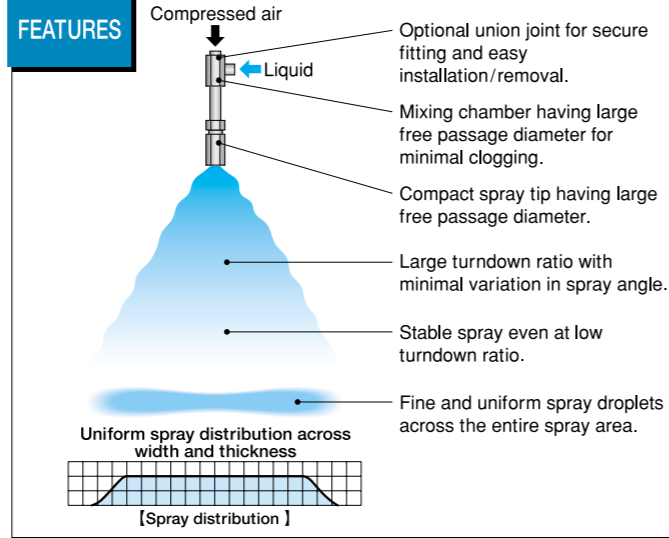
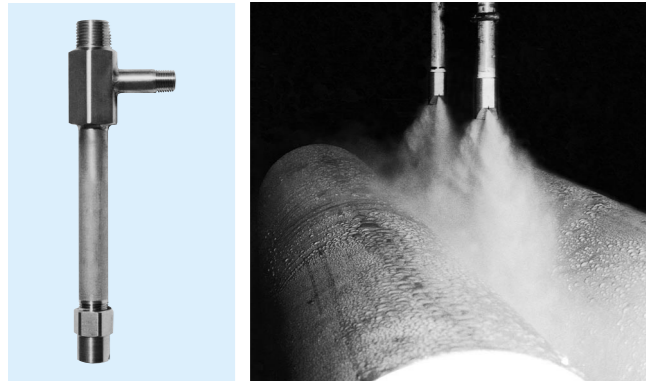


DOVEA series Secondary Cooling Nozzles Flat Spray with Even Distribution

Patented

Steel making process ● Cooling continuous casted steel (slab and bloom)

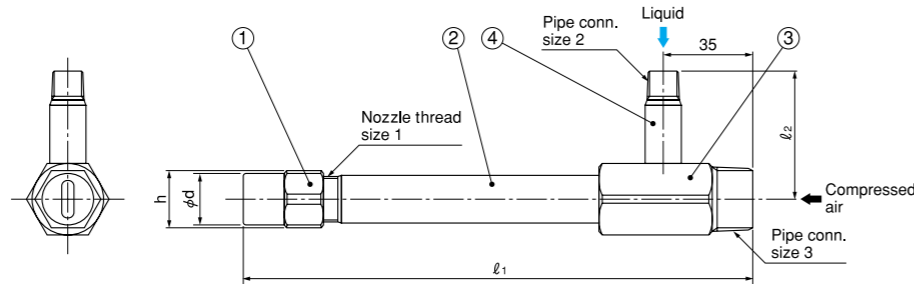
Rolling mill process ● Roll cooling



DOVEA series

MATERIALS

- ① Nozzle: S303
- ② Pipe: S304
- ③ Mixing adaptor: S304
- ④ Liquid pipe: S304

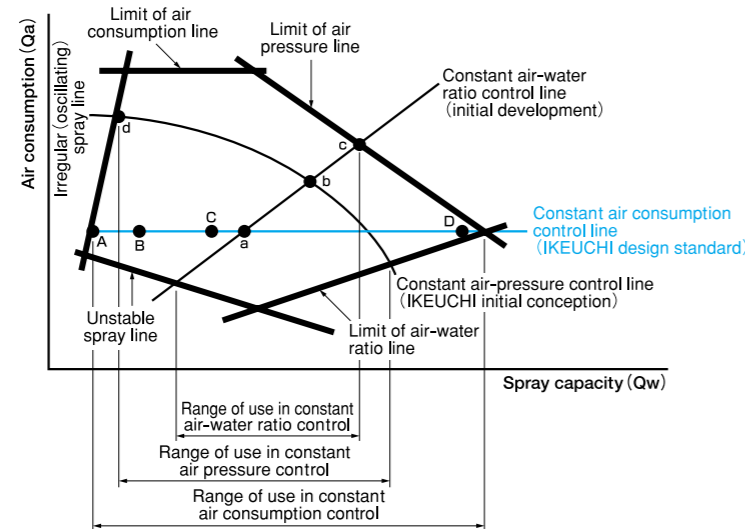


Series	Spray capacity code	Nozzle thread size	Pipe connection sizes			Outer dimensions (mm)				Mass (g)
			1	2	3	ℓ ₁	ℓ ₂	φd	h	
DOVEA	82	1/4F	1/4F	1/2F	500	47.5	18	19	550	
	110									
	180									
	230	3/8F	1/4F	1/2F						
	300									
400	1/2F	1/4F	1/2F							

*1: ℓ₁=200~1500mm
 *2: Pipe connection sizes for air and liquid are same.
 *3: Mass shown is for DOVEA with 500mm straight pipe. For mass of DOVEA with a longer/shorter pipe, please add or subtract the corresponding amount below for each 100mm length.
 1/4B.....63g
 3/8B.....85g
 1/2B.....130g

[Note] Please ask our sales staff about the union joint option for secure fitting and easy installation/removal.

Pneumatic spray nozzle flow rate control for CCM



Wide flow control range can meet various casting conditions.

DOVEA series Secondary Cooling Nozzles Flat Spray with Even Distribution

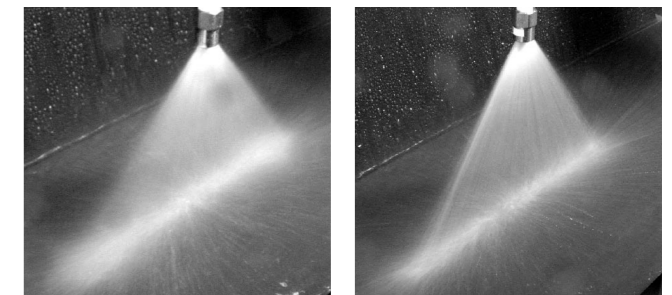
Spray angle code	Spray capacity code	Air pressure (MPa)	Spray capacity (ℓ/min) & Air consumption (ℓ/min, Normal)					Mean droplet dia. (μm)		Free passage dia. (mm)		
			Liquid pressure (MPa)					Immersion sampling method	Fraunhofer diffraction method	Spray tip	Adaptor	
			0.07 Liquid / Air	0.1 Liquid / Air	0.2 Liquid / Air	0.4 Liquid / Air	0.7 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	—	—			
	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	—	—			
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	—	—			
	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	—	—			
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	—	—				
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	—	—			
	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	—	—			
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	—	—				
55°	400	0.1	—	—	—	—	—	—	—	5.6	5.2	7.7
		0.2	—	—	—	—	—	—	—			
		0.3	—	—	—	—	—	—	—			

Conversion of unit [Pressure] 0.1MPa ≅ 14.50psi [Flow rate] 1ℓ(liter) ≅ 0.264 US gal. 10psi ≅ 0.069MPa 1US gal. ≅ 3.79ℓ(liter)

Affiliated Products DOVEA-W series Secondary Cooling Nozzles/Flat Spray - Wider Spray Thickness -

Double-wide* spray thickness makes a difference in cooling applications

*Comparison with DOVEA



DOVEA-W series

Conventional nozzles (DOVEA series)

How to order

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

Example) 1/4 DOVEA 95 82 U x 500 S303 - n

1/4	DOVEA	95	82	U	x	500	S303	-	n
Nozzle thread size 1		Spray angle code	Spray capacity code	Pipe conn.		Total length ℓ ₁			Code of bent pipe*
■ 1/4		■ 110°	■ 82	■ U (Union joint)		■ Min. 200			*This code will be determined upon receipt of an inquiry.
■ 3/8		■ 95°	■ 400	■ M (Male thread)		■ Standard 500			
■ 1/2		■ 70°				■ Max. 1500			
		■ 55°							

DDA series Secondary Cooling Nozzles / Oval Spray

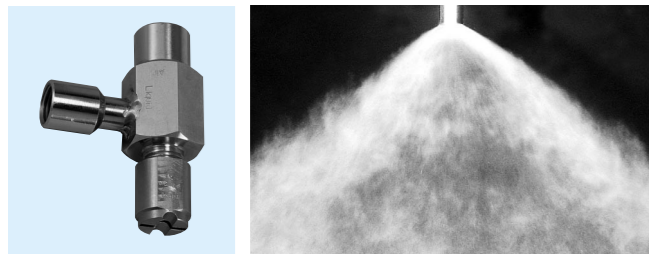
Patented

Steel making process

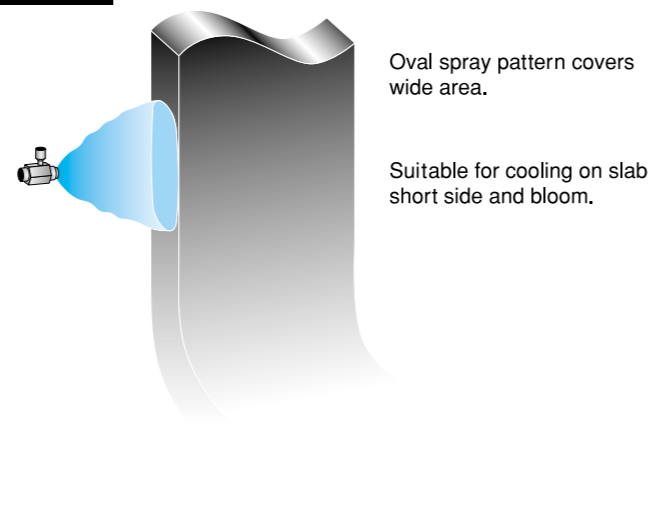
- Cooling continuous casted steel (Bloom)
- Cooling continuous casted steel (Slab short side)
- Cooling continuous casted steel (Billet)
- Cooling roll on continuous casting machine

Rolling mill process

- Cooling sheets on continuous annealing line
- Cooling roll in heat treatment
- Cooling magnetic steel



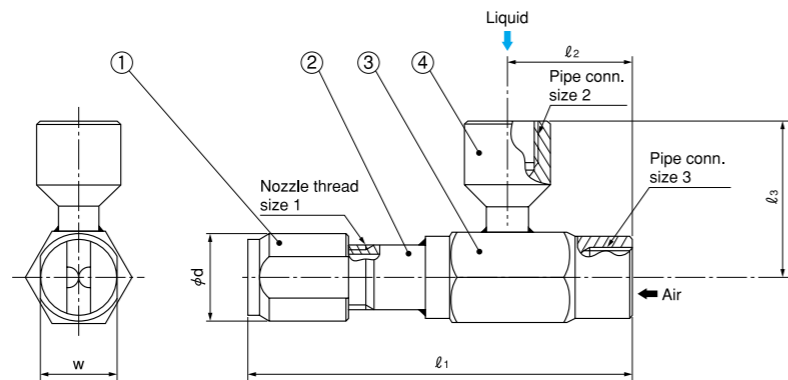
FEATURES



DDA series

MATERIALS

- Nozzle: S303
- Pipe: S304
- Mixing adaptor: S304
- Liquid pipe: S304



Series	Nozzle thread size 1	Pipe connection sizes 2, 3	Dimensions (mm)					Mass (g)
			l ₁	l ₂	l ₃	w	φd	
DDA	1/8F	1/4F	70	32.5	40	12	14	170
	1/4F	1/4F	70	32.5	40	16	18	180
	3/8F	3/8F	100	32.5	40	20	23	320
	1/2F	1/2F	130	40	50	25	28	450
	3/4F	1/2F	150	45	50	32	35	650

*1: l₁ shows the standard length, which is shortest, and the longest length, 1500mm.
 *2: Pipe connection sizes for air and liquid are same.
 *3: Each mass is for DDA with standard length, for longer units please add the corresponding amount below for each 100mm length.

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

DDA series Secondary Cooling Nozzles / Oval Spray

Spray angle code	Spray capacity code	Nozzle thread size 1	Pipe conn. size 2, 3	Air pressure (MPa)	Spray capacity (ℓ/min) & Air consumption (ℓ/min, Normal)										Mean droplet dia. (μm)		Free passage dia. (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			
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	—	—	—	—	—	—			
	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	—	—	—	—				—	
	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	—	—	—	—					
	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	—	—				
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	—	—					
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	—	—					
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						

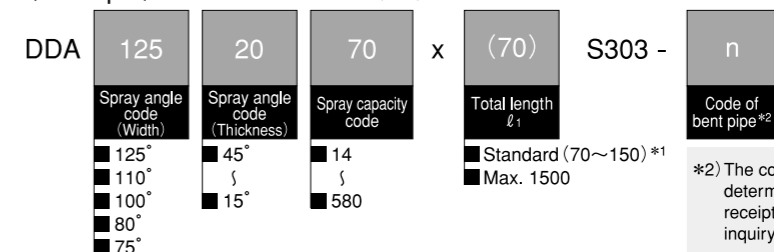
Conversion of unit [Pressure] 0.1MPa ≈ 14.50psi [Flow rate] 1ℓ (liter) ≈ 0.264 US gal. 10psi ≈ 0.069MPa 1US gal. ≈ 3.79ℓ (liter)

Spray angle code	Spray capacity code	Nozzle thread size 1	Pipe conn. sizes 2, 3	Air pressure (MPa)	Spray capacity (ℓ/min) & Air consumption (ℓ/min, Normal)										Mean droplet dia. (μm)		Free passage dia. (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	
125°	20°	70	1/4F	1/4F	0.1	1.51	29	2.22	24	—	—	—	—	—	—	200	100			2.4
					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	—	—			
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	64	2.64	64	3.64	57	—	—			
					0.4	0.50	82	0.90	82	1.55	82	2.50	82	3.60	76	—	—			
110°	20°	50	1/4F	1/4F	0.1	1.20	46	1.62	46	2.72	41	—	—	—	—	200	100	2.4	2.0	2.1
					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	—	—			
110°	20°	130	3/8F	3/8F	0.1	2.20	200	4.50	150	8.50	75	—	—	—	—	150	75	3.7	3.9	3.5
					0.2	1.20	325	2.90	310	5.80	250	12.3	120	—	—	—	—			
					0.3	0.60	430	2.10	430	4.40	400	10.7	250	—	—	—	—			
					0.4	—	—	—	—	—	—	—	—	—	—	—	—			

How to order

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

(Example) DDA 125 20 70 x (70) S303 - n



*1) Standard length differs with nozzle code. See "Dimensions" on page 17.

DDRP+AS series

Hydraulic/Pneumatic (dual-use) Thick flat spray nozzles with Even Distribution

Patent pending

Steel making process

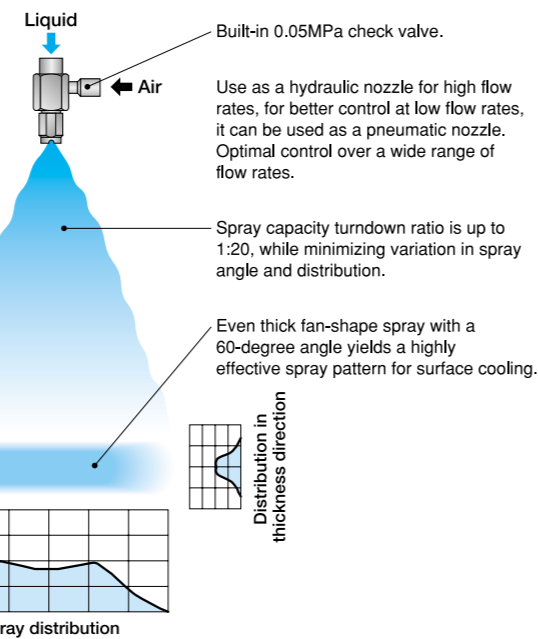
- Cooling continuous casted steel (Bloom)
- Cooling continuous casted steel (Slab short side)
- Cooling continuous casted steel (Billet)
- Cooling roll on continuous casting machine

Rolling mill process

- Cooling sheets on continuous annealing line
- Cooling roll in heat treatment
- Cooling electromagnetic steel



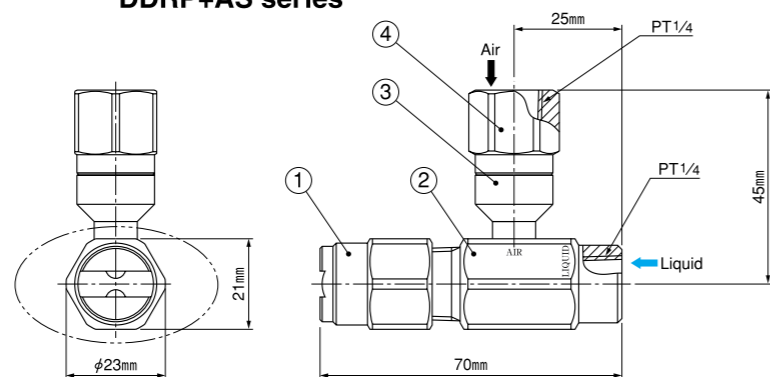
FEATURES



DDRP+AS series

MATERIALS

- ① Nozzle: S303
- ② Mixing adaptor: S304
- ③ Check valve: S304
- ④ Air socket: S303



Pipe conn. size	Spray angle code		Spray angle (width)				Spray angle (thickness)				Spray capacity Qw (ℓ/min) & Air consumption Qa (ℓ/min, Normal) at Liquid pressure Pw (MPa) & Air pressure of 0.1MPa										Mean droplet diameter (μm)	Free pass. dia. (mm)		Mass (g)		
	Width	Thickness	0.01 MPa	0.1 MPa	0.3 MPa	1 MPa	0.01 MPa	0.1 MPa	0.3 MPa	1 MPa	0.01 MPa	0.02 MPa	0.05 MPa	0.07 MPa	0.1 MPa	0.2 MPa	0.3 MPa	0.5 MPa	1 MPa	1.5 MPa		Nozzle	Adaptor			
1/4F	115°	60°	200	110	113	115	116	65	58	60	60	Qw	1.55	2.93	6.81	9.29	10.9	15.5	19	24.5	34.7	42.5	430	2.9	6.7	1.8
			260	110	113	115	116	65	58	60	60	Qa	29	25	2	—	—	—	—	—	—	—				
	90°	60°	200	86	89	90	90	65	58	60	60	Qw	1.55	2.93	6.81	9.29	10.9	15.5	19	24.5	34.7	42.5	455	2.9	6.7	1.8
			260	86	89	90	90	65	58	60	60	Qa	29	25	2	—	—	—	—	—	—	—				
											Qw	2.01	3.81	8.86	12.1	14.2	20.1	24.7	31.9	45.1	55.3	463	3.3	7.6	2.0	
											Qa	38	33	3	—	—	—	—	—	—	—					—
											Qw	1.55	2.93	6.81	9.29	10.9	15.5	19	24.5	34.7	42.5	488	3.4	7.6	2.0	
											Qa	38	33	3	—	—	—	—	—	—	—					—

Conversion of unit [Pressure] 0.1MPa ≈ 14.50psi [Flow rate] 1ℓ (liter) ≈ 0.264 US gal. 10psi ≈ 0.069MPa 1US gal. ≈ 3.79ℓ (liter)

How to order

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

⟨Example⟩ 1/4DDRP11560200S303+1/4F×3/8AS S303

1/4 DDRP 115 60 200 S303+1/4F×3/8AS S303

Spray angle code (width)
■ 115°
■ 90°

Spray capacity code
■ 200
■ 260

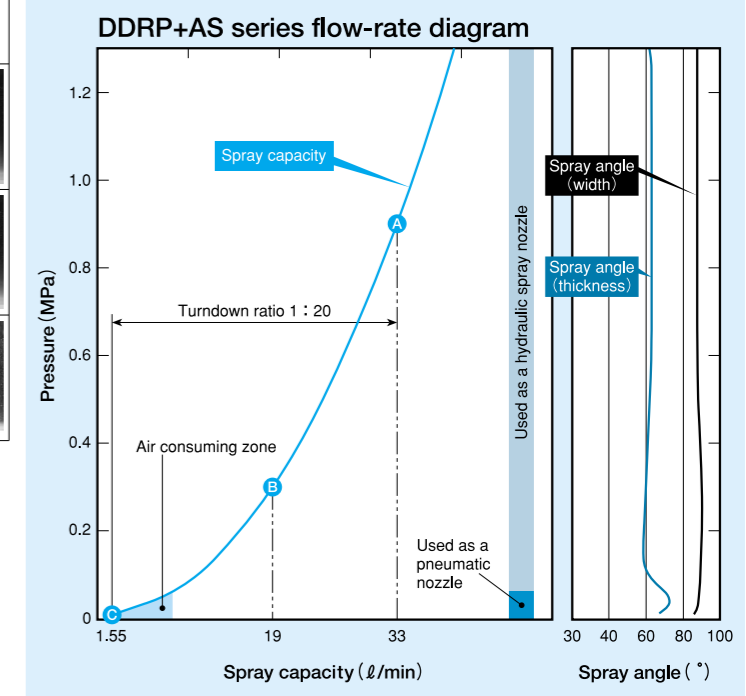
DDRP+AS series Hydraulic/Pneumatic (dual-use) Thick flat spray nozzles with Even Distribution

Turndown ratio of DDRP+AS

Turndown ratio range of normal hydraulic spray nozzles at maximum pressure is limited by pump capacity, and at minimum pressure it is limited by narrower spray angle and unstable spray condition. When the max liquid pressure of water is 0.9MPa, the turndown ratio of normal hydraulic spray nozzles is 1: 4-4.5.

DDRP+AS series can keep stable spray at very low flow due to air pressure. When the maximum liquid pressure is 0.9MPa, turndown ratio can be extended to 1: 20.

Large ↑ Spray capacity ↓ Small	Spray capacity (ℓ/min)	Liquid pressure (MPa)	Air pressure (MPa)	Air consumption (ℓ/min, Normal)	Width	Thickness
	A	33	0.9	0.1	0	
B	19	0.3	0.1	0		
C	1.55	0.01	0.1	29		



Turndown ratio of hydraulic spray nozzle

Turndown ratio range of hydraulic spray nozzles at maximum pressure is limited by pump capacity, and at minimum pressure it is limited by narrower spray angle and unstable spray condition. When the maximum liquid pressure is 0.6MPa, the turndown ratio of hydraulic nozzle is 1: 2.5-3.5.

