

Semi-Fine Mist, Semi-Coarse Mist Nozzles

DOVEA / DDA / JJA series Nozzles VVEA / PSN

Patented

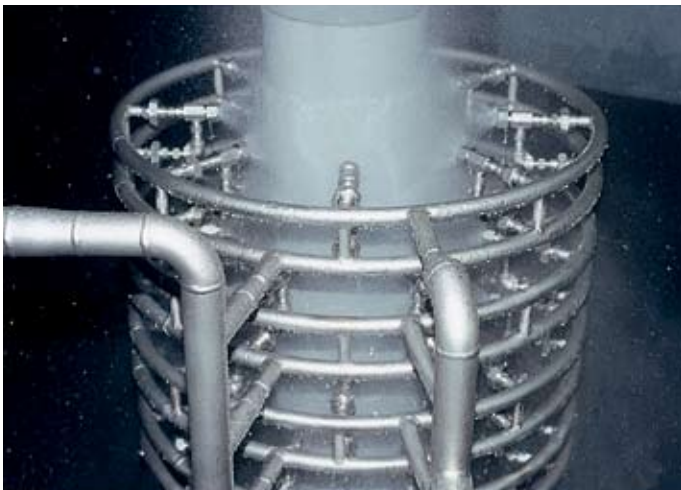


■DOVEA, DDA and JJA series, developed to satisfy the crucial requirements for spray nozzles in the continuous casting process of steel making, feature stable spray angles and distributions with large turndown ratios, having fine and uniform spray droplet size distributions across the entire spray area.

Also, free passage diameters are twice as large as those of hydraulic nozzles to minimize clogging.

With these features, DOVEA, DDA and JJA series are highly effective nozzles for steel / gas cooling.

■VVEA, PSN series are innovative pneumatic spray nozzles developed for new cleaning method requiring high-velocity and concentrated spraying of fine atomization, which can wash out fine dirt particles that conventional cleaning could not clean.



Contents

DOVEA series Flat Spray Semi-fine, Semi-coarse Mist Nozzles	p.46
DDA series Oval Spray Semi-fine, Semi-coarse Mist Nozzles	p.51
JJA series Full Cone Spray Semi-fine, Semi-coarse Mist Nozzles	p.54
VVEA series High Impact Flat Spray Semi-Fine/Semi-Coarse Mist Nozzles	p.57
PSN series Pneumatic Slit Nozzles	p.60

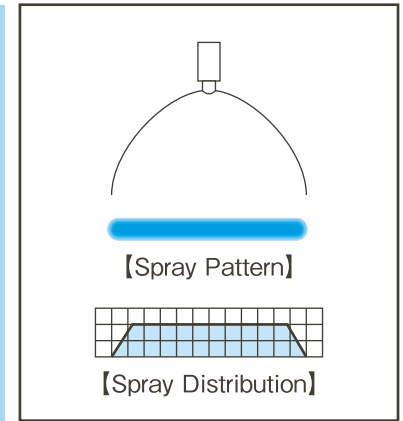
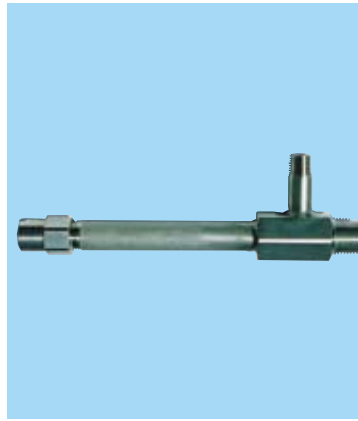
Flat Spray Semi-fine, Semi-coarse Mist Nozzles

DOVEA

Features

- Flat spray pneumatic nozzle producing a large volume of semi-fine atomization with a mean droplet diameter of 50 μ m or more (*1).
- Large turn-down ratio with minimal variation in spray angle.
- Uniform spray droplet size distribution across the entire spray area.
- Uniform distribution suitable for multiple-nozzle arrangements.
- Large free passage diameter minimizes clogging.

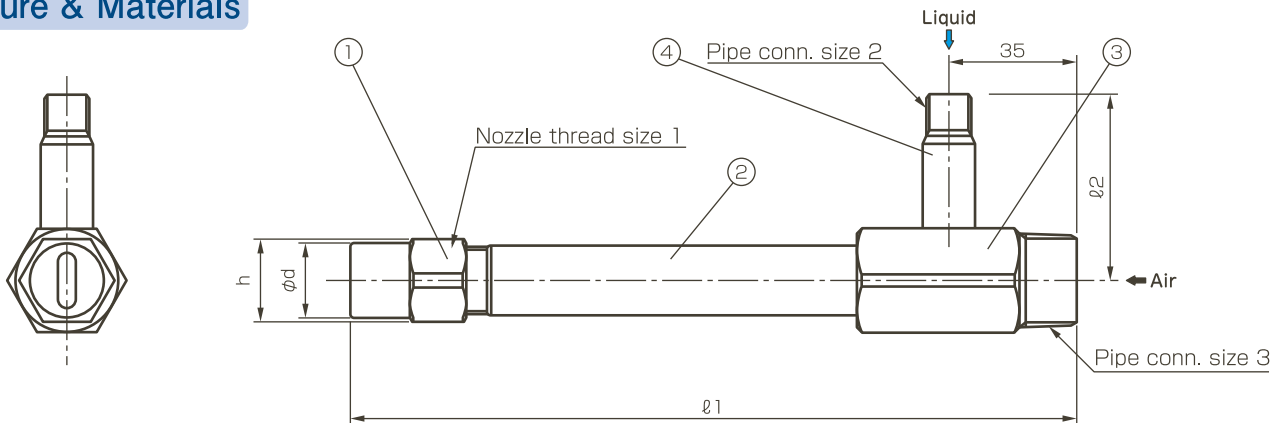
*1) Measured by the Fraunhofer Diffraction method.
Please refer to page 6-7 for comparison with Laser Doppler Method.



Applications

- Cooling: Gas, steel plates, steel pieces, moldings, etc.
- Moisture control: Gas, etc.
- Combustion: Waste water, etc.

Structure & Materials



Components and materials

No.	Component	Standard Material
①	Nozzle	S303
②	Pipe	S304
③	Mixing Adaptor	S304
④	Liquid Pipe	S304

Dimensions & Pipe Conn. Sizes

Spray Capacity Code	Nozzle Thread Size (in.)			Pipe Connection Sizes*2 (in.)				Outer Dimensions*1 (mm)				Mass*3 (kg)
	1	2	3	$\varnothing 1$	$\varnothing 2$	$\varnothing d$	h					
82 110	PT1/4M	PT1/4M	PT1/2M	500	47.5	18	19	0.55				
180 230	PT3/8M	PT1/4M	PT1/2M	500	47.5	19	21	0.65				
400	PT1/2M	PT1/4M	PT1/2M	500	47.5	25	26	0.85				

Note: Please ask our sales offices about the union joint option for secure fitting and easy installation/removal.

*1: $\varnothing 1=200\sim 1500$ mm

*2: Pipe connection sizes for air and liquid are the same.

*3: The mass shown is for DOVEA with 500mm straight pipe.

For the mass of DOVEA with a longer/shorter pipe, please add or subtract the corresponding mass (listed below) for each 100mm of length.

1/4B 63g
3/8B 85g
1/2B 130g

Flat Spray Semi-fine, Semi-coarse Mist Nozzles

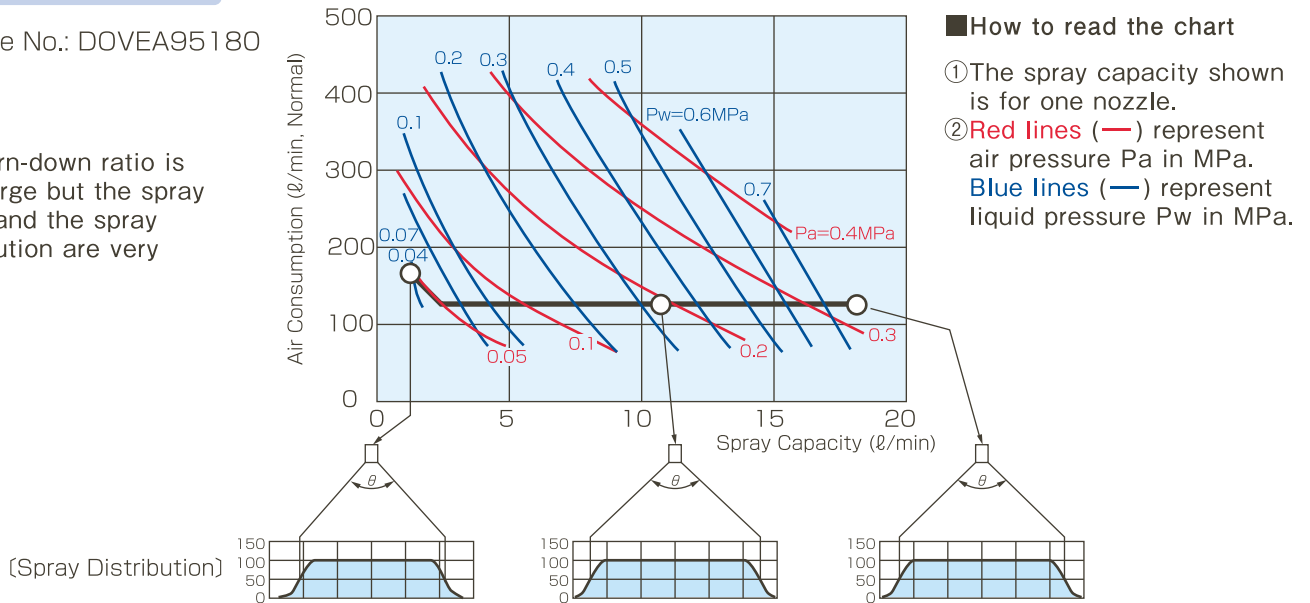
DOVEA series

Spray Angle Code	Spray Capacity Code	Air Pressure (MPa)	Spray Capacity (ℓ/min) & Air Consumption (ℓ/min, Normal)										Mean Droplet Diameter (μm)		Free Passage Diameter (mm)		
			Liquid Pressure (MPa)										Immersion Sampling Method	Fraunhofer Diffraction Method	Spray Tip	Adaptor	
			0.07		0.1		0.2		0.4		0.7					Liquid	Air
Liquid	Air	Liquid	Air	Liquid	Air	Liquid	Air	Liquid	Air	Liquid	Air						
110°	180	0.1	0.92	275	3.18	180	9.21	65	—	—	—	—	100	50	2.7	3.6	5.1
		0.2	—	—	—	—	—	4.34	280	12.9	100	—	—	∫			
0.3		—	—	—	—	—	—	—	9.49	250	18.0	100	∫	∫			
0.4		—	—	—	—	—	—	—	—	—	15.9	200	350	150			
110°	400	0.1	2.05	620	7.07	410	20.5	150	—	—	—	—	100	50	4.1	5.2	7.7
		0.2	—	—	—	—	—	9.65	630	28.6	220	—	—	∫			
0.3		—	—	—	—	—	—	—	21.1	560	40	225	∫	∫			
0.4		—	—	—	—	—	—	—	—	—	35.4	450	400	200			
95°	82	0.1	0.42	125	1.45	85	4.19	30	—	—	—	—	100	50	2.0	2.5	3.5
		0.2	—	—	—	—	—	1.98	125	5.86	45	—	—	∫			
0.3		—	—	—	—	—	—	—	4.32	110	8.2	45	∫	∫			
0.4		—	—	—	—	—	—	—	—	—	7.26	90	300	150			
95°	180	0.1	0.92	275	3.18	180	9.21	65	—	—	—	—	100	50	3.0	3.6	5.1
		0.2	—	—	—	—	—	4.34	280	12.9	100	—	—	∫			
0.3		—	—	—	—	—	—	—	9.49	250	18.0	100	∫	∫			
0.4		—	—	—	—	—	—	—	—	—	15.9	200	350	175			
95°	400	0.1	2.05	620	7.07	410	20.5	150	—	—	—	—	100	50	4.5	5.2	7.7
		0.2	—	—	—	—	—	9.65	630	28.6	220	—	—	∫			
0.3		—	—	—	—	—	—	—	21.1	560	40	225	∫	∫			
0.4		—	—	—	—	—	—	—	—	—	35.4	450	400	200			
70°	110	0.1	0.56	180	1.94	120	5.63	40	—	—	—	—	100	50	2.8	2.8	4.1
		0.2	—	—	—	—	—	2.65	180	7.87	65	—	—	∫			
0.3		—	—	—	—	—	—	—	5.8	160	11.0	65	∫	∫			
0.4		—	—	—	—	—	—	—	—	—	9.74	130	300	150			
70°	230	0.1	1.18	355	4.07	240	11.8	85	—	—	—	—	100	50	4.1	4.0	5.9
		0.2	—	—	—	—	—	5.55	370	16.4	130	—	—	∫			
0.3		—	—	—	—	—	—	—	12.1	320	23.0	130	∫	∫			
0.4		—	—	—	—	—	—	—	—	—	20.4	260	350	150			
55°	400	0.1	2.05	620	7.07	410	20.5	150	—	—	—	—	100	50	5.6	5.2	7.7
		0.2	—	—	—	—	—	9.65	630	28.6	220	—	—	∫			
0.3		—	—	—	—	—	—	—	21.1	560	40	225	∫	∫			
0.4		—	—	—	—	—	—	—	—	—	35.4	450	400	200			

Flow-rate Diagram

Nozzle No.: DOVEA95180

The turn-down ratio is very large but the spray angle and the spray distribution are very stable.

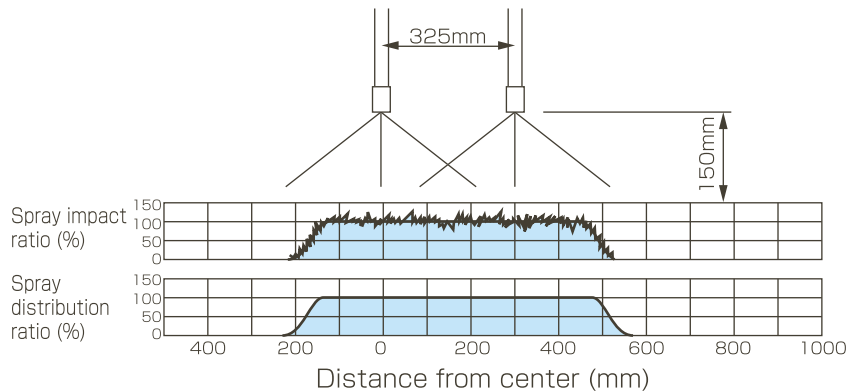


Spray Distribution & Spray Impact

Nozzle No.: DOVEA95180

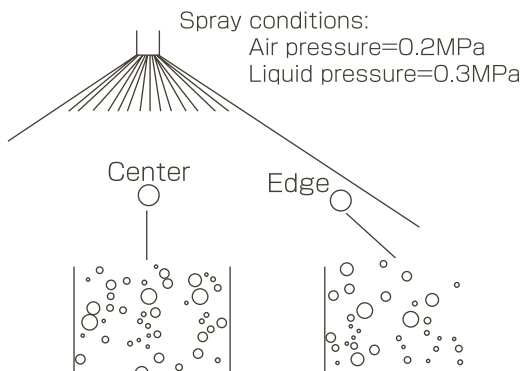
Spray conditions:
Air pressure=0.2MPa
Liquid pressure=0.3MPa

DOVEA nozzles produce a flat spray pattern with tapered spray pattern edges, which provide uniform spray distribution and spray impact in multiple-nozzle arrangements.



Spray Droplet

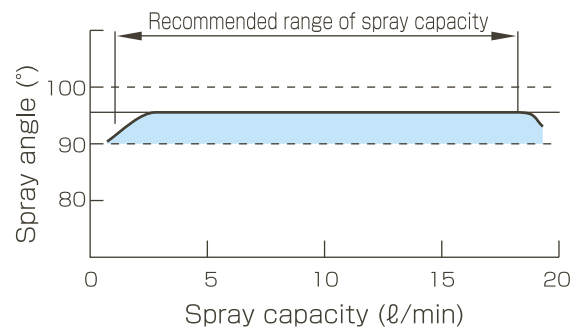
Nozzle No.: DOVEA95180



The spray droplet sizes are fine and uniform across the entire spray area.

Variation in Spray Angle

Nozzle No.: DOVEA95180

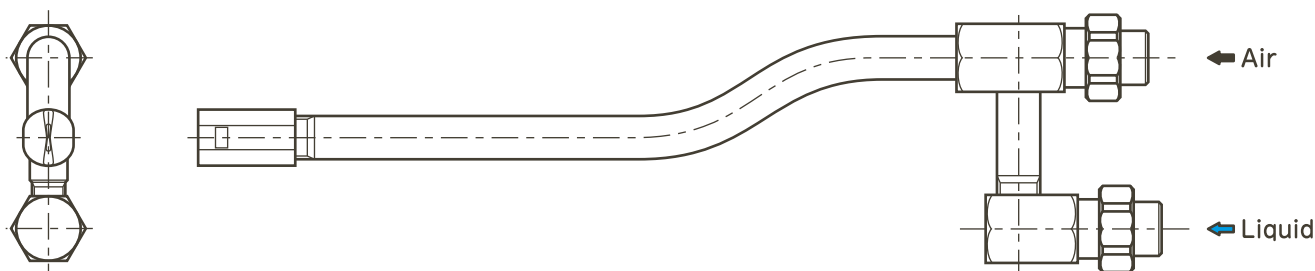


The variation in spray angle is minimized despite the large modulation of spray capacities.

*Spray angle (θ) means the angle between two lines from the nozzle orifice to both sides of spray distribution where the spray distribution ratio is 50%, taking the spray distribution ratio at the center as 100%.

Special Pipe

— Bent Pipe —



Note: For details of bent pipes, please contact our local sales office.

How to inquire / order

Please inquire or order for a specific nozzle using this coding system.

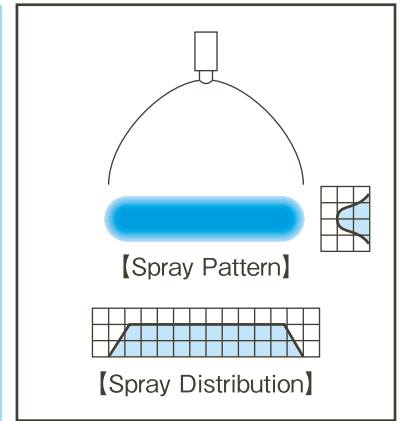
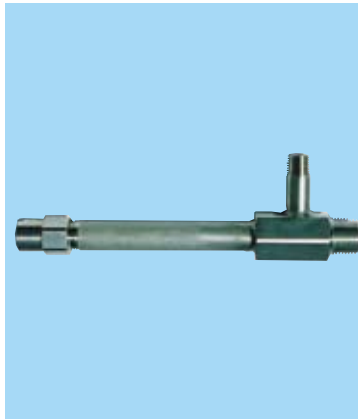
<Example> 1/4DOVEA95180-Ux500S303-n

1/4	DOVEA	95	180	U	x	500	S303	-	n
Nozzle Thread Size 1		Spray Angle Code	Spray Capacity Code	Pipe Connection		Total Length $\varnothing 1$			Code of Bent Pipe*
■ 1/4		■ 110°	■ 82	■ U (Union Joint)		■ Min. 200			
■ 3/8		■ 95°	}	■ M (Male Thread)		■ Standard 500			
■ 1/2		■ 70°	■ 400			■ Max. 1500			
		■ 55°							

(*This code will be determined upon receipt of an inquiry.)

Features

- Flat spray pneumatic nozzle with spray area larger in direction of spray thickness compared with DOVEA series.
- Feature uniform distribution of flow-rate and spray droplets across the entire spray area, large turn-down ratio with minimal variation in spray angle as with DOVEA series.
- DOVEA-W series have a high cooling effect for cooling metal sheets.



Applications

- Cooling: Steel plates, steel pieces, gas, etc.

Double-wide spray thickness makes a difference in cooling applications (Comparison with DOVEA)

DOVEA-W series



Conventional nozzles (DOVEA-series)



For further information, please contact our local sales office.

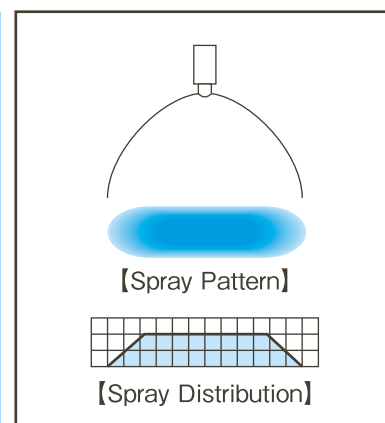
Oval Spray Semi-fine, Semi-coarse Mist Nozzles

DDA

Features

- Oval spray pneumatic nozzle producing a large volume of semi-fine atomization with a mean droplet diameter of 50 μ m or more (*1).
- Oval spray pattern covers wide area.
- Large turn-down ratio with minimal variation in spray angle.
- Uniform spray droplet size distribution across the entire spray area.
- Uniform distribution suitable for multiple-nozzle arrangements.
- Large free passage diameter minimizes clogging.

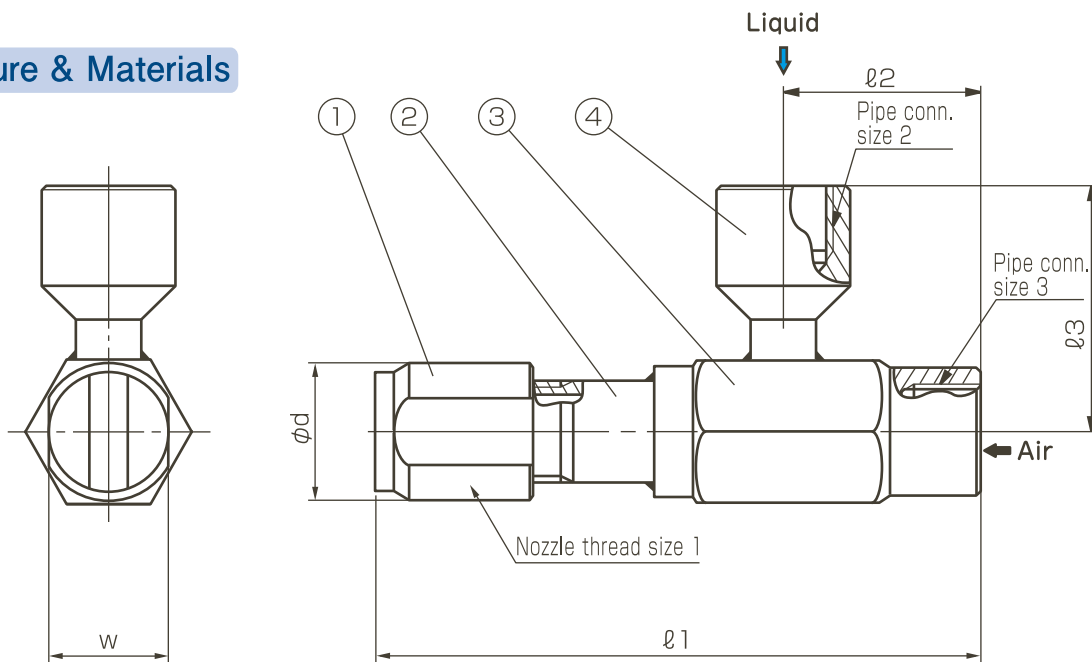
*1) Measured by the Fraunhofer Diffraction method.
Please refer to page 6-7 for comparison with Laser Doppler Method.



Applications

- Cooling: Gas, steel plates, steel pieces, pipes, moldings, etc.
- Moisture control: Gas, etc.
- Combustion: Waste water, etc.

Structure & Materials



Components and materials

No.	Component	Standard Material
①	Nozzle Body	S303
②	Pipe	S304
③	Mixing Adaptor	S304
④	Liquid Pipe	S304

Dimensions & Pipe Connection Sizes

Dimensions

Nozzle Thread Size 1 (in.)	Pipe Connection Size 2,3 (in.) *2	ϕd (mm)	w (mm)	$\ell 1$ (mm) *1	$\ell 2$ (mm)	$\ell 3$ (mm)	Mass(g) *3
PT1/8F	PT1/4F	18	16	70	32.5	40	170
PT1/4F	PT1/4F	18	16	70	32.5	40	180
PT1/2F	PT1/2F	28	25	130	40	50	450
PT3/4F	PT1/2F	35	32	150	45	50	650

- *1: $\ell 1$ shows the standard length which is shortest, and the longest length is 1500mm.
- *2: Pipe connection sizes for air and liquid are the same.
- *3: Each mass shows DDA with standard length. For longer lengths please add the corresponding mass (listed below) for each 100mm of length.

Pipe size	Mass per 100mm
1/4"	80g
3/8"	110g
1/2"	160g

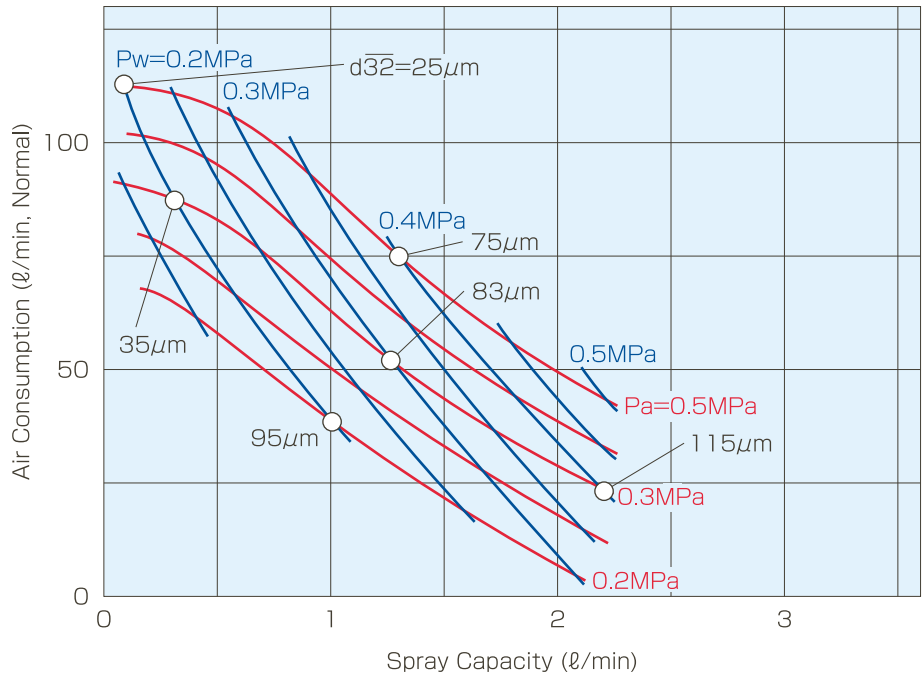
Spray Angle Code		Spray Capacity Code	Nozzle Thread Size 1 (in.)	Pipe Conn. Size 2,3 (in.)	Air Press. (MPa)	Spray Capacity (ℓ/min) & Air Consumption (ℓ/min, Normal)										Mean Droplet Diameter (μm)		Free Passage Diameter (mm)		
Coverage	Thickness					Liquid Pressure (MPa)										Immersion Sampling Method	Fraunhofer Diffraction Method	Spray Tip	Adaptor	
						0.07		0.1		0.2		0.4		0.7					Liquid	Air
		Liquid	Air	Liquid	Air	Liquid	Air	Liquid	Air	Liquid	Air	Liquid	Air			Liquid	Air			
125°	20°	70	1/4F	1/4F	0.1	1.51	29	2.22	24	—	—	—	—	—	—	200	100	2.4	2.2	1.5
					0.2	1.39	47	2.02	47	3.18	45	5.13	33	7.07	18	∫	∫			
					0.3	1.29	63	1.84	63	2.92	63	4.77	55	6.66	41					
					0.4	1.19	79	1.70	79	2.70	79	4.42	77	6.29	64	300	150			
110°	25°	36	1/4F	1/4F	0.1	0.87	34	1.20	34	1.87	31	—	—	—	—	200	100	2.0	1.7	1.5
					0.2	0.75	50	1.10	50	1.76	49	2.80	44	3.70	36	∫	∫			
					0.3	0.63	66	1.00	66	1.66	66	2.64	64	3.64	57					
					0.4	0.50	82	0.90	82	1.55	82	2.50	82	3.60	76	300	150			
	20°	50	1/4F	1/4F	0.1	1.20	46	1.62	46	2.72	41	—	—	—	—	200	100	2.4	2.0	1.8
					0.2	1.00	69	1.47	69	2.45	65	3.86	55	5.13	43	∫	∫			
					0.3	0.80	92	1.28	92	2.17	91	2.56	85	5.04	72					
					0.4	0.60	114	1.10	114	1.93	114	3.30	111	4.86	99	300	150			
100°	45°	470	3/4F	1/2F	0.1	8.79	220	15.6	170	—	—	—	—	—	—	120	60	6.0	5.8	4.1
					0.2	5.86	370	12.2	330	20.2	280	—	—	—	—	∫	∫			
					0.3	3.45	490	9.66	480	15.5	443	32.1	285	—	—					
					0.4	1.21	610	7.07	610	12.9	587	20.7	491	46.3	240	350	175			
	45°	580	3/4F	1/2F	0.1	12.6	278	18.8	213	—	—	—	—	—	—	140	70	7.0	6.5	4.7
					0.2	6.87	500	12.2	462	24.2	336	—	—	—	—	∫	∫			
					0.3	—	—	—	—	17.9	550	38.9	325	—	—					
					0.4	—	—	—	—	—	—	32.5	535	57.3	190	400	200			
15°	25	1/8F	1/4F	0.1	—	—	—	—	—	—	—	—	—	—	30	15	2.0	1.9	1.8	
				0.2	—	—	—	—	1.05	37	—	—	—	—	∫	∫				
				0.3	—	—	—	—	0.34	87	2.20	240	—	—						
				0.4	—	—	—	—	—	—	1.30	75	—	—	200	100				
80°	20°	14	1/4F	1/4F	0.1	0.36	19	0.50	19	0.71	19	1.11	18	1.40	17	70	35	2.0	1.1	1.2
					0.2	0.29	29	0.46	29	0.68	29	1.10	28	1.41	27	∫	∫			
					0.3	0.22	39	0.41	39	0.65	39	1.08	39	1.42	37					
					0.4	0.14	49	0.37	49	0.62	49	1.06	49	1.43	48	150	75			
	20°	37	1/4F	1/4F	0.1	0.93	33	1.35	32	2.02	30	3.01	24	3.74	17	200	100	2.8	1.7	1.5
					0.2	0.80	51	1.23	51	1.92	50	2.90	47	3.74	41	∫	∫			
					0.3	0.68	68	1.12	68	1.83	68	2.80	65	3.74	61					
					0.4	0.57	84	1.00	84	1.74	84	2.72	83	3.74	80	300	150			
	20°	50	1/4F	1/4F	0.1	1.06	44	1.70	41	2.78	32	—	—	—	—	200	100	2.8	2.0	1.8
					0.2	0.86	71	1.40	70	2.37	65	3.79	48	4.95	35	∫	∫			
					0.3	0.67	96	1.18	95	2.05	92	3.40	82	4.84	62					
					0.4	0.50	121	0.92	121	1.68	119	3.06	111	4.70	89	300	150			
75°	25°	230	1/2F	1/2F	0.1	4.48	133	7.03	116	—	—	—	—	—	—	120	60	4.0	4.1	2.9
					0.2	3.50	207	5.76	199	10.4	168	16.2	104	—	—	∫	∫			
					0.3	2.54	271	4.58	268	9.27	249	15.1	200	22.3	110					
					0.4	1.61	330	3.47	330	8.33	320	14.1	278	21.7	191	300	150			

Flow-rate Diagram

Nozzle No.: DDA1001525

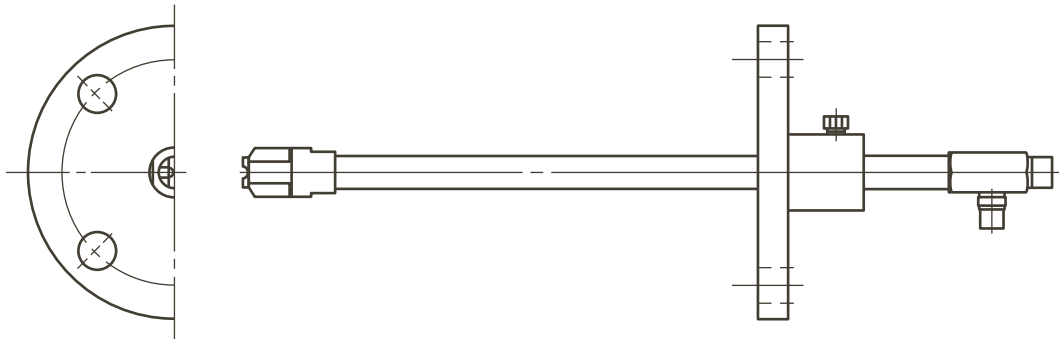
How to read the chart

- ① The spray capacity shown is for one nozzle.
- ② Red lines (—) represent air pressure Pa in MPa.
Blue lines (—) represent liquid pressure Pw in MPa.
- ③ Droplet diameter d_{32} is Sauter mean droplet diameter measured by the Immersion Sampling Method.



DDA with Flange

- DDA with a fixed flange is available.



How to inquire / order

Please inquire or order for a specific nozzle using this coding system.

<Example> 1/4DDA1252070×(70)S303-n

1/4	DDA	125	20	70	×	(70)	S303	-	n
Nozzle Thread Size 1		Spray Angle Code (Coverage)	Spray Angle Code (Thickness)	Spray Capacity Code		Total Length			Code of Bent Pipe*2
■ 1/8		■ 125°	■ 45°	■ 14		■ Standard (70~150)*1			(*2) This code will be determined upon receipt of an inquiry.
■ 1/4		■ 110°	}	■ 580		■ Max. 1500			
■ 1/2		■ 100°	■ 15°						
■ 3/4		■ 80°							
		■ 75°							

*1: Standard length differs with nozzle code.
See "Dimensions" on page 51.

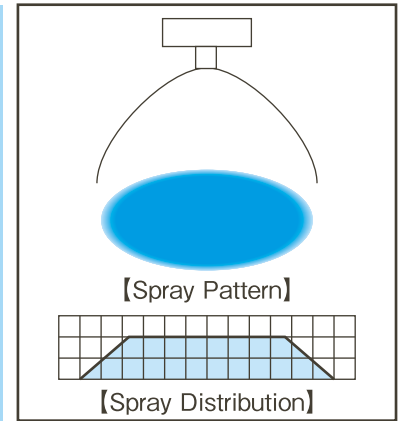
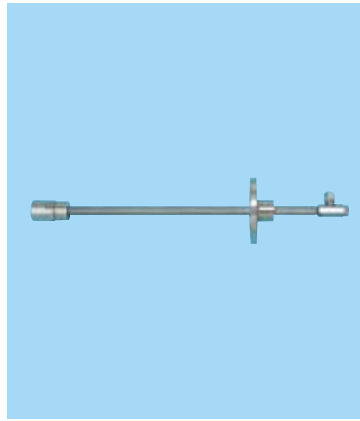
Full Cone Spray Semi-fine, Semi-coarse Mist Nozzles

JJA

Features

- Full cone spray pneumatic nozzle producing a large volume of semi-fine to semi-coarse atomization with a mean droplet diameter of 50 μ m or more (*1).
- Large turn-down ratio.
- Uniform spray droplet size distribution across the entire spray area.
- Large free passage diameter minimizes clogging. Ideal for spraying liquid containing foreign particles and combustion of waste liquid at waste incinerators.

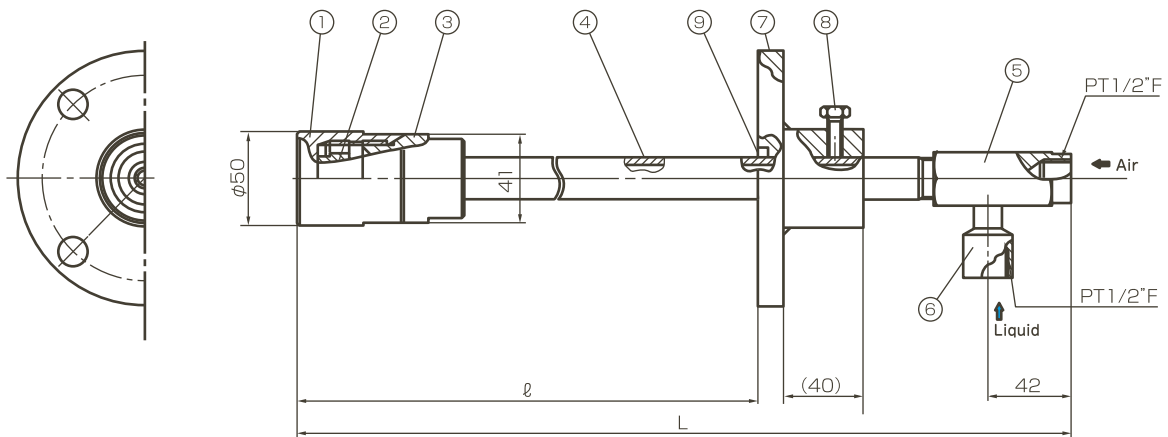
*1) Measured by the Fraunhofer Diffraction method.
Please refer to page 6-7 for comparison with Laser Doppler Method.



Applications

- Spraying: Refuse waste water, etc.
- Cooling: Gas, moldings, etc.
- Combustion: Waste water, etc.

Structure, Dimensions, Materials and Pipe Connection Sizes



■ Nozzle length

Type	Total Length L (mm)	Length ℓ (mm)	Mass (kg) *1 (without Flange)
A	440	200~300	1.8
B	540	300~400	2.0
C	740	400~600	2.3
D	940	600~800	2.6
E	1140	800~1000	2.9

*1) Mass of Flange is not included.

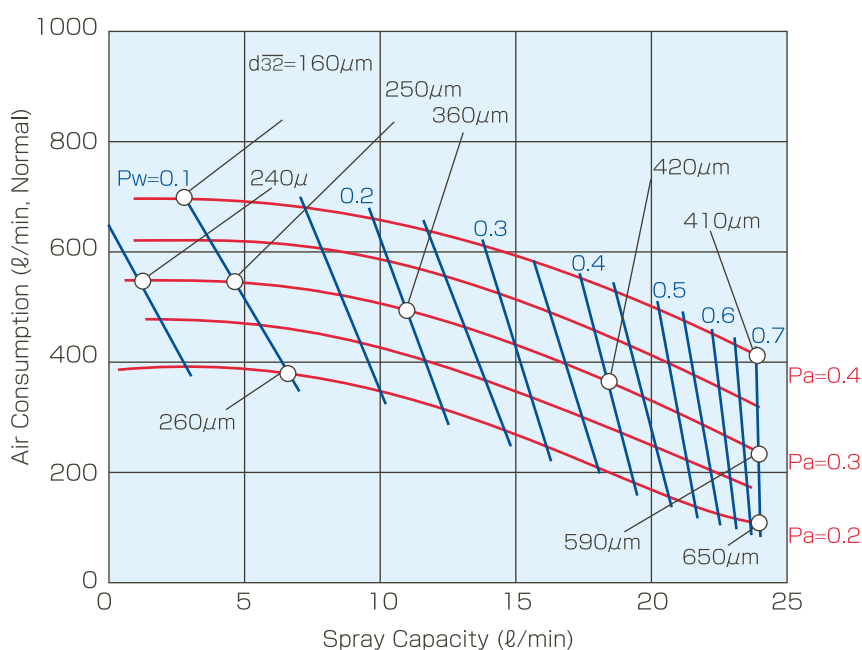
■ Components and materials

No.	Component	Standard Material
①	Nozzle Body	S316L
②	Core	S316L
③	Nozzle Adaptor	S316L
④	Pipe	S316LTP
⑤	Mixing Adaptor	S304
⑥	Liquid Connection	S304
⑦	Flange	S304
⑧	Bolt	S304
⑨	Packing	Ceramic fibre + Stainless steel wire

Spray Capacity Code	Air Pressure (MPa)	Spray Capacity (ℓ/min) & Air Consumption (ℓ/min, Normal)										Mean Droplet Diameter (μm)		Free Passage Diameter (mm)		
		Liquid Pressure (MPa)										Immersion Sampling Method	Fraunhofer Diffraction Method	Spray Tip	Adaptor	
		0.05		0.1		0.3		0.5		0.7					Liquid	Air
12	0.2	1.4	190	2.8	190	7.1	160	10.6	100	13.0	50	150	75	3.7	2.9	3.0
	0.3	0.9	250	2.3	250	6.5	230	9.8	190	12.0	150	∫	∫			
	0.4	—	—	1.7	330	6.0	310	8.1	270	11.2	230	450	230			
24	0.2	3.9	380	6.6	380	16.0	250	21.5	150	24.2	110	200	100	5.2	4.1	4.2
	0.3	1.2	540	4.6	540	14.9	430	20.7	310	24.0	240	∫	∫			
	0.4	—	—	3.7	690	13.8	620	20.0	500	23.9	420	650	330			

Flow-rate Diagram

Nozzle No.: JJA24



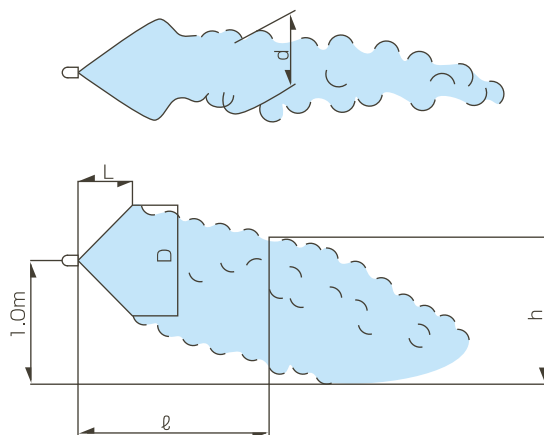
How to read the chart

- ① The spray capacity shown is for one nozzle.
- ② Red lines (—) represent air pressure Pa in MPa.
Blue lines (—) represent liquid pressure Pw in MPa.
- ③ Droplet diameter d_{32} is Sauter mean droplet diameter measured by the Immersion Sampling Method.

Spray Dimensions

Spray Capacity Code	Pressure (MPa)		Spray Dimensions (m)					
			L	D	h/d			
	Air	Liquid			ℓ=2.0	ℓ=3.0	ℓ=4.0	ℓ=5.0
12	0.2	0.05	0.6	0.7	0.5/1.1	-	-	-
		0.1	1.4	1.1	0.8/1.2	-	-	-
		0.2	1.5	1.2	1.1/1.5	0.5/1.2	-	-
		0.4	1.8	1.4	1.4/1.7	0.6/1.2	-	-
		0.7	1.9	1.7	1.5/1.8	0.9/1.6	0.6/1.1	-
	0.3	0.05	1.1	0.8	0.7/1.0	0.4/1.4	-	-
		0.1	1.5	1.1	1.0/1.2	0.8/1.4	-	-
		0.2	1.5	1.3	1.2/1.3	0.9/1.5	0.5/1.0	-
		0.4	2.0	1.5	1.5/1.4	1.2/1.5	0.6/1.1	-
		0.7	2.1	1.8	1.7/1.5	1.5/1.6	1.0/1.3	0.7/0.9
	0.4	0.05	1.4	0.9	0.8/1.0	0.5/1.5	-	-
		0.1	1.9	1.1	1.1/1.0	0.9/1.5	0.5/1.0	-
		0.2	2.0	1.5	1.5/1.4	1.3/1.4	0.9/1.5	0.4/1.5
		0.4	2.1	1.5	1.5/1.4	1.4/1.5	1.3/1.5	0.5/1.6
		0.7	2.3	1.8	1.7/1.8	1.8/1.9	1.8/1.9	1.0/2.0
24	0.2	0.05	0.7	0.8	0.7/0.8	-	-	-
		0.1	1.4	1.4	1.3/0.8	0.8/0.7	-	-
		0.2	1.5	1.6	1.3/1.5	1.1/1.8	0.6/0.9	-
		0.4	1.8	1.8	1.8/2.8	1.3/2.0	0.9/1.4	-
		0.7	2.0	2.1	2.1/3.0	1.5/2.5	1.2/2.0	1.7/1.5
	0.3	0.05	1.1	0.9	0.9/1.2	0.7/1.0	-	-
		0.1	1.5	1.3	1.1/1.5	0.8/1.8	0.6/1.0	-
		0.2	1.5	1.4	1.3/1.5	1.1/2.0	0.7/1.3	-
		0.4	1.9	1.5	1.5/2.0	1.3/2.1	0.9/1.7	0.6/1.2
		0.7	2.1	2.0	2.0/2.3	1.5/2.5	1.2/1.8	0.9/1.4
	0.4	0.05	1.4	1.1	1.0/1.2	0.8/1.0	0.4/0.9	-
		0.1	1.9	1.2	1.1/1.0	0.9/1.5	0.7/1.3	-
		0.2	2.0	1.4	1.4/1.1	1.1/1.6	0.8/1.5	0.5/1.0
		0.4	2.2	1.5	1.5/1.8	1.2/2.5	1.1/1.8	0.6/1.8
		0.7	2.4	1.8	1.7/2.8	1.4/3.0	1.3/2.8	0.9/2.0

Note: The above data were measured with tap water in a laboratory, in windless conditions.



How to inquire / order

Please inquire or order for a specific nozzle using this coding system.

<Example> JJA12BS316L+2T10S304

1/2F	JJA	12	B	S316L +	2T10	S304
		Spray Capacity Code	Nozzle Length	Material of Nozzle	Flange Size	Material of Flange
		■ 12	■ A ■ D			
		■ 24	■ B ■ E			
			■ C			

(See p.54)

Flange size: Refer to the table of flange dimensions on page 78.