Everloy Spray Nozzles

# DESCALING

# NOZZLES

EVERLOY KYORITSU GOKIN CO.,LTD.

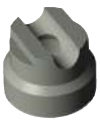
QUALITY ASSURANCE JIC
REGISTERED ORGANIZATION
No.0421-ISO9001
No.E487-ISO14001
NOZZLE DIVISION

**In 1957, Kyoritsu Gokin developed a descaling nozzle made of tungsten carbide and started the sale of nozzles under the brand name of EVERLOY.**
**We have contributed to the steel industry and grown drastically as a nozzle maker through the development of this type of nozzle.**
**Currently, we are playing a key role as a pioneer and contributor in the descaling technology domestically and internationally by developing new products based on descaling nozzles and descaling technology, releasing the result of our research work, etc.**

# CONTENTS

# Descaling Nozzle Series



| Nozzle type | Maximum working pressure | Orifice types | Straightening Filter types |
|---|---|---|---|
| TYPE DNX  DNX type | 25 MPa  |  U-Type Orifice ( Tungsten carbide ) |  Short / Long Filter Brass (JIS C3604BD) |
| TYPE DNR  DNR type | 30 MPa  |  Trumpet-type orifice ( High hardness tungsten carbide ) |  Short / Long Filter Brass (JIS C3604BD) |
| TYPE DNM  DNM type | 50 MPa  |  Trumpet-type orifice ( High hardness tungsten carbide ) |  Short / Long Filter AISI 303 (JIS SUS 303) |
| TYPE DNK  DNK type | 50 MPa  |  Trumpet-type orifice ( High hardness tungsten carbide ) |  Short / Long Filter AISI 303 (JIS SUS 303) |
| TYPE DNH  DNH type | 25 MPa  |  U-Type Orifice ( Tungsten carbide ) |  Short / Long Filter Brass (JIS C3604BD) |
| TYPE DNB  DNB type | 25 MPa  |  U-Type Orifice ( Tungsten carbide ) |  DNB type Conventional Filter Brass (JIS C3604BD) |

*New-type nozzle tip proves renarkable improvement in durability, compared with the conventional one.*

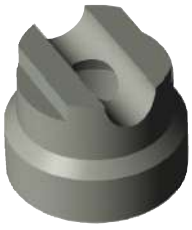
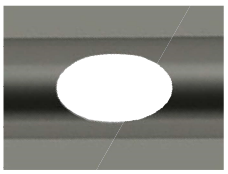
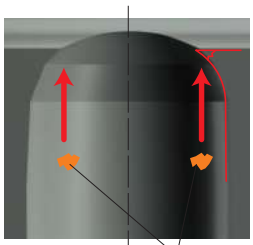
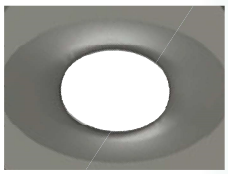
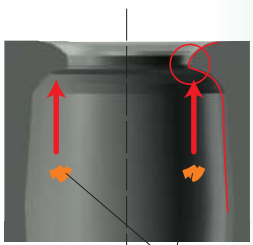
## Excellent durability

# Trumpet-type orifice

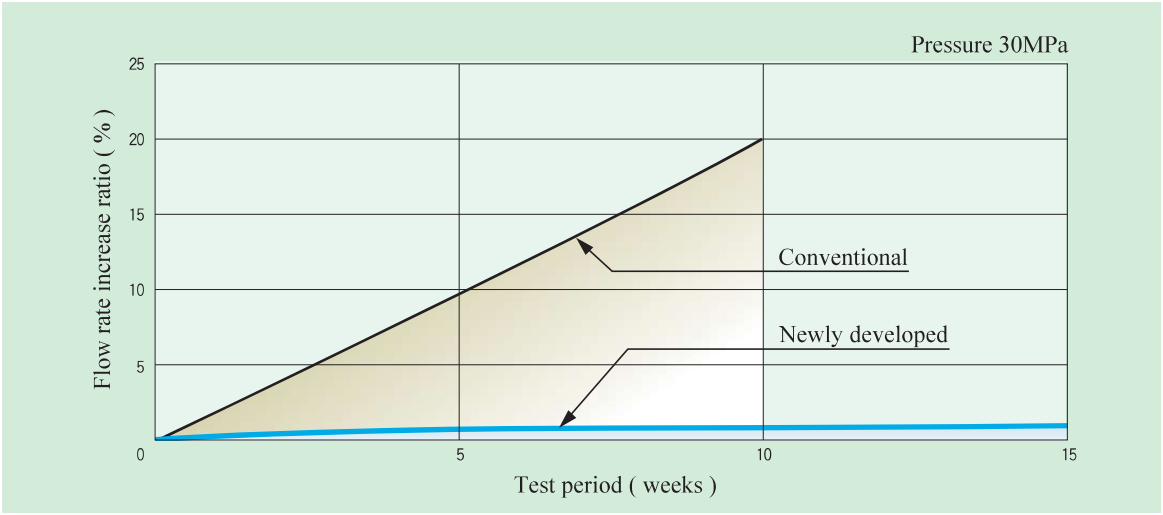
Patent

A descaling nozzle used at high pressure is always placed under severe conditions.
The durability of a nozzle is an important factor in the assured quality of a steel plate. For a newly developed trumpet-type orifice, the rim of orifice is thickened and cemented carbide of high hardness is employed to improve the durability drastically so that it can be used steadily for a long time.

### Comparison with conventional orifices

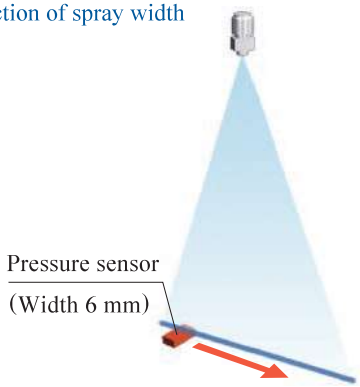
| Conventional Orifice | Newly developed Orifice |
|---|---|
| **U-type orifice**<br>Materials : Tungsten carbide | **Trumpet-type Orifice**<br>Materials : High hardness Tungsten carbide |
|  |  |
|  <br>  <br>Foreign materials |  <br>  <br>Foreign materials |
| The ridge of the orifice is thin and knife-edged, so that it is apt to chip. | The ridge of the orifice is thickened, so that it is resistant to chipping even when it collides with foreign matters. |

## Abrasion test example with an actual machine

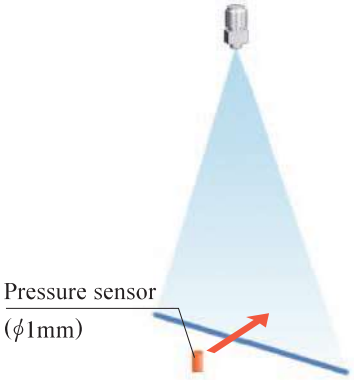



## Impact force distribution

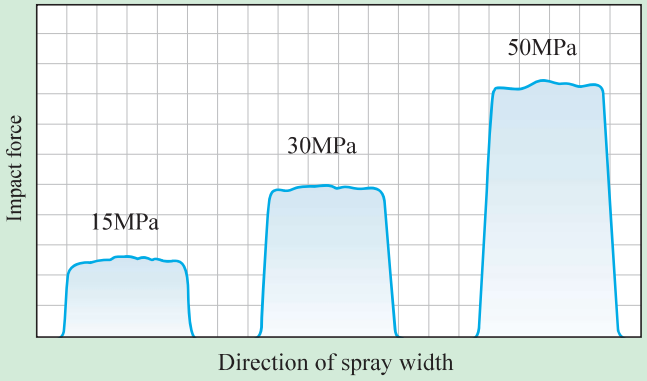
Method of measuring the impact force distribution in the direction of spray width



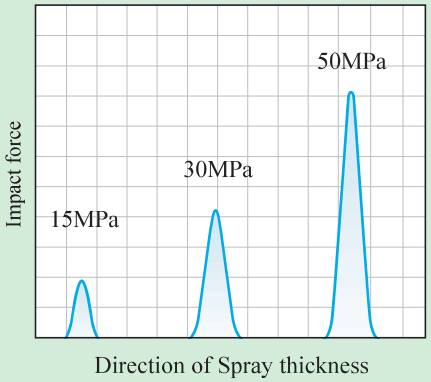

Method of measuring the impact force per unit area




Impact force distribution graph in the direction of spray width




Impact force graph per unit area




Trumpet-type orifice

# Powerful impact force type
# Short Filter

Patent

A large turbulent flow in the descaling nozzle header degrades the original nozzle performance. For example, a straight and long pipe ( Fig. 1) which can maintain an almost complete straightened flow provides a sharp and steady spray pattern.

The installation of the nozzle on the header ( Fig. 2), however, will disturb the spray irregularly and reduces the impact force due to the deformation of the spray and an increase in the water screen thickness.

However, it is impossible to install a straight and long pipe on an actual rolling mill. Straightening filter is a product developed to straighten the turbulent flow in a pipe before the nozzle orifice so that the nozzle performance can be maximized. ( Fig. 3 )

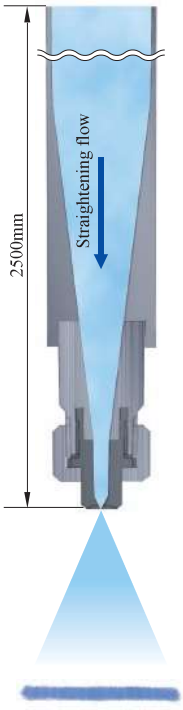



Fig.1


Fig.2

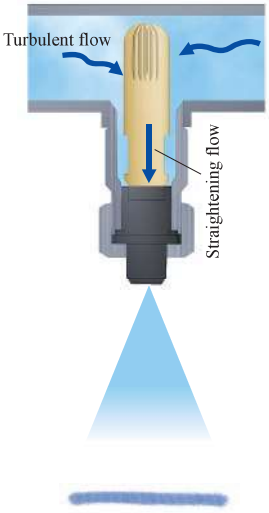



Fig.3

## Principle of straightening flow

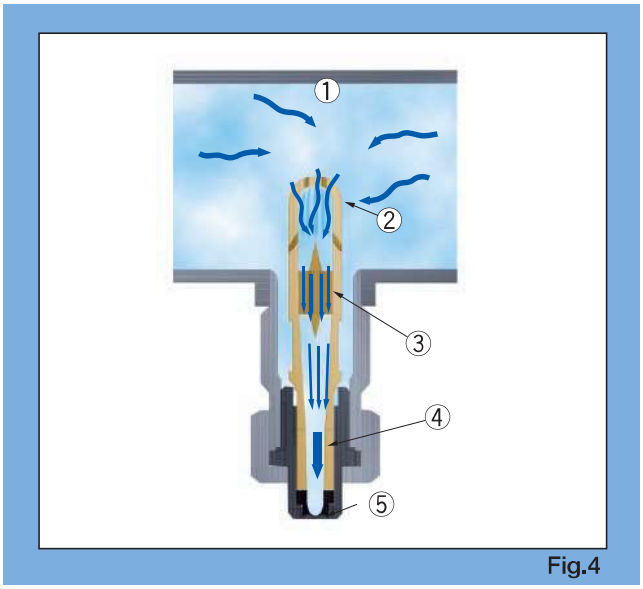
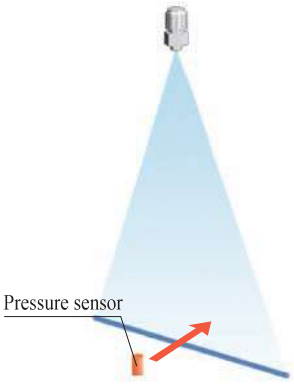
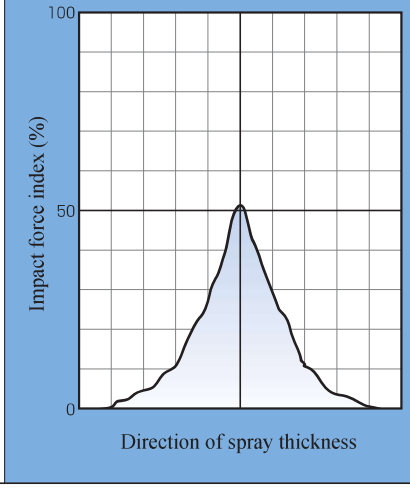
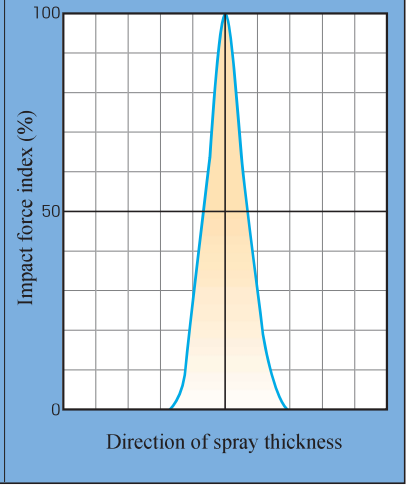


Fig.4

Fig. 4 shows a cross section of the nozzle. The turbulent flow ① is straightened slightly when it enters the slit ② in the filter. And then, the flow is forced to be devided and delivered to pass through the next flow straightener ③, so that it is straightened almost completely. The flow is straightened completely when it passes through the smoothly tapered passage ④ and reaches the nozzle orifice ⑤ as it is.
In this manner, the turbulent flow in the header is straightened in one direction.

## Comparison with conventional nozzles

| | With DNB Conventional Filter  | With Powerful impact force type Short Filter  |
|---|---|---|
| Nozzle model number | **DNB1525** | **DNH1525** |
| Spray pressure | **12MPa** | |
| Flow rate | **99.2 ℓ/min** | |
| Impact force per unit area   |   |   |

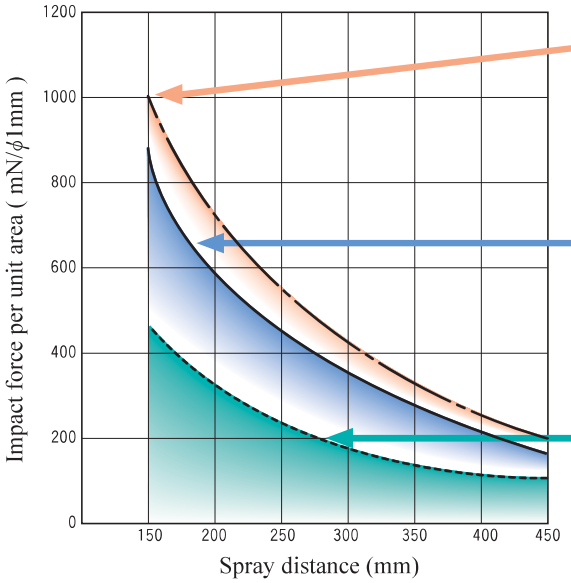
The method of straightening flow used for short/long filter is employed in the models of DNX, DNH, DNR DNM and DNK. Short Filter

# Powerful impact force type
# Long Filter

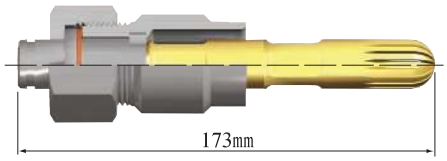
Patent

A more powerful impact force can be obtained by improving the straightening flow effect of the long filter.

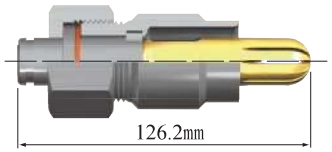
## Spray distance vs. Impact force graph



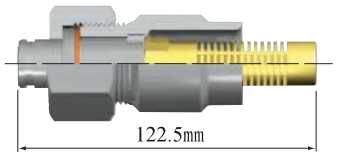

DNH1525 with Long Filter




DNH1525 with Short Filter

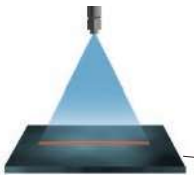



DNB1525 with Conventional Filter




Long Filter increases the impact force by approx. 1.2 times than Short Filter, and by approx. 2.4 times than a DNB descaling nozzle.

## Result of lead plate erosion tests

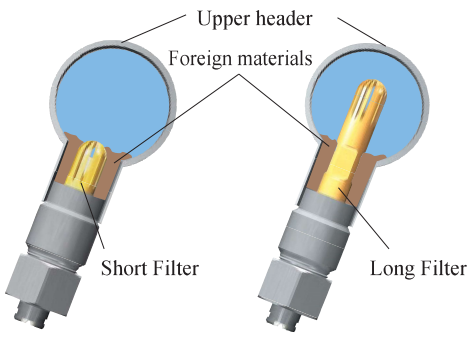


Spray pressure 12 MPa
Spray distance 300 mm
Spray time 3 minutes

Lead plate


Results of comparison of each digging force. DNH type descaling nozzle, which has thinner spray thickness and stronger impact force, digs the lead plate more deeply.
DNH nozzle with Long Filter digs further deeper.

## Preventive measures against filter clogging




The slits of Long Filter, as shown above, protrudes into the upper header pipe, so that foreign matters gathering in the bottom of the header will not come in to the slits. This prevents the filter form clogging.

*Protects the nozzle tip from accidental impact.*

# NEW Racetrack Shaped Nozzle Case

The stainless steel cases of DNB, DNH, DNR and DNX models have been modified to a racetrack shape to protect nozzle tips. The new and previous shapes offer the same spray performance.

## Description of the Modification

Descaling nozzles are used under particularly severe conditions in rolling mills. The tungsten carbide nozzle tip of a descaling nozzle is always exposed to possible damage by radiant heat and accidental impact (collision with flying scale, rolled material, etc.). By mounting a stainless steel racetrack shaped case onto the tungsten carbide nozzle tips, the above possible damage can be reduced.

| Conventional shape | Modified shape |
|---|---|
| Straight groove shape | Racetrack shape |
|  |  |

TYPE DNX

**Maximum working pressure 25MPa**

NEW

# DNX-type

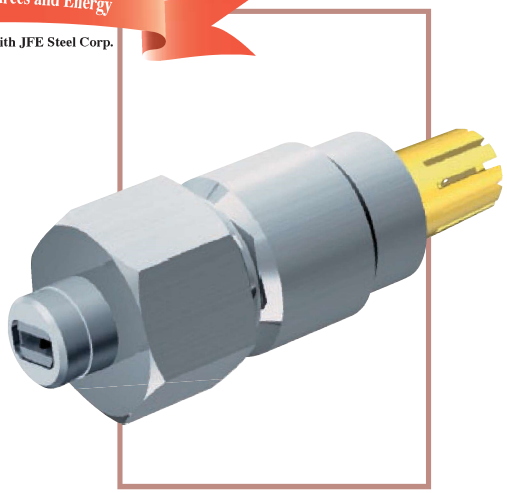
Patent

Powerful impact force type short/long filter

Racetrack shaped nozzle case

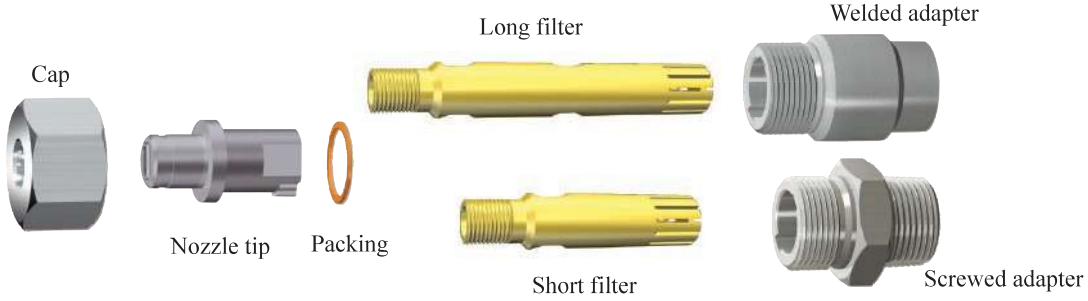
Honored with a Prize from Director of Agency for Natural Resources and Energy

Honored together with JFE Steel Corp.



- Improved steepness is achieved in the widthwise distribution curve of the impact force.
- Compared with conventional models, DNX model delivers three times or more strong impact force on aluminum specimens, and achieves the similan level of descaling performance at the reduced water flow rate.
- Adapters and caps designed for DNH, DNR and DNB are usable for DNX as they are.

## Components




| Name | Parts number | Material | Weight (g) |
|---|---|---|---|
| Cap | 01C00 | AISI 303 (JIS SUS 303) | 150 |
| Nozzle tip | DNX●●●● ※1 | Tungsten carbide+AISI 303 (JIS SUS 303) | 115 |
| Packing | 01P00 | Copper (JIS C1201P-1/4H) | 4 |
| Short filter | 01F01 | Brass (JIS C3604BD) | 120 |
| Long filter | 01F04 | Brass (JIS C3604BD) | 215 |
| Welded adapter | 01A00 ※2 | AISI 304 (JIS SUS 304) | 255 |
| Screwed adapter | 01A01 ※2※3 | AISI 304 (JIS SUS 304) | 215 |

**Please note when ordering.**

※1 For the tip model number, refer to the table of nozzle tip model numbers on page 16.

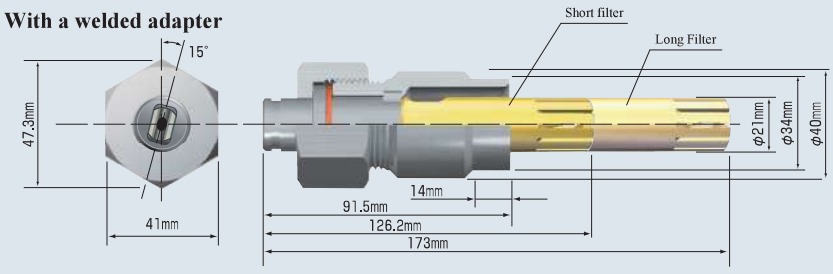
DNX●●●●
Model number

※2 For the adapter material, SUS403 and SUS316 are also available at your request.

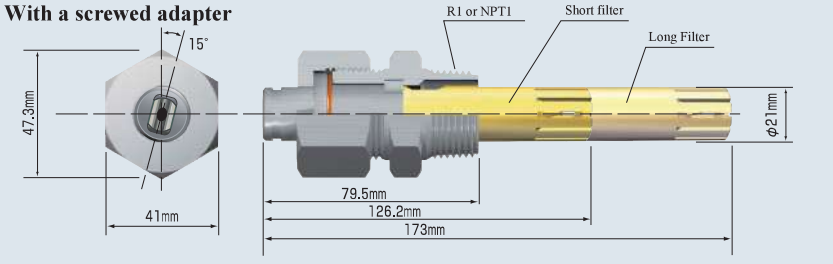
※3 There are R1 and NPT1 set screws for a screwed adapter.
Specify which is required.

## Shapes & Dimensions

**With a welded adapter**

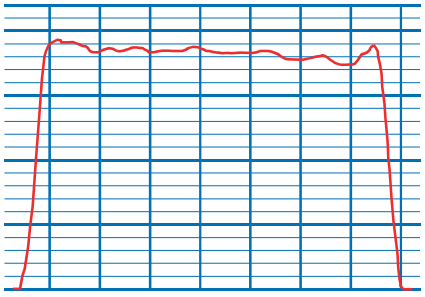
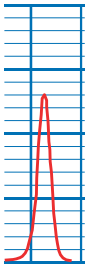
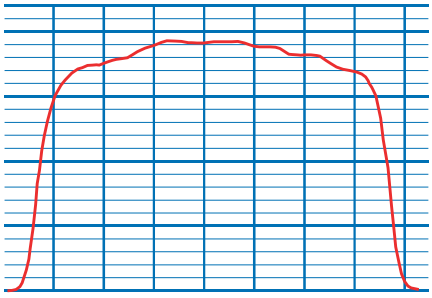
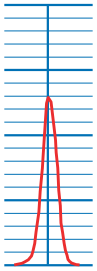



**With a screwed adapter**



## DNX Model performance data

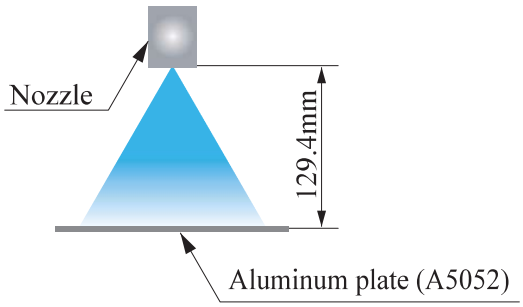
### ■ Impact force distribution graph

| DNX 1550 | | DNH 1550 | |
|---|---|---|---|
| Direction of spray width | Direction of spray thickness | Direction of spray width | Direction of spray thickness |
|  |  |  |  |

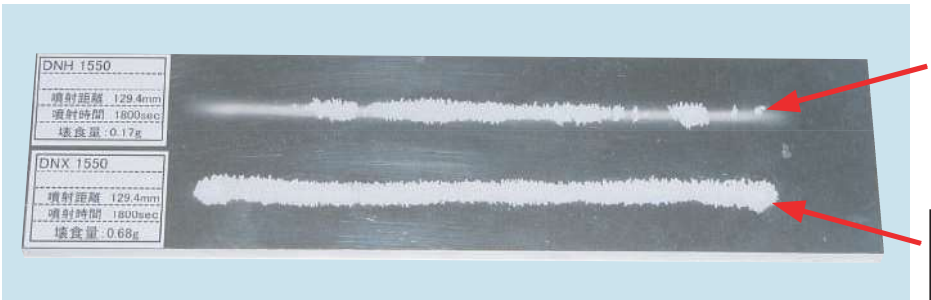
### ■ Erosion test on aluminum plate

【Test Conditions】

Water Pressure ： 15 MPa
Spray Distance ： 129.4 mm
Spray Time ： 1800 sec.




**The result of erosion test on aluminum plate (A5052)**




| DNH 1550 |
|---|
| Water Pressure ： 15 MPa |
| Spray Distance ： 129.4 mm |
| Spray Time ： 1800 sec. |
| Erosion Amount ： 0.17 g |

| DNX 1550 |
|---|
| Water Pressure ： 15 MPa |
| Spray Distance ： 129.4 mm |
| Spray Time ： 1800 sec. |
| Erosion Amount ： 0.68 g |

TYPE DNR

**Maximum working pressure 30MPa**

# DNR-type

Patent

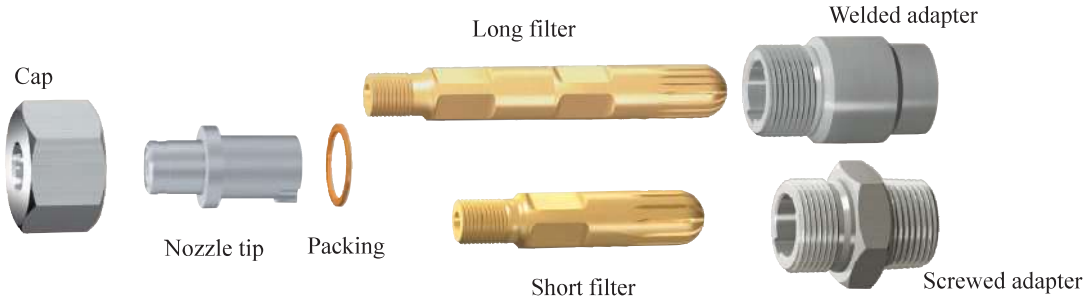
Trumpet-type orifice

Powerful impact force type short/long filter

Racetrack shaped nozzle case

- Trumpet orifice and high hardness tungsten carbide improve nozzle tip durability substantially.
- Straightening filter provides a uniform high impact force.
- Except for the nozzle tip every part designed for DNH model is usable.

## Components




| Name | Parts number | Material | Weight (g) |
|---|---|---|---|
| Cap | 01C00 | AISI 303 (JIS SUS 303) | 150 |
| Nozzle tip | DNR●●●● ※1 | High hardness tungsten carbide+AISI 303 (JIS SUS 303) | 115 |
| Packing | 01P00 | Copper (JIS C1201P-1/4H) | 4 |
| Short filter | 01F01 | Brass (JIS C3604BD) | 120 |
| Long filter | 01F04 | Brass (JIS C3604BD) | 215 |
| Welded adapter | 01A00 ※2 | AISI 304 (JIS SUS 304) | 255 |
| Screwed adapter | 01A01 ※2※3 | AISI 304 (JIS SUS 304) | 215 |

**Please note when ordering.**

※1 For the tip model number, refer to the table of nozzle tip model numbers on page 16.

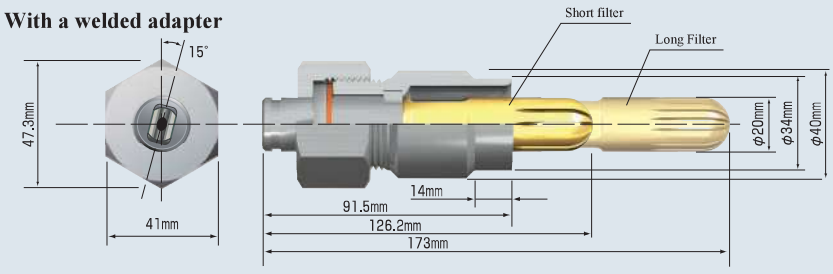
DNR●●●●
Model number

※2 For the adapter material, SUS403 and SUS316 are also available at your request.

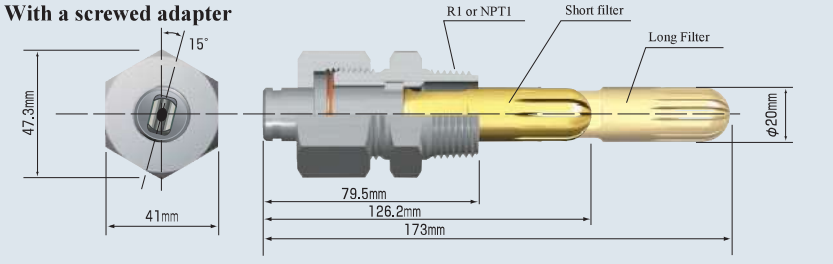
※3 There are R1 and NPT1 set screws for a screwed adapter.
Specify which is required.

## Shapes & Dimensions

**With a welded adapter**




**With a screwed adapter**



TYPE DNM

**Maximum working pressure 50MPa**

# DNM-type

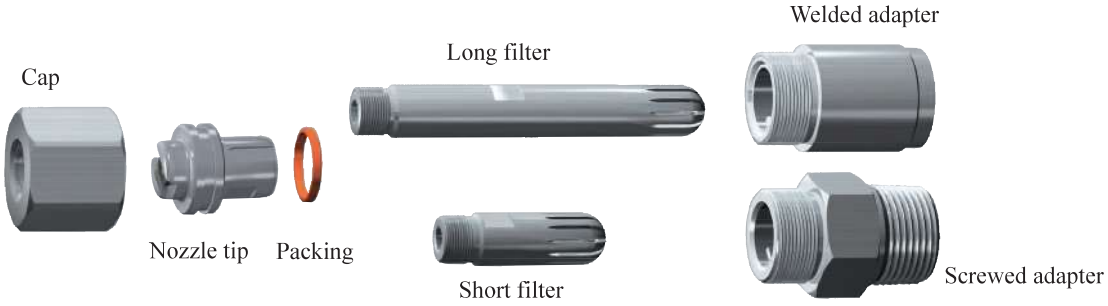
Patent

Trumpet-type orifice

Powerful impact force type short/long filter

- Trumpet orifice and high hardness tungsten carbide improve nozzle tip durability substantially.
- Straightening filter provides a uniform high impact force.
- Compact design of the nozzle allow reduced nozzle intervals.

## Components




| Name | Parts number | Material | Weight (g) |
|---|---|---|---|
| Cap | 01C01 | AISI 303 (JIS SUS 303) | 80 |
| Nozzle tip | DNM●●●● ※1 | High hardness tungsten carbide+AISI 303 (JIS SUS 303) | 45 |
| Packing | 01P01 | Copper (JIS C1201P-1/4H) | 1 |
| Short filter | 01F02 | AISI 303 (JIS SUS 303) | 25 |
| Long filter | 01F05 | AISI 303 (JIS SUS 303) | 75 |
| Welded adapter | 01A02 ※2 | AISI 304 (JIS SUS 304) | 120 |
| Screwed adapter | 01A03 ※2※3 | AISI 304 (JIS SUS 304) | 120 |

**Please note when ordering.**

※1 For the tip model number, refer to the table of nozzle tip model numbers on page 16.

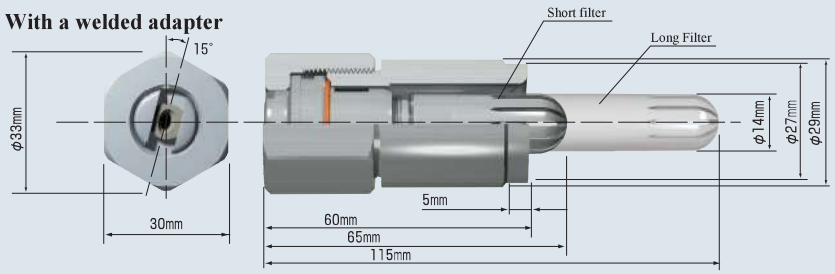
**DNM●●●●**
Model number

※2 For the adapter material, SUS403 and SUS316 are also available at your request.

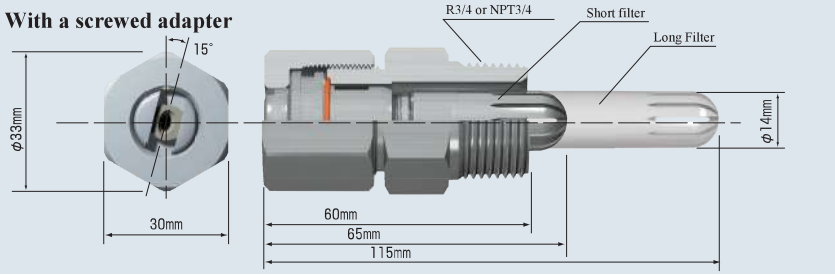
※3 There are R3/4 and NPT3/4 set screws for a screwed adapter.
Specify which is required.

## Shapes & Dimensions

**With a welded adapter**




**With a screwed adapter**



TYPE DNK

**Maximum working pressure 50MPa**

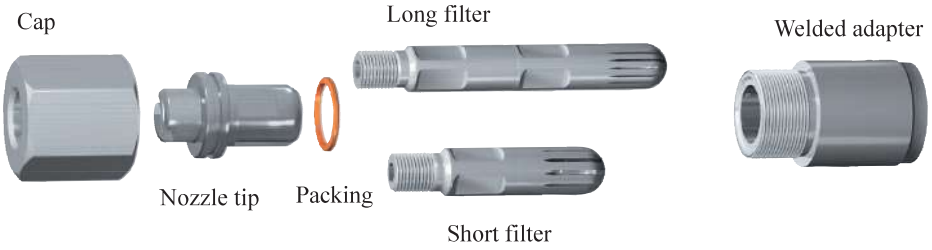
# DNK-type Patent

Trumpet-type orifice

Powerful impact force type short/long filter

- Trumpet orifice and high hardness tungsten carbide improve nozzle tip durability substantially.
- Straightening filter provides a uniform high impact force.

## Components




| Name | Parts number | Material | Weight (g) |
|---|---|---|---|
| Cap | 01C02 | AISI 303 (JIS SUS 303) | 345 |
| Nozzle tip | DNK●●●● ※1 | High hardness tungsten carbide+AISI 303 (JIS SUS 303) | 180 |
| Packing | 01P02 | Copper (JIS C1201P-1/4H) | 5 |
| Short filter | 01F03 | AISI 303 (JIS SUS 303) | 113 |
| Long filter | 01F06 | AISI 303 (JIS SUS 303) | 203 |
| Welded adapter | 01A04 ※2 | AISI 304 (JIS SUS 304) | 530 |

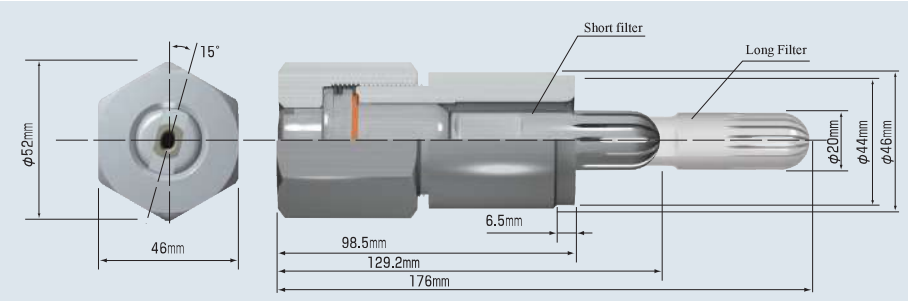
**Please note when ordering.**

※1 For the tip model number, refer to the table of nozzle tip model numbers on page 16.

DNK●●●●
Model number

※2 For the adapter material, SUS403 and SUS316 are also available at your request.

## Shapes & Dimensions



TYPE DNH

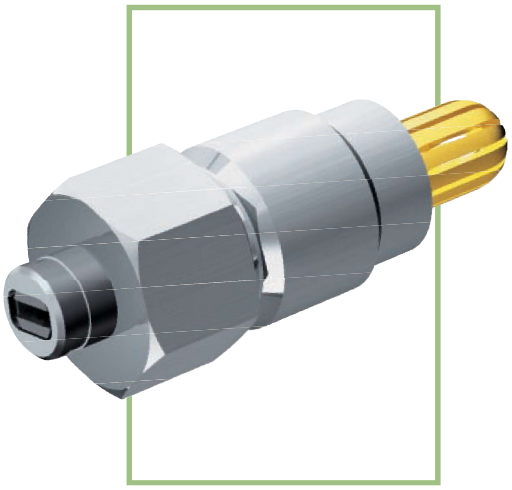
**Maximum working pressure 25MPa**

# DNH-type

Patent

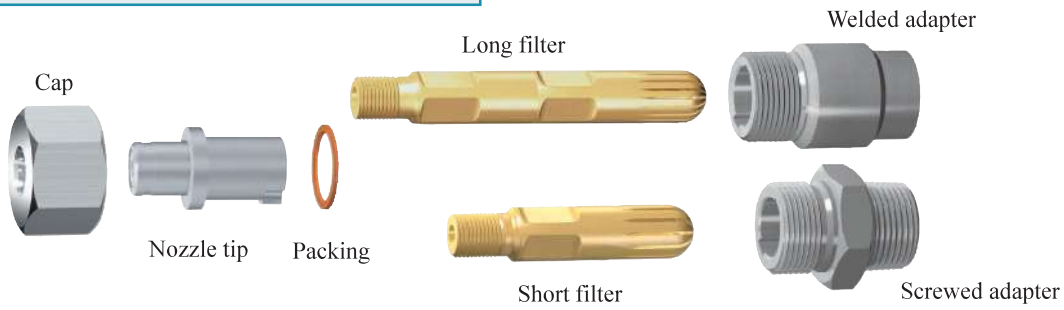
Powerful impact force type short/long Filter

Racetrack shaped nozzle case



- Developed together with Straightening Filter to obtain a powerful impact force.
- DNH model delivers approximately double the impact force peak value in the thicknesswise direction of the spray as that of DNB model.

## Components




| Name | Parts number | Material | Weight (g) |
|---|---|---|---|
| Cap | 01C00 | AISI 303 (JIS SUS 303) | 150 |
| Nozzle tip | DNH●●●● ※1 | Tungsten carbide+AISI 303 (JIS SUS 303) | 115 |
| Packing | 01P00 | Copper (JIS C1201P-1/4H) | 4 |
| Short filter | 01F01 | Brass (JIS C3604BD) | 120 |
| Long filter | 01F04 | Brass (JIS C3604BD) | 215 |
| Welded adapter | 01A00 ※2 | AISI 304 (JIS SUS 304) | 255 |
| Screwed adapter | 01A01 ※2※3 | AISI 304 (JIS SUS 304) | 215 |

**Please note when ordering.**

※1 For the tip model number, refer to the table of nozzle tip model numbers on page 16.

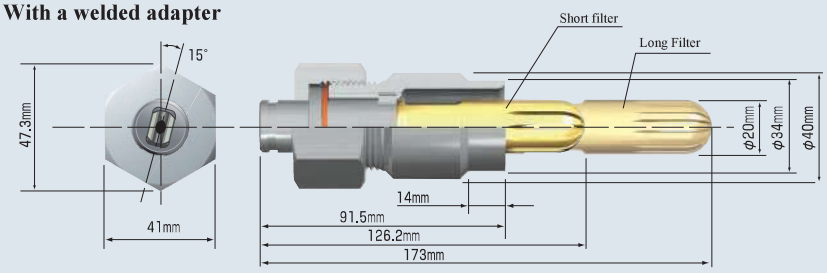
DNH●●●●
Model number

※2 For the adapter material, SUS403 and SUS316 are also available at your request.

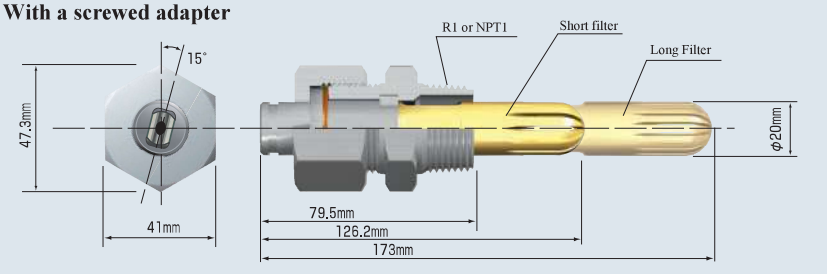
※3 There are R1 and NPT1 set screws for a screwed adapter.
Specify which is required.

## Shapes & Dimensions

**With a welded adapter**




**With a screwed adapter**

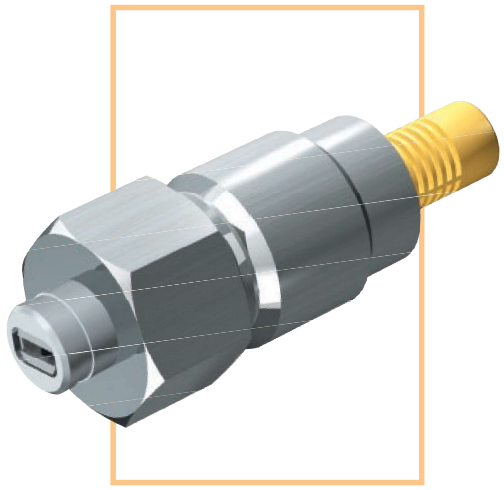


TYPE DNB

**Maximum working pressure 25MPa**

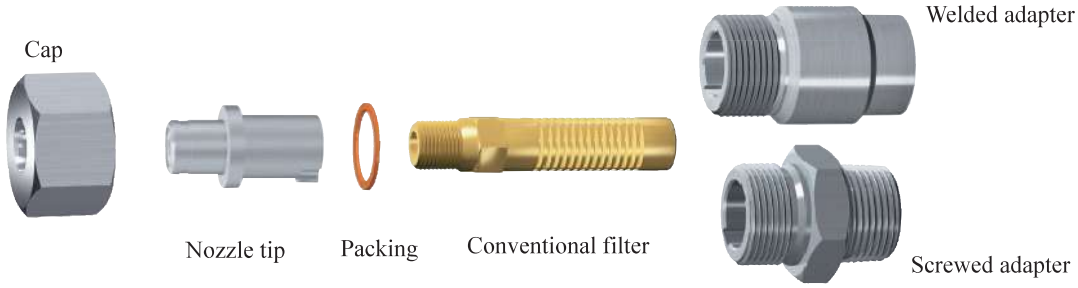
# DNB-type

Racetrack shaped nozzle case



- In the descaling nozzle series, DNB model is the first product to combine key ways in the nozzle tip. It is designed so that the offset angle is automatically set when the nozzle is installed.

## Components




| Name | Parts number | Material | Weight (g) |
|---|---|---|---|
| Cap | 01C00 | AISI 303 (JIS SUS 303) | 150 |
| Nozzle tip | DNB●●●● ※1 | Tungsten carbide+AISI 303 (JIS SUS 303) | 115 |
| Packing | 01P00 | Copper (JIS C1201P-1/4H) | 4 |
| Conventional filter | 01F00 | Brass (JIS C3604BD) | 105 |
| Welded adapter | 01A00 ※2 | AISI 304 (JIS SUS 304) | 255 |
| Screwed adapter | 01A01 ※2※3 | AISI 304 (JIS SUS 304) | 215 |

**Please note when ordering.**

※1 For the tip model number, refer to the table of nozzle tip model numbers on page 16.

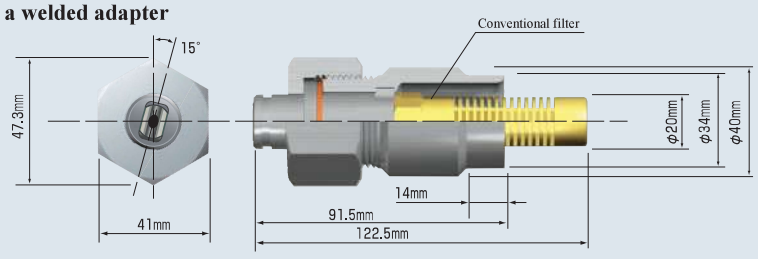
DNB●●●●
Model number

※2 For the adapter material, SUS403 and SUS316 are also available at your request.

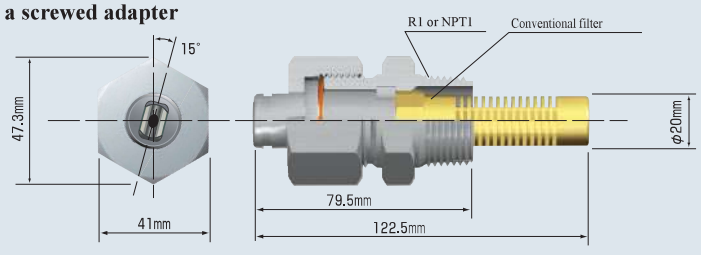
※3 There are R1 and NPT1 set screws for a screwed adapter.
Specify which is required.

## Shapes & Dimensions

**With a welded adapter**



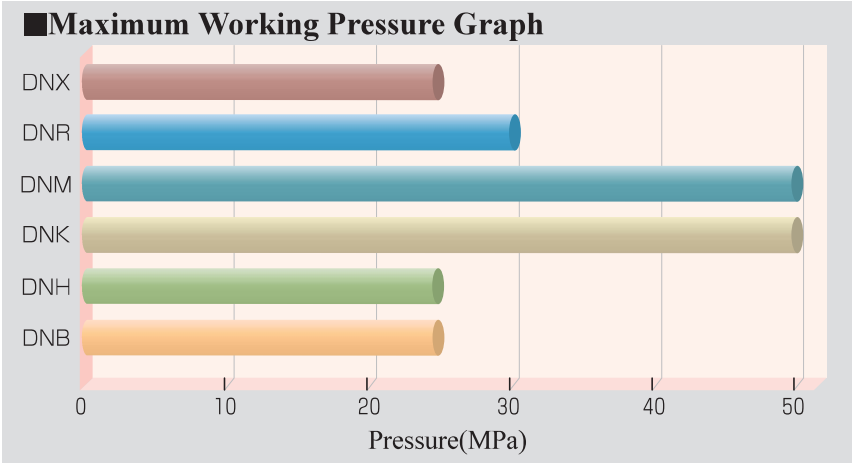

**With a screwed adapter**



## ■Table of nozzle tip model numbers

| Type | | | | | | Model number | Minimum orifice diameter (mm) | Flow rate (ℓ/min) at following pressure (MPa) | | | | | | | Spray angle at following pressure (MPa) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DNX | DNR | DNM | DNK | DNH | DNB | | | 1 | 10 | 15 | 20 | 30 | 40 | 50 | 15 | 50 |
| | ● | ● | | ● | ● | 0325 | 1.5 | 5.7 | 18.0 | 22.0 | 25.5 | 31.2 | 36.0 | 40.2 | 27 | 28 |
| | ● | ● | | ● | ● | 0332 | 1.4 | 5.7 | 18.0 | 22.0 | 25.5 | 31.2 | 36.0 | 40.2 | 35 | 36 |
| | ● | ● | | ● | ● | 0340 | 1.3 | 5.7 | 18.0 | 22.0 | 25.5 | 31.2 | 36.0 | 40.2 | 43 | 44 |
| | ● | ● | | ● | ● | 0425 | 1.7 | 7.6 | 24.0 | 29.4 | 33.9 | 41.6 | 48.0 | 53.7 | 27 | 28 |
| | ● | ● | | ● | ● | 0432 | 1.6 | 7.6 | 24.0 | 29.4 | 33.9 | 41.6 | 48.0 | 53.7 | 35 | 36 |
| | ● | ● | | ● | ● | 0440 | 1.5 | 7.6 | 24.0 | 29.4 | 33.9 | 41.6 | 48.0 | 53.7 | 43 | 44 |
| ● | ● | ● | | ● | ● | 0525 | 1.9 | 9.5 | 30.0 | 36.8 | 42.4 | 52.0 | 60.0 | 67.1 | 27 | 28 |
| ● | ● | ● | | ● | ● | 0532 | 1.8 | 9.5 | 30.0 | 36.8 | 42.4 | 52.0 | 60.0 | 67.1 | 35 | 36 |
| ● | ● | ● | | ● | ● | 0540 | 1.7 | 9.5 | 30.0 | 36.8 | 42.4 | 52.0 | 60.0 | 67.1 | 43 | 44 |
| ● | ● | ● | | ● | ● | 0625 | 2.1 | 11.4 | 36.0 | 44.1 | 50.9 | 62.4 | 72.0 | 80.5 | 27 | 28 |
| ● | ● | ● | | ● | ● | 0632 | 2.0 | 11.4 | 36.0 | 44.1 | 50.9 | 62.4 | 72.0 | 80.5 | 35 | 36 |
| ● | ● | ● | | ● | ● | 0640 | 1.9 | 11.4 | 36.0 | 44.1 | 50.9 | 62.4 | 72.0 | 80.5 | 43 | 44 |
| ● | ● | ● | | ● | ● | 0725 | 2.3 | 13.3 | 42.0 | 51.4 | 59.4 | 72.7 | 84.0 | 93.9 | 27 | 28 |
| ● | ● | ● | | ● | ● | 0732 | 2.2 | 13.3 | 42.0 | 51.4 | 59.4 | 72.7 | 84.0 | 93.9 | 35 | 36 |
| ● | ● | ● | | ● | ● | 0740 | 2.1 | 13.3 | 42.0 | 51.4 | 59.4 | 72.7 | 84.0 | 93.9 | 43 | 44 |
| ● | ● | ● | | ● | ● | 0825 | 2.5 | 14.3 | 45.3 | 55.5 | 64.1 | 78.5 | 90.6 | 101 | 27 | 28 |
| ● | ● | ● | | ● | ● | 0832 | 2.3 | 14.3 | 45.3 | 55.5 | 64.1 | 78.5 | 90.6 | 101 | 35 | 36 |
| ● | ● | ● | | ● | ● | 0840 | 2.2 | 14.3 | 45.3 | 55.5 | 64.1 | 78.5 | 90.6 | 101 | 43 | 44 |
| ● | ● | ● | | ● | ● | 0925 | 2.6 | 17.1 | 54.0 | 66.1 | 76.4 | 93.5 | 108 | 121 | 27 | 28 |
| ● | ● | ● | | ● | ● | 0932 | 2.5 | 17.1 | 54.0 | 66.1 | 76.4 | 93.5 | 108 | 121 | 35 | 36 |
| ● | ● | ● | | ● | ● | 0940 | 2.4 | 17.1 | 54.0 | 66.1 | 76.4 | 93.5 | 108 | 121 | 43 | 44 |
| ● | ● | | | ● | ● | 1125 | 3.1 | 21.4 | 67.7 | 83.0 | 95.7 | 117 | 135 | 151 | 27 | 28 |
| ● | ● | | | ● | ● | 1132 | 2.8 | 21.4 | 67.7 | 83.0 | 95.7 | 117 | 135 | 151 | 35 | 36 |
| ● | ● | | | ● | ● | 1140 | 2.7 | 21.4 | 67.7 | 83.0 | 95.7 | 117 | 135 | 151 | 43 | 44 |
| ● | ● | | | ● | ● | 1325 | 3.2 | 24.5 | 77.5 | 95.0 | 110 | 134 | 155 | 173 | 27 | 28 |
| ● | ● | | | ● | ● | 1332 | 3.1 | 24.5 | 77.5 | 95.0 | 110 | 134 | 155 | 173 | 35 | 36 |
| ● | ● | | | ● | ● | 1340 | 2.9 | 24.5 | 77.5 | 95.0 | 110 | 134 | 155 | 173 | 43 | 44 |
| ● | ● | | | ● | ● | 1525 | 3.5 | 28.6 | 90.5 | 111 | 128 | 157 | 181 | 202 | 27 | 28 |
| ● | ● | | | ● | ● | 1532 | 3.3 | 28.6 | 90.5 | 111 | 128 | 157 | 181 | 202 | 35 | 36 |
| ● | ● | | | ● | ● | 1540 | 3.2 | 28.6 | 90.5 | 111 | 128 | 157 | 181 | 202 | 43 | 44 |
| | ● | | | ● | ● | 1825 | 3.8 | 34.2 | 108 | 132 | 153 | 187 | 216 | 241 | 27 | 28 |
| | ● | | | ● | ● | 1832 | 3.6 | 34.2 | 108 | 132 | 153 | 187 | 216 | 241 | 35 | 36 |
| | ● | | | ● | ● | 1840 | 3.4 | 34.2 | 108 | 132 | 153 | 187 | 216 | 241 | 43 | 44 |
| | ● | | | ● | ● | 1925 | 3.9 | 35.7 | 113 | 138 | 160 | 196 | 226 | 253 | 27 | 28 |
| | ● | | | ● | ● | 1932 | 3.7 | 35.7 | 113 | 138 | 160 | 196 | 226 | 253 | 35 | 36 |
| | ● | | | ● | ● | 1940 | 3.6 | 35.7 | 113 | 138 | 160 | 196 | 226 | 253 | 43 | 44 |
| | ● | | | ● | ● | 2325 | 4.3 | 43.0 | 136 | 167 | 192 | 236 | 272 | 304 | 27 | 28 |
| | ● | | | ● | ● | 2332 | 4.1 | 43.0 | 136 | 167 | 192 | 236 | 272 | 304 | 35 | 36 |
| | ● | | | ● | ● | 2340 | 3.9 | 43.0 | 136 | 167 | 192 | 236 | 272 | 304 | 43 | 44 |

## ■Maximum Working Pressure Graph




Note: The tip model numbers available to each type are marked with ●.
For the maximum working pressure of each type, refer to the maximum working pressure graph.
The spray angle shown in the table is calculated from the spray width at a distance of 300mm. Note that the value of spray angle varies with spray distance.

# REMOVER

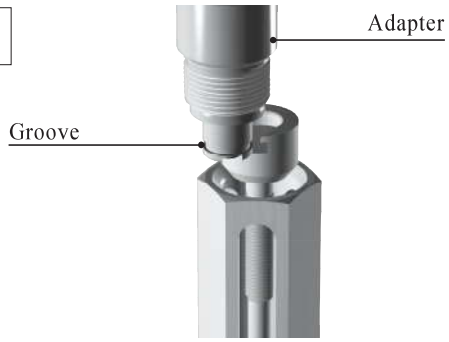
Three types of remover tools are available.
You can remove the nozzle unit more easily with them.

## Screw Remover


With the cap detached, put the screw remover in the nozzle tip groove and pull out the nozzle by turning the tool handle.
The nozzle is held in the nozzle guide of the remover so as to prevent it from dropping during removal.

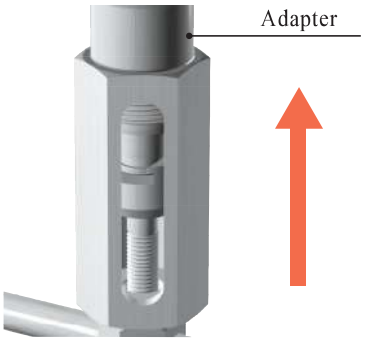
## How to use

1




Detach the cap and put the end of the tool in the groove in the nozzle tip.

2




Push up the nozzle guide toward the adapter.

3

Turn the tool handle counterclockwise.

4

You can remove the nozzle without dropping it.

### Parts list

| Use for | Parts number |
|---|---|
| DNB,DNH,DNR,DNX | 01J00 |
| DNM | 01J01 |
| DNK | 01J02 |

## C - type remover

Prior to loosening the cap, put the C-type remover in the groove in the tip end.
You can pull out and remove the nozzle easily by loosening the cap.

### How to use

1


Put the C-type remover in the groove in the nozzle tip.

2

Turn the cap counterclockwise by using a wrench or spanner.

3

You can remove the nozzle together with the cap.

### Parts list

| Use for | Parts number |
|---|---|
| DNB,DNH,DNR,DNX | 01J03 |

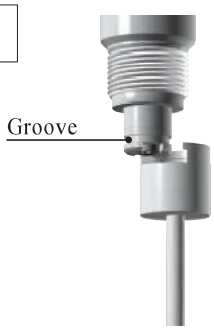
---

## Pull-out remover


With the cap detached, put the pull-out remover in the groove in the nozzle tip and pull the handle.
You can pull out the nozzle with ease.

### How to use

1




Detach the cap and put the end of the tool in the groove in the nozzle tip.

2

Pull it in the direction opposite to the nozzle.

3

The nozzle can be removed.

### Parts list

| Use for | Parts number |
|---|---|
| DNB,DNH,DNR,DNX | 01J04 |
| DNM | 01J05 |
| DNK | 01J06 |

# DESCALING CHECK VALVE

Patent

## Features

### 1 Compact Design

Has valve function and also allows the same installation as a standard filter.

### 2 Powerful Impact Force

The reduction in the pressure loss can maintain a powerful impact force.

### 3 High Durability

The design and selected materials of parts have materialized a prolonged life.
This valve has recorded its life more than one year and more than one million cycle of open/close operation.

### 4 Maintenance Cost Reduction

Each part is replaceable to reduce the maintenance cost.

| Items | Without valve | With valve |
|---|---|---|
| Water Flow Rate | 100% | 94.5% |
| Widthwise Water Impact Force | 100% | 90.4% |
| Thicknesswise Water Impact Force | 100% | 92.9% |

The numerical data in the table are based on DNH1623.

## Benefits of use

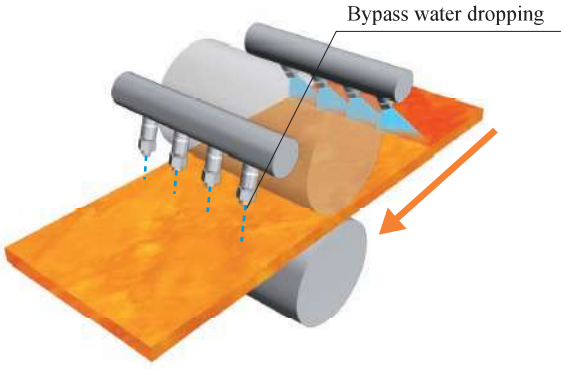
Prevents water hammering.

Prevents bypass water drop.

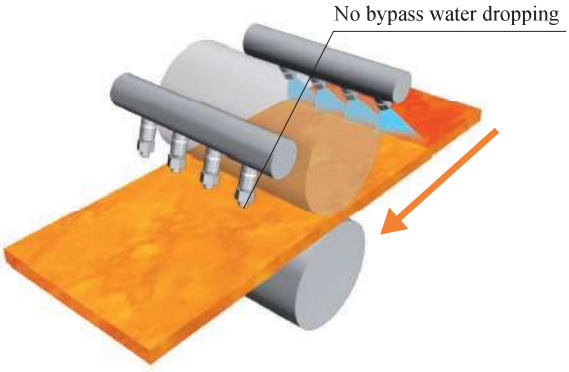
Prevents a temperature drop of the steel plate due to bypass water.

Reduces the idling time and enhances the productivity.

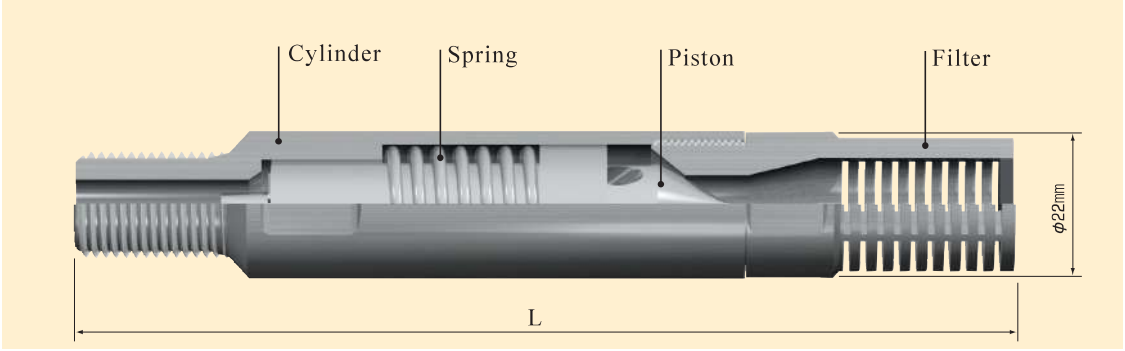
**Nozzle without check valve**




**Nozzle with check valve**




## Shapes & Dimensions




### Parts list

| Use for | Parts number | Dimension L (mm) | Weight (g) |
|---|---|---|---|
| DNH , DNR | 01V00 | 143 | 250 |
| DNX | 01V01 | 189.5 | 330 |

# ON/OFF VALVE

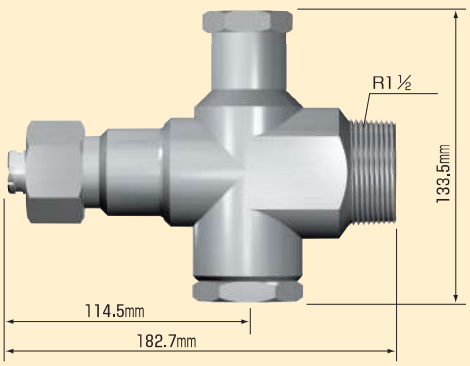
Patent

The On/Off Valve is developed as Interstand Descaling, to shut off a nozzle from which spraying is not required. This valve can be operated with air, water, or oil.
The use of this valve saves disconnecting the nozzle and enhances the workability.

**Normal spray**


**Traverse cutting**


## Shapes & Dimensions

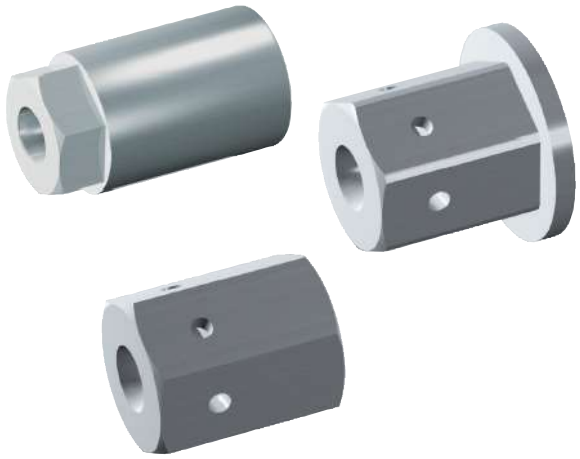



### Parts list

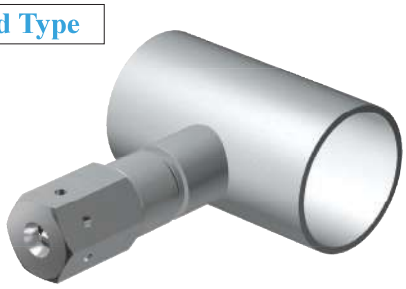
| Use for | Parts number |
|---|---|
| DNH,DNR | 01V03 |

# PROTECTIVE CAP

Three types of protective caps are available to minimize damage to nozzles given by rebounded descaling water and scales.



## Standard Type



Damage to a nozzle tip can be minimized by putting a cap on the entire nozzle tip.
To enhance the protectiveness of a nozzle tip, the nozzle tip is so designed that the end of the nozzle tip is located in the inner part of the cap.
Also, to prevent water from gathering in the cap, drain holes are made around it.

### Parts list

| Use for | Parts number |
|---|---|
| DNB,DNH,DNR,DNX | 01C03 |
| DNM | 01C04 |
| DNK | 01C05 |

## Flange Type

For a flange type, there is a flange round the rim of a normal type.
In addition to the tip, it can protect a wide range.

### Parts list

| Use for | Parts number |
|---|---|
| DNB,DNH,DNR,DNX | 01C06 |
| DNM | 01C07 |
| DNK | 01C08 |

## Full Face type

A full face type can protect the adapter as well as the tip by putting a cap on the entire adapter.

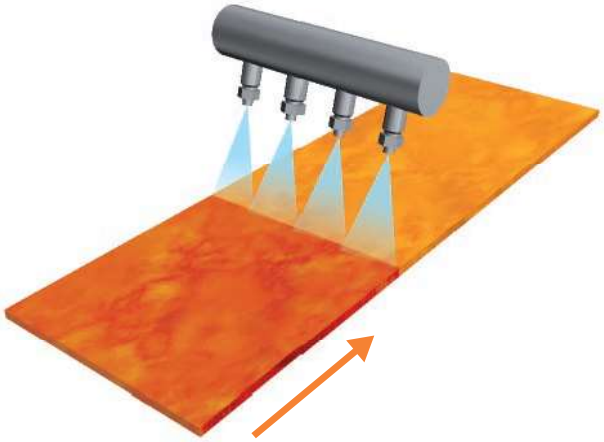
### Parts list

| Use for | Parts number |
|---|---|
| DNB,DNH,DNR,DNX | 01C09 |
| DNM | 01C10 |
| DNK | 01C11 |

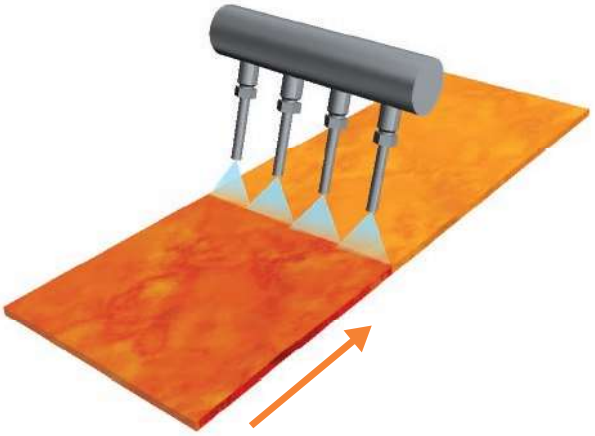
# LONG NOSE TIP

A long nose tip is used for brief test purpose only, to make a close spray test.
After test, use the normal standard tips.

## Use of the normal standard tip



## Use of the long nose tip



## Protective cap for the long nose tip

### Long Nose Protective Cap

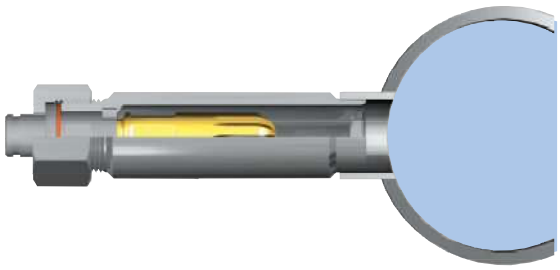
### Long Nose Protective Cap ( Full Face type )

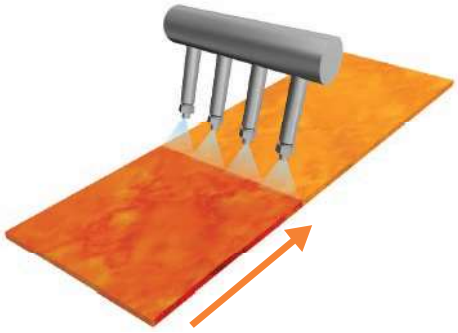
### Long Nose Protective Cap ( Flange type )

# LONG ADAPTER

When the ascent/descent of the descaling header is difficult, the best spray distance can be maintained by installing the long adapter .

## Use of Long Adapter







# NOZZLE ASSEMBLY JIG

When assembling nozzle tip and straightening filter, use this Assembly Jig.

## Use of Nozzle Assembly Jig

### Parts list

| Use for | Parts number |
|---|---|
| DNB,DNH,DNR,DNX | 01J07 |
| DNM | 01J08 |
| DNK | 01J09 |

# How to calculate the impact force per unit area.

Formula $H = \rho \cdot Q \cdot Cv \cdot V$

Calculation example

Impact force of a nozzle DNH1525 used under the pressure of 150MPa at the distance of 300mm

$Q = 111\,\ell/min = 1.85 \times 10^{-3}\,m^3/s$

$V = C\sqrt{2gh} = 0.85 \times \sqrt{2 \times 9.8 \times 1530}$

$= 147.2\,m/s$

Substituting Q and V into the formula above.

$H = 1000 \times 1.85 \times 10^{-3} \times 0.95 \times 147.2$

$= 258.7\,kg \cdot m/s^2 = 258.7N$

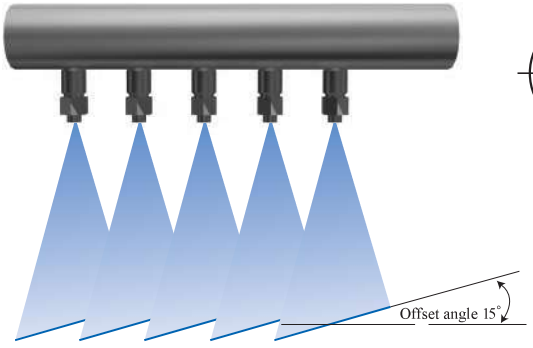
The impact force per unit area can be obtained as an averaged impact force by dividing the value above by the cross-sectional area of spray

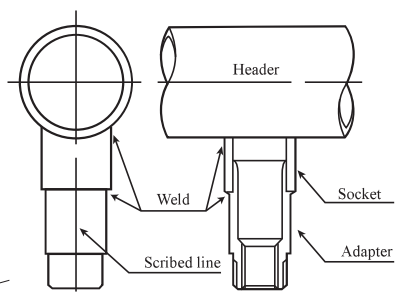
H : Impact force N
$\rho$ : Density= 1000kg/m$^3$
Q : Flow rate m$^3$/s
V : Flow velocity just after sprayed from nozzle m/s
Cv: Atmospheric velocity deceleration coefficient
Distance 200 mm Cv= 1
Distance 300 mm Cv= 0.95
Distance 500 mm Cv= 0.85
C : Flow rate coefficient= 0.85
g : Gravitational constant= 9.8 m/s$^2$
h : Pressure head 1MPa= 102 m

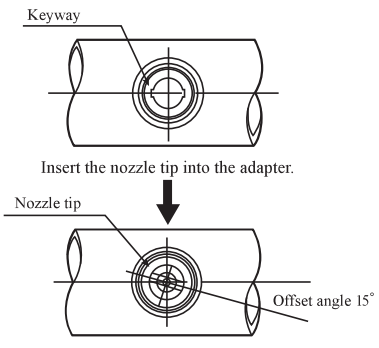
Documents

# How to install welded adapter

There are two keyways in the internal surface of the adapter and the center line of the keyways is scribed on the outside surface of the adapter. Align this scribed line with the axial center of the header pipe and weld the adapter. Insert the nozzle tip keys into the keyways in the adapter properly. Tightening them with the cap yields the specified offset angle automatically.

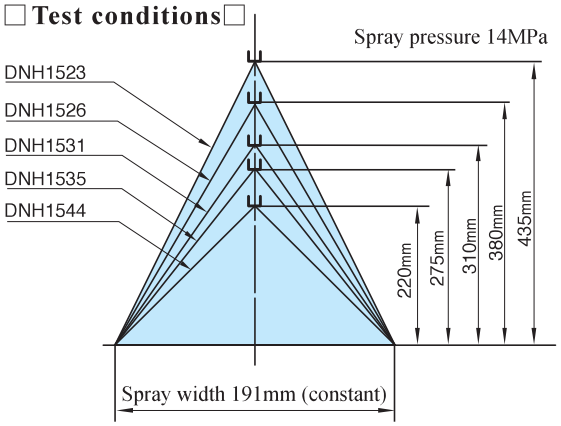


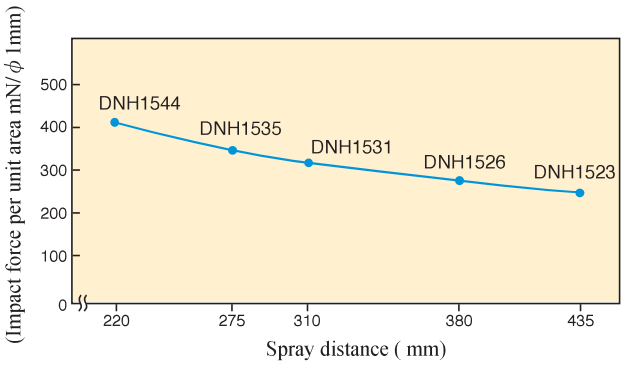



# Variation of impact force by different spray angles.

## Test conditions

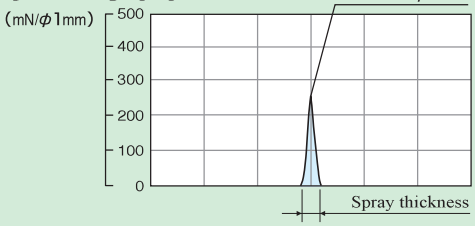



## Test result

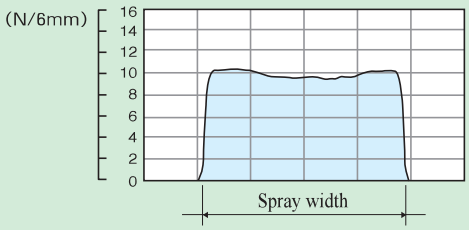



DNH1523

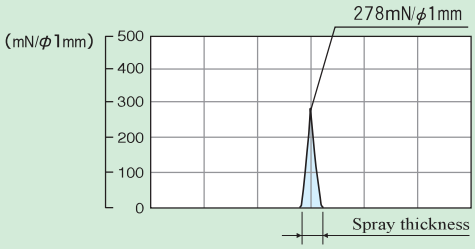
〈Impact force graph per unit area〉

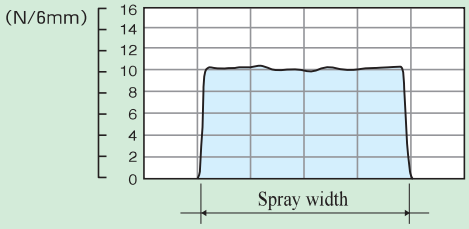



〈Impact force graph per spray width〉

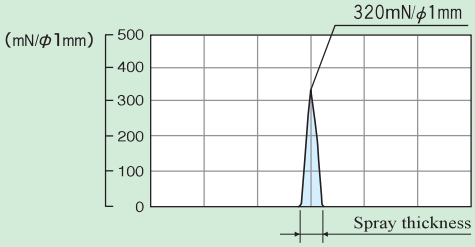


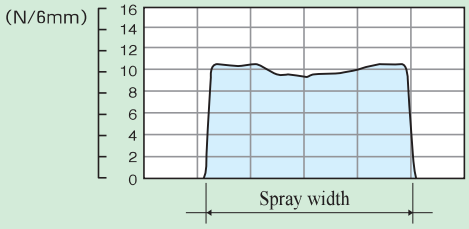

DNH1526



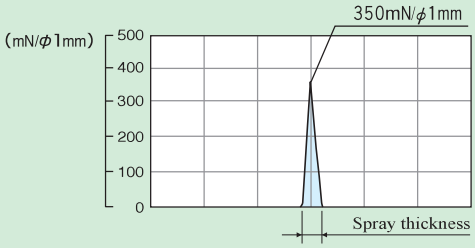



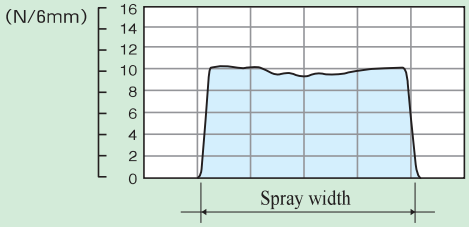

DNH1531



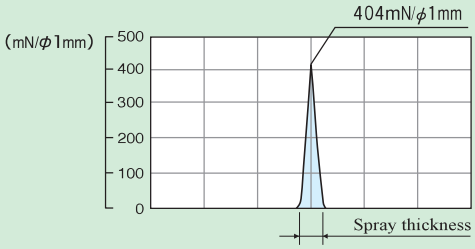



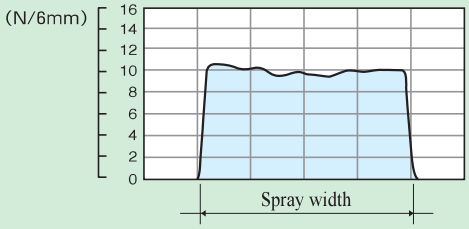

DNH1535



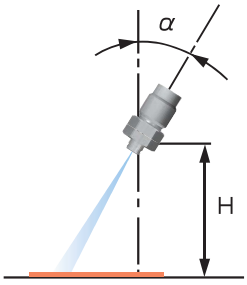

DNH1544

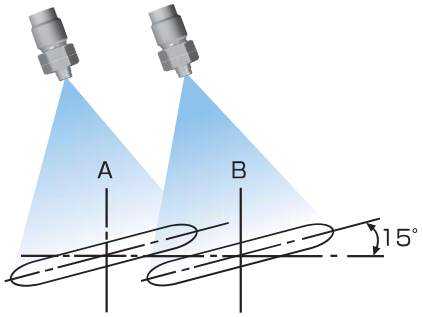


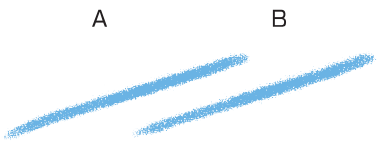
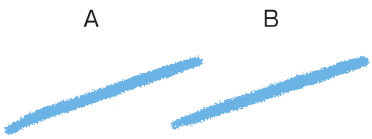
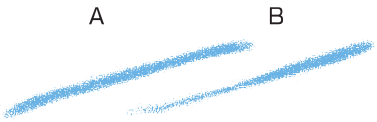
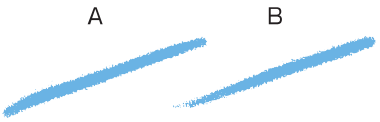
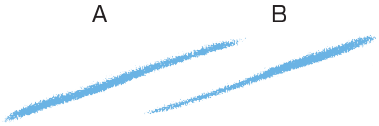
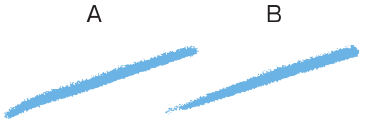
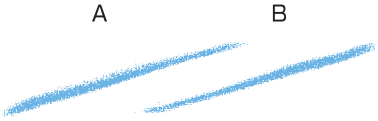
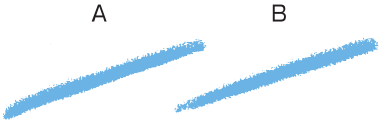



# Effects of lead angle and overlapping on spray

Nozzle Model Number : DNH1534
Spray Pressure : 6.5MPa
Nozzle Pitch : 120mm
Nozzle Height : H
Lead Angle : $\alpha$




| | Large overlapping H=370mm | Best overlapping H=210mm |
|---|---|---|
| ① Patterns sprayed one by one $\alpha = 15^\circ$ |   |   |
| ② Patterns sprayed simultaneously $\alpha = 15^\circ$ |   |   |
| ③ Patterns sprayed simultaneously $\alpha = 5^\circ$ |   |   |
| ④ Patterns sprayed simultaneously $\alpha = 0^\circ$ |   |   |

## Overlapping

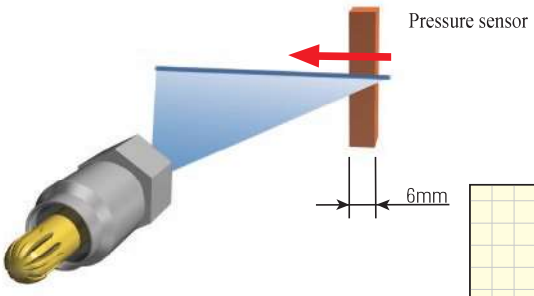
In case of large overlapping amount, the overlapped parts are affected by the flow and spray patterns become thinner.
Spray patterns marked on the pressure sensitive paper clearly show that the best amount of overlapping has the least effect of the flow.
That is, the best overlapping amount contributes to an improvement of descaling performance by preventing a decrease of the impact force on a steel plate and overcooling of the overlapped parts.

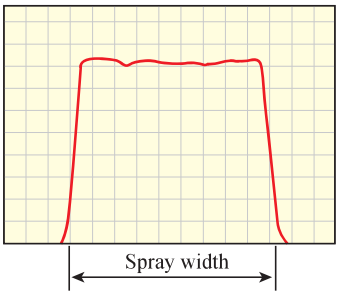
## Lead Angle

At a lead angle of 15° of ② , the spray pattern B of the overlapped part is thinned due to the effect of the flow. At a lead angle of 0° of ④ , i.e. Vertical spray, the spray patterns both A and B of the overlapped parts are thinned, since the flows of both A and B effect each other.
This means that by having a certain lead angle, just one of the two spray patterns of the overlapped parts will be affected by the flow and a decrease of impact force will be alleviated.

# Impact force distribution test

## ☐ Spray width direction ☐



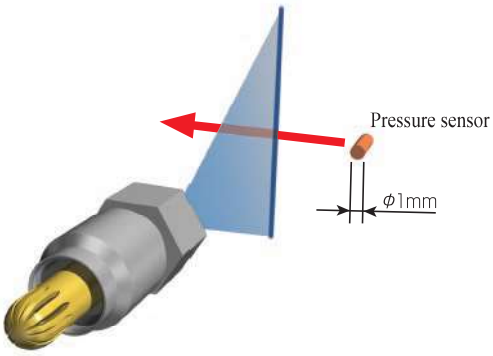

### Measuring Method

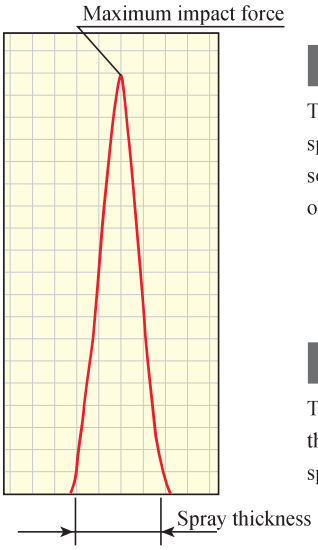
The impact force in the direction of spray width is measured with a 6mm width sensor traveling a certain speed and recording the obtained data.

### Measured Data

The recorded data are used for the evaluation of a distribution pattern, impact force, spray width, etc.

## ☐ Spray thickness direction ☐




### Measuring method

The impact force distribution in the direction of spray thickness is measured with 1mm diameter sensor traveling across and recording the obtained data.

### Measured data

The recorded data are used for the evaluation of the maximum impact force per unit area and spray thickness.

Documents

# Ultra High Pressure Descaling Pump


A test of ultra high pressure up to 60 MPa can be made.

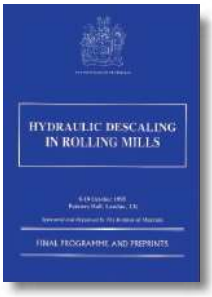
# HYDRAULIC DESCALING IN ROLLING MILLS

## " A paper on Descaling Technology in Rolling Mills"

Shown is a paper that was put out in the world conference on " Hydraulic Descaling in Rolling Mills" held under the auspices of the Institute of Materials ( IOM ) in UK.

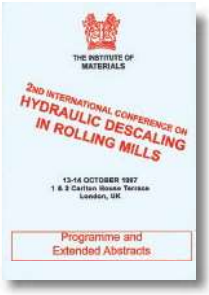
### 1995 HYDRAULIC DESCALING IN ROLLING MILLS

Theme : Research on higher pressure descaling nozzles together with extended life and durability.




### 1997 HYDRAULIC DESCALING IN ROLLING MILLS

Theme :Research for the impact force on super high pressure descaling nozzles.




### 2000 HYDRAULIC DESCALING IN ROLLING MILLS

Theme : Improvement of strip surface by eliminating tiger mark.


**The data above can be downloaded from our Web site**

**URL http://www.everloy-spray-nozzles.com/**

# Questionnaire Sheet

**Please fill in the blanks with your existing descaling nozzle arrangement so that we can select our proper nozzle.**

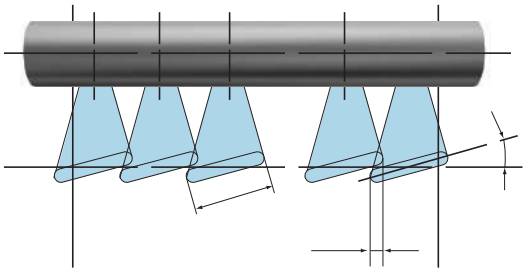
Overseas Sales Department FAX./int. +81-6-6452-2187

Date / / /

Customer Name

Person in Charge :

(Upper Header)



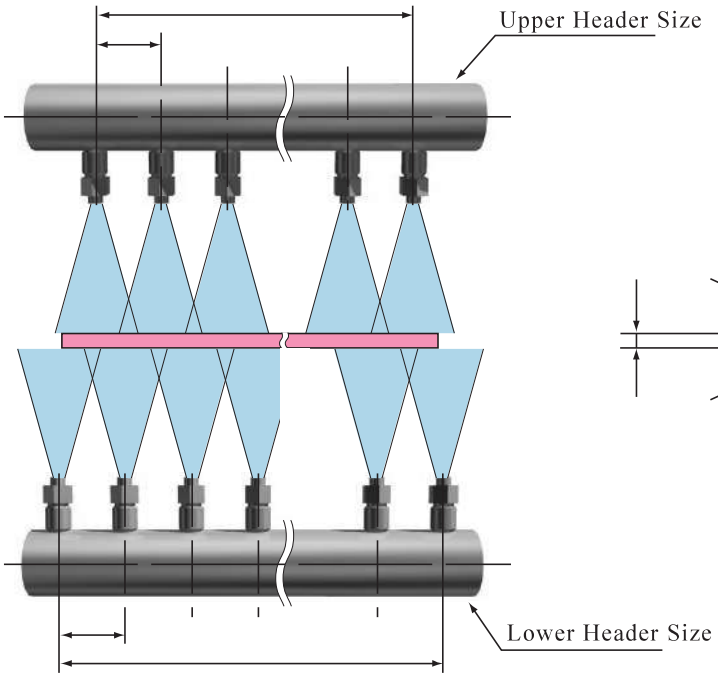
Location of descaling:

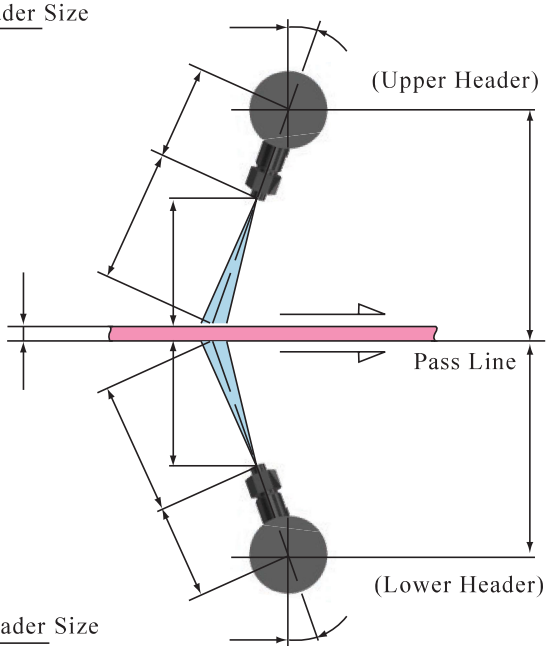
Existing Nozzle:

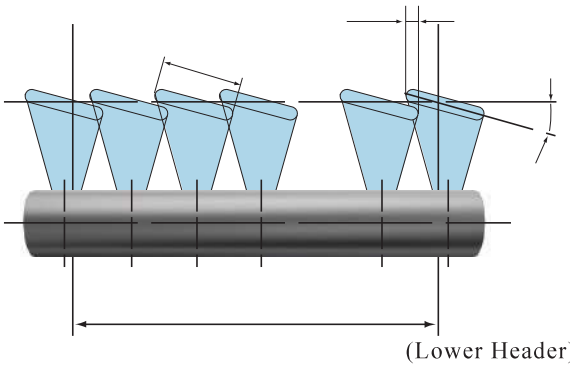
Pressure:

Flow Rate per one nozzle:

Number of nozzles: Pcs. per header



(Lower Header)

Location of descaling:

Existing Nozzle:

Pressure:

Flow Rate per one nozzle:

Number of nozzles: Pcs. per header

# DESCALING NOZZLES

EVERLOY

## KYORITSU GOKIN CO., LTD.


| | |
|---|---|
| **Head Office** | 12-16,Imazu-yamanaka-cho, Nishinomiya, Hyogo-pref. 663-8211 Japan<br>TEL (0798) 26-3606 FAX (0798) 26-0544 |
| **Kaibara Factory** | |
| (Spray Nozzle Division) | 130-3, Kitayama, Kaibara-cho, Tamba, Hyogo-pref. 669-3313 Japan<br>TEL (0795) 72-3374 FAX (0795) 72-3376 |
| (Tungsten Carbide Division) | 100-1, Ohniya, Kaibara-cho, Tamba, Hyogo-pref. 669-3315 Japan<br>TEL (0795) 73-0026 FAX (0795) 72-2643 |
| **Overseas Sales Department** | 2-24, 4-chome, Sagisu, Fukushima-ku, Osaka, 553-0002 Japan<br>TEL (06) 6452-2273 FAX (06) 6452-2187 |

URL http://www.everloy-spray-nozzles.com/ E-mail nozzle@everloy.co.jp


CT01E-003R1-0603