CKD

SM-A09594-A

INSTRUCTION MANUAL

NITROGEN GAS EXTRACTION UNIT

NS series

- Please read this instruction manual carefully before using this product, particularly the section describing safety.
- Retain this instruction manual with the product for further consultation whenever necessary.

APR-2021 Ver.3
CKD Corporation

Safety Precautions

Be sure to read this section before use.

When designing and manufacturing equipment using CKD products, the manufacturer is obligated to ensure that the safety of the mechanism, pneumatic control circuit and/or water control circuit and the system that runs the electrical controls are secured.
It is important to select, use, handle and maintain CKD products appropriately to ensure their safe usage.
Check that device safety is ensured, and manufacture a safe device.

WARNING

1. This product is designed and manufactured as a general industrial machine part. It must be handled by an operator having sufficient knowledge and experience.

2. Use this product in accordance with specifications.

This product must be used within its stated specifications. In addition, never modify or additionally machine this product.
This product is intended for use in general industrial machinery equipment or parts.
It is not intended for use outdoors (except for products with outdoor specifications) or for use under the following conditions or environments.
(Note that this product can be used when CKD is consulted prior to its usage and the customer consents to CKD product specifications. The customer should provide safety measures to avoid danger in the event of problems.)

① Use for applications requiring safety, including nuclear energy, railways, aircraft, marine vessels, vehicles, medical devices, devices or applications in contact with beverages or foodstuffs, amusement devices, emergency cutoff circuits, press machines, brake circuits, or safety devices or applications.
② Use for applications where life or assets could be significantly affected, and special safety measures are required.

3. Observe organization standards and regulations, etc., related to the safety of the device design and control, etc.

ISO4414, JIS B 8370 (General rules for pneumatic systems)
JFPS2008 (Principles for pneumatic cylinder selection and use)
Including the High Pressure Gas Safety Act, Industrial Safety and Health Act, other safety rules, organization standards and regulations, etc.

4. Do not handle, pipe, or remove devices before confirming safety.

① Inspect and service the machine and devices after confirming safety of the entire system related to this product.
② Note that there may be hot or charged sections even after operation is stopped.
③ When inspecting or servicing the device, turn OFF the energy source (air supply or water supply), and turn OFF power to the facility. Discharge any compressed air from the system, and pay enough attention to possible water leakage and leakage of electricity.
④ When starting or restarting a machine or device that incorporates pneumatic components, make sure to secure system safety, such as pop-out prevention measures.

Warranty

1. Warranty period

Warranty period of this product is one year after purchase.

2. Scope of warranty

If any malfunction or damage occurs on the CKD's own responsibility within above warranty period, we will repair the product immediately free of charge.

However, the following are excluded from warranty.

① When using the product under the conditions or environment deviating from this specification.

② When the malfunction or damage results from mishandling or improper control.

③ When the malfunction is caused by factors other than CKD product.

④ When the product is used improperly.

⑤ When the malfunction or damage results from the modification of functions, structures or specifications which CKD is not involved in, or repairs which is not designated by CKD after delivery.

⑥ When the damage can be avoided if the machine and apparatus of your company which CKD product is installed in has functions and structures which commonly equipped with in the industry.

⑦ When the malfunction or damage results from unforeseeable causes with the technology applied at the time of delivery.

⑧ When the malfunction or damage results from fire, earthquake, flood, thunder, other natural disaster, pollution, salt hazard, gas hazard, abnormal voltage, abnormal water pressure or quality, congelation, or other external causes.

⑨ In the case of repair parts which are used excessively.(filter element, dessicant etc.)

The warranty refers to only delivered products. We do not warrant for any secondary damage or loss caused by the faults of delivered products.

This product is premised on transaction and use in Japan.

As for the warranty of the product which is exported outside Japan, the following are applied.

① CKD will repair the products which returned to our factory freight prepaid. (We do not compensate transportation cost)

② After repairing the product we will deliver it to the designated domestic place in Japan with domestic packaging specifications.

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Table of Contents

1. INTRODUCTION

Thank you very much for purchasing our Nitrogen gas extraction unit NS series.

This manual explains basic points of installation, operation, etc. to have our Nitrogen gas extraction unit perform at their best. Be sure to read this manual before using your Nitrogen gas extraction unit.

Keep this manual together with the warranty book.

This manual is edited consisting of the following seven sections.

- ○ INTRODUCTION
- ○ PRODUCTS
- ○ CAUTION
- ○ INSTALLATION
- ○ HANDLING AND CHECKING
- ○ MAINTENANCE
- ○ MODEL CODING

Originally it is preferable to use this product after reading this manual, but if you wish to install immediately,

- ○ INSTALLATION

It is created so that you can understand even if you read from any chapter such as you read only.

2. PRODUCTS

2-1 Specifications

■ Single cylinder

Item				NS-3S1	NS-3L1	NS-4S1	NS-4L1
Range of working conditions	Working fluid			Compressed air			
	Inlet air pressure	MPa		0.4 to 1.0			
	Proof pressure	MPa		1.5			
	Inlet air temperature	°C		5 to 50			
	Relative humidity of inlet air	RH		50% or less			
	Ambient temperature	°C		5 to 50			
Rating	Inlet air purity class			1:6:1(JIS B 8392-1:2012, ISO 8573-1:2010)			
	Inlet air pressure	MPa		0.7			
	Inlet air temperature	°C		25			
	Ambient temperature	°C		25			
Rated flow rate	Outlet nitrogen gas flow rate L/min(ANR)	Nitrogen concentration (%) or higher	99.9	1.9	5.6	11.0	30.6
			99	5.0	15.5	28.2	66.9
			97	8.9	28.7	49.9	118.1
			95	14.0	39.8	65.3	169.2
			90	27.0	78.1	137.3	313.5
	Inlet air flow rate L/min(ANR)		99.9	17.3	50.9	100.0	278.2
			99	20.9	64.6	117.5	278.8
			97	24.1	77.6	134.9	319.2
			95	31.2	88.5	145.2	376.0
			90	60.0	173.6	305.1	696.7

■ Multiple cylinder

Item				NS-4S2	NS-4S3	NS-4L2	NS-4L3	NS-4L4	NS-4S6	NS-4S8	NS-4SA	NS-4L6	NS-4L8
Range of working conditions	Working fluid			Compressed air									
	Inlet air pressure	MPa		0.4 to 1.0									
	Proof pressure	MPa		1.5									
	Inlet air temperature	°C		5 to 50									
	Relative humidity of inlet air	RH		50% or less									
	Ambient temperature	°C		5 to 50									
Rating	Inlet air purity class			1:6:1 (JIS B 8392-1:2012, ISO 8573-1:2010)									
	Inlet air pressure	MPa		0.7									
	Inlet air temperature	°C		25									
	Ambient temperature	°C		25									
RatingFlow rate	Outlet nitrogen gas flow rate L/min(ANR)	Nitrogen concentration (%) or higher	99.9	22.0	33.0	61.2	91.8	122.4	66.0	88.0	110.0	183.6	244.8
			99	56.4	84.6	133.8	200.7	267.6	169.2	225.6	282.0	401.4	535.2
			97	99.8	149.7	236.2	354.3	472.4	299.4	399.2	499.0	708.6	944.8
			95	130.6	195.9	338.4	507.6	676.8	391.8	522.4	653.0	1015.2	1353.6
			90	274.6	411.9	627.0	940.5	1254.0	823.8	1098.4	1373.0	1881.0	2508.0
	Inlet air flow rate L/min(ANR)		99.9	200.0	300.0	556.4	834.6	1112.8	600.0	800.0	1000.0	1669.2	2225.6
			99	235.0	352.5	557.6	836.4	1115.2	705.0	940.0	1175.0	1672.8	2230.4
			97	269.8	404.7	638.4	957.6	1276.8	809.4	1079.2	1349.0	1915.2	2553.6
			95	290.4	435.6	752.0	1128.0	1504.0	871.2	1161.6	1452.0	2256.0	3008.0
			90	610.2	915.3	1393.4	2090.1	2786.8	1830.6	2440.8	3051.0	4180.2	5573.6

2-2. Selection guide

< Model selection method >

As temperature and inlet air pressure affect outlet nitrogen gas flow rate, correction is required if they differ from the rated values listed in the specifications.

STEP1 Confirm the working conditions and the rated values listed in the specifications.
Working conditions: Inlet air pressure, inlet air temperature, required nitrogen gas flow rate.

STEP2 Confirm the compensation coefficient for outlet nitrogen gas flow rate affected by inlet air temperature.

(1) Temperature – Gas flow rate compensation coefficient

Temperature (℃)	Outlet nitrogen gas concentration				
	99.9%	99%	97%	95%	90%
5	0.64	0.79	0.79	0.75	0.78
10	0.73	0.84	0.84	0.81	0.84
25	1	1	1	1	1
35	0.97	1.05	1.04	1.07	1.07
40	0.95	1.08	1.06	1.11	1.11
50	0.9	1.09	1.11	1.15	1.2

STEP3 Confirm the compensation coefficient for outlet nitrogen gas flow rate affected by inlet air pressure.

(2) Pressure – Gas flow rate compensation coefficient

Pressure (MPa)						
0.4	0.5	0.6	0.7	0.8	0.9	1.0
0.4	0.65	0.75	1	1.07	1.2	1.3

STEP4 Find the appropriate model based on the rated outlet nitrogen gas flow rate of each model.
Rated outlet nitrogen gas flow rate x (1) temperature gas flow rate compensation coefficient x (2) pressure gas flow rate compensation coefficient = compensated outlet nitrogen gas flow rate.
Select one with sufficient outlet nitrogen gas flow rate after compensation with above formula.

STEP5 Confirm the compensation coefficient for inlet air flow rate affected by inlet air temperature.

(3) Temperature – Air flow rate compensation coefficient

Temperature (℃)	Outlet nitrogen gas concentration				
	99.9%	99%	97%	95%	90%
5	0.73	0.68	0.75	0.69	0.76
10	0.8	0.76	0.81	0.77	0.82
25	1	1	1	1	1
35	1.21	1.17	1.11	1.13	1.11
40	1.32	1.25	1.17	1.2	1.16
50	2.05	1.38	1.31	1.31	1.3

STEP6 Confirm the compensation coefficient for inlet air flow rate affected by inlet air pressure.

(4) Pressure– Air flow rate compensation coefficient

Pressure (MPa)						
0.4	0.5	0.6	0.7	0.8	0.9	1.0
0.61	0.79	0.91	1	1.07	1.2	1.3

STEP7 Find the inlet air flow rate from the rated outlet nitrogen gas flow rate of each model.
Inlet air flow rate of the model selected in STEP 4 x (3) temperature air flow rate compensation coefficient x (4) pressure air flow rate compensation coefficient = compensated inlet air flow rate L/min (ANR)
Based on the inlet air flow rate compensated as above, confirm whether the compressor capacity is sufficient.

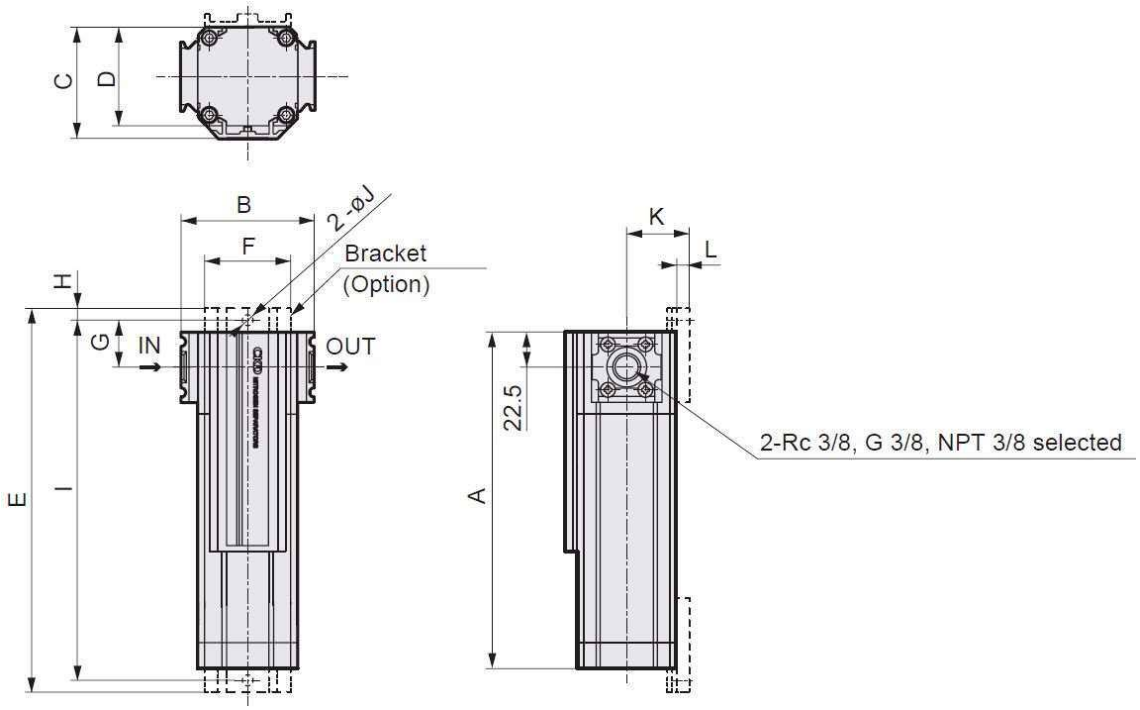
Example of calculation

Conditions	Working conditions	Selecting conditions	Compensation coefficient for outlet nitrogen gas flow rate	Compensation coefficient for inlet air flow rate
Inlet air temperature	35℃ to 39℃	40℃	(1)1.08	(3)1.25
Inlet air pressure	0.5 MPa to 0.55MPa	0.5MPa	(2)0.65	(4)0.79

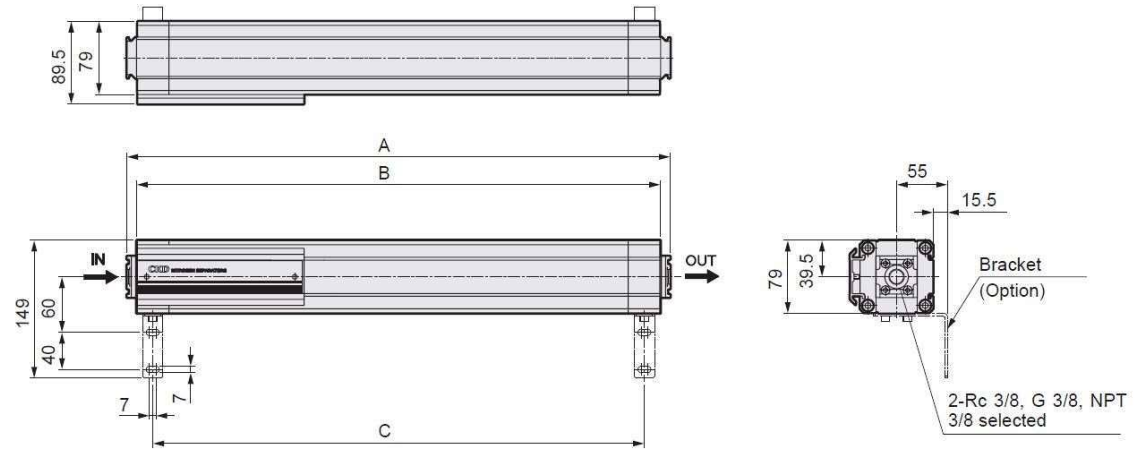
Substitute the above conditions into the equation above to obtain the outlet nitrogen gas flow rate when using NS-4L1□ at a nitrogen concentration of 99%.
It will be: 66.9(rated outlet nitrogen gas flow rate) x 1.08 x 0.65＝46.9 L/min(ANR).
If the required nitrogen gas flow rate is less than or equal to this value, select that model.
In this case, the inlet air flow rate is calculated as: 278.8 x 1.25 x 0.79＝275.3 L/min(ANR).

2-3. Dimensions

■ Single cylinder

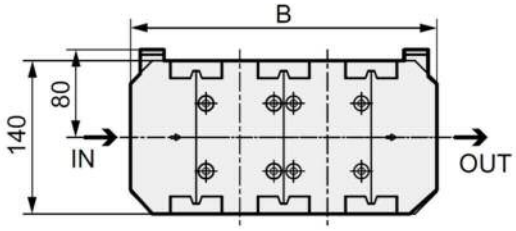


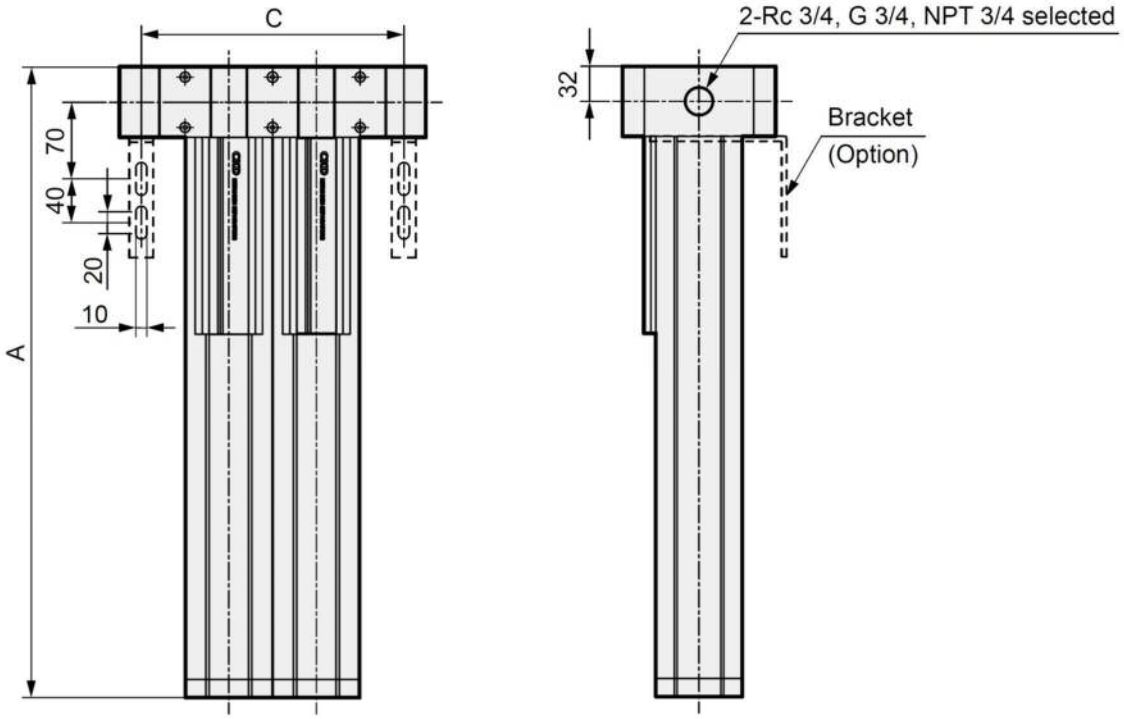
Model No.	A	B	C	D	Weight (kg)	Bracket relational dimensions							
						E	F	G	H	I	J	K	L
NS-3S1	315	85	71	63	1.8	345	55	30	7.5	330	7	40	8
NS-3L1	565	85	71	63	2.7	595	55	30	7.5	580	7	40	8
NS-4S1	565	100	90	79	4.0	605	70	32.5	10	585	9	50	10
NS-4L1	1065	100	90	79	6.8	1105	70	32.5	10	1085	9	50	10



Model No.	A	B	C	Weight (kg)
NS-4S1*-*T	587	566	531	4.2
NS-4L1*-*T	1087	1066	1031	7.0

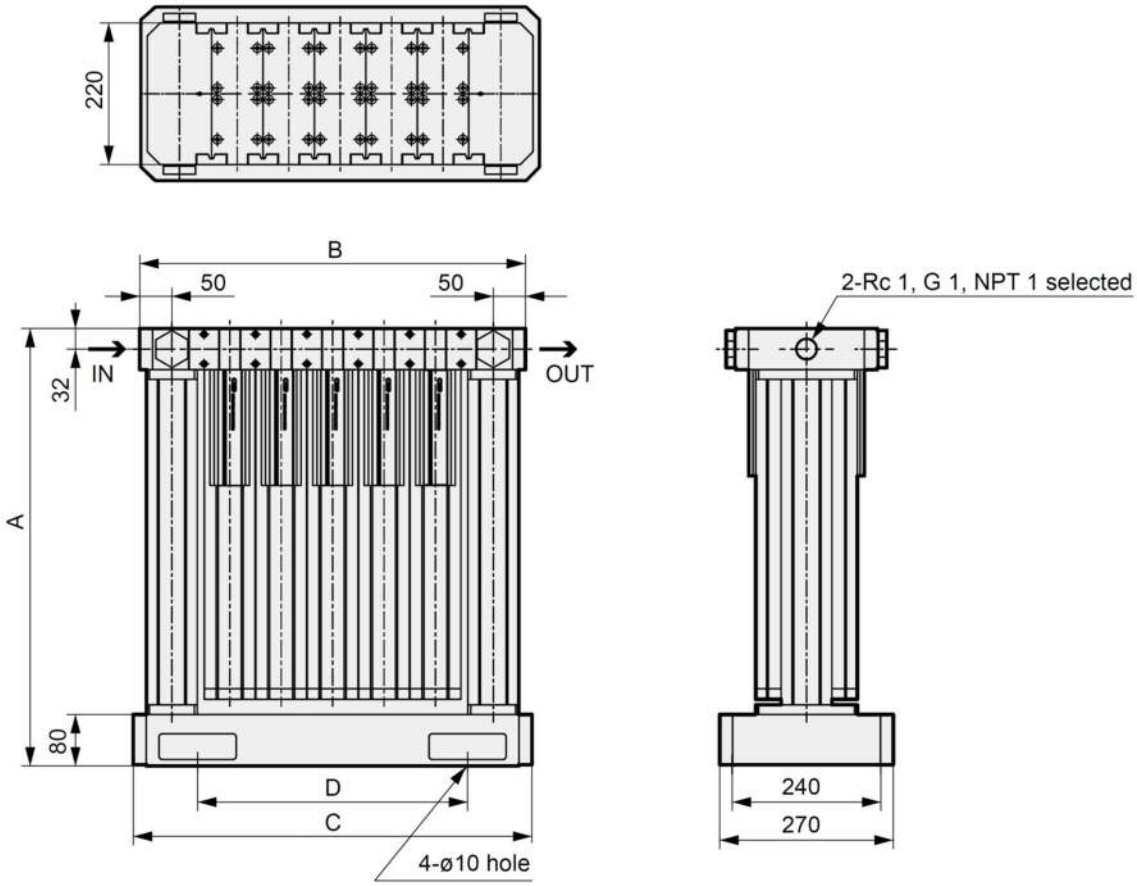
■ Multiple cylinder(2 ,3 or 4 units)





Model No.	A	B	C	Weight (kg)
NS-4S2	577	280	240	12
NS-4S3	577	360	320	17
NS-4L2	1077	280	240	18
NS-4L3	1077	360	320	25
NS-4L4	1077	440	400	32

■ Multiple cylinder(6, 8 or 10 units)



Model No.	A	B	C	D	Weight (kg)
NS-4S6	680	440	460	260	41
NS-4S8	680	520	540	340	50
NS-4SA	680	600	620	420	59
NS-4L6	1180	440	460	260	63
NS-4L8	1180	520	540	340	78

3. CAUTION

1. Working environment

1) Avoid installing this product where it will be subject to direct sunlight or rain.
2) Avoid use in environments where ozone is generated.
3) Avoid using this product where vibration and impact are present.
4) Avoid use in environments with moist air with a relative humidity of 50% or higher. (Performance will decrease sharply if the separation membrane gets wet with droplets (such as water).)
5) Avoid air flow containing corrosive gas (strongly acidic gases such as hydrogen sulfide, sulfur dioxide, hydrogen chloride or fluorine) or strongly alkaline gas (amines, ammonia, caustic soda, etc.).
6) Use within ambient temperature of 5℃ to 50℃.
7) Keep operating pressure below 1.0 MPa.
8) Avoid installation close to welding or spray painting areas.
9) Air filter of 5 μm filtration and oil mist filter to be installed at inlet of Nitrogen gas extraction unit when supplied air is lubricated and close to saturated.
10) In case of hydrocarbons may be contained in compressed air, install activated carbon filter inside this unit(For the type in which activated carbon particles flow to the secondary side, please install the oil mist filter on the secondary side of the activated carbon filter).
11) Pressure reducing valve, such as regulator to be installed at outlet of Nitrogen gas extraction unit.

2. Warning

1) As nitrogen gas involves the risk of oxygen deficiency, use the product according to the following instructions.
   ・Use in well ventilated locations.
   ・Ventilate the work area when nitrogen gas is being used.
   ・Periodically inspect nitrogen gas piping for leakage.
2) As oxygen-enriched gas is released from the exhaust unit of the membrane unit, note the following when installing the product.
   ・install away from fire or flammable objects.
   ・Ventilate the work area during operation of the equipment.
3) Do not use the product for any purpose directly related to human life.
4) This product was designed to obtain nitrogen-enriched gas from compressed air. Do not use it for any purpose other than this purpose.
5) Do not remodel this product.
6) Do not step onto the body.
7) Note that it takes time to obtain the required nitrogen concentration after supplying compressed air.

4. INSTALLATION

4-1. Piping

1) Install so as an air flow coincides with the directional arrows on the cover.
2) Flush air into the pipe to blow out foreign substances and metal chips before piping.
3) Leave at least two thread pitches prior to the end of pipe before applying sealant or sealing tape to reduce the possibility of contamination or fowling.

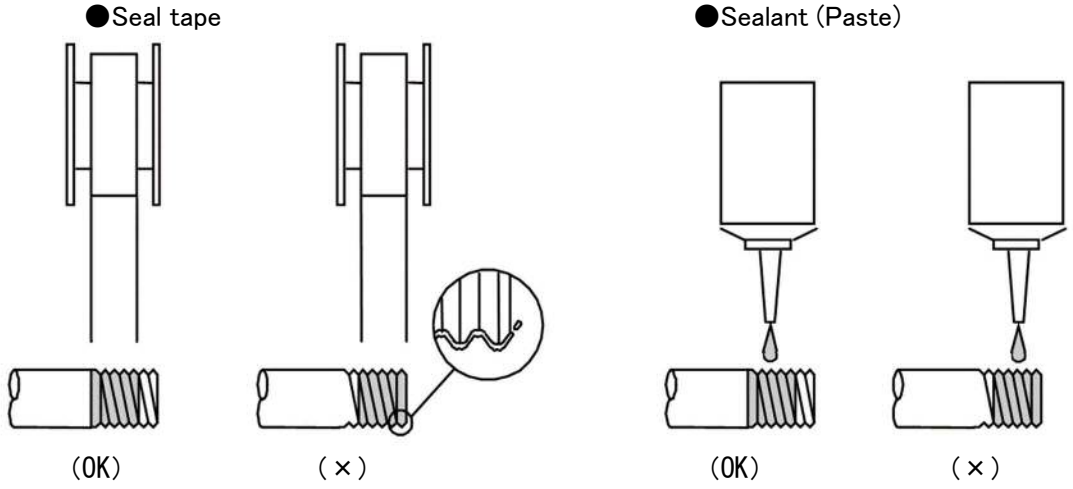


Fig.1

4-2.Installation

■ Single cylinder

(When the mounting direction "No sign: Vertical mounting" is selected)

1) When bracket attached as an option is used, insert bracket to the rail slit of Nitrogen gas extraction unit, fix it by retaining screw after positioning with Stopper pin. (Refer to Fig.2) Use tightening torque 3 N·m for set screw.
2) Install Super dryer so that base of it is parallel to floor.
3) Allow a minimum of 100 mm upward and 20 mm downward for maintenance purpose. (Refer to Fig.3)
4) In case of the exhaust port of NS-3S and 3L series, piping of exhaust air should use the hose or piping material of I.D. 8 mm or more, and give length as less than 3 m. (Refer to Fig.4)
5) In case of the exhaust port of NS-4S and 4L series, piping of exhaust air should use the hose or piping material of I.D. 8.9 mm or more, and give length as less than 2 m. (Refer to Fig.4)

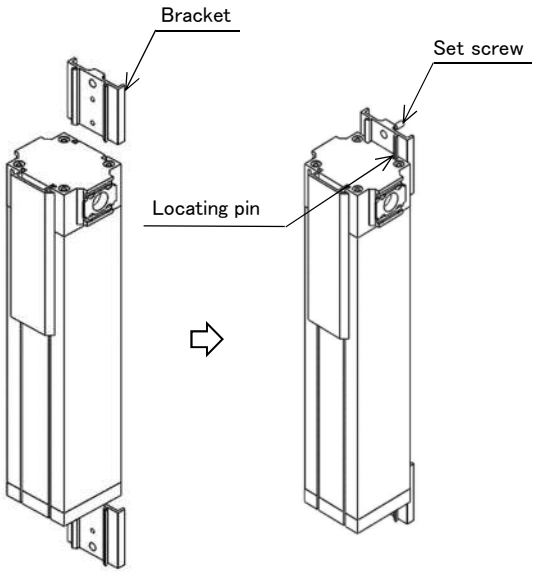


Fig.2

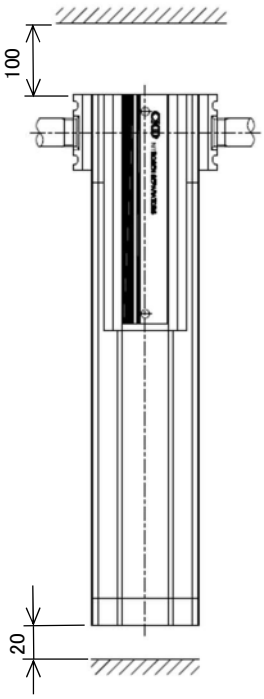


Fig.3

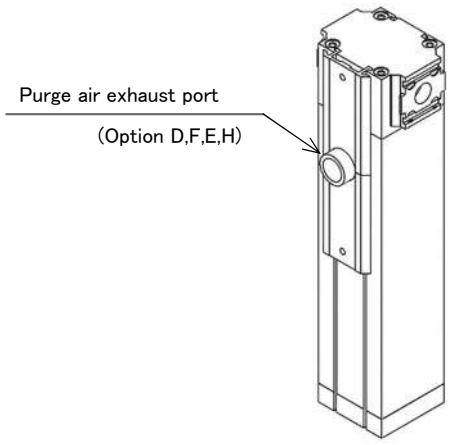


Fig.4

■ Single cylinder

(When the mounting direction "T: Horizontal mounting" is selected)

1) When bracket attached as an option is used, position the brackets according to the screw hole on the lower side of the Nitrogen gas extraction unit and fix it with four attached M5 hex socket bolts. Use tightening torque 3 N·m for M5 hex socket bolts. (Refer to Fig.5)
2) Install Super dryer so that base of it is parallel to floor.
3) In case of the exhaust port, piping of exhaust air should use the hose or piping material of I.D. 8.9 mm or more, and give length as less than 2 m. (Refer to Fig.6)

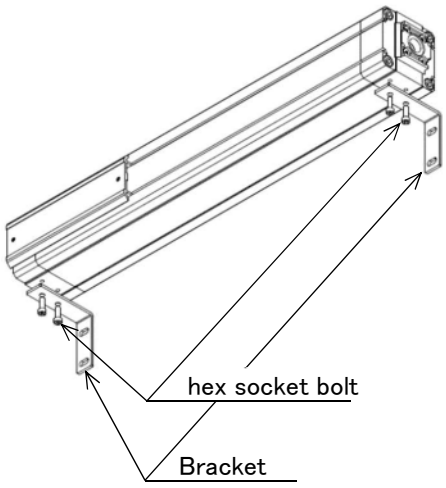


Fig.5

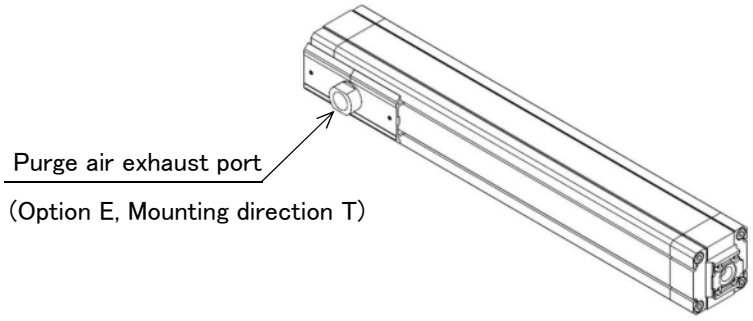


Fig.6

■ Multiple cylinder(2 ,3 or 4 unit)

1) Both inlet and outlet pipes must be fixed, when the Nitrogen gas extraction unit will be used as suspended by pipes, or a filter will be installed before or after itself. (Refer to Fig.7) The dryer body can be fixed with brackets, also. (Refer to Fig.8)
2) Allow a minimum of 300 mm upward and 30 mm downward for maintenance purpose. (Refer to Fig.7,8)

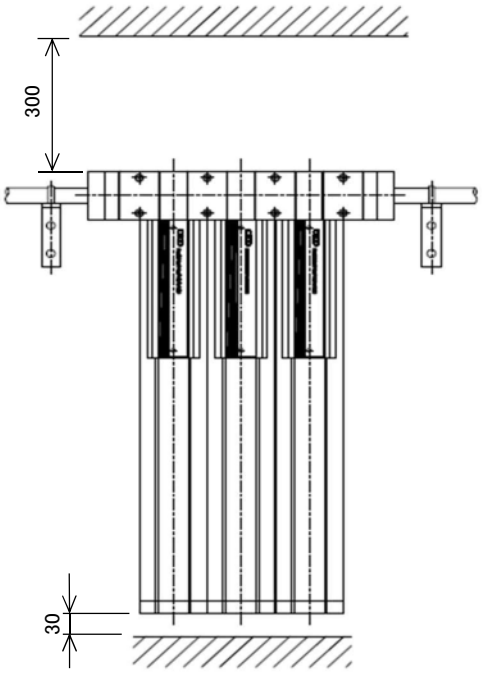


Fig.7

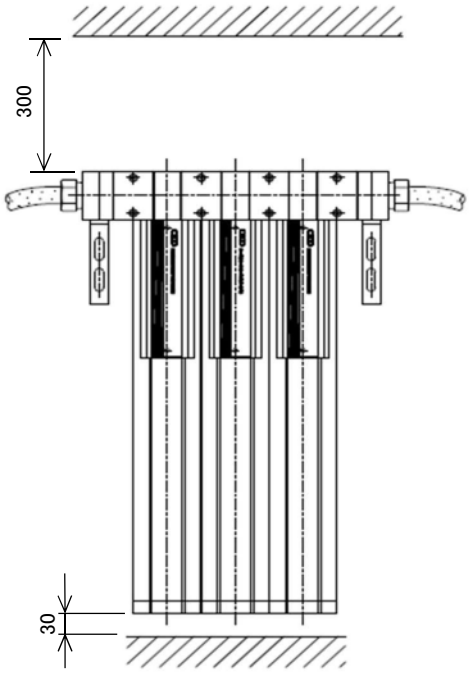


Fig.8

■ Multiple cylinder(6,8 or 10 unit)

1) The place where the Nitrogen gas extraction unit will be installed must be flat and strong enough to support it.
2) The base has four fixture holes (Φ10). Please see the dimensions on the catalog about those holes' dimensions.
3) Allow a minimum of 300 mm upward for maintenance purpose. (Refer to Fig.9)

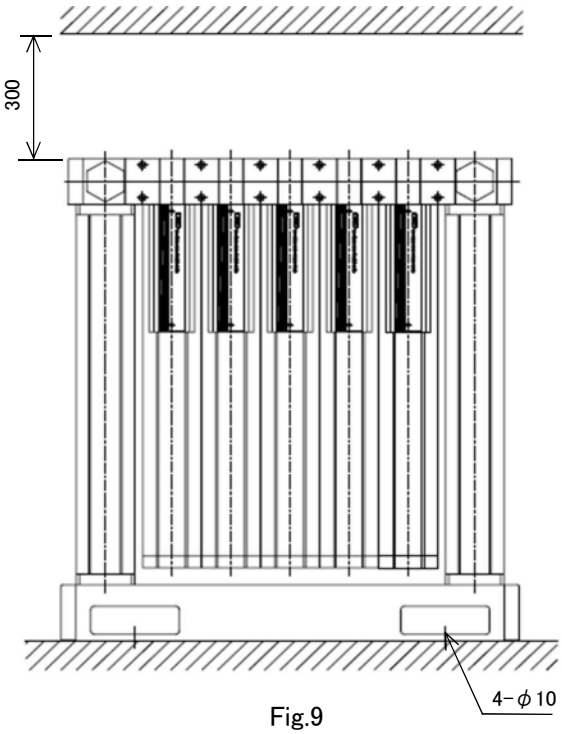


Fig.9

5. OPERATION START/STOP AND INSPECTION

5-1. Operation start/stop

〈Operation start〉

1) After the secondary side valve is fully closed, gradually open the primary side valve.
2) Gradually open the secondary side valve and adjust to a predetermined outlet nitrogen gas flow rate and oxygen concentration.

〈Operation stop〉

1) Fully closed the secondary side valve.
2) Fully closed the primary side valve.

5-2. INSPECTION

Regularly check the oxygen concentration in the outlet nitrogen gas with an oxygen concentration meter.

If the predetermined concentration has not been obtained, please check the following items are predetermined values.

- ・Compressed air pressure
- ・Compressed air temperature
- ・Outlet nitrogen gas flow rate
- ・Outlet nitrogen gas pressure

The oxygen concentration in the outlet nitrogen gas change by compressed air pressure, temperature and outlet nitrogen gas flow rate.

Always measure under certain conditions

6. MAINTENANCE

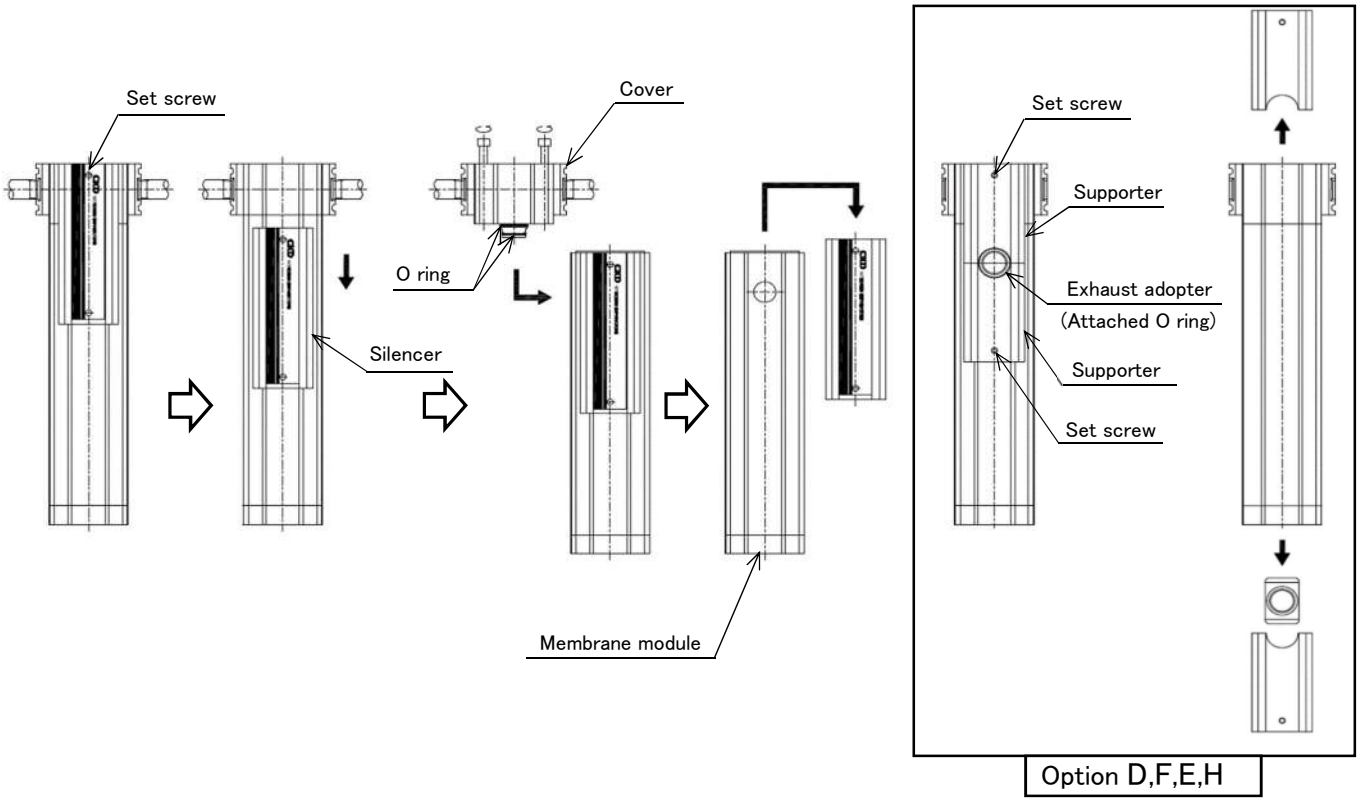
6-1. Membrane module replacement

■ Single cylinder

(When the mounting direction "No sign: Vertical mounting" is selected)

1) Slide silencer downward by loosening two set screws at silencer portion with hex key wrench. (2.5 mm) (In case of option "D, F, E, H ", shift supporter up and down, and remove exhaust adapter.)
2) Remove membrane module downward by loosening four hex socket bolts. (Upper face) with hex key wrench. (5 mm for NS-3S,3L. 6 mm for NS-4S,4L)
3) Using hex key wrench (2.5 mm) to loosen two silencer fixture screws at each membranes module assembly allows removing silencers. The silencer will be removed along the rail.
4) Do not damage membrane modules face; follow above steps in reverse manner when assembled. In case of option "D, F, E, H", since it positions so that an exhaust adapter may close purge exhaust port, fix with up-and-down supporter.
   Tightening torque is as follows:

Hex key wrench	Tightening torque
2.5 mm	3 N·m
5 mm	6 N·m
6 mm	10 N·m



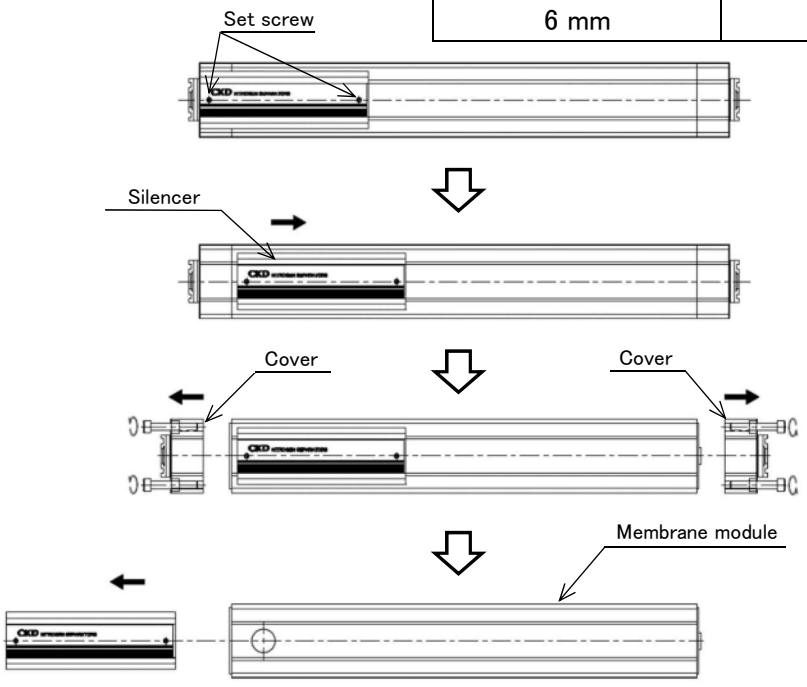
■ Single cylinder

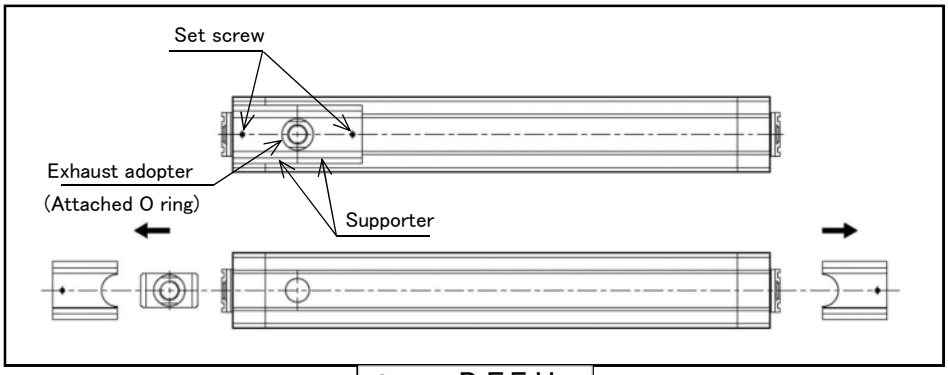
(When the mounting direction "T: Horizontal mounting" is selected)

1) Slide silencer rightward by loosening two set screws at silencer portion with hex key wrench. (2.5 mm) (In case of option "D, F, E, H ", shift supporter left and right, and remove exhaust adapter.)
2) Remove membrane module by loosening each four hex socket bolts from the left and right covers with hex key wrench (6 mm).
3) Remove the silencer along the rail.
4) Do not damage membrane modules face; follow above steps in reverse manner when assembled. In case of option "D, F, E, H", since it positions so that an exhaust adapter may close purge exhaust port, fix with left-and-right supporter.

Tightening torque is as follows:

Hex key wrench	Tightening torque
2.5 mm	3N·m
6 mm	10N·m



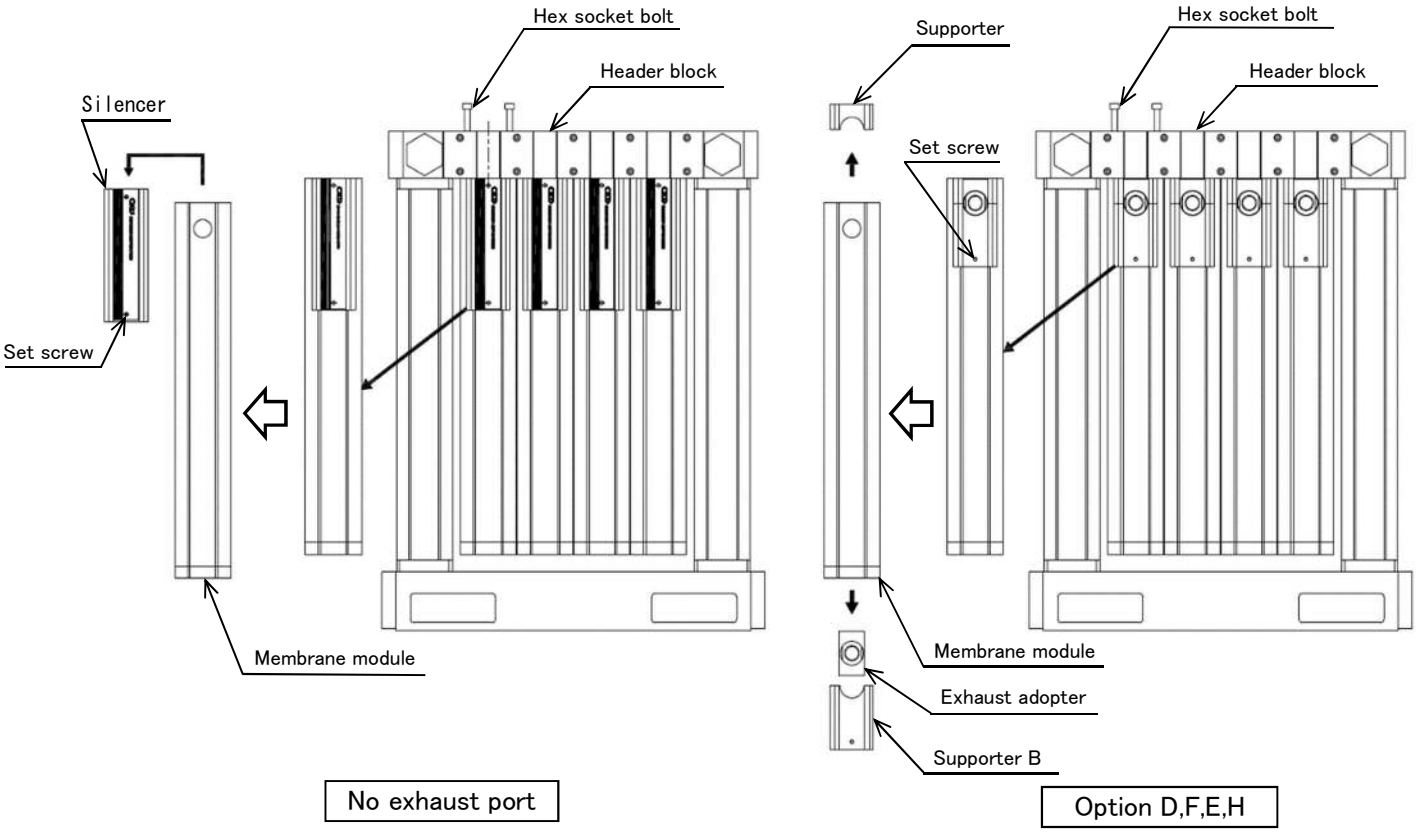


Option D,F,E,H

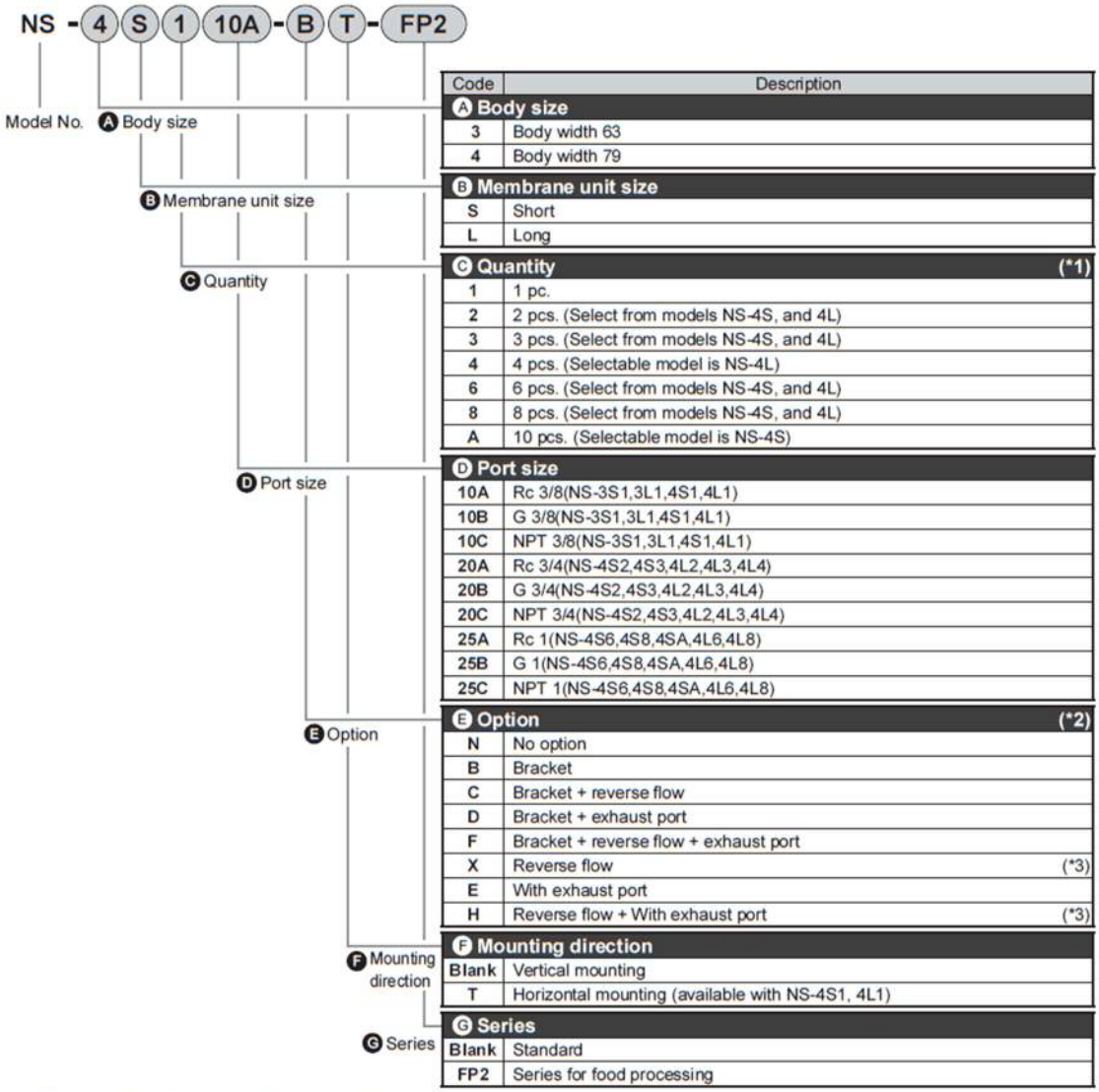
■ Multiple cylinder

1) Using hex key wrench to loose four hex socket bolts supporting each module at the upper header block enables to replace membranes modules.
2) Using hex key wrench to loosen two silencer fixture screws at each membranes module assembly allows removing silencers. The silencer will be removed along the rail.
3) The silencer will be inserted and fixed at the header block with the reverse procedure of removing.
4) The silencer should be pushed and reached to the header block along the rail, then fixed by silencer fixture screws.
   The tightening torque is followings.

Hex key wrench	Tightening torque
2.5 mm	3 N·m
6 mm	10 N·m



7. MODEL CODING



Code	Description
A Body size	
3	Body width 63
4	Body width 79
B Membrane unit size	
S	Short
L	Long
C Quantity	**(*1)**
1	1 pc.
2	2 pcs. (Select from models NS-4S, and 4L)
3	3 pcs. (Select from models NS-4S, and 4L)
4	4 pcs. (Selectable model is NS-4L)
6	6 pcs. (Select from models NS-4S, and 4L)
8	8 pcs. (Select from models NS-4S, and 4L)
A	10 pcs. (Selectable model is NS-4S)
D Port size	
10A	Rc 3/8(NS-3S1,3L1,4S1,4L1)
10B	G 3/8(NS-3S1,3L1,4S1,4L1)
10C	NPT 3/8(NS-3S1,3L1,4S1,4L1)
20A	Rc 3/4(NS-4S2,4S3,4L2,4L3,4L4)
20B	G 3/4(NS-4S2,4S3,4L2,4L3,4L4)
20C	NPT 3/4(NS-4S2,4S3,4L2,4L3,4L4)
25A	Rc 1(NS-4S6,4S8,4SA,4L6,4L8)
25B	G 1(NS-4S6,4S8,4SA,4L6,4L8)
25C	NPT 1(NS-4S6,4S8,4SA,4L6,4L8)
E Option	**(*2)**
N	No option
B	Bracket
C	Bracket + reverse flow
D	Bracket + exhaust port
F	Bracket + reverse flow + exhaust port
X	Reverse flow (*3)
E	With exhaust port
H	Reverse flow + With exhaust port (*3)
F Mounting direction	
Blank	Vertical mounting
T	Horizontal mounting (available with NS-4S1, 4L1)
G Series	
Blank	Standard
FP2	Series for food processing

⚠ Precautions for model No. selection

*1: The product will be floor-mounted without bracket for 6 units or more.

*2: Exhaust air (oxygen-enriched gas) from standard products is released into the atmosphere. For "E", piping connection for exhaust (oxygen-rich gas) is possible. Size of exhaust port is Rc1/2.

*3: Viewed from the front, a standard product has an air inlet on the left port, while an air outlet on the right port. For "X", an air inlet is provided on the right port, with an air outlet provided on the left port .

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