ALX-OM00016

OPERATION MANUAL

D. P. LUB

MODEL ALD 600, 900

AND

D. P. LUB UNIT

MODEL ALDU 600, 900

SMC CORPORATION

CONTENTS

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I. GENERAL DESCRIPTION

D. P. Lub and D. P. Lub Unit, installed in a main air line, are designed for feeding oil to various valves, air cylinders, air tools etc.

The use of them makes it possible to centralize control of lubr cation conduct to end-line components.

II. FEATURES

- Centralized control of multi-points lubrication is possible.
- Adoption of a lubrication system oil feeding, in which oil is fed in the form of micromist, ensures stable lubrication even for long, complex piping applications.
- Comstant feed of micromist is assured by adjusting the differential pressure alone.
- Replenishment of oil can easily be made during operation without interrupting an air line by only opening the oil supply plug.
- Micromist can be observed through an oil supply port.

III. SPECIFICATIONS AND MODELS

Specifications	D. P. Lub ALD 600, 900	D. P. Lub Unit ALDU 600, 900
Proof Pressure	1.5 MPa {15.3 kgf/cm²}	
Operating Pressure Range	0.1～1MPa {1～10.2kgf/cm²}	0.15～1.0MPa {1.5～10.2kgf/cm²}
Differential Pressure Range	0.03～0.1MPa {0.31～1kgf/cm²}	
Ambient Temp. and Operating Fluid Temp.	5 ～ 60°C	
Recommended Oil	Turbine oil Class 1, ISO VG32 (JIS K2213)	

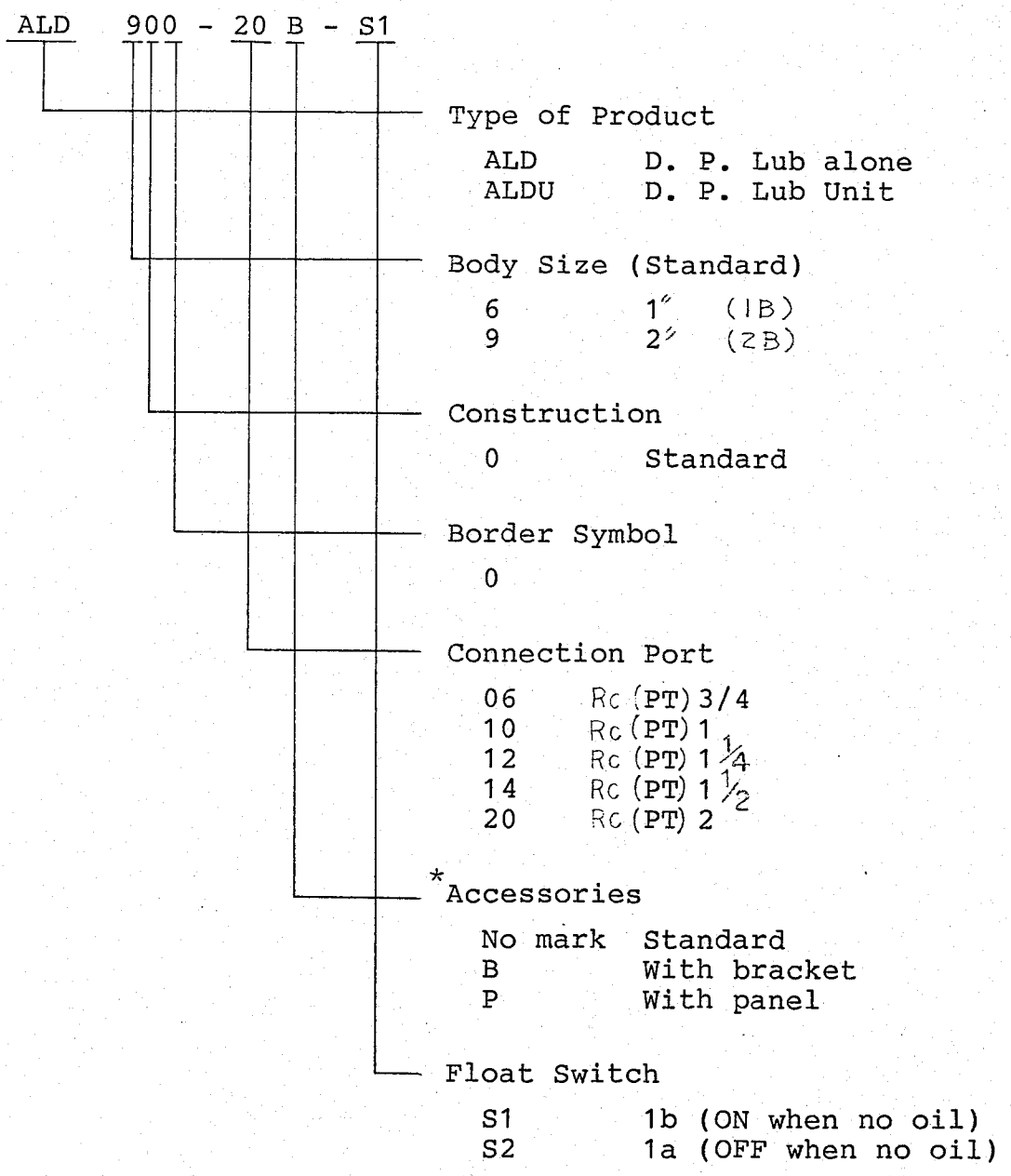
MODEL		D. P. Lub		D. P. Lub Unit	
		ALD600	ALD900	ALDU600	ALDU900
Connection Port Rc (PT)		3/4, 1	1 1/4 1 1/2, 2	3/4, 1	1 1/4 1 1/2, 2
Nominal Diameter		20 A～ 25 A	32 A ～ 50 A	20 A～ 25 A	32 A ～ 50 A
Oil Capacity (cm^3)		2000	5000	2000	5000
Weight MPa {kgf/cm²}		8.9	21.3	*11.1 (18.6)	*31.6 (48.1)
Max. Flowrate ℓ/min (ANR)		6000	15000	6000	15000
Acces-sories	Bracket	o	o	o	o
	Panel	-	-	o	o
	Float Switch	o	o	o	o

* With panel

Float Switch

Voltage:	200 VAC,	200 VDC
Max. breaking capacity:	12 VA,	10 W
Max. break current:	0.6 A,	0.5 A
Contact configuration:	1a,	1b
Level indication:	Lower limit	

IV. MODEL IDENTIFICATION SYMBOLS



* For D. P. Lub Unit

Models with no mark (standard), B (with bracket), and P (with panel) are provided with unions at IN and OUT connection ports.

V. PRINCIPLE OF OPERATION

ALD 600

The D. P. Lub is a lubricator that regulates the amount of mist generation using a differential pressure between the primary and secondary pressures. It consists primarily of a differential pressure regulating valve section that maintains the differential pressure constant despite a change in air consumption and a mist generating section.

In Fig. 1, the supply air from the primary side is introduced to both differential pressure regulating valve and mist generating section. The air supplied to the valve is first led to primary side diaphragm chamber ① to force diaphragm ② upward, opening main valve ④ by means of rod ③ fixed to diaphragm ② . This allows the air to flow to the secondary side and further to pass through feed-back hole ⑤ on rod ③ to secondary side diaphragm chamber ⑥ . When the force generated by this air pressure and the force of spring ⑧ generated by adjusting screw ⑦ balances the force generated by the pressure in primary side diaphragm chamber ① , main valve ④ is closed, resulting in the differential pressure set at a desired level. This means that the

forces acting on both sides of diaphragm ② from above and below balance each other. In other words, the following equation holds:

$$F + P_2 \times S = P_1 \times S$$

$$\therefore \quad P_1 - P_2 = \frac{F}{S}$$

where F: the spring force in kgf

P_1: the pressure in primary diaphragm chamber in MPa {kgf/cm²}

P_2: the pressure in secondary diaphragm chamber in MPa {kgf/cm²}

S: the pressure sensing area of diaphragm in cm^2

This gives us that the pressure difference between the primary and secondary pressures can be set by the force generated at spring ⑧ . To increase the differential pressure, adjusting screw ⑦ is rotated clockwise to increase the force of spring ⑧ , and to decrease, screw ⑦ is rotated counterclockwise to decrease the force.

On the other hand, the air introduced to the mist generation section via 2-way valve ⑨ and filter element ⑩ will be sprayed into the oil in

casing (11) out of mist generating nozzle (12) by the amount corresponding to the pressure difference set by the differential pressure regulator because the pressure in casing (11) is nearly equal to the secondary side pressure. As a result, the oil is stirred and oil particles is created by means of bubbles generated by stirring. Larger particles will settle in the casing and only those smaller than a few μm in size will be transferred to the secondary side.

Condition of oil stirring can be observed through transparent casing (13) at the bottom of the unit. This enables troubles resulting from a blocking of nozzle (12) or clogging of filter element (10) to be prevented.

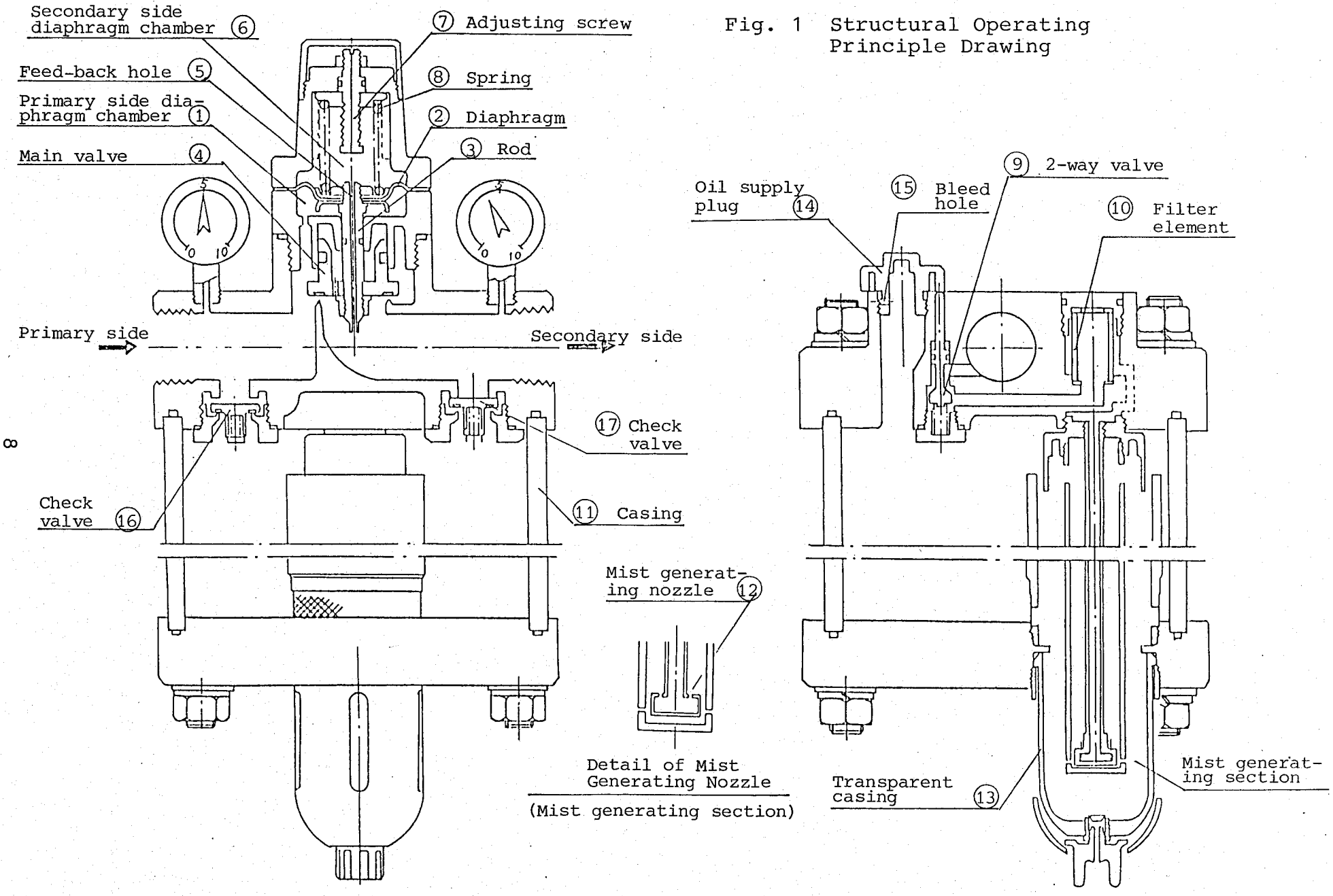


Fig. 1 Structural Operating Principle Drawing

ALD 900

The D. P. Lub is a lubricator that regulates the amount of mist generation using a differential pressure between the primary and secondary pressures. It consists primarily of a differential pressure regulating valve section that maintains the differential pressure constant despite changes in air consumption and a mist generating section.

In Fig. 3, the supply air from the primary side is introduced to both differential pressure regulating valve and mist generating section. The air supplied to the valve is first led to the primary side diaphragm chamber to force the diaphragm (A) upward. The air further passes through the pilot hole and is reduced in pressure to that corresponding to the force generated by the spring compressed through the adjusting screw, and supplied to the pilot chamber.

This air pressure is introduced to the diaphragm (B) upper chamber to force diaphragm (B) downward, pushing the stem downward. This causes the valve port to be open status, allowing the supply air in the primary side to flow to the secondary side. This air passes through the feed-back hole to the diaphragm (B) lower chamber. When the force generated by this

air pressure balances the force generated the pressure in the diaphragm (B) upper chamber (the same as the pressure in the pilot chamber), the pilot valve is closed, resulting in the differential pressure set at a desired level. This means that the forces acting on both sides of diaphragm (A) from above and below balance each other. In other words, the following equation holds:

$$F + P_2 \times S = P_1 \times S$$

$$\therefore \quad P_1 - P_2 = \frac{F}{S}$$

where F: the spring force in kgf

P_1: the pressure in primary diaphragm chamber in MPa {kgf/cm²}

P_2: the pressure in pilot chamber in MPa {kgf/cm²} <secondary side pressure>

S: the pressure sensing area of diaphragm (A) in cm^2

This gives us that the pressure difference between the primary and secondary pressures can be set by the force generated at the spring .

To increase the differential pressure, the adjusting screw is rotated clockwise to increase the force of

the spring. Then, the force acting on the diaphragm (A) from above increases, pushing the diaphragm (A) downward to force the pilot valve downward. This allows the pressure in the diaphragm (B) upper chamber to flow out of the bleed hole to atmosphere, resulting in decreased pressure. As a result, the differential pressure increases. To decrease, the screw is rotated counterclockwise to decrease the spring force.

On the other hand, the air introduced to the mist generation section via the 2-way valve and filter element will be sprayed into the oil in the casing out of the mist generating nozzle by the amount corresponding to the pressure difference set by the differential pressure regulator because the pressure in the casing is nearly equal to the secondary side pressure. As a result, the oil is stirred and oil particles is created by means of bubbles generated by stirring. Larger particles will settle in the casing and only those smaller than a few μm in size, called micromist, will be transferred to the secondary side.

Fig. 2 Structural Operating Principle Drawing

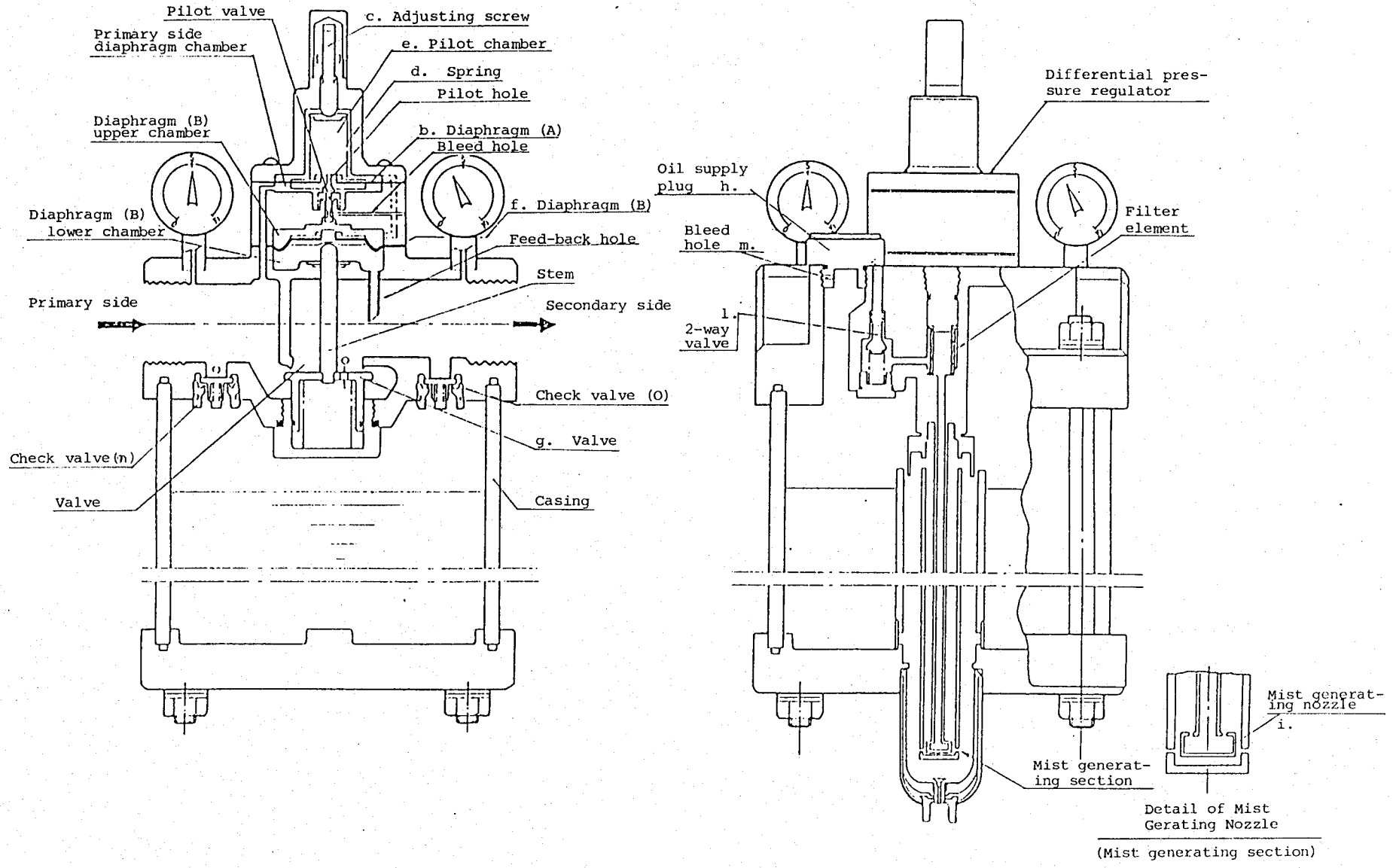
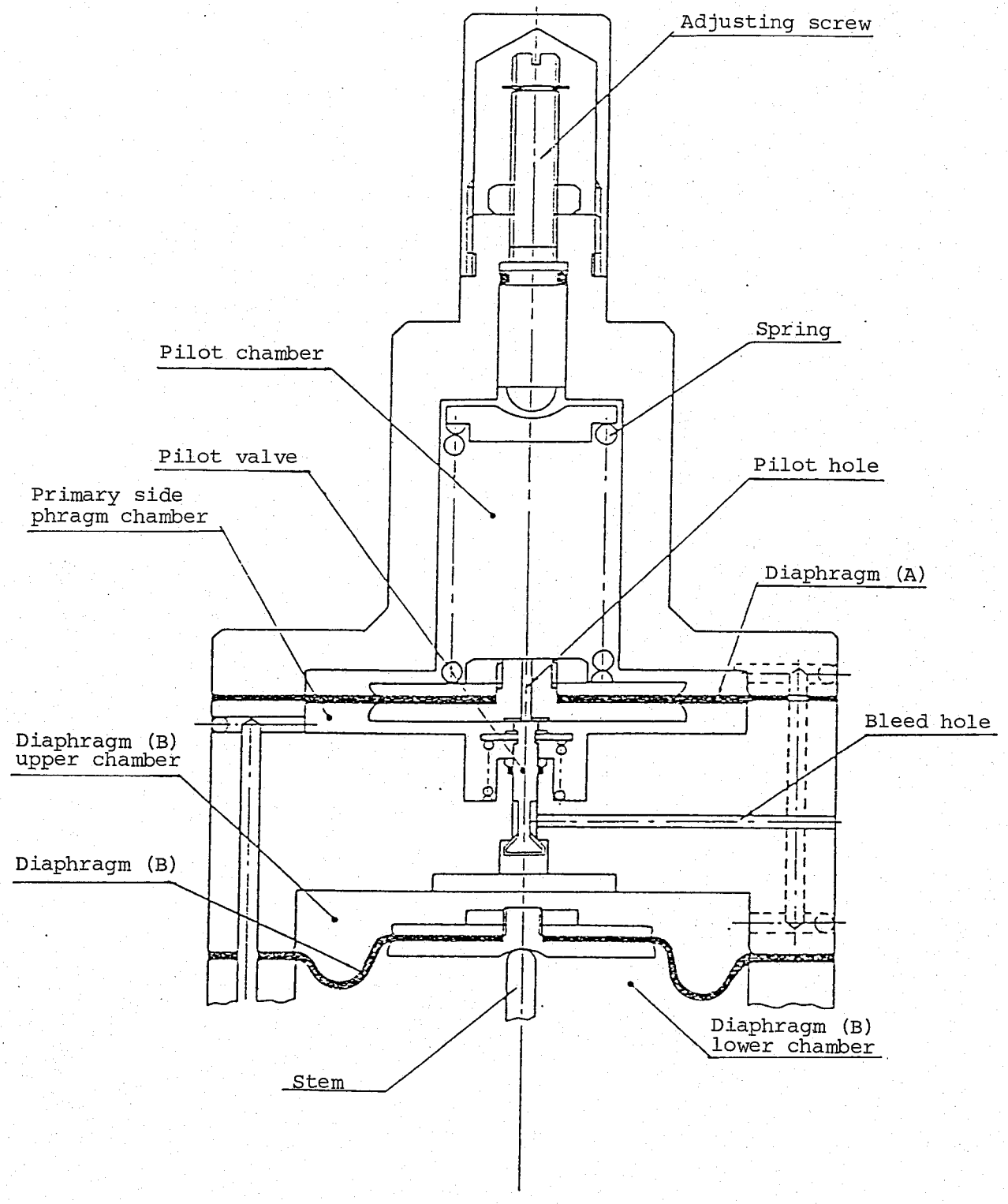


Fig. 3 Sectional View of Differential Pressure Regulating Valve



o Replenishing Oil during Operation

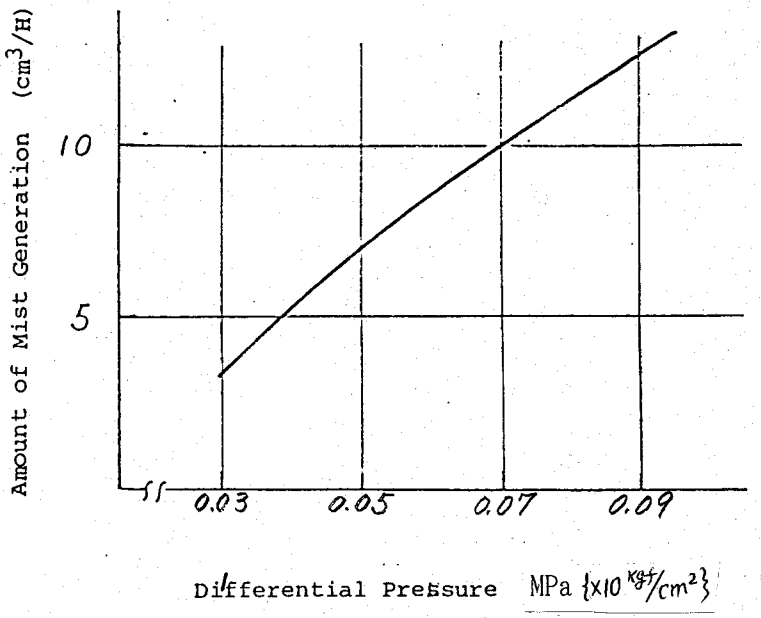
Replenishing oil to the unit can be made even during operation.

When replenishing oil, unscrew oil supply plug (h), and 2-way valve (l) is closed, blocking the primary air to mist generating nozzle (i). Unscrew further the plug to about half turns from the fully closed position, and the pressure in the case will be exhausted through bleed hole (m) on oil supply plug (h). Then, the primary pressure and secondary pressure are both blocked by check valves (n) and (o) respectively. After exhausting noise at bleed hole (m) on oil supply plug (h), the unit is now ready for replenishing.

VI. CHARACTERISTICS

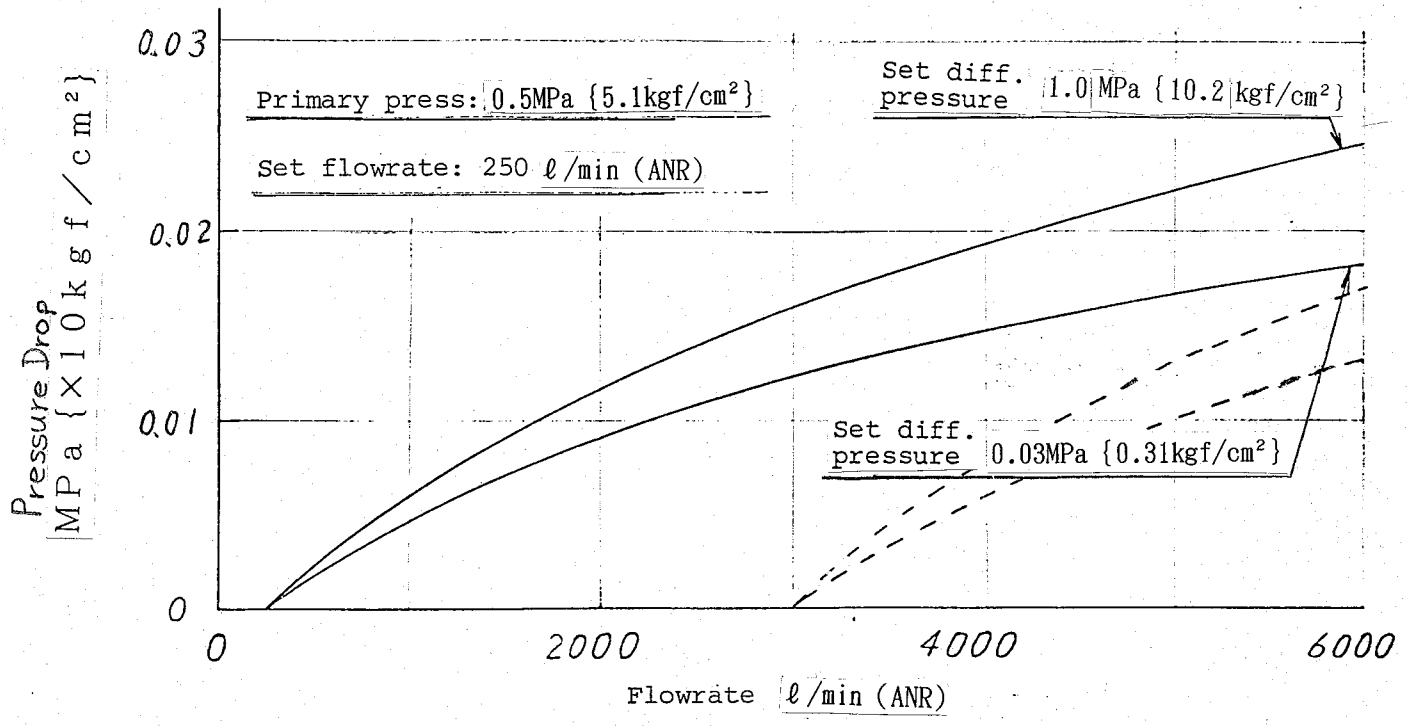
o Differential Pressure and Amount of Mist Generating

ALD 600, 900



o Characteristics of Flowrate

ALD 600-10



Description on Data

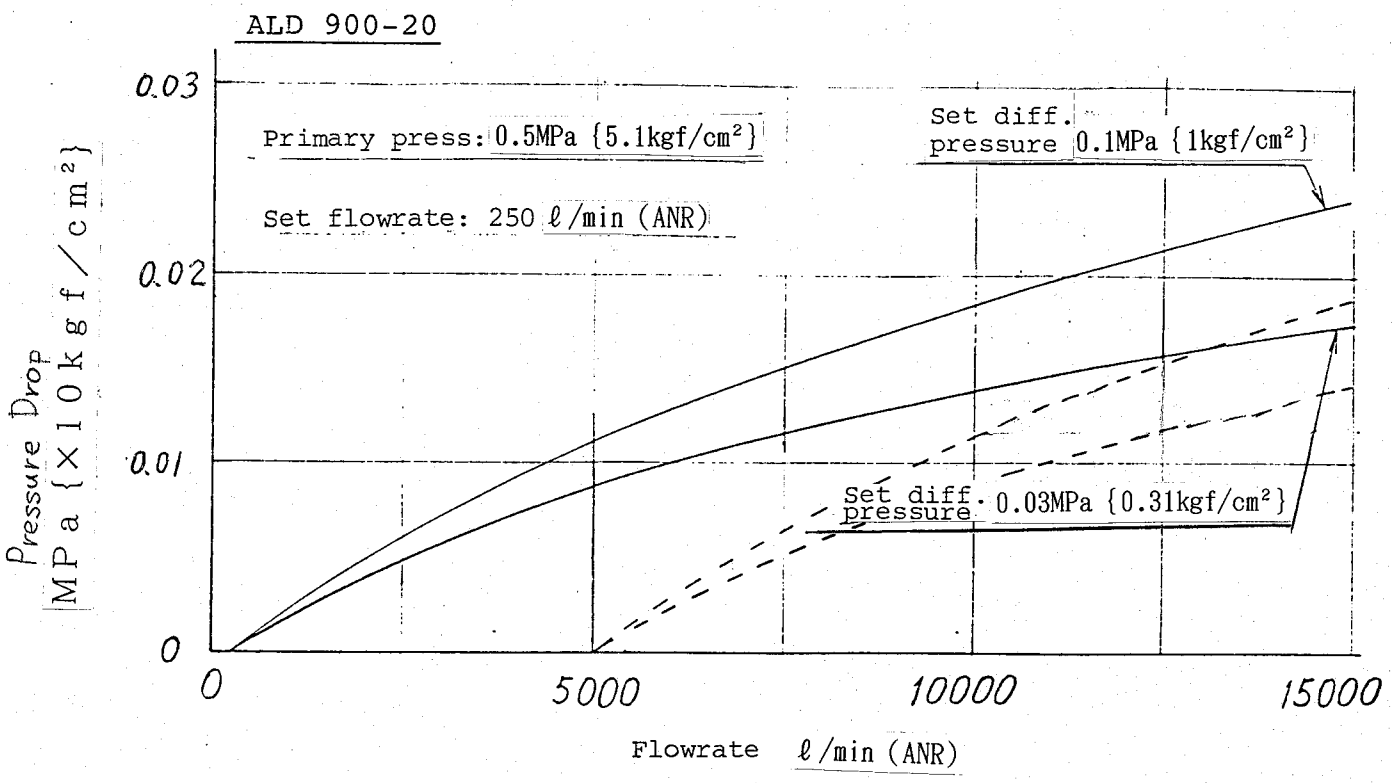
o The above chart shows how to find a pressure drop (an increase in differential pressure) when the flowrate set at 250 ℓ/min (ANR) at a primary pressure of 0.5MPa {5.1kgf/cm²} and a differential pressure of 0.03~0.1MPa {0.31~1kgf/cm²} is increased to 6000 ℓ/min (ANR)

Example: When the flowrate is 250 ℓ/min (ANR) and the differential pressure is set at 0.03MPa {0.31kgf/cm²}, if the consumption flowrate in-

creases to 5000 ℓ/min (ANR), the total differential pressure is a set of differential pressure of 0.03MPa {0.31kgf/cm²} plus pressure drop or an increase in differential pressure of 0.017MPa {0.17kgf/cm²} or 0.46MPa {0.47kgf/cm²}.

- The pressure drop (an increase in differential pressure) with an increase in flowrate when the differential pressure is set at other flowrate will shift in parallel to the right.

  Example: The pressure drop with an increase in consumption flowrate when the flowrate is 3000 ℓ/min (ANR) and the differential pressure is set at 0.03~0.1MPa {0.31~1kgf/cm²} will be shown by broken lines.



Description on Data

o The above chart shows how to find a pressure drop (an increase in differential pressure) when the flowrate set at 250 ℓ/min (ANR) at a primary pressure of 0.5MPa {5.1kgf/cm²} and a differential pressure of 0.03~0.1MPa {0.31~1kgf/cm²} is increased to 15000 ℓ/min (ANR)

Example: When the flowrate is 250 ℓ/min (ANR) and the differential pressure is set at 0.03MPa {0.31kgf/cm²}, if the consumption flowrate increases to 5000 ℓ/min (ANR), the total differential pressure is a set of differential pressure of 0.03MPa {0.31kgf/cm²} plus pressure drop

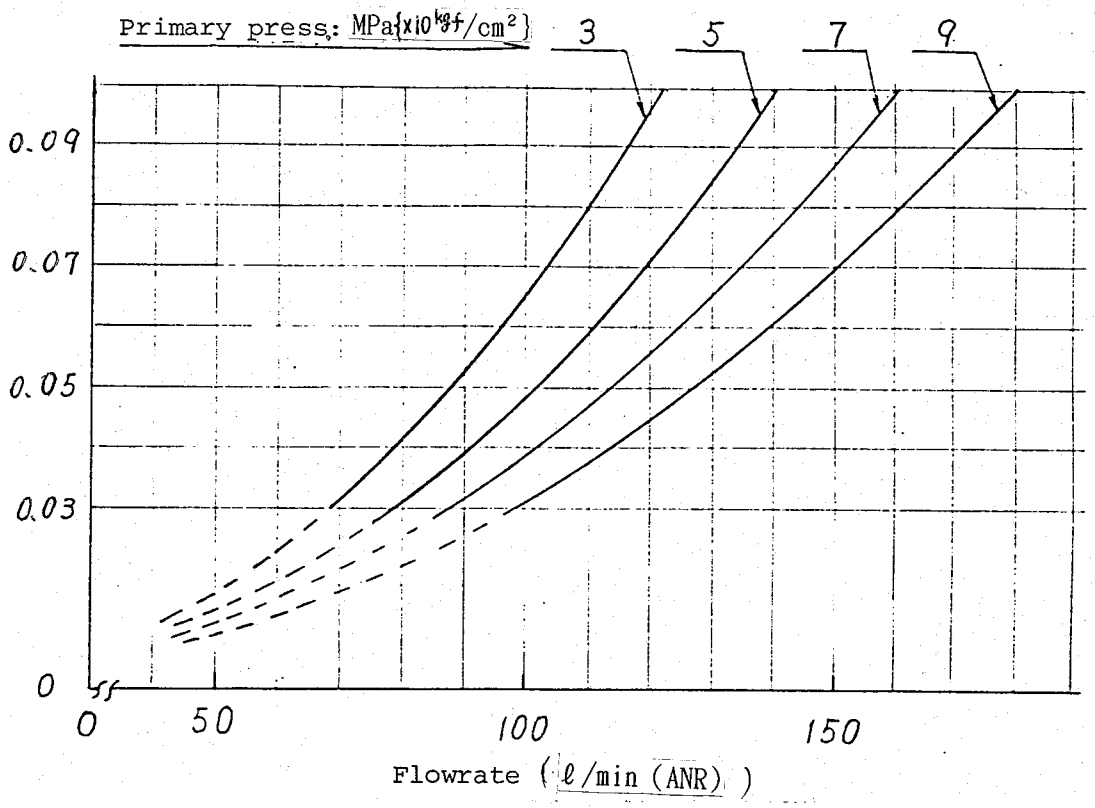
or an increase in differential pressure of 0.009MPa {0.09kgf/cm²}, or 0.038MPa {0.39kgf/cm²}

o The pressure drop (an increase in differential pressure) with an increase in flowrate when the differential pressure is set at other flowrate will shift in parallel to the right.

Example: The pressure drop with an increase in consumption flowrate when the flowrate is 5000ℓ/min (ANR) and the differential pressure is set at 0.03~0.1MPa {0.31~1kgf/cm²} will be shown by broken lines.

o Minimum Flowrate for Setting Differential Pressure

ALD 600, 900



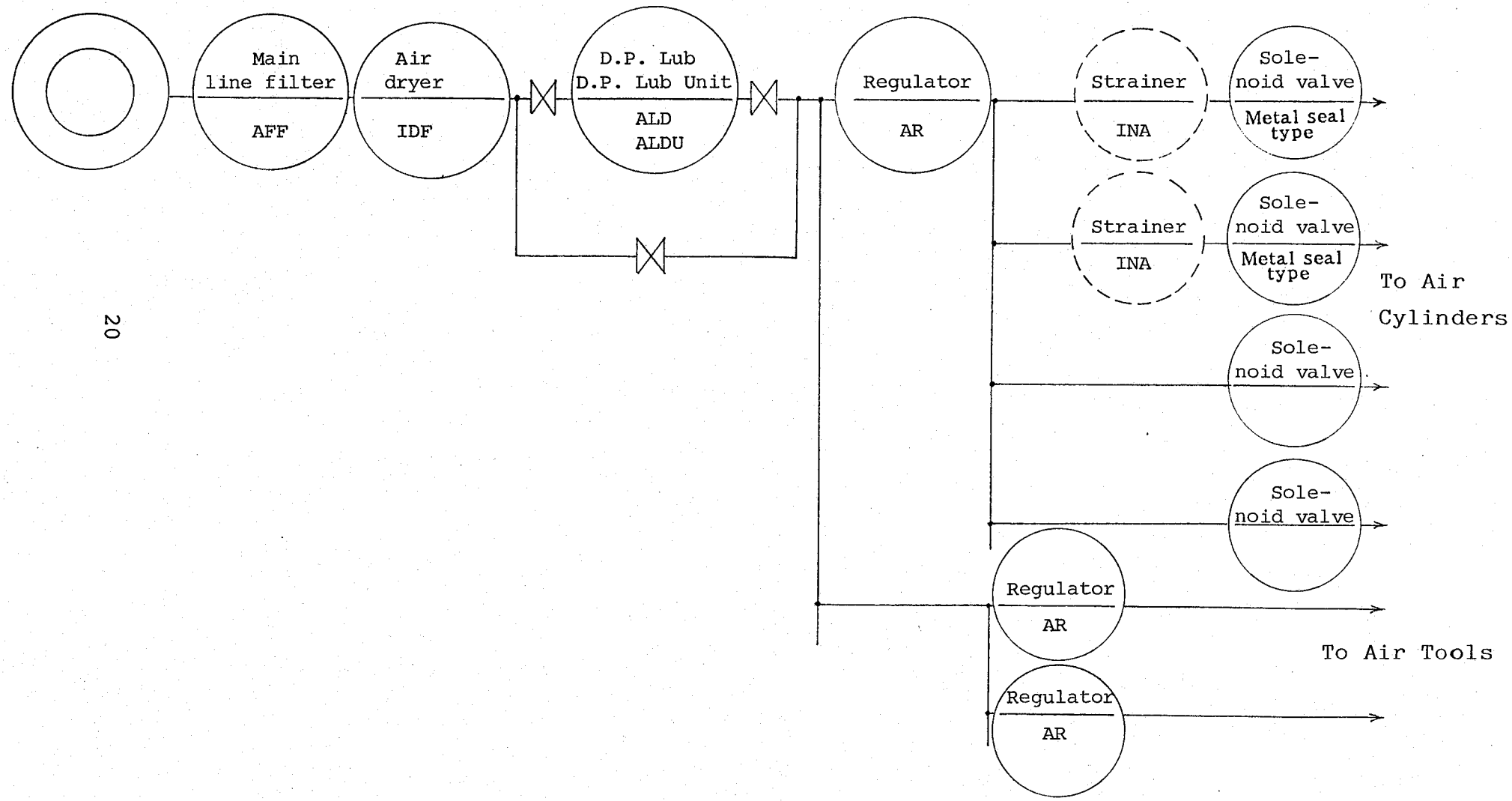
Description on Data

o The above chart shows the minimum flowrate required to set the differential pressure for each pressure.

Example: To set a differential pressure of 0.05MPa {0.51kgf/cm²} at a primary pressure of 0.5MPa {5.1kgf/cm²}, a flowrate of at least 102 ℓ/min (ANR) is necessary. Below this flowrate, differential pressure setting of 0.05MPa {0.51kgf/cm²} is impossible.

VII. PIPING

o Typical Piping Example around D. P. Lub and D. P. Lub Unit



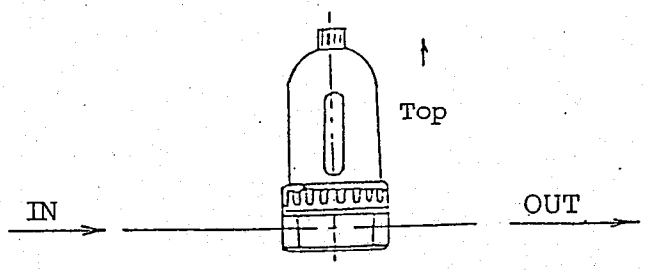
o Strainers for D. P. Lub

Regarding the installation of strainers indicated in the example of model pipes on either side of this unit, when using a metal seal type solenoid valve in a line which employs a solenoid valve etc., cutting chips and foreign matters which find their way into the pipes during piping work may cause incorrect or improper operation. To prevent this, install a strainer upstream of the solenoid valve.

List of Strainers

Model No.	Port Dia	Filtration Accuracy
INA-11-402	Rc (PT) 1/4	5 μm
INA-11-403	3/8	
INA-11-404	1/4 3/8 1/2	
INA-11-405	3/4	
INA-11-406	3/4 1	
INA-11-407	1	

- Strainer installation position



VIII. HOW TO OPERATE

o Setting the Differential Pressure

- Differential pressure should preferably be set at between 0.05~0.06MPa {0.51~0.61kgf/cm²}.
- In applications where consumption flowrate largely fluctuates, set the differential pressure to LOW FLOWRATE which means a low consumption flowrate.
- Rotating the differential pressure adjusting screw clockwise will cause the differential pressure to increase and counter-clockwise to decrease. Differential pressure is read out as difference between both readings on pressure gauges on IN and OUT sides.
- While the line is out of service, air enough to set the differential pressure is not flowing; setting differential pressure, adjustment, and confirmation are impossible.

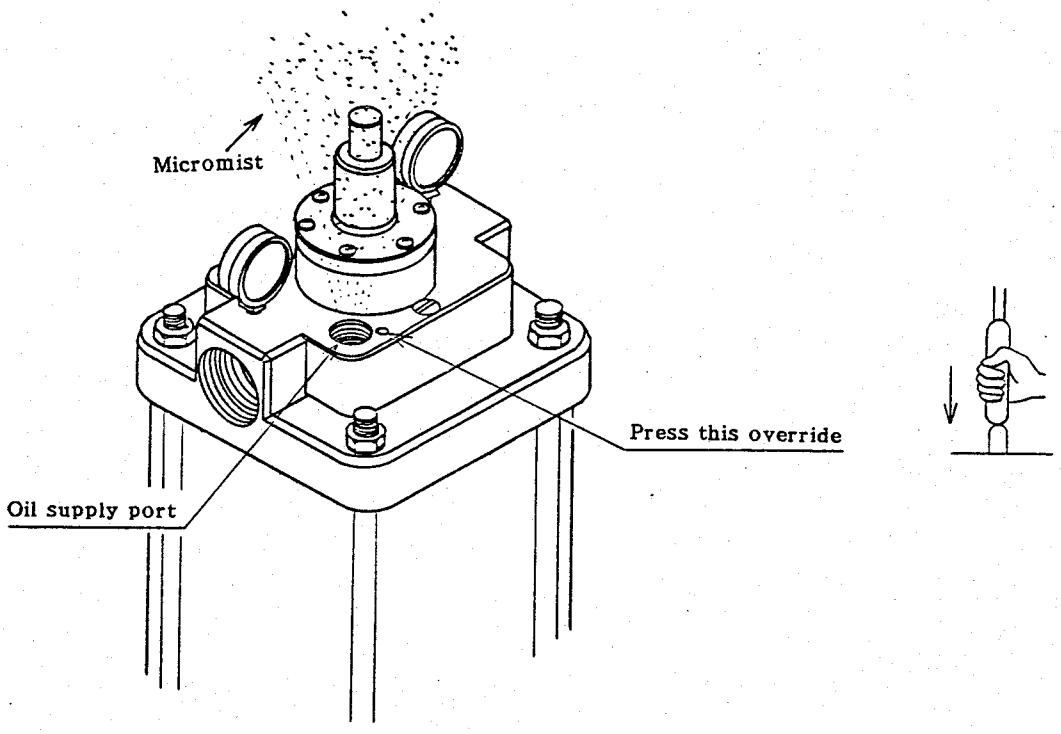
o Replenishing the Oil

- With the oil supply plug loosened two and a half turns, wait until the pressure in the case has completely been evacuated (or until an exhausting noise has vanished), and then remove the plug.

- After the oil has been replenished, replace the plug to the oil supply port, and then the unit can be restored to the pre-replenishment condition.

o Confirming the Micromist

- Remove the oil supply plug in the same manner as in "Replenishing the Oil". Press the tip of the 2-way valve with a tool (such as the grasp of a screw-driver), and micromist is confirmed to be jetted out of the oil supply port.



IX. TROUBLE SHOOTING

o D. P. Lub

Trouble	Possible Cause	Remedy
No differential pressure is developed.	• Flow rate is too low to regulate differential pressure.	• Review line.
	• Loosened differential pressure regulating screw.	• Re-adjust screw and secure by lock nut.
	• Faulty pressure gauge.	• Replace gauge.
Differential pressure developed is too high.	• Too much screwing-in of differential pressure regulating screw.	• Re-adjust screw and secure by lock nut
	• Faulty pressure gauge.	• Replace gauge.
Too much air leaks out of relief port. (ALD 900 type only)	• Poor seal of pilot valve.	• Replace differential pressure regulator
Jetting of micro-mist out of oil supply port is dull.	• Clogged element.	• Replace element
	• Blocked mist generating nozzle.	• Replace nozzle.
	• Invasion of drain.	• Check drain separator (filter) on primary side.

o Filter (with autodrain)

Trouble	Possible Cause	Remedy
Air resistance is too much. (Primary pressure of D. P. Lub has extremely dropped.)	• Clogged element.	• Disassemble filter and clean element.

Trouble	Possible Cause	Remedy
Drain or air keeps blowing out of drain port.	• Operating pressure is below 0.15MPa {1.5kgf/cm²}. Note that to keep blowing for a certain period right before and after start-up of compressor is not a trouble. • Unit is installed on the tilt. • Faulty autodrain.	• Increase operating pressure setting over 0.15MPa {1.5kgf/cm²}. • Correct installation to vertical position. • Replace autodrain.
No drain is discharged.	• Faulty autodrain.	• Replace autodrain.

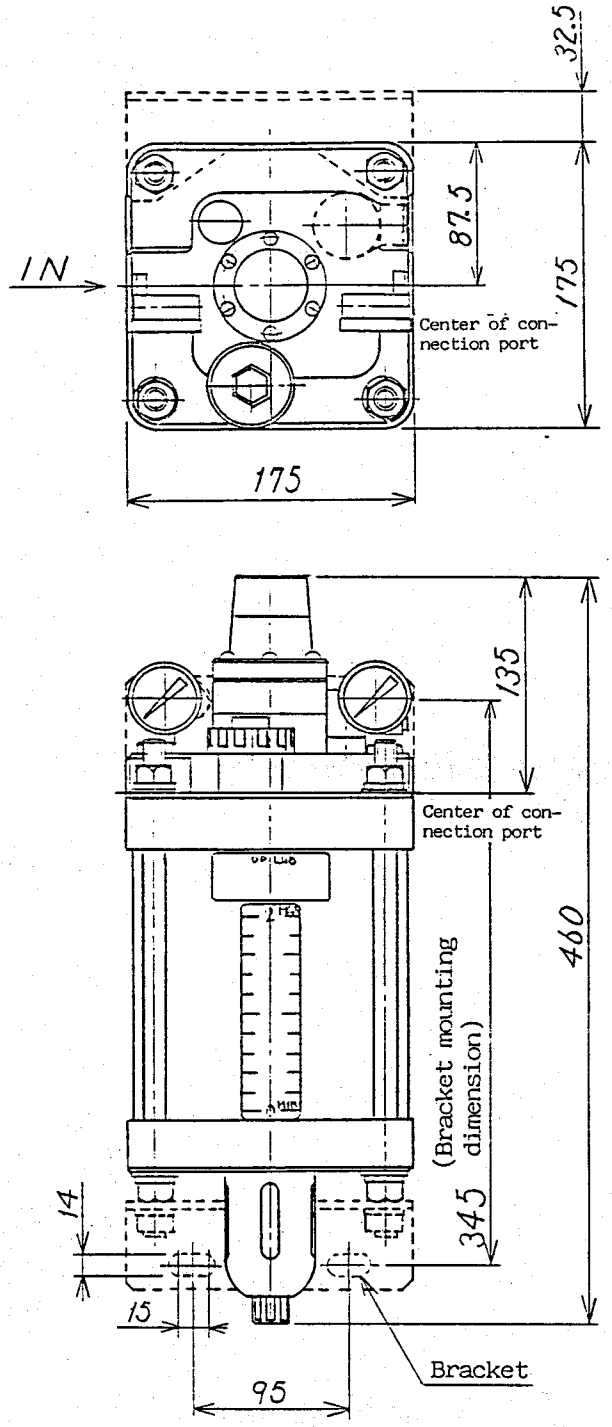
X. PRECAUTIONS

- Before connecting them to the D. P. Lub or D. P. Lub Unit, thoroughly air flush the pipings.
- Before and after the D. P. Lub Unit, provide a bypass piping as shown in Model Piping Example to facilitate servicing.
- Reserve spaces of about 30 cm over and below the unit for servicing.
- In applications where a filter drain piping is provided, the piping should have an inner diameter of at least 10 mm with a length of not more than 5 m. Rising should be avoided.
- Since the case is made of glass-fibre-filled epoxy

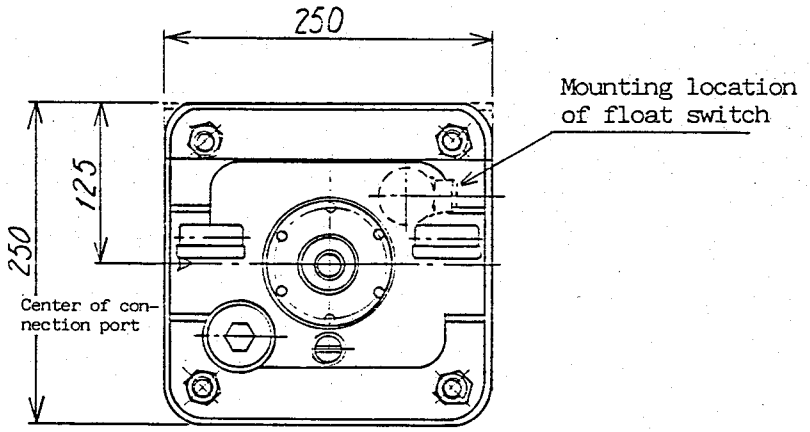
resin and polycarbonate resin, application of chemicals such as thinner, carbon tetrachloride, trichloroethylene, sulfuric acid etc. to the case or the use of the unit in the atmosphere of such chemicals should be avoided.

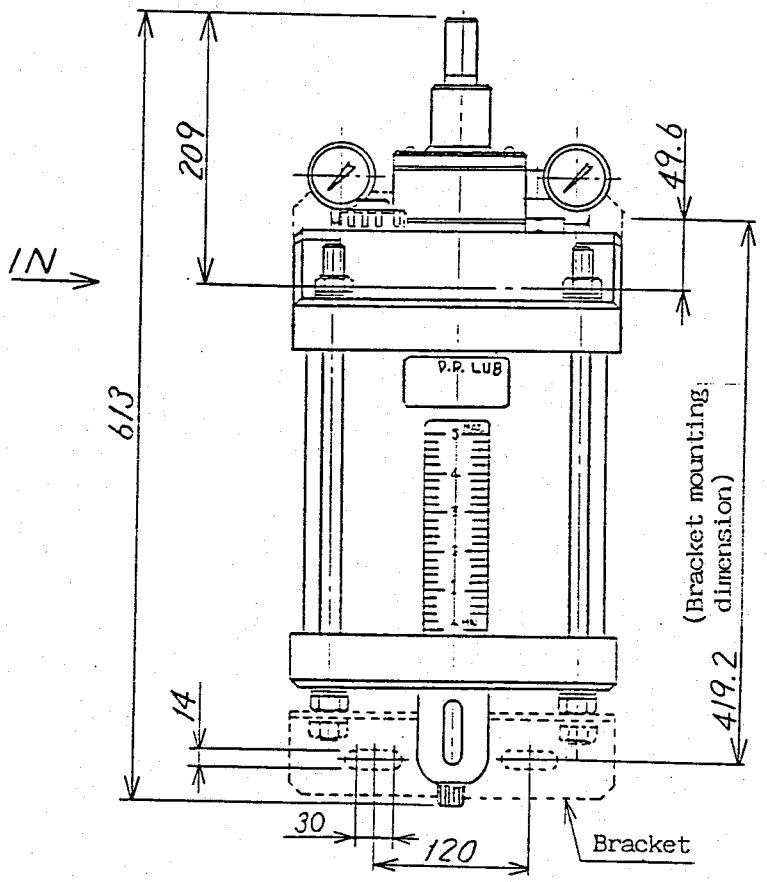
XI. DIMENSIONS

o D. P. Lub ALD 600-06 ~ 10*

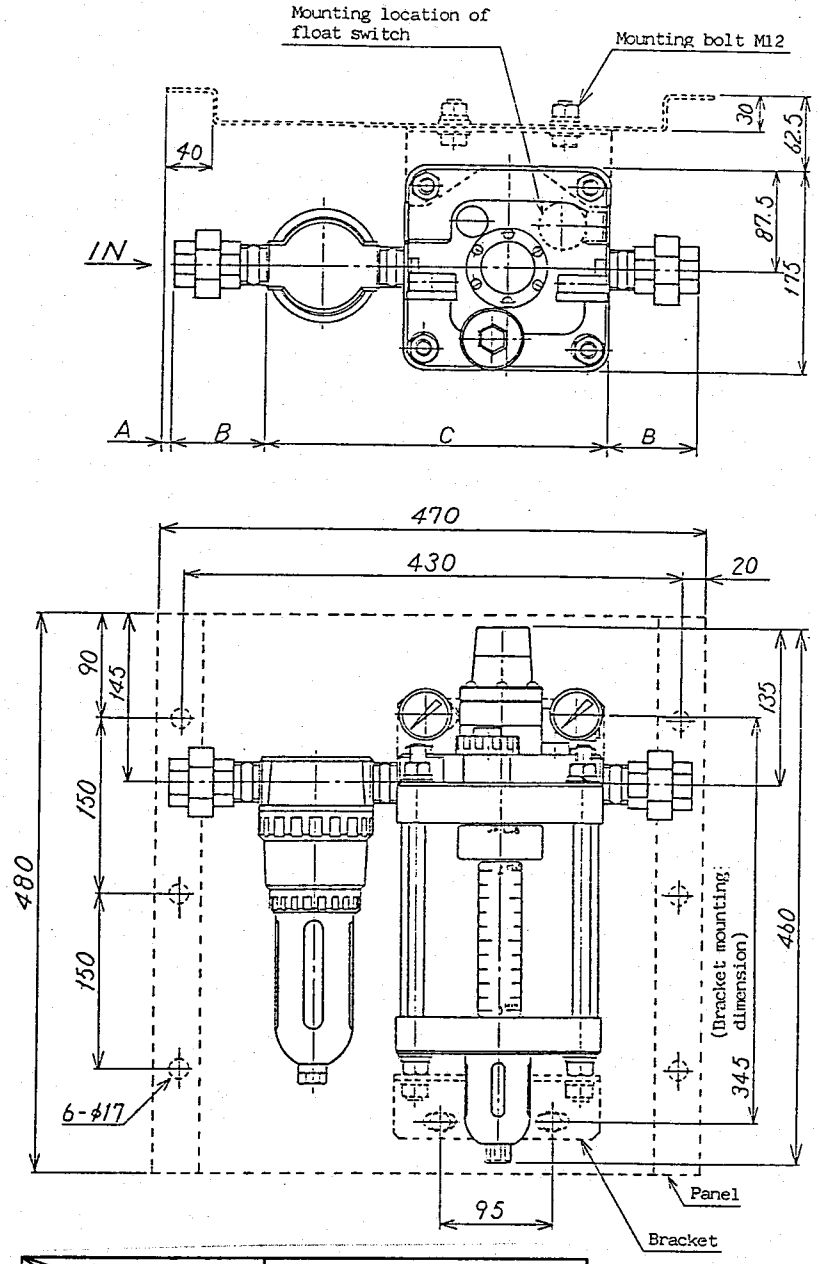


ALD 900-12 ~ 20*


250
Mounting location
of float switch
125
250
Center of con-
nection port

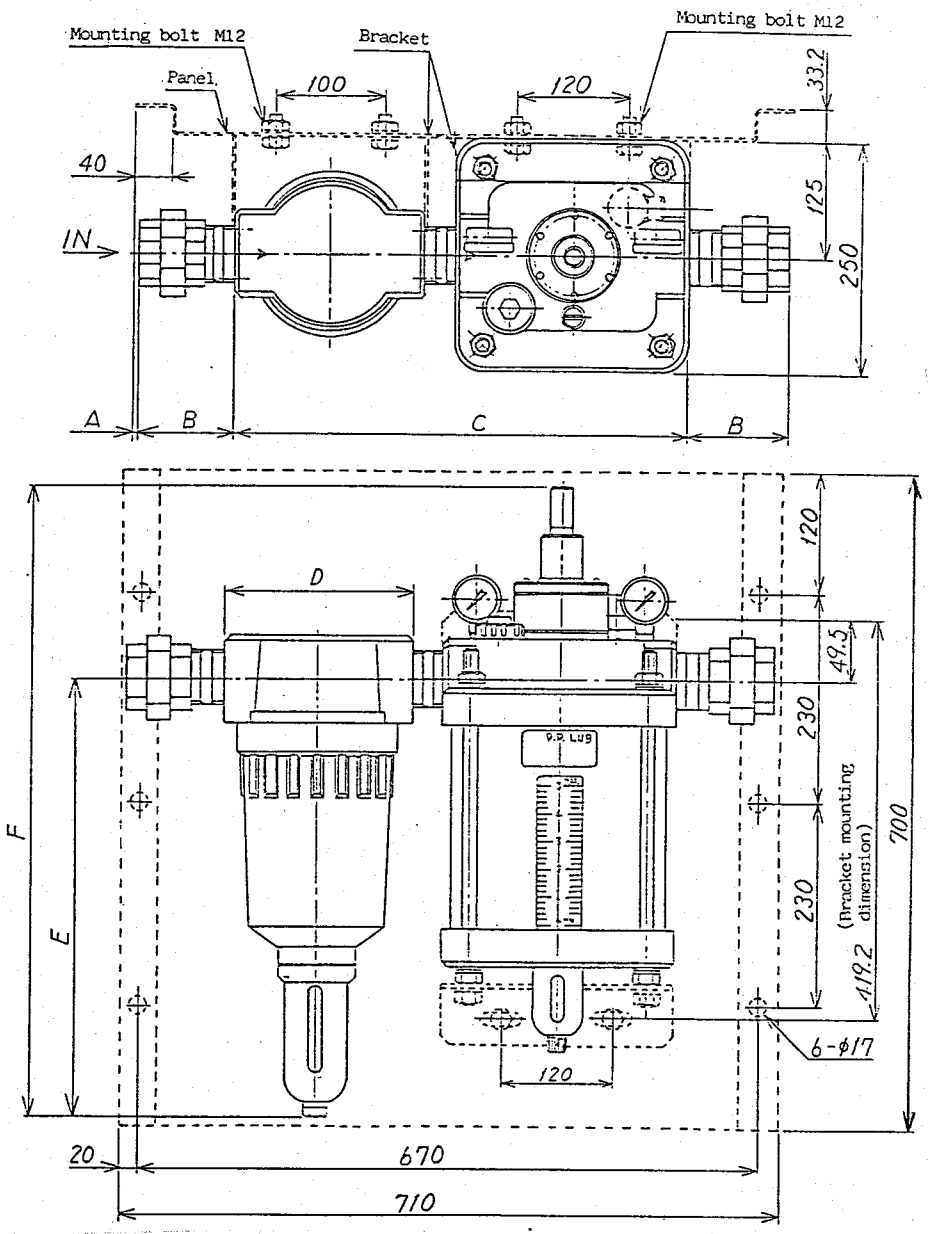

IN
209
49.6
613
P.P. LUB
(Bracket mounting
dimension)
419.2
14
30
120
Bracket

o D. P. Lub Unit ALDU 600-06 ~ 10*



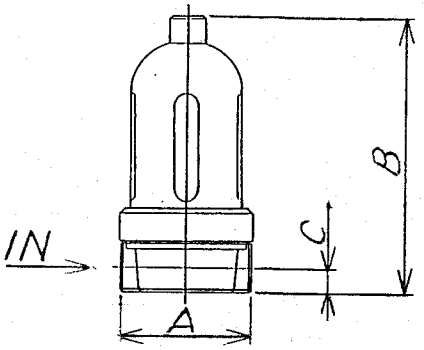
Model / Dim. \ Bore	ALDU 600-06 ~ 10*	
	Rc(PT)3/4	Rc(PT) 1
A	43	10
B	67	77
C	283	296
D	90	100

ALDU 900-12 ~ 20*

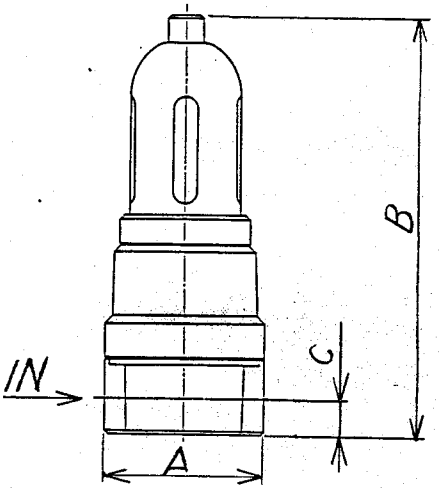


Model	ALDU 900-12 ~ 20*		
Dim. \ Bore	Rc(PT)1 1/4	1 1/2	2
A	57	51	16
B	85	90	100
C	424	424	476
D	150	150	200
E	406	406	473
F	615	615	682

o Strainer for D. P. Lub



INA-11-402 - 405



INA-11-406, 407

Model	Bore Rc(PT)	A	B	C
INA-11-402	1/4	63	141	15
INA-11-403	3/8	63	164.5	15
INA-11-404	1/4 ~ 1/2	80	170	15
INA-11-405	3/4	85	180	20
INA-11-406	3/4, 1	90	230	22
INA-11-407	1	100	251	22