

# Return-flow Nozzles for Gas Cooling

## **SPB** Series



## **SPILLBACK** Nozzles

## **Return-flow Nozzles for Gas Cooling**

With the liquid/water supplied at constant pressure, the spray capacity can be controlled by opening or closing the return flow valve. The SPB series features minimal variation in the spray droplet size and a large turn-down ratio of the spray capacity. This makes it ideal for gas cooling where the temperature and volume of the inlet gas varies.







[Spray distribution]

#### [FEATURES]

- Variable capacity hollow cone spray nozzles, generate fine atomization with uniform spray distribution (single-head).
- Spray capacity can be controlled by simply adjusting the return pressure while the supply pressure is kept constant. Spray capacity is maximized by fully closing the return flow valve and minimized by fully opening the return flow valve. The turn-down ratio of the spray capacity is 1:10 (except for SPB8530R).
- Part of the supplied liquid flows back when the return flow valve is opened, causing the supply flow to increase. The increase of supply flow is within 40–50% of the maximum spray capacity.
- Minimal variation in spray droplet diameter, regardless of the spray flow rate, makes the SPILLBACK nozzles ideal for gas cooling where the temperature of the inlet gas varies.
- Available in spray angle code 60 or 85.

[STANDARD PRESSURE] Supply pressure: 2.0 MPa (with return flow valve totally closed) [APPLICATIONS]

Gas cooling, moisture control at blast furnace



Components	and	materials

No.	Components	Standard material							
1	Nozzle body & whirler	S316L							
2	Inlet pipe	S316L							
3	Outlet pipe	S304							
4	Outlet socket	S304							
5	Inlet socket	S304							
6	Ring	S304							
1	Spring	S304							
8	O-ring	NBR							
9	Packing	Metal wire reinforced AES wool							
10	Flange	SCS13 (S304)							
1	Bolt	S304 equivalent							
In the	In the material code "S" represents "stainless steel"								

The above diagram is an example.

Inquiry forms with outline drawings are available to verify desired dimensions and specifications.

In addition to the example above, SPB series with 90° or 45° angle adaptor and an optional protection pipe are also available. Custom designs can be tailored to your needs.



■ 45° Angle Bend Type



The protection pipe is available also for the angle bent type.

#### Performance Chart

	Spray ca	pacity (L/min) at	supply pressure	2.0 MPa	Spray angle (			
Nozzle code		Return p	oressure			Return pressure	9	Free passage
	Max.*1	0.8 MPa	0.4 MPa	0 MPa*²	Max.*1	0.8 MPa	0 MPa* <sup>2</sup>	
6003R	3.00	1.76	0.65	0.30				1.5
6004R	4.00	2.35	0.85	0.40	65	85	110	2.0
6005R	5.00	2.75	1.05	0.50				2.0
6006R	6.00	3.05	1.18	0.60				2.0
6007R	7.00	3.56	1.37	0.70	]			2.0
6008R	8.00	4.05	1.60	0.80	1			2.0
6010R	10.0	5.09	1.96	1.00	60	84	110	2.5
6012R	12.0	6.11	2.36	1.20				2.5
6014R	14.0	7.13	2.75	1.40				2.5
6016R	16.0	8.15	3.15	1.60				2.5
6018R	18.0	9.16	3.54	1.80				2.5
6020R	20.0	10.2	3.93	2.00				3.0
		Return p	oressure					
	Max.*1	0.6 MPa	0.3 MPa	0 MPa* <sup>2</sup>	Max.*1	0.6 MPa	0 MPa* <sup>2</sup>	
8505R	5.00	2.97	0.90	0.50	85	95	130	1.3
8510R	10.0	4.20	1.50	1.00	85	100	130	2.0
8515R	15.0	5.20	2.25	1.50	85	105	130	2.5
8520R	20.0	6.80	3.00	2.00	]			2.5
8525R	25.0	9.25	3.75	2.50	]			3.0
8530R	30.0	14.40	5.60	3.80	85	100	130	3.0

\*1) When the return flow valve is totally closed \*2) When the return flow valve is totally open



## **SPB-R** SERIES



## Single-head Return-flow Nozzles SPB-R series

### Spray Droplet Diameter



Spray liquid: tap water, normal temperature

#### Spray Angle Code: 60

_ · · ·		-	-				
	Return	Spray	Spray	Sauter mea	an diameter	Dista	ance
Nozzle code	pressure*	angle	capacity	d32 (	(µm)	L (n	nm)
NOLLIC COUC	Pr		Q	Immersion	Laser	Immersion	Laser
	(MPa)	(°)	(L/min)	sampling	analyzer	sampling	analyzer
	1.15 (MAX)	65	3.00	133	120	500	300
SPB6003R	0.80	85	1.76	_	_	_	
CI DOUDIN	0.40	105	0.65	_		_	_
	0 (MIN)	110	0.30	99	91	150	100
	1.15 (MAX)	65	4.00	139	125	500	300
SPB6004R	0.80	85	2.35	_	_	_	_
	0.40	105	0.85			—	
	0 (MIN)	110	0.40	103	93	150	100
	1.20 (MAX)	65	5.00	147	132	500	300
SPB6005R	0.80	85	2.75			_	
0. 20000.0	0.40	105	1.05			_	
	0 (MIN)	110	0.50	106	96	150	100
	1.25 (MAX)	60	6.00	154	139	500	300
SPB6006R	0.80	84	3.05			—	
0. 20000.0	0.40	108	1.18			_	
	0 (MIN)	110	0.60	117	105	150	100
	1.25 (MAX)	60	7.00	160	144	500	300
SPB6007R	0.80	84	3.56	_		_	
01 0000/10	0.40	108	1.37	_		—	
	0 (MIN)	110	0.70	123	111	150	100
	1.25 (MAX)	60	8.00	165	149	500	300
SPB6008R	0.80	84	4.05	_	_	_	_
	0.40	108	1.60	_		—	_
	0 (MIN)	110	0.80	129	116	150	100
	1.25 (MAX)	60	10.00	174	157	500	300
SPB6010R	0.80	84	5.09	_	_	_	_
OF BOOTOR	0.40	108	1.96	_			
	0 (MIN)	110	1.00	146	120	150	100
	1.25 (MAX)	60	12.00	184	166	500	300
SPB6012R	0.80	84	6.11	_	_	_	
01 2001210	0.40	108	2.36	_			
	0 (MIN)	110	1.20	149	130	150	100
	1.25 (MAX)	60	14.00	192	173	500	300
SPB6014R	0.80	84	7.13	_			
01 2001 111	0.40	108	2.75			_	
	0 (MIN)	110	1.40	158	142	150	100
	1.25 (MAX)	60	16.00	199	179	500	300
SPB6016R	0.80	84	8.15	_		_	
OF BOOTOR	0.40	108	3.15			_	
	0 (MIN)	110	1.60	166	149	150	100
	1.25 (MAX)	60	18.00	206	185	500	300
SPB6018R	0.80	84	9.16	_	_	_	_
OF BOUTOR	0.40	108	3.54	_	_	_	_
	0 (MIN)	110	1.80	174	157	150	100
	1.25 (MAX)	60	20.00	213	192	500	300
SPB6020P	0.80	84	10.20	_	_	_	_
01 00020IX	0.40	108	3.93	_	_	—	_
	0 (MIN)	110	2.00	180	162	150	100

\*(MAX): return flow valve is totally closed, (MIN): return flow valve is totally open

Supply pressure Ps: 2.0 MPa Spray Angle Code: 85 Supply pressure Ps: 2.0 MPa											
diameter	Dista	ance		Return	Spray	Spray	Sauter mea	an diameter	Dista	ance	
n)	L (n	nm)	Normale and a	pressure*	angle	capacity	d32 (	μm)	L (n	L (mm)	
laser	Immersion	laser	Nozzle code	PR	_	Q	Immersion	Laser	Immersion	Laser	
analyzer	sampling	analyzer		(MPa)	(°)	(L/min)	sampling	analyzer	sampling	analyzer	
120	500	300		0.80 (MAX)	85	5.00	147	132	500	300	
-			CDD0505D	0.60	95	2.97	_	_	_	_	
			SEPODOR	0.30	120	0.90	_	_	_	_	
01	150	100		0 (MIN)	130	0.50	106	96	150	100	
125	500	200		0.90 (MAX)	85	10.00	174	157	500	300	
125	500	300	CDD0510D	0.60	100	4.20	_	_	_	_	
	_	_	SEPOSIOK	0.30	125	1.50	-	_	_	_	
	-			0 (MIN)	130	1.00	146	131	150	100	
93	150	100		0.95 (MAX)	85	15.00	198	178	500	300	
132	500	300	CDD0545D	0.60	105	5.20	_	_	_	_	
_	_	_	SPB8515K	0.30	127	2.25	_	_	_	_	
_	_	_		0 (MIN)	130	1.50	162	146	150	100	
96	150	100		0.95 (MAX)	85	20.00	215	194	500	300	
139	500	300	00000000	0.60	105	6.80	_	_	_	_	
_	_	_	SP88520R	0.30	127	3.00	_	_	_	_	
_	_	_		0 (MIN)	130	2.00	180	162	150	100	
105	150	100		0.95 (MAX)	85	25.00	228	205	500	300	
144	500	300	ODDOCOCD	0.60	105	9.25	_	_	_	_	
_	_	_	5F00020K	0.30	127	3.75	_	_	_	_	
_	_	_		0 (MIN)	130	2.50	191	172	150	100	
111	150	100		0.90 (MAX)	85	30.00	237	213	500	300	
149	500	300	CDD0500D	0.60	100	14.40	_	_	_	_	
			SEB0030K	0.30	125	5.60	_		_		
				0 (MINI)	120	2 00	217	105	150	100	

 $^{\ast}(\text{MAX}):$  return flow valve is totally closed, (MIN): return flow valve is totally open

### Spray Dimensions

Largest spray width (d) at distance L



#### Spray dimension (h1-h4) by reach distance



<sup>(</sup>Unit: mm)

#### Spray Angle Code: 60

#### Supply pressure Ps: 2.0 MPa

	Return	Distance	Spray dimensions (mm)						
Nozzle code	pressure*	(mm)		Spray	unnension	5 (11111)			
	Pr (MPa)	L	d	h1	h2	h3	h4		
	1.15 (MAX)	700	900	1,100	900	700	400		
CDR6002D	0.80	600	1,000	900	700	500	300		
SPD0003R	0.40	300	800	500	100	0	0		
	0 (MIN)	150	450	100	0	0	0		
	1.15 (MAX)	800	1,000	1,000	900	700	400		
SDB6004D	0.80	650	1,100	900	700	500	300		
3F 00004K	0.40	400	900	500	100	0	0		
	0 (MIN)	150	550	100	0	0	0		
	1.20 (MAX)	900	1,050	1,050	950	800	500		
SDB6005D	0.80	700	1,150	1,000	850	600	400		
SEDOUOIK	0.40	400	950	600	150	0	0		
	0 (MIN)	200	650	150	0	0	0		
	1.25 (MAX)	1,000	1,000	1,100	1,000	900	700		
SDB6006D	0.80	800	1,200	1,050	950	700	500		
SEDUUUK	0.40	450	1,000	700	200	0	0		
	0 (MIN)	250	700	200	0	0	0		
	1.25 (MAX)	1,000	1,050	1,100	1,000	900	750		
SDB6007D	0.80	850	1,200	1,050	950	750	550		
SFDOUUR	0.40	450	1,000	700	250	0	0		
	0 (MIN)	300	750	300	0	0	0		
	1.25 (MAX)	1,050	1,100	1,150	1,050	950	750		
SPB6008R	0.80	900	1,300	1,100	1,000	800	600		
	0.40	500	1,050	750	300	100	0		
	0 (MIN)	350	800	350	0	0	0		
	1.25 (MAX)	1,100	1,100	1,200	1,100	1,000	800		
SDB6010D	0.80	900	1,300	1,150	1,000	800	600		
SEDUVIUR	0.40	500	1,100	800	400	100	0		
	0 (MIN)	350	900	400	100	0	0		
	1.25 (MAX)	1,100	1,150	1,200	1,100	1,000	800		
SDB6012D	0.80	950	1,350	1,150	1,000	850	600		
SF DOU 12K	0.40	550	1,200	800	400	100	0		
	0 (MIN)	350	950	450	100	0	0		
	1.25 (MAX)	1,150	1,200	1,250	1,150	1,050	850		
SPB6014P	0.80	950	1,400	1,150	1,050	900	650		
01 000 1410	0.40	600	1,300	850	450	100	0		
	0 (MIN)	400	1,000	500	150	0	0		
	1.25 (MAX)	1,150	1,250	1,250	1,150	1,050	900		
SPB6016R	0.80	1,000	1,400	1,200	1,050	950	700		
OF DOUTOR	0.40	600	1,350	850	450	150	0		
	0 (MIN)	400	1,050	550	150	0	0		
	1.25 (MAX)	1,200	1,250	1,300	1,200	1,100	900		
SPR6018P	0.80	1,000	1,450	1,200	1,100	1,000	750		
OF DOUTOR	0.40	650	1,400	900	500	200	0		
	0 (MIN)	450	1,100	550	200	0	0		
	1.25 (MAX)	1,200	1,300	1,300	1,200	1,100	950		
SPB6020P	0.80	1,050	1,500	1,200	1,100	1,000	800		
51 D0020R	0.40	700	1,500	900	500	200	0		
	O (MINI)	450	1 200	600	200	0	0		

Spray Angle Code: 85

Supply pressure Ps: 2.0 MPa

Nozzle code	Return pressure*	Distance (mm)	Spray dimensions (mm)						
	Pr (MPa)	L	d	h1	h2	h3	h4		
	0.80 (MAX)	900	1,400	1,000	1,000	900	750		
CDD0505D	0.60	800	1,400	1,050	950	800	600		
SEDOJUJK	0.30	300	1,000	900	500	100	0		
	0 (MIN)	250	700	250	100	0	0		
	0.90 (MAX)	1,100	1,400	1,150	1,050	950	850		
CDD0510D	0.60	900	1,500	1,050	1,000	850	700		
SEDOJIUK	0.30	500	1,250	950	700	400	150		
	0 (MIN)	400	1,000	700	450	200	0		
	0.95 (MAX)	1,300	1,400	1,250	1,150	1,100	1,000		
	0.60	1,000	1,600	1,100	1,050	950	900		
SPD0515K	0.30	500	1,400	950	800	500	200		
	0 (MIN)	400	1,200	850	600	300	0		
	0.95 (MAX)	1,400	1,450	1,300	1,150	1,100	1,050		
SDB0520D	0.60	1,100	1,700	1,200	1,100	1,050	950		
SPD0J20R	0.30	600	1,400	1,000	850	600	300		
	0 (MIN)	500	1,300	900	750	400	0		
	0.95 (MAX)	1,400	1,500	1,400	1,200	1,150	1,050		
CDD0525D	0.60	1,200	1,800	1,300	1,200	1,100	1,000		
SEDOJZJK	0.30	650	1,500	1,100	950	700	400		
	0 (MIN)	550	1,350	1,000	850	500	100		
	0.90 (MAX)	1,400	1,500	1,450	1,250	1,150	1,100		
SDB9520D	0.60	1,300	1,900	1,350	1,250	1,150	1,050		
3F 00330K	0.30	700	1,600	1,150	1,000	850	500		
	0 (MIN)	600	1,400	1,100	900	600	200		

\*(MAX): return flow valve is totally closed, (MIN): return flow valve is totally open

\*(MAX): return flow valve is totally closed, (MIN): return flow valve is totally open

## Four-tip head Compact Return-flow Nozzles 4SPB-S Series

Even equipped with four nozzle tips, the nozzle body is lightweight and compact with an outside diameter of 50 mm. This allows for a smaller protection pipe.

Compared to a single-head return-flow nozzle at the same flow rate, the spray droplet diameter is smaller.





## Multi-tip head Return-flow Nozzles 4SPB / 8SPB Series

Multiple nozzle tips are installed on one customized nozzle head. Capable of the finest atomization in the SPB nozzles having the same spray flow rate.

#### 4SPB series





8SPB series



### Large Capacity High-Pressure Return-flow Nozzles GSPB Series

Hollow cone spray nozzle able to produce a spray flow of 1–10,000 liters per hour. Suitable for circulating fluidized bed flue gas desulfurization (CFB-FGD).





### INQUIRY

## This nozzle series is mainly used in gas cooling towers for cooling exhaust gas.

When selecting a nozzle, it is necessary to consider various factors such as the shape of the cooling tower, the nature and flow of the gas, the nozzle installation position, and the piping layout.

## <u>Please consult with our expert engineers during the design stage.</u>

IKEUCHI will select optimal spray nozzles, configure ancillary devices and design an installation layout to assure ideal cooling performance. Without our engineering service, efficient performance may not be achieved.



## **Related Products**

#### The following are available to suit a variety of installation needs.



### **For Effective Cooling**

Finding the best spray nozzle for effective cooling is not the only thing that matters. The location where the nozzle will be installed is important as well.

In a gas cooling tower, the nozzle should be installed so that the nozzle tip extends into the laminar flow, avoiding the turbulences near the furnace wall and thus preventing the wall from getting wet.



In order to maximize the cooling effect, IKEUCHI's offer includes measures for improving nozzle durability and prevention of contamination. Please contact IKEUCHI for details.



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