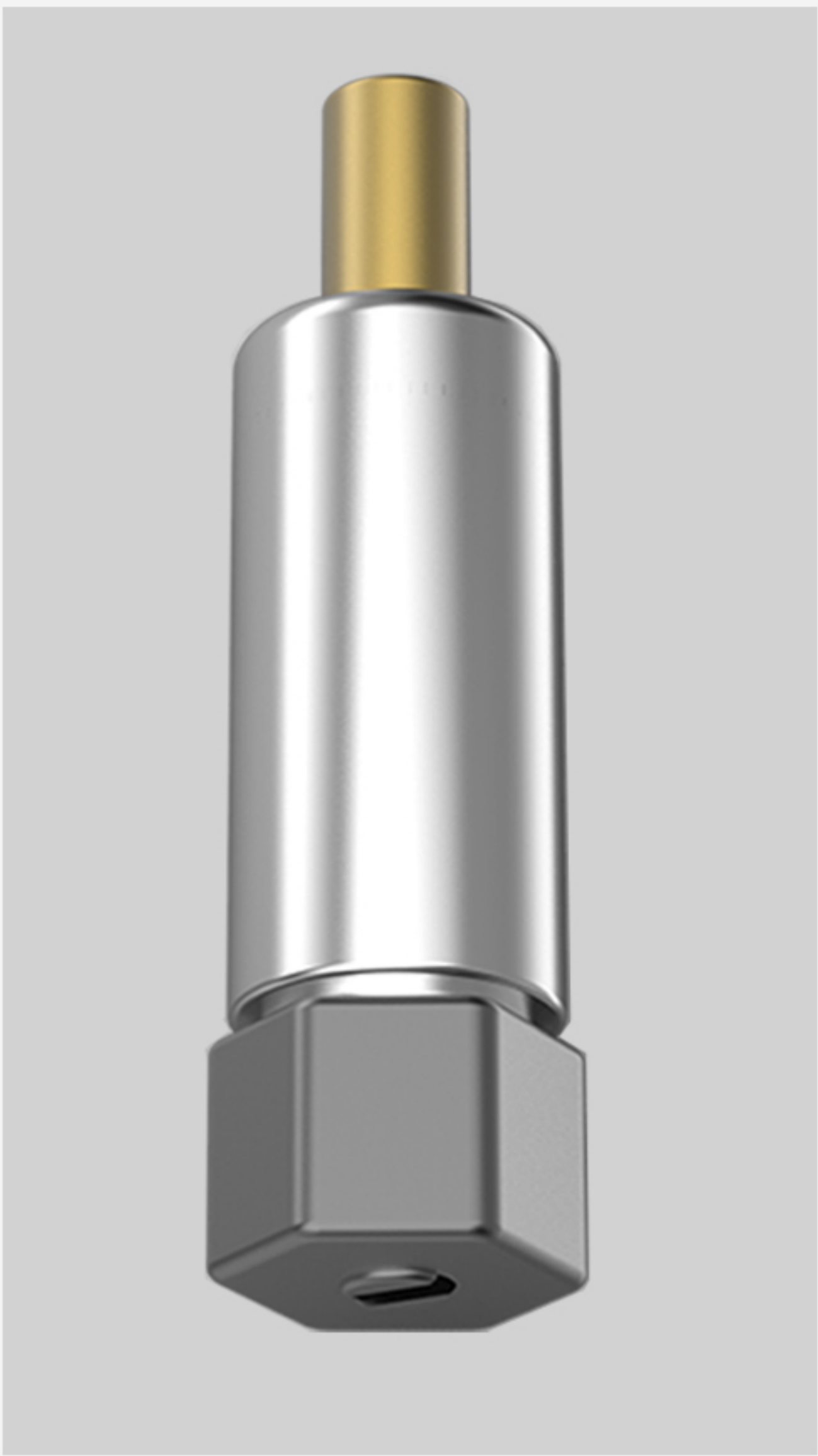
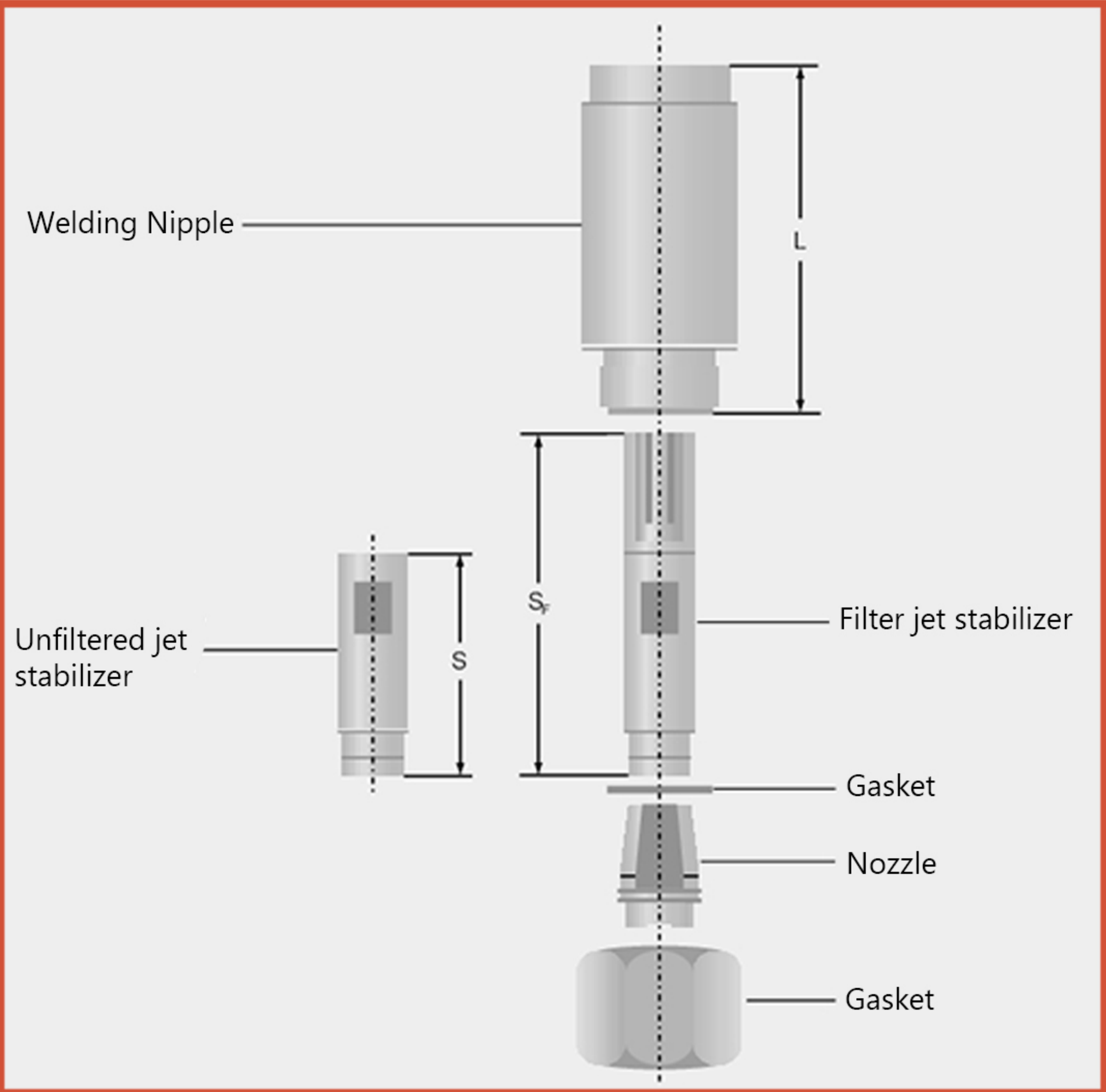


# Standard Scalemaster AP® Series

## M6.682



Components (products)		Ordering No.	Weight [kg]
Welding nipple Material: AISI 304	Length: L = 120mm L = 100mm L = 73mm	M6.69.411.1C.00	0,830
		M6.69.410.1C.10	0.690
		M6.69.410.1C.73	0.480
Jet stabilizer Material Brass	No filter S = 74	M6.64.231.16	0.070
	No filter S = 94	M6.64.233.16	0.080
	Filtred S = 110	M6.64.250.16	0.110
	Filtred S = 130	M6.64.252.16	0.140
	Filtred S = 150	M6.64.253.16	0.160
Gasket Material: Copper		M6.95.015.34.04.02.2	0.04
Nozzle		682.XXX.XX see table	0.085
Nut (Standard) Material: AISI 431	Hex 41	M6.69.400.11	0.153
Hexagon socket nut Material: AISI 431	Hex 24/36 see page 5	M6.69.402.11	0.240
Alingment tip / Blank tip (see Page 9) Material: Ming steel	Data sheet on request	M6.69.490.01	0.072
Dismantling tool Material: Mild steel	Data sheet on request	M6.69.491.01	0.140
Tip extractor	Data sheet on request	M6.95.009.00.12.56.0	0.950



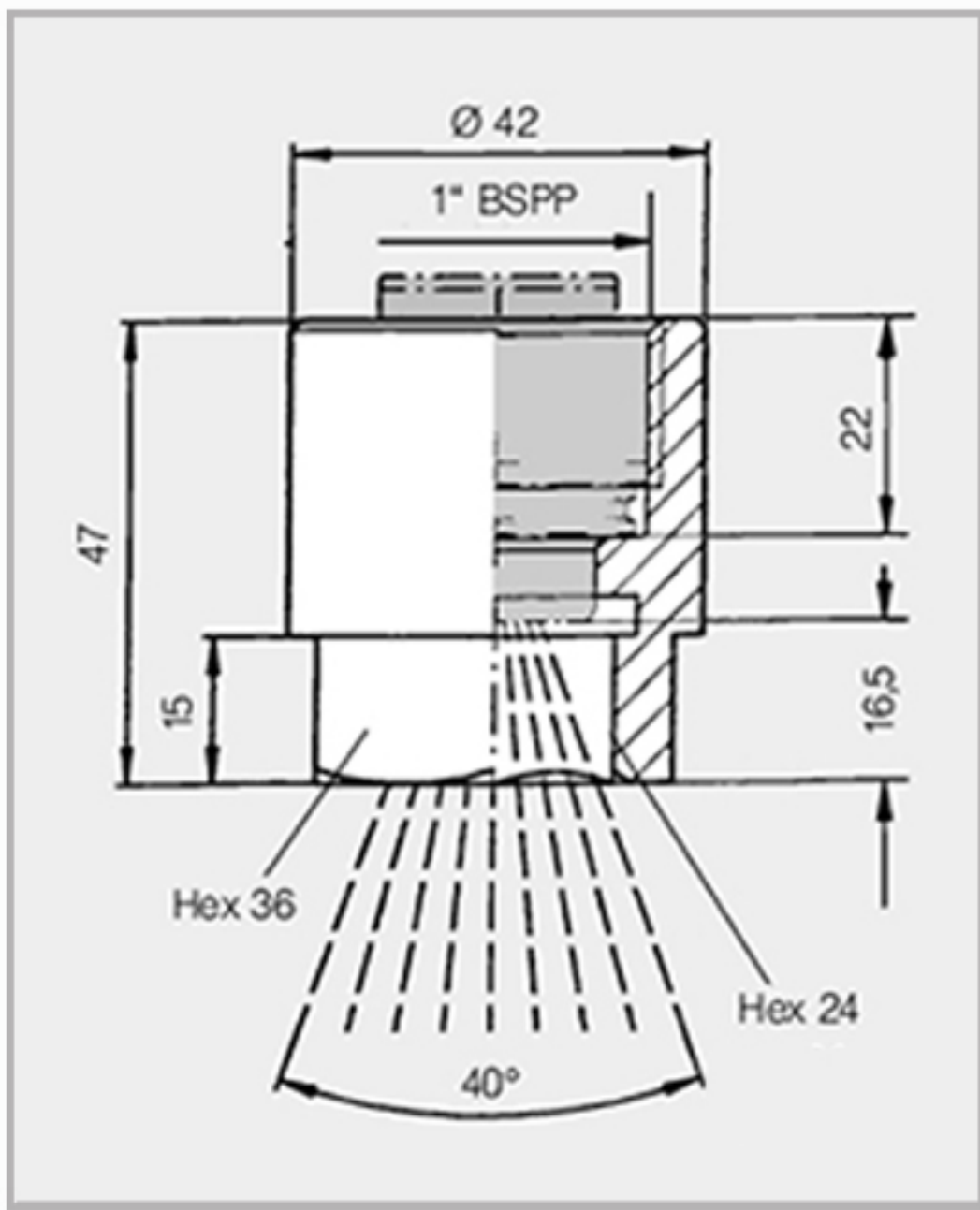


# Standard Scalemaster AP Flow Rate Charge and Ordering Data



Volume ratio conversion formula:

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



Special nut with hexagon socket.  
For very short spray heights.  
Ord-No: M6.69.402.11

Ordering No.							Flow water for water (V)					
Type					Mat.-No.							
Series	Code				Tungsten carbide	Long life in tungsten carbide	p = 100 bar (1450 psi)		p = 200 bar (2900 psi)		p = 400 bar (5800 psi)	
	22	26	30	40			[l/min]	[US Gall./min]	[l/min]	[US Gall./min]	[l/min]	[US Gall./min]
M6.682	495	496	497	498	○	-	12,00	3,17	16,97	4,50	24,00	6,34
M6.682	535	536	537	538	○	○	15,00	3,96	21,21	5,60	30,00	7,92
M6.682	565	566	567	568	○	○	18,00	4,76	25,46	6,73	36,00	9,52
M6.682	605	606	607	608	○	○	23,00	6,08	35,53	9,39	46,00	12,16
M6.682	645	646	647	648	○	○	28,00	7,40	39,60	10,46	56,00	14,80
M6.682	685	686	687	688	○	○	36,00	9,51	50,91	13,45	72,00	19,02
M6.682	725	726	727	728	○	○	45,00	11,89	63,64	16,81	90,00	23,78
M6.682	765	766	767	768	○	○	58,00	15,32	82,02	21,67	116,00	30,64
M6.682	805	806	807	808	○	○	72,00	19,02	101,82	26,90	144,00	38,04
M6.682	845	846	847	848	○	○	89,00	23,51	125,87	33,25	178,00	47,02
M6.682	885	886	887	888	○	○	112,00	29,59	158,39	41,85	224,00	59,18
M6.682	-	906	907	908	○	○	125,00	33,03	176,78	46,70	250,00	66,06
M6.682	-	916	917	918	○	○	134,00	35,40	189,50	50,07	268,00	70,80

Example      Series + Code + Mat.-No. = Ordering No.  
for Ordering: M6.682 + 495 + 27 = M6.682.495.55

Type (Spray angle 22)	E [mm]	A [mm]
M6.682.495	1,20	1,50
M6.682.535	1,40	1,75
M6.682.565	1,60	2,00
M6.682.605	1,80	2,10
M6.682.645	2,00	2,50
M6.682.685	2,20	2,80
M6.682.725	2,50	3,00
M6.682.765	2,80	3,50
M6.682.805	3,20	3,80
M6.682.845	3,50	4,30
M6.682.885	3,90	4,70

Type (Spray angle 26)	E [mm]	A [mm]
M6.682.496	1,17	1,50
M6.682.536	1,30	1,75
M6.682.566	1,50	2,00
M6.682.606	1,70	2,10
M6.682.646	1,90	2,50
M6.682.686	2,20	2,80
M6.682.726	2,40	3,00
M6.682.766	2,50	3,50
M6.682.806	3,00	3,80
M6.682.846	3,50	4,30
M6.682.886	3,90	4,70
M6.682.906	4,00	5,00
M6.682.916	4,20	5,20

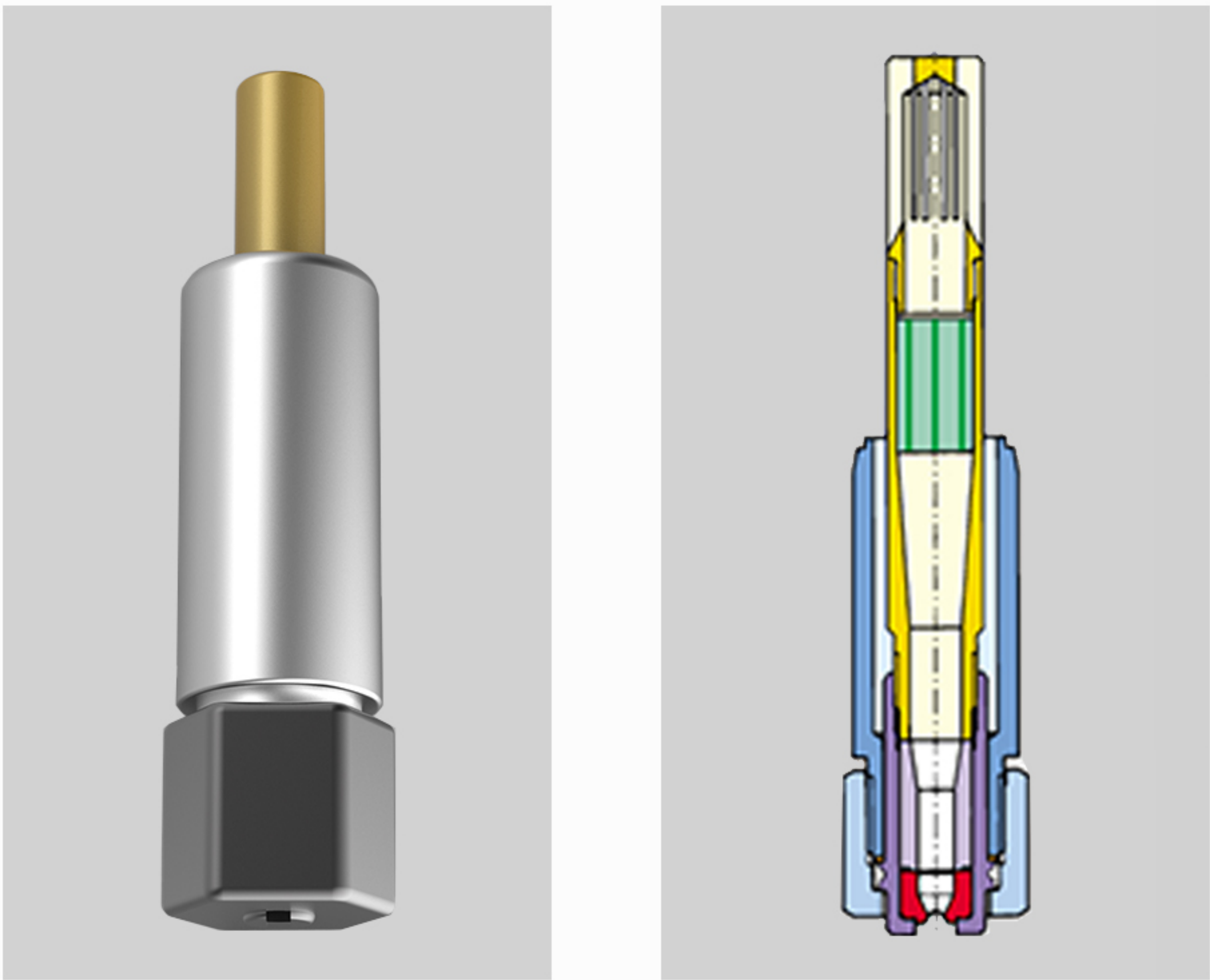
Type (Spray angle 30)	E [mm]	A [mm]
M6.682.497	1,16	1,50
M6.682.537	1,30	1,75
M6.682.567	1,40	2,00
M6.682.607	1,60	2,10
M6.682.647	1,80	2,50
M6.682.687	2,10	2,80
M6.682.727	2,30	3,00
M6.682.767	2,40	3,50
M6.682.807	2,90	3,80
M6.682.847	3,20	4,30
M6.682.887	3,70	4,70
M6.682.907	3,90	5,00
M6.682.917	4,00	5,20

Type (Spray angle 40)	E [mm]	A [mm]
M6.682.498	1,11	1,50
M6.682.538	1,20	1,75
M6.682.568	1,20	2,00
M6.682.608	1,50	2,10
M6.682.648	1,60	2,50
M6.682.688	2,00	2,80
M6.682.728	2,90	3,00
M6.682.768	2,30	3,50
M6.682.808	2,70	3,80
M6.682.848	3,00	4,30
M6.682.888	3,40	4,70
M6.682.908	3,70	5,00
M6.682.918	3,80	5,20

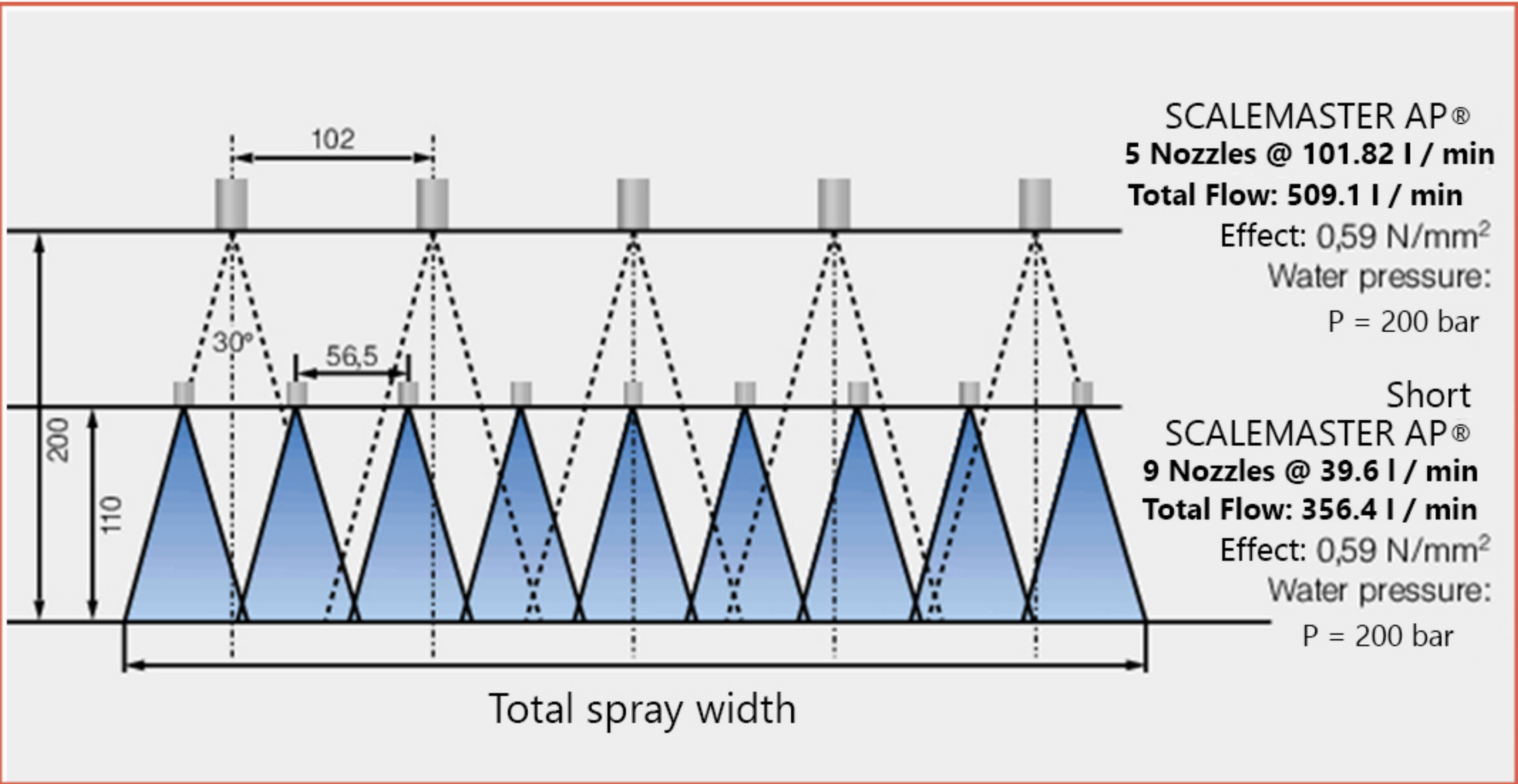


The ShortSCALEMASTER AP is designed to be used in the areas where lower spray height needed.

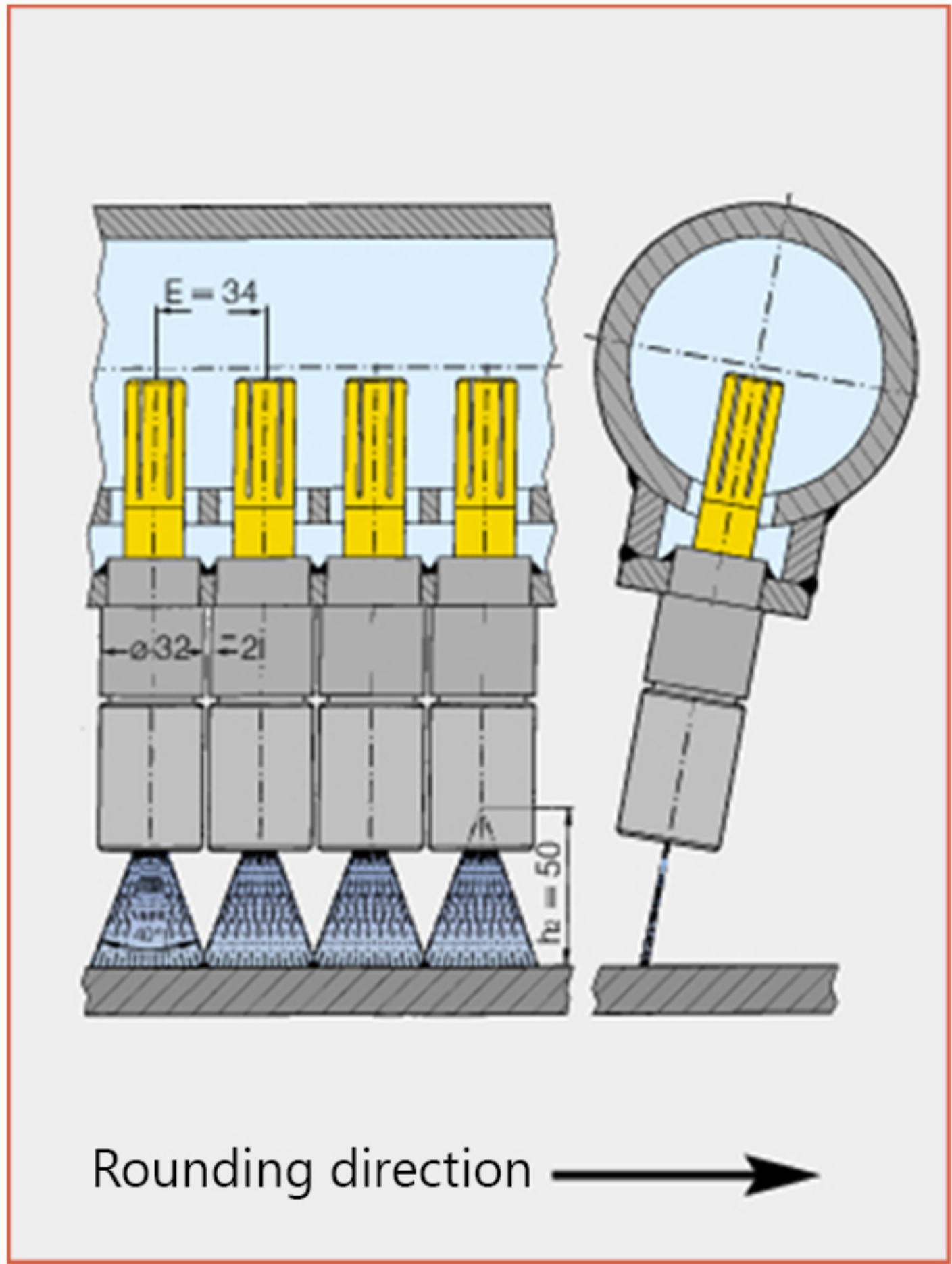
Under normal conditions, the minimum spray height is 50 mm because the nozzles cannot be placed closer. In need of a spray height less than 50 mm, MITSUDA provides a special retaining nut. (See on the right side)



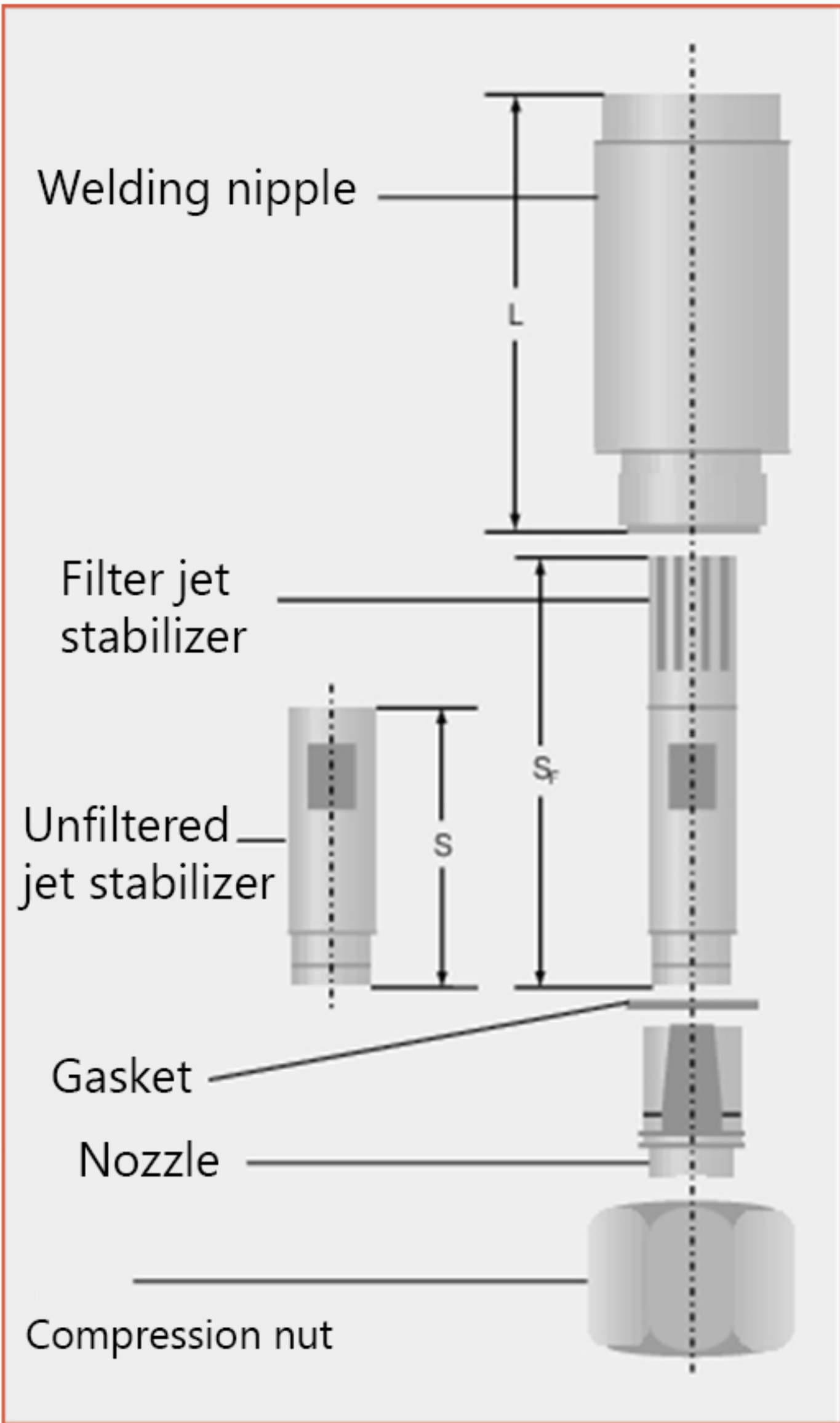
Components (products)		Ordering No.	Weight [kg]
Welding nipple Material: AISI 304	Length: L = 32mm	M6.60.020.1C.01	0,065
	L = 39mm	M6.60.020.1C.00	0,082
	L = 80mm	M6.60.020.1C.02	0,192
Jet stabilizer Material Brass	No filter S = 74	M6.64.231.16	0,070
	No filter S = 94	M6.64.233.16	0,080
	Filtred S = 110	M6.64.250.16	0,110
	Filtred S = 130	M6.64.252.16	0,140
Gasket Material: Copper	Filtred S = 150	M6.64.253.16	0,160
		M6.95.015.34.02.07.0	0,001
Nozzle		642.XXX.XX see table	0,067
Nut (Standard) Material: AISI 431	Hex 32	M6.64.400.11	0,085
Hexagon socket nut Material: AISI 431	Hex 22	M6.64.401.11	0,120
Alingment tip / Blank tip (see Page 9) Material: Ming steel	Data sheet on request	M6.64.490.01	0,056
Dismantling tool Material: Mild steel	Data sheet on request	M6.64.491.01	0.110
Tip extractor	Data sheet on request	M6.95.009.00.12.56.0	0,950



Water saving example using SCALEMASTER AP®



SCALEMASTER AP® layout welding nipple arrangement (with hexagon socket)



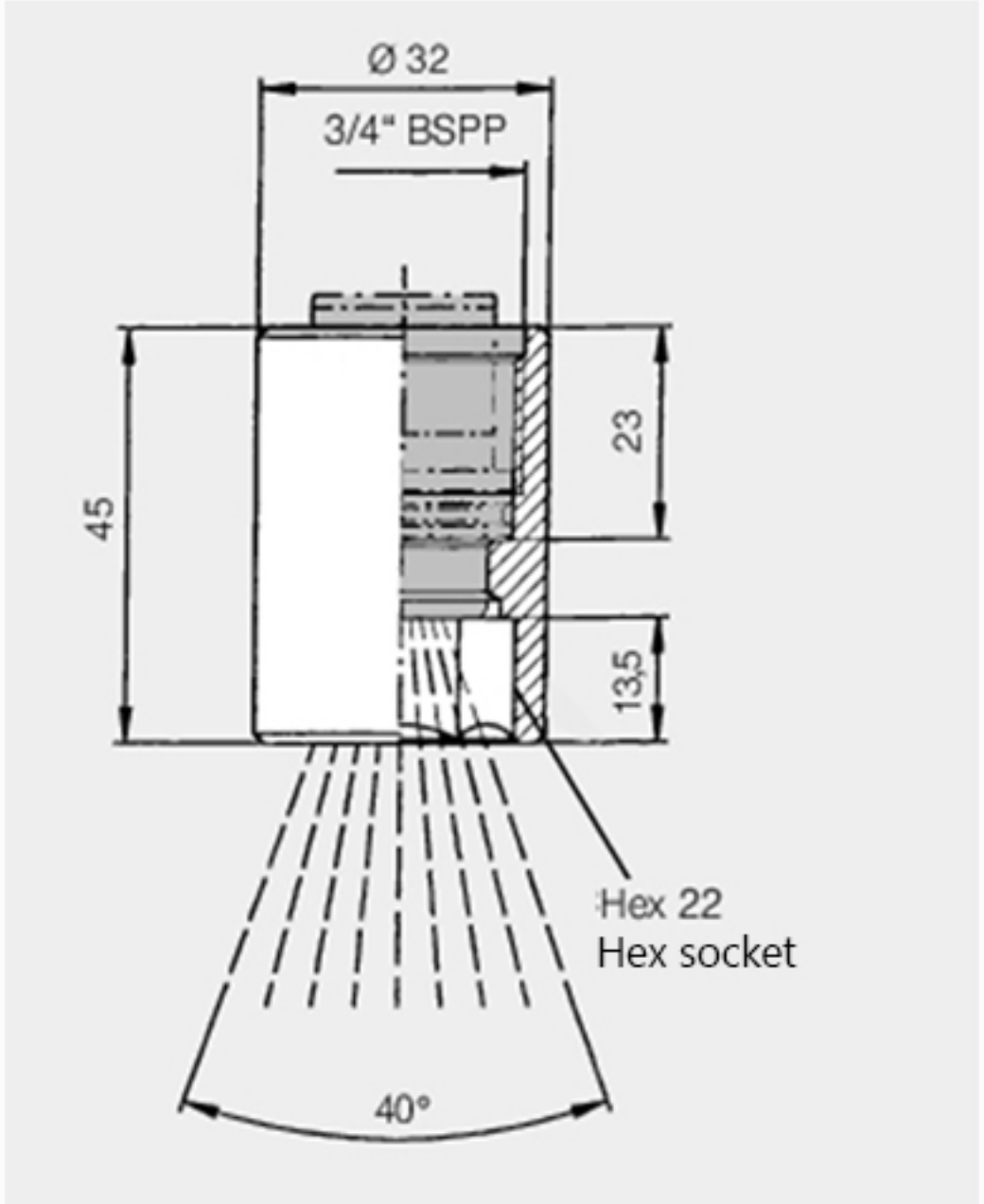


ShortSCALEMASTER AP®Flow  
Rate & Ordering Data



Volume ratio conversion formula

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



Ordering No.							Flow rate for water (V)					
Type					Mat.-No.							
Series	Code				Tungsten carbide 55	Tungsten carbide long life S7	p = 100 bar (1450 psi)		p = 200 bar (2900 psi)		p = 400 bar (5800 psi)	
	Spray angle						[l/min]	[US Gall./min]	[l/min]	[US Gall./min]	[l/min]	[US Gall./min]
	22	26	30	40								
M6.642	495	496	497	498	○	-	12,00	3,17	16,97	4,50	24,00	6,34
M6.642	535	536	537	538	○	○	15,00	3,96	21,21	5,60	30,00	7,92
M6.642	565	566	567	568	○	○	18,00	4,76	25,46	6,73	36,00	9,52
M6.642	605	606	607	608	○	○	23,00	6,08	35,53	9,39	46,00	12,16
M6.642	645	646	647	648	○	○	28,00	7,40	39,60	10,46	56,00	14,80
M6.642	685	686	687	688	○	○	36,00	9,51	50,91	13,45	72,00	19,02
M6.642	725	726	727	728	○	○	45,00	11,89	63,64	16,81	90,00	23,78
M6.642	765	766	767	768	○	○	58,00	15,32	82,02	21,67	116,00	30,64
M6.642	805	806	807	808	○	○	72,00	19,02	101,82	26,90	144,00	38,04
M6.642	845	846	847	848	○	○	89,00	23,51	125,87	33,25	178,00	47,02
M6.642	885	886	887	888	○	○	112,00	29,59	158,39	41,85	224,00	59,18
M6.642	-	906	907	908	○	○	125,00	33,03	176,78	46,70	250,00	66,06
M6.642	-	916	917	918	○	○	134,00	35,40	189,50	50,07	268,00	70,80

Exapmle      Series + Code +Mat.-No.      = Ordering No.  
for Ordering: M6.642 + 495 + 27      = M6.642.495.55

Type (Spray angle 22°)	E [mm]	A [mm]
M6.642.495	1,20	1,50
M6.642.535	1,40	1,75
M6.642.565	1,60	2,00
M6.642.605	1,80	2,10
M6.642.645	2,00	2,50
M6.642.685	2,20	2,80
M6.642.725	2,50	3,00
M6.642.765	2,80	3,50
M6.642.805	3,20	3,80
M6.642.845	3,50	4,30
M6.642.885	3,90	4,70

Type (Spray angle 26°)	E [mm]	A [mm]
M6.642.496	1,17	1,50
M6.642.536	1,30	1,75
M6.642.566	1,50	2,00
M6.642.606	1,70	2,10
M6.642.646	1,90	2,50
M6.642.686	2,20	2,80
M6.642.726	2,40	3,00
M6.642.766	2,50	3,50
M6.642.806	3,00	3,80
M6.642.846	3,50	4,30
M6.642.886	3,90	4,70
M6.642.906	4,00	5,00
M6.642.916	4,20	5,20

Type (Spray angle 30°)	E [mm]	A [mm]
M6.642.497	1,16	1,50
M6.642.537	1,30	1,75
M6.642.567	1,40	2,00
M6.642.607	1,60	2,10
M6.642.647	1,80	2,50
M6.642.687	2,10	2,80
M6.642.727	2,30	3,00
M6.642.767	2,40	3,50
M6.642.807	2,90	3,80
M6.642.847	3,20	4,30
M6.642.887	3,70	4,70
M6.642.907	3,90	5,00
M6.642.917	4,00	5,20

Type (Spray angle 40°)	E [mm]	A [mm]
M6.642.498	1,11	1,50
M6.642.538	1,20	1,75
M6.642.568	1,20	2,00
M6.642.608	1,50	2,10
M6.642.648	1,60	2,50
M6.642.688	2,00	2,80
M6.642.728	2,90	3,00
M6.642.768	2,30	3,50
M6.642.808	2,70	3,80
M6.642.848	3,00	4,30
M6.642.888	3,40	4,70
M6.642.908	3,70	5,00
M6.642.918	3,80	5,20

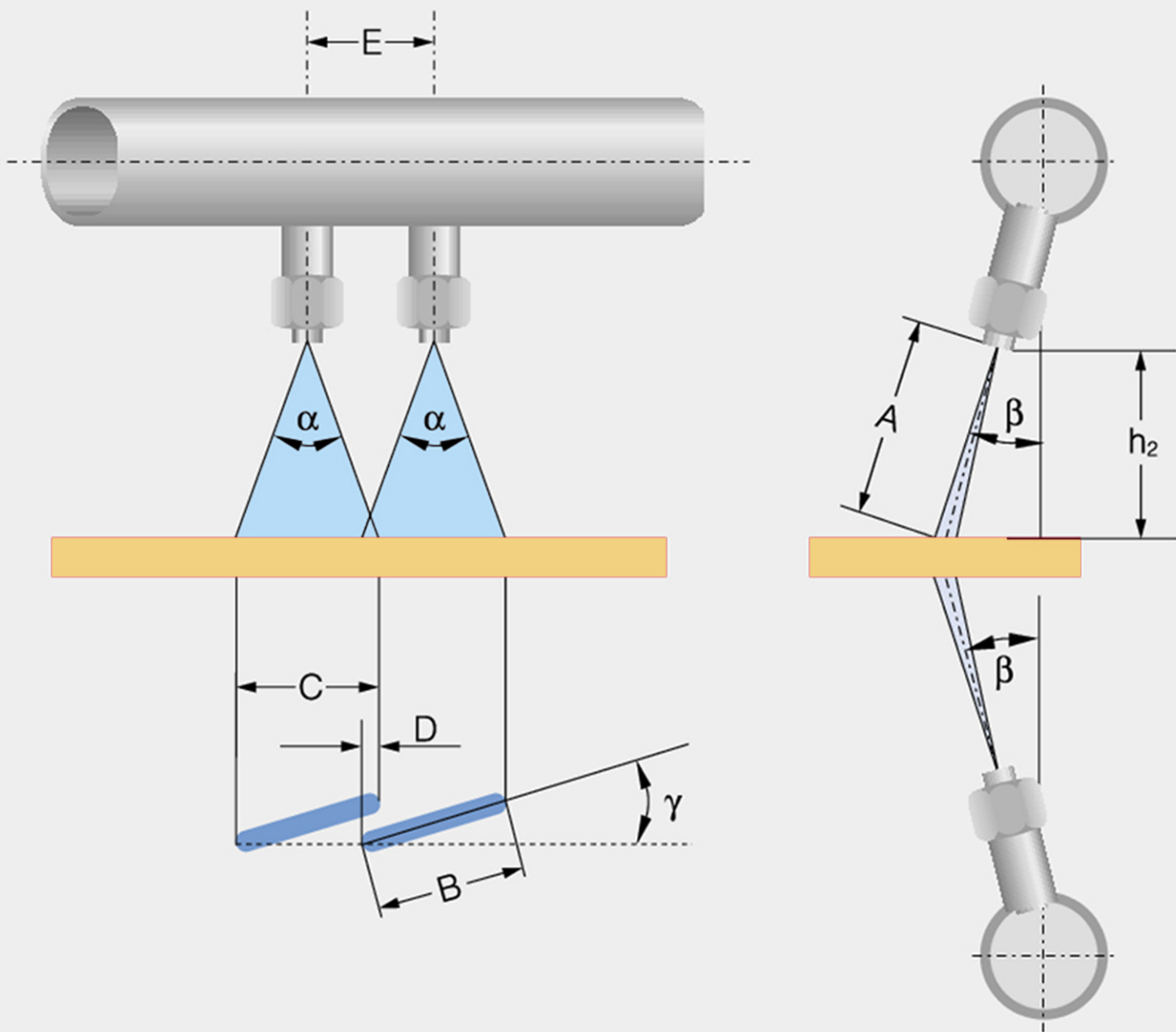


# Nozzle Arrangement on Descaling Header

## Positioning of nozzles on a spray header

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

- A = Spray length  
B = Spray width  
C = Spray width in rolling direction  
D = Over lap  
E = Nozzle distance  
 $h_2$  = Vertical spray height  
 $\alpha$  = Nozzle spray angle  
 $\beta$  = Angle of inclination  
 $\gamma$  = Offset angle of nozzle against pipe roll axis



Spray length (A), spray width (B, C), over lapping (D), nozzle distance (E) with vertical spray height ( $h_2$ ), nozzle spray angle ( $\alpha$ ) and angle of inclination ( $\beta$ )

### Table Explanation

#### 1. Spray Width

The listed values are provided according to  $p = 150$  bar spray pressure. Spray width data for other pressures can be listed upon request.

#### 2. Spray Angles Tolerances

+  $3^\circ$  at  $\alpha = 22^\circ, 26^\circ$  and  $30^\circ$ ,  
+  $5^\circ$  at  $\alpha = 40^\circ$ .

So,  $B+C$  are minimum values.

Vertical spray height $h_2$ [mm]	Angle of inclination $\beta = 15^\circ$  A [mm]	Nominal nozzle spray angle $\alpha$ at $p = 150$ bar															
		$\alpha = 22^\circ$				$\alpha = 26^\circ$				$\alpha = 30^\circ$				$\alpha = 40^\circ$			
		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]
50	52	28	27,0	-	-	34	32,7	-	-	38	36,9	-	-	50	47,3	4	48,8
75	78	40	38,8	4	34,8	48	45,9	4	41,8	54	52,3	4	48,3	71	68,3	4	64,3
100	104	52	49,8	5	44,8	60	57,7	5	52,7	69	66,3	5	61,3	90	87,2	5	82,2
150	155	73	70,0	5	65	81	78,3	5	73,3	94	90,9	5	85,9	126	121,2	8	113,2
175	181	82	79,4	5	74,4	91	87,6	5	82,6	106	102,2	5	97,2	142	137,1	8	129,1
200	207	92	88,4	5	83,4	100	96,6	5	91,6	117	113,0	5	108	158	152,4	10	142,4
225	233	101	96,9	5	91,9	109	105,5	5	100,5	128	123,5	5	118,5	174	167,5	10	157,5
250	259	109	104,9	8	96,9	119	114,3	8	106,3	139	134,0	8	126	189	182,4	12	170,4
270	280	115	110,6	8	102,6	126	121,5	8	113,5	148	142,4	8	134,4	202	194,4	12	182,4
300	311	123	118,1	8	110,1	137	132,5	8	124,5	161	155,2	8	147,2	221	212,5	15	197,5



### Nozzle Positions

- 1. All nozzle tips are placed in one direction (See fig. 1)
- 2. All nozzle tips are placed towards the nearest outside edge, so sprays directed away from the center of the strip. This lead to achieve higher performance and better drainage.

### Nozzle Arrangements

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. You can achieve this through our alignment tip. (Fig. 1, 2, 4). Alignment tip provides to get the most appropriate nipple positioning during welding.

### Easy Nozzle Assembly

One of the many other benefits of the new Scalemaster nozzle is its easy assembly as the most assembly is done before installation. The assembly unit that consist of the tip, stabilizer and strainer is inserted into the base and are rotated until flats are aligned, allowing more insertion and cover thread engagement. To preserve tip from damage, for standard SCALEMASTER AP, the cap has not been tightened to more than 250 Nm and for ShortSCALEMASTER not more than 250 Nm.

### Automatic Positioning of the Nozzle Tip

15-degree offset is adjusted to every nozzle tip which makes wrong assembly of the nozzle impossible. The nozzle tip works perfectly after the cap is tightened.

fig. 1

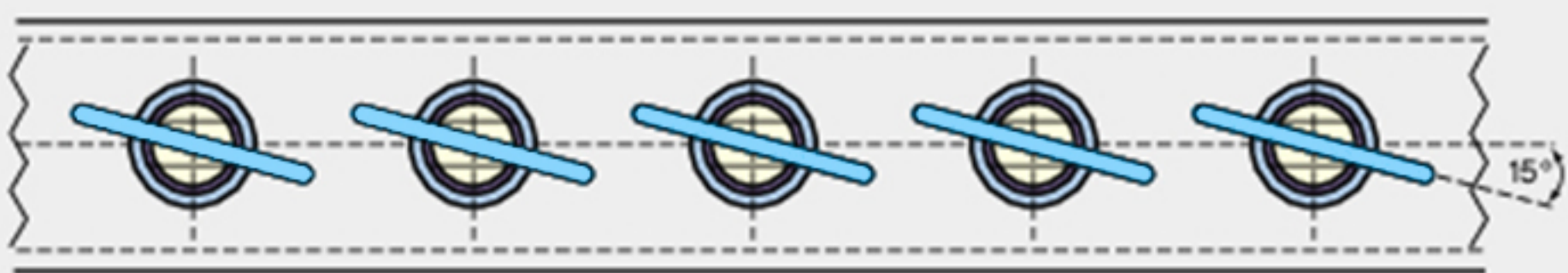
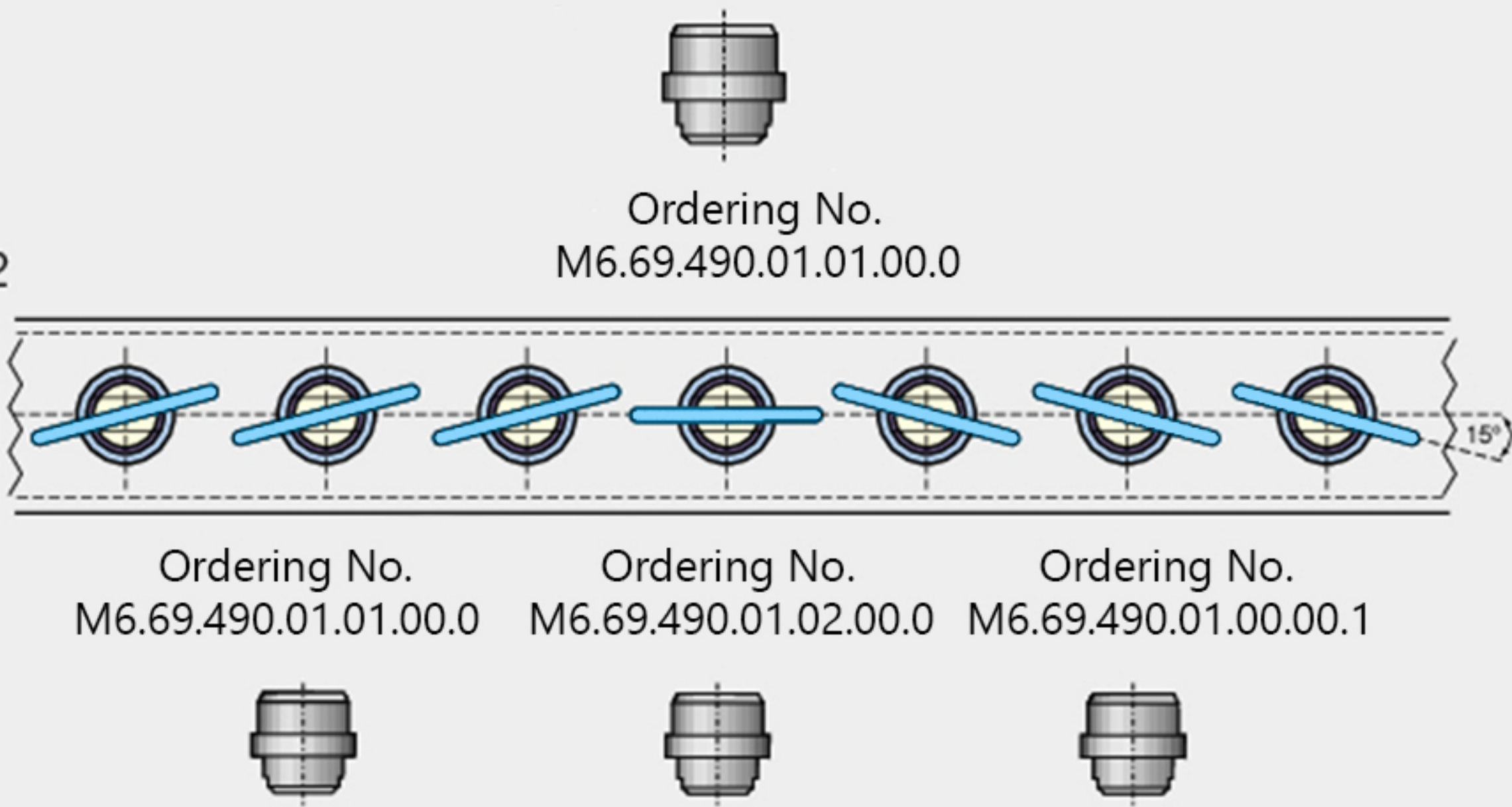


fig. 2



### Equipment

Alignment tip (figure1,2,4) can also be used to determine location of nozzle tips or for testing spray headers' pressure.

### General Information

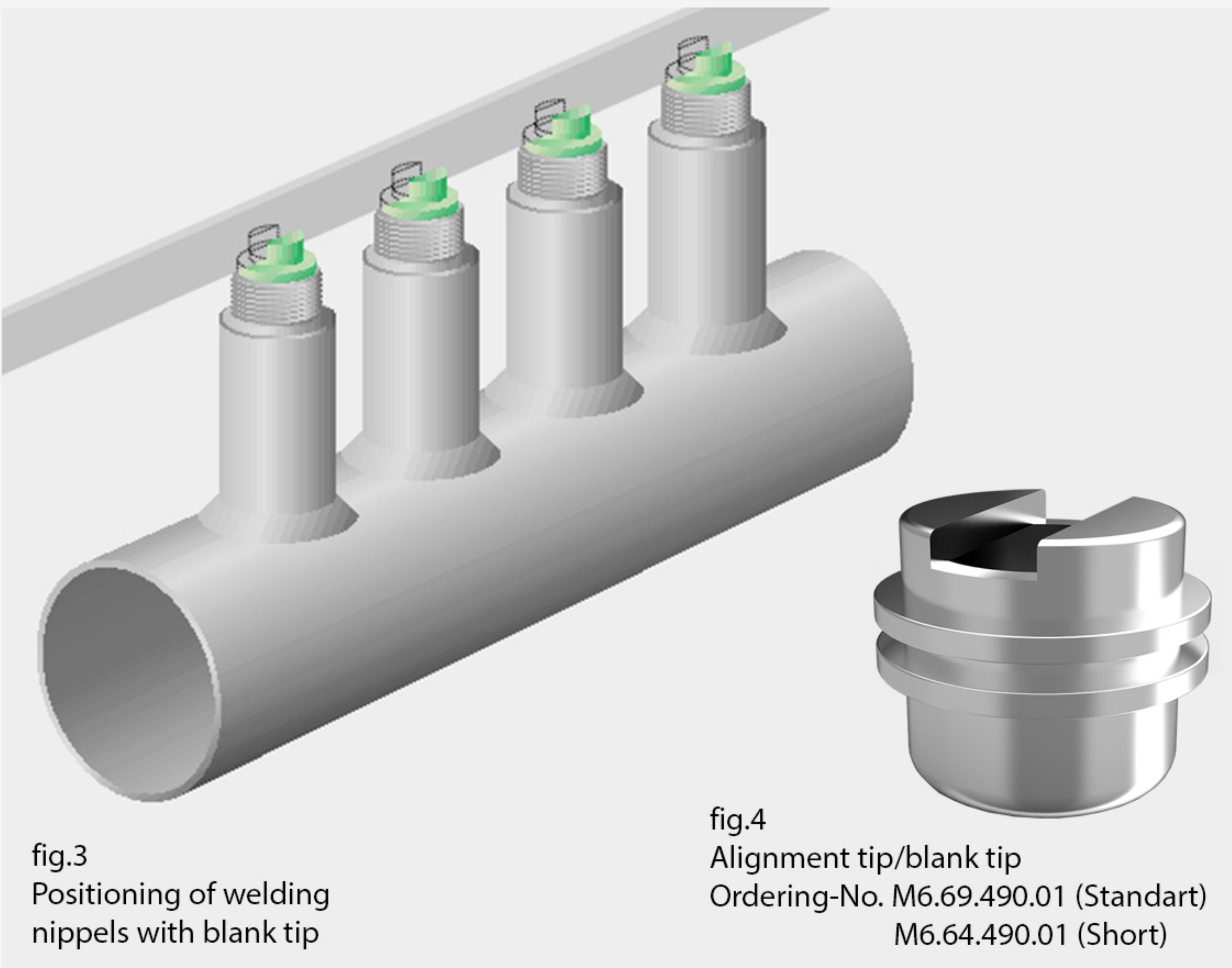
The water flow should not exceed 5 m/s in the water mains and 1 m /s in the descaling header.

### Nozzle Life

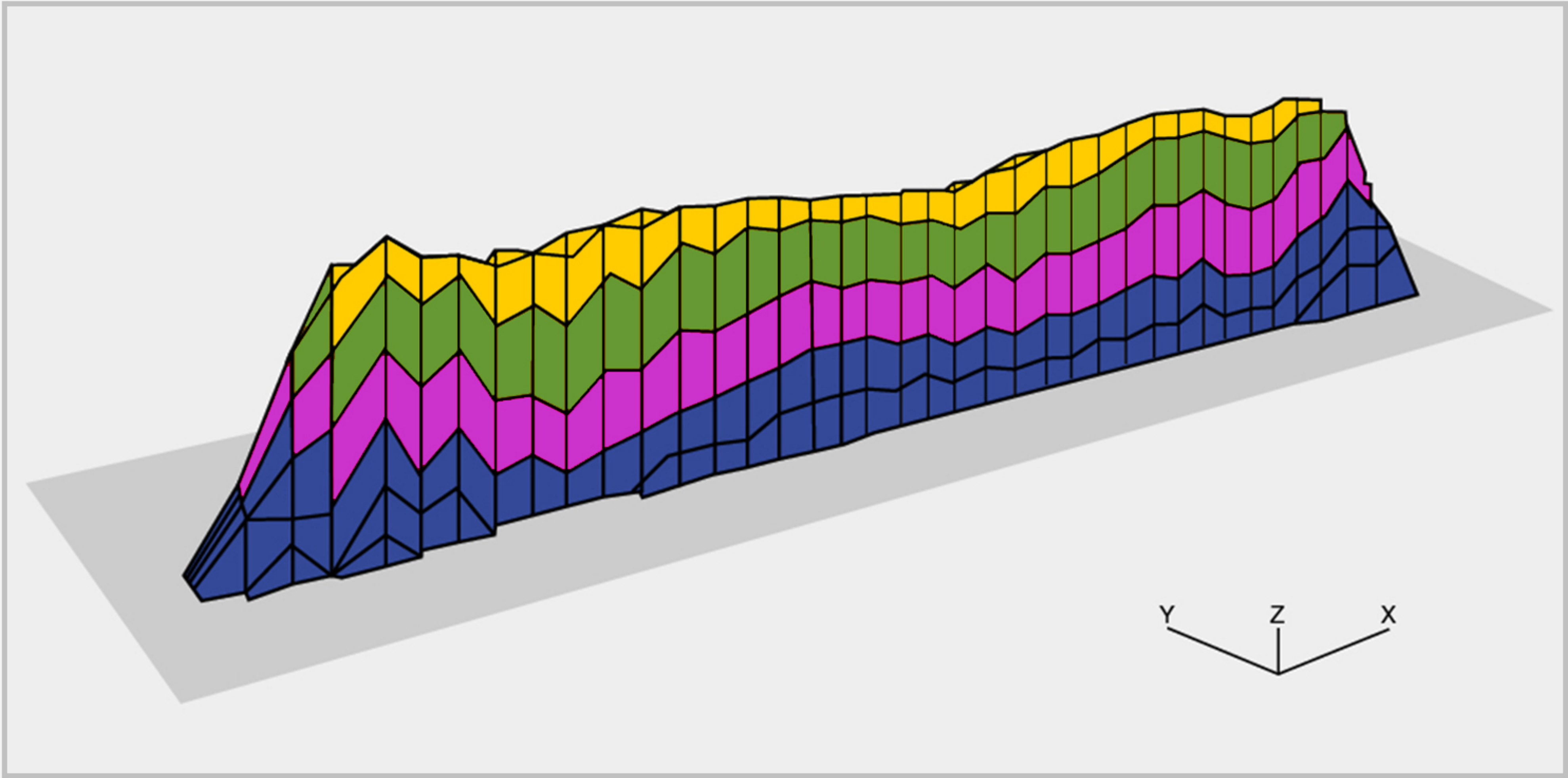
Nozzles will wear out. This wear is directly proportional to the parameters in the water and working environment. For instance, Solid contents in water are of great importance in nozzles wearing. Regular checks are important to ensure that the nozzles always operate at top performance. These checks must be made on a



pig.5  
tip extractor with  
alignment tip  
(data sheet on  
request)

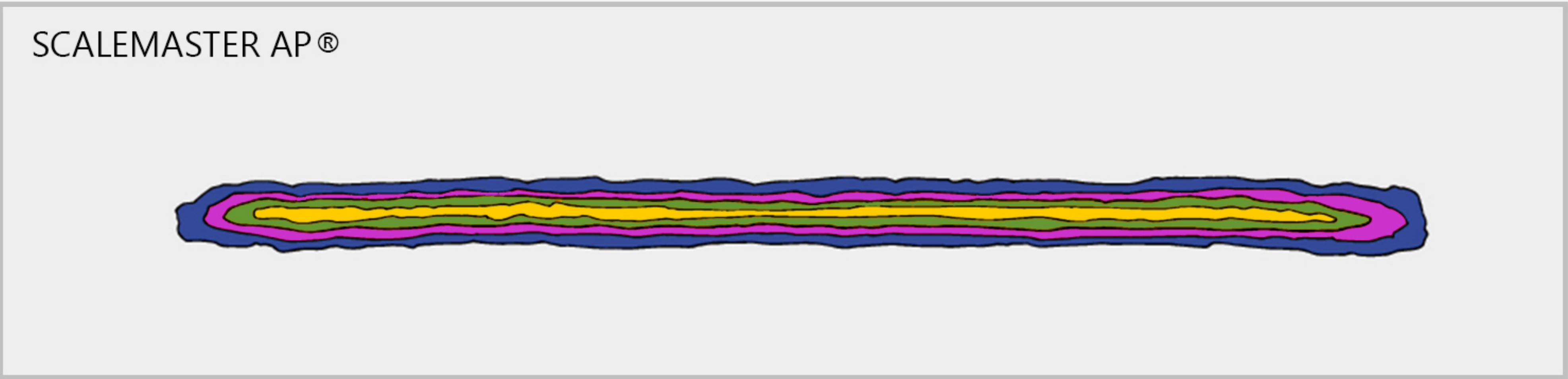




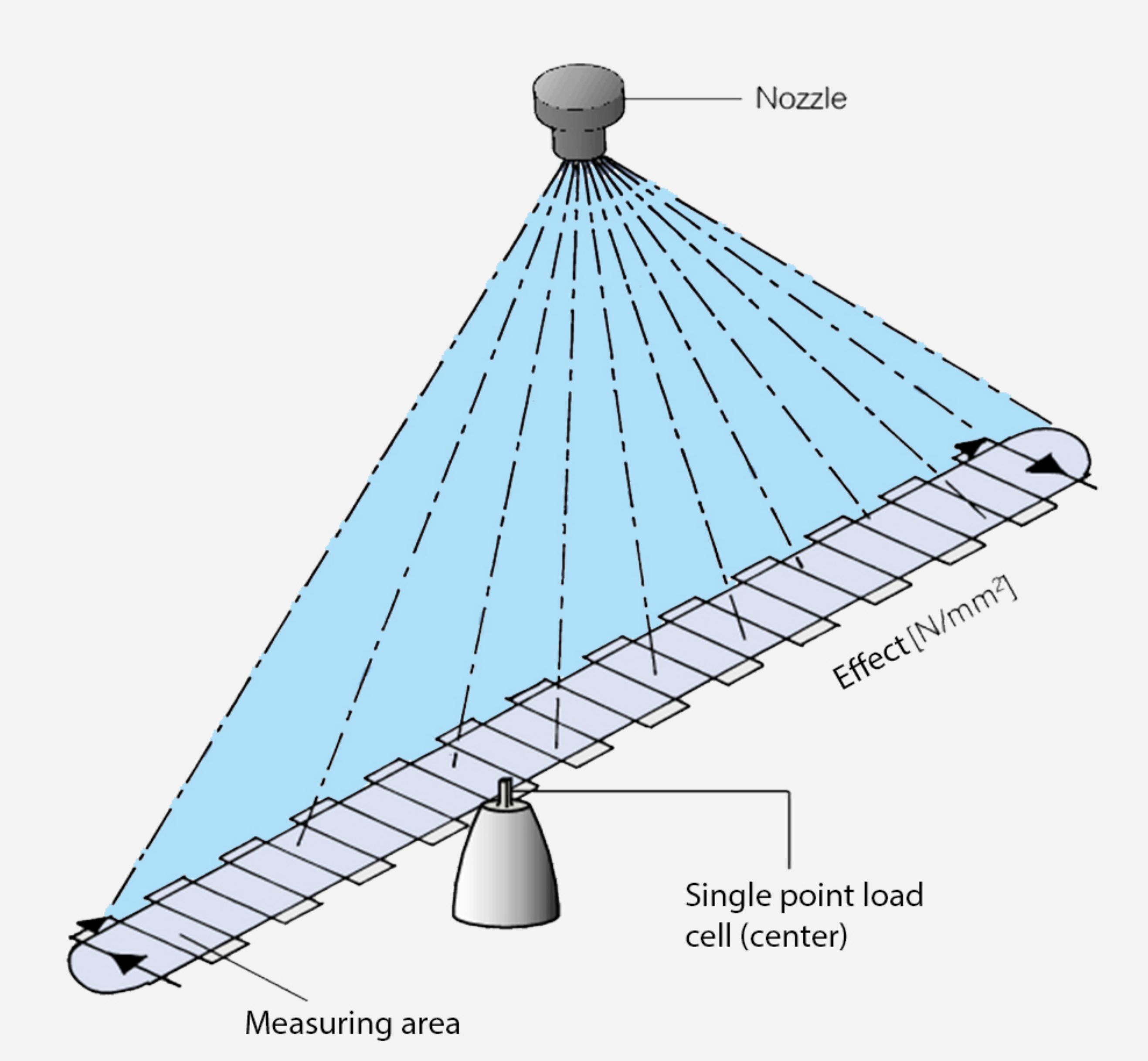


Our advanced design strength stems from our ability to provide accurate and precise analysis. Mitsuda makes these advanced designs with the help of modernized systems. These systems are our greatest helpers in product development processes. Thanks to its 3D and 5D supported systems, MITSUDA is rapidly progressing to become a Leading company in the spray nozzle sector in the world

Three-dimensional representation of the spray effect distribution



Footprint



Measuring principle





# Optimization of System Parameters with SCALEMASTER AP<sup>®</sup>



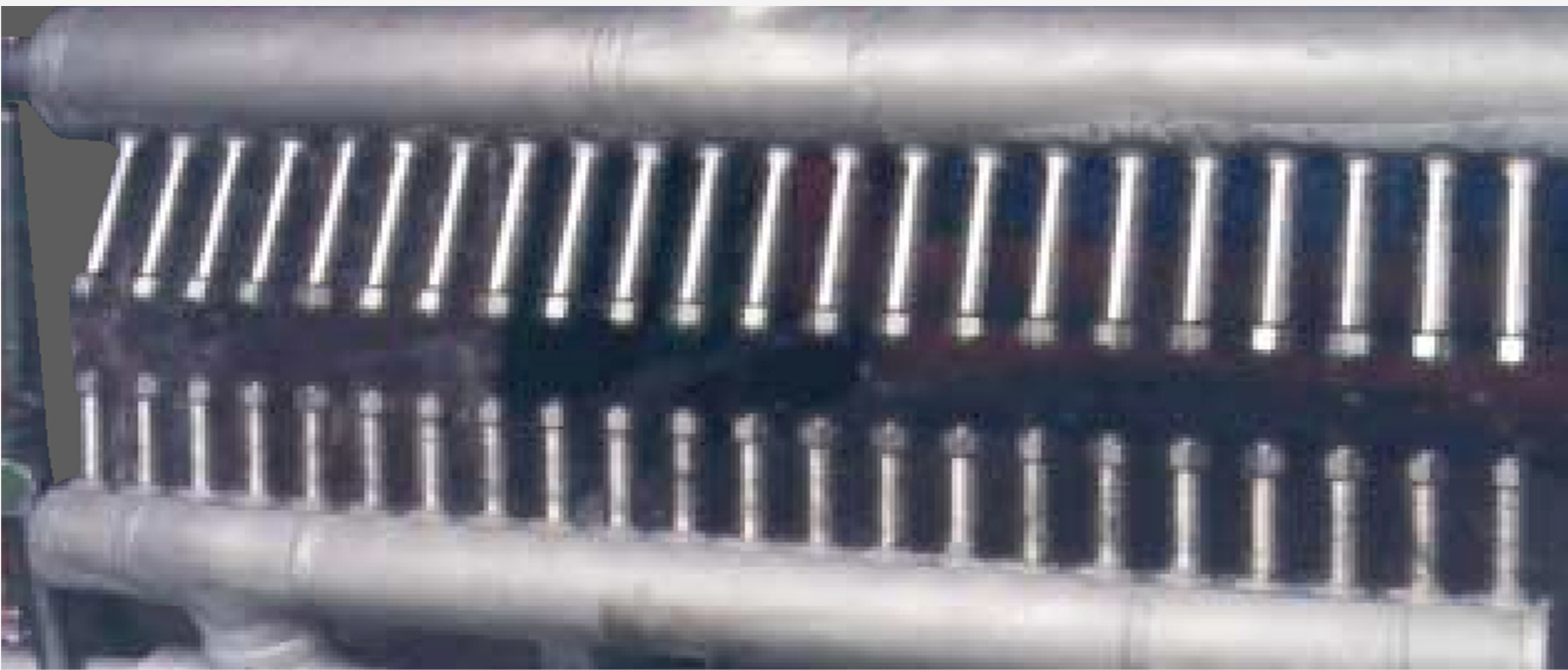
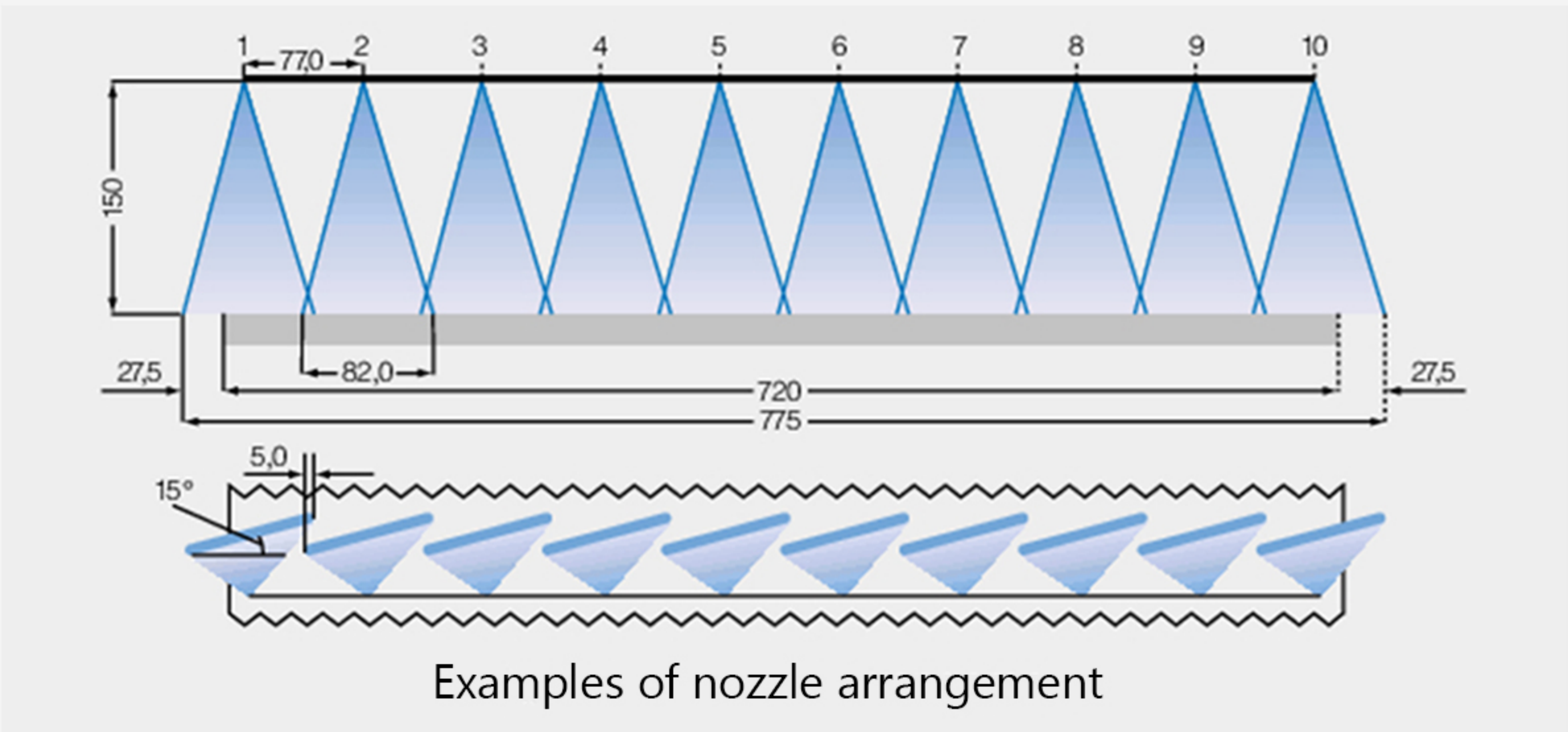
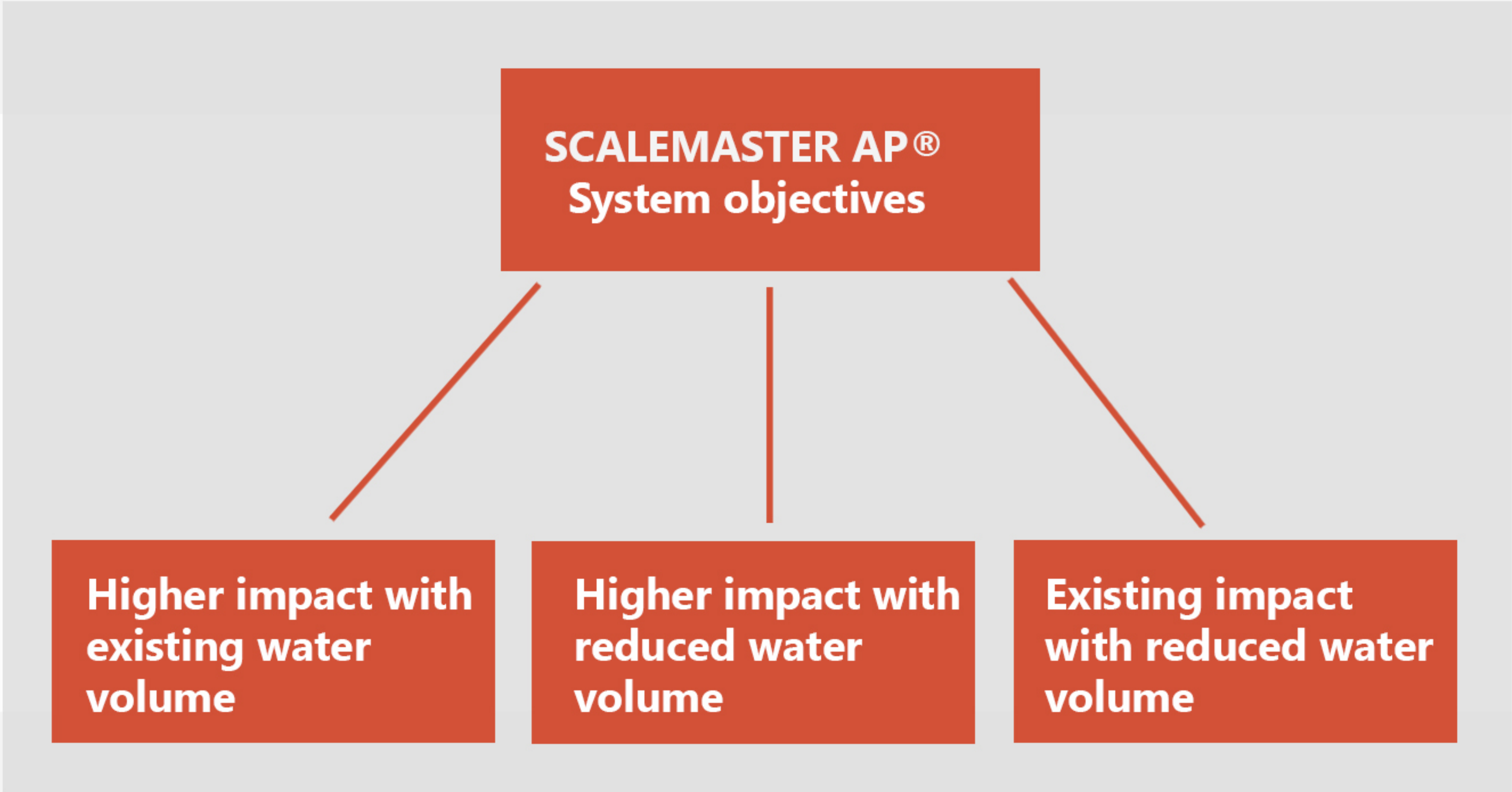
Optimizing a working system can be achieved by realizing one of the 3 main design goals.

MITSUDA will work with you to achieve the targets at the start of an improvement project.

## Nozzle Arrangements

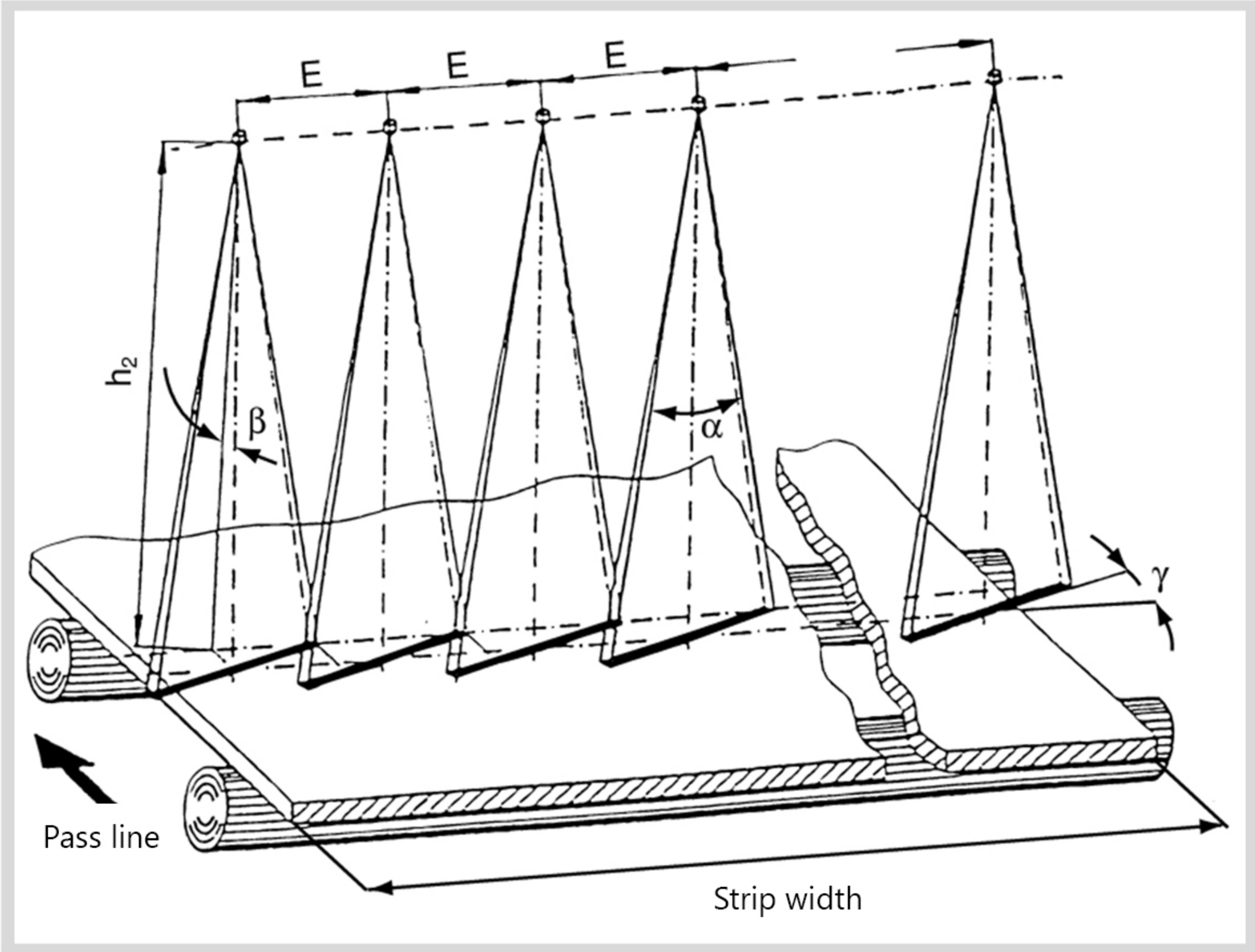
Mitsuda uses its own software to prepare the proposal quickly and economically. To get a quote from

**Mitsuda, please fill out the questionnaire on the back of the brochure and send it by mail.**



Mitsuda, please fill out the questionnaire on the back of the brochure and send it by mail.





Company

Responsible

Address

Phone

Fax

E-mail

Questionnaire about existing 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:			
Strip			Top	Bottom	
Floor		Number of headers			
Plaque		Nozzle type			
Spray angle		Horizontal distance (E)			
Billet		Vertical spray height (h <sub>2</sub> )	mm	mm	
Rounds		Spray angle ( )	mm	mm	
Material speed		m/s	Offset angle ( ) α	o	o
Pressure at header		bar	Impignement angle ( )	o	o
Max. Water flow		l/min	Room for sketch:		
		l/h			



