


**INSTRUCTION MANUAL
OF
MICRON-LUB CABINET WITH AIR-OIL HEATER
FOR
A CENTRALIZED MICRON-FOG LUBRICATION**

MODEL NO.
MC6-1024-2S56

The TACO logo is a red, stylized, slanted text mark positioned to the left of the model number.

Related Drawings:

H-8762-01Dimensions

H-8762-02System Diagram of Components

H-8762-03Electrical Wiring

H-8762-04Terminal Box Inside

TACO CO., LTD.

Tokyo Engineering Service: Tel 03-3936-2311 Nagoya Engineering Service: Tel 052-322-1631

Kita-Kanto Engineering Service: Tel 048-556-9511 Osaka-Shiga Engineering Service: Tel 077-553-0611

Ebina Engineering Service: Tel 046-233-6741 Hiroshima Engineering Service: Tel 082-875-4041

Tokai Engineering Service: Tel 0538-43-0451 Kyushu Engineering Service: Tel 093-651-4955

MICRON-LUB CABINET “MC6” Series

Equipped with Air-oil Heater

— for Centralized Micron-fog Lubrication of Heavy Loaded Machine Elements —

1. GENERAL

This Micron-Lub Cabinet is specially designed for Micron-fog lubrication of heavy loaded machine elements such as roll neck bearings of mill that require high viscosity oil.

Ceramic air-oil heater incorporated in the cabinet offers long life and effective air heating as well as oil. This unit can be systematized for automatic oil replenishing by furnishing oil pump, which send pressurized oil to the cabinet reservoir.

2. SPECIFICATIONS

Model No.	MC6-1024-2S56
Lubrication Capacity	700~2000 BI
Air Supply Port	Rc1/2
Micron-Fog Outlet port	Rc2-1/2 (connection with pipe flange)
Supply Pressure Range	0.40~0.70MPa Supply pressure should be higher than operating pressure by 0.2MPa or more.
Operating Pressure Range	0.05~0.35MPa
Air Consumption	19.3 dm ³ /sec (ANR) (at condition of 0.13MPa operating pressure, and with reclassifiers equivalent 1000BI at manifold)
Viscosity of Lubricating Oil	ISO VG 150~VG 680
Reservoir (Tank) Capacity	10.6dm ³ (Effective) (Total 16.1dm ³)
Rated Voltage	AC220V 60Hz (AC200V 50/60Hz)
Electric Consumption	2.5kVA
Mass	Approx. 70 kg

3. CONTAINED CONTROL EQUIPMENTS

1) Air Filter: Model No. F4000-15-FM

Automatic Drain, 5 μ m element, Rc1/2 size.

This is used for removal of both liquids and solids contained in supply air.

The collected liquid is expelled automatically by air pressure through an attached 1/8 size drain waste pipe.

2) 2-Way Solenoid Valve:

Model No. MVS-2204JY-02 AC220V 60Hz.

2-way solenoid valve, Rc1/2 pipe size, normally closed type, with manual override, AC220V 60Hz.

This controls “ON-OFF” of air supply to Micron-Lub cabinet.

This valve is opened when the electrical power is applied.

A manual override screw is provided at the valve body for testing and manual operation.

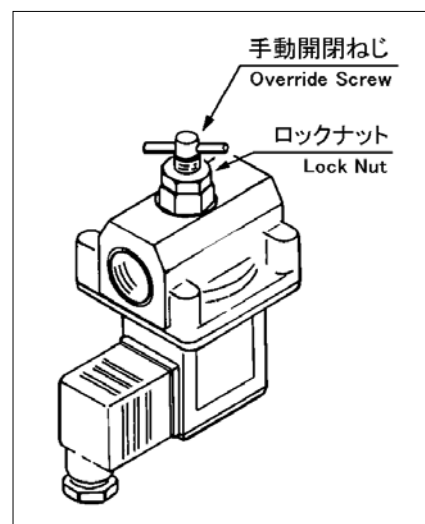


Fig. MVS-2204JY-02

Fully anticlockwise rotation of manual override screw
.....equivalent to electrically de-energized. (Air is not supplied)
Fully clockwise rotation of manual override screw
.....equivalent to electrically energized. (Air is supplied)

Caution: The manual override screw should be kept on fully turned anti-clockwise position during normal lubrication operation.

3) Oil Removal Filter: Parts No. A00916

Automatic Drain, Coalescing type element, Metal bowl with level gauge, Rc1/2.

This removes oil mist in supply air, and protects the air-oil heater and venturi from fouling by deteriorated oil mist.

4) Air Regulator: SK No.95023-09

This regulator adjusts air pressure for operation of Micron-Lub lubricator that generates Micron Fog.

The operating pressure is adjusted with rotating adjusting screw with a screwdriver.

Lock the adjusting screw with lock nut after adjustment of the operating pressure. Adjusted pressure is indicated on the pressure gauge (15).

5) Check Valve:

This valve protects the air-oil heater from oil entering in the event of reverse oil flow happened.

6) Micron-lub Lubricator Head: SK No. 95024-03

Lubrication capacity: 1000 BI

The oil dropped in the sight dome are turned into small oil particles called Micron-fog at the Micron-fog (mist) generator(=venturi-nozzle Assembly)

Oil amount adjusting screw (7) is attached to this head.

8) Relief Valve: SK No. 95212-04

Rc1/2 Size

This is a spring-loaded relief valve for protection of the oil reservoir and is factory adjusted at 0.04MPa pressure.

9), 10) Pressure Switch: Parts No. SPS-5

This provides electrical warning signals in the event of air pressure failure of manifold line.

Warning pressure set is as follows.

(9) is for high manifold (Micron-fog) pressure warning 15kPa

(10) is for low manifold (Micron-fog) pressure warning 3kPa

11), 12) Temperature Gauge: 01070

Dial range: 0—150°C

One is installed at body (11) and the other at oil reservoir (12).

These gauges indicate the temperature of air supplied to lubricator head and temperature of oil in the oil reservoir.

13) Oil Level Switch: SK No.95212-03

These level switches give warning signal of oil level (Lack of oil or Excess of oil in the reservoir) and signal for automatic oil replenishment. A float at oil surface operates level switch.

1. Warning signal for min. oil level.....Contact closes when oil level is fallen
2. Starting signal of oil replenishment...Contact closes when oil level is fallen

3. Stopping signal of oil replenishment···Contact closes when oil level is risen
4. Warning signal for max. oil level······Contact closes when oil level is risen

• Electrical specifications of the Oil Level Switches

	Contact Cap.	Max. Voltage	Max. Electric Current	Withstanding Voltage
AC	50VA	200V	0.5A	280V
DC	50W	200V	0.5A	400V

14) Oil Level Gauge: 05676-03

This indicates the oil amount in the reservoir. Oil surface should be always visible below the max. oil level line. The space above the max. oil level line is necessary to generate the Micron-fog.

Over-filling will impair the function of the Micron-Fog generation.

DO NOT OVERFILL THE OIL.

15) Pressure Gauge for Set of Operating Pressure:

Dial range: 0~0.4MPa

Indicates set pressure for lubricator head

Air regulator (4) can adjust operating pressure according to required BI rate.

16) Pressure Gauge for Manifold Pressure:

Dial range: 0~30kPa.

Indicates Manifold pressure.

Manifold pressure can be read when 3 way valve (20) for gauge protection is turned on.

17) Air-Oil Heater: SK No. 95212-01

Electrical Consumption: 2.0kVA

This heater heats air. This is installed into the oil tank from the body block.

Oil is also heated thru surface of air-oil heater case.

This is adjusted with thermal controller temperature adjusting knob in the terminal box (19).

18) Thermister: 01021

This is inserted directly before the Micron fog generator, and senses air temperature supplied to the lubricator head. Signal of thermister is used to control temperature by air-oil heater constantly.

19) Terminal Box

All electrical wiring for the electrical equipments in this cabinet are made on terminal blocks in this box.

Thermal controller, which controls the temperature of Air-oil heater, is installed in this terminal box.

20) 3-way valve: 05035-19

Normally, the passage to manifold pressure gauge can shut to prevent over-pressurization with this valve. When the button is pushed, the passage from inside of the reservoir to manifold pressure gauge is open to indicate manifold pressure.

4. INSTALLATION

4-1 MOUNTING

Micron-lub Cabinet should be securely mounted with the mounting bracket at both sides. The space for maintenance, adjustment and oil replenishment should be considered before installation.

4-2 AIR SUPPLY

Air inlet port (Rc1/2) located on the left side of the cabinet should be supplied clean air through clean pipes.

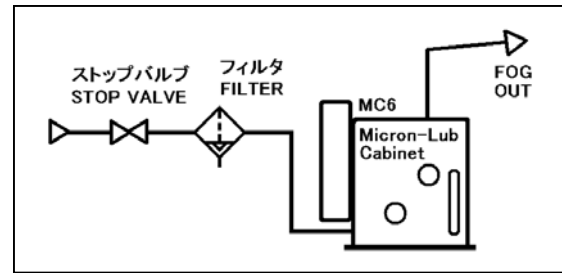


Fig. AIR SUPPLY

4-3 MICRON-FOG OUTLET

Micron-fog outlet is located at the right backside of the cabinet. A pipe flange of Rc2-1/2 is furnished for manifold piping.

Correct piping using clean pipes should be required. Before piping work, refer to Technical report No.3 and No.32.

4-4 DRAIN LINE

Connect piping to the drain port of air filter and oil removal filter and conduct drain to convenient place. Caution should be taken to avoid stress exerted on bowl of filter by plumbing and vibration of machine.

Drain is expelled automatically, so the end of drainpipe should be opened. Flexible tubing is recommended for a drain waste line.

4-5 AUTOMATIC OIL FILL CIRCUIT

Automatic oil fill circuit is furnished on the back of the cabinet.

This consists of a globe valve, Y-strainer, 2-way solenoid valve and oil flow calculation meter.

4-6 ELECTRICAL CONNECTIONS

All electrical devices in the cabinet are connected to terminal box located at the right side of the cabinet, according to the electrical circuit diagram.

4-7 MANUALLY INITIAL OIL REPLENISHMENT

Manual oil replenishment port is located at the left side of the cabinet. Fill the clean oil to the reservoir. If the reservoir is empty, fill oil about 15~17dm³. Max. oil level is shown on the level gauge glass on the reservoir.

High viscosity oil is needed some minutes to indicate the correct oil amount on the gauge glass as oil column arises slowly.

DO NOT OVERFILL THE OIL.

5. ADJUSTMENT

5-1 INITIAL OPERATION

Adjustment is made as follows after the correct piping and electrical wiring are confirmed.

1. Supply air to the cabinet. Open the shut off valve in the air supply line, if installed.

2. Turn on the electric source for the cabinet and energize the 2-way solenoid valve.

If the solenoid valve cannot be energized electrically due to relations to electrical sequence controls at testing, use the manual override screw.

Turn the manual override screw clockwise completely, 2-way valve is held at electrically energized position.

If the air-oil heater cannot be energized at manual operation of 2-way valve, due to relations to electrical sequence controls, efficiency of Micron-fog generator is lowered.

Manual operation should be restricted within under mentioned case.

- 1) Manual override screw should be used to confirm set pressure of air regulator and/or manifold pressure.
- 2) Use as an emergency measure at coil failure of 2-way solenoid valve. In this case, it is important to confirm air-oil heater working normally.

If the air-oil heater is not working, the operation of the system should be ceased immediately and take a measure to meet the situation.

Note: If the machines and/or plants enter to automatic operation, fix the manual override screw at de-energized position.

5-2 ADJUSTMENT OF AIR PRESSURE

Air flows to thru regulator the 2-way solenoid valve. Adjust operating pressure slowly utilizing the air regulator.

If the adjusting screw is locked by lock nut, release the lock by unscrewing the nut.

At adjustment of operating pressure, refer to relational diagram of pressure setting and lubrication capacity.

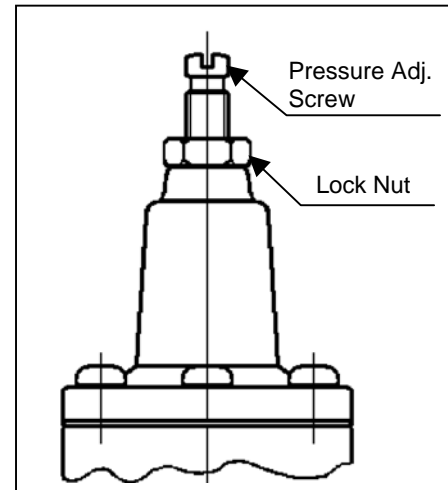
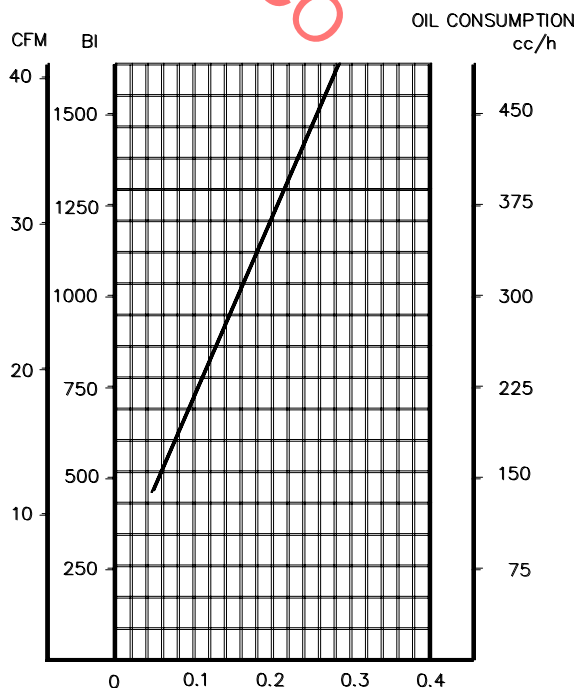


Fig. Regulator Section

Manifold pressure should be adjusted by air regulator in the range of 3~15kPa.

If manifold pressure out of the range 3~15kPa required, pressure setting for the pressure switches should be changed similarly. (Refer to 8. Pressure settings change procedure of pressure switch)

In case that desired manifold pressure couldn't be obtained by adjustment of air regulator, following case can be considered.

- Air leakage from manifold piping
- Plugging of Micron-fog generator
- Malfunction of air regulator

5-3 ADJUSTMENT OF AIR-OIL HEATER

- Air temperature adjusting screw is factory adjusted at 70°C.
If it is requested to change according to ambient temperature and oil viscosity to be used, adjust air temperature adjusting screw. Dial of this adjusting screw does not indicate air temperature directly. It should be used only for the aim when adjusting.

Exact air temperature is indicated by temperature gauge (11).

- Low warning of air temperature is factory adjusted to warn at 50°C
- High warning of air temperature is factory adjusted at 85°C.

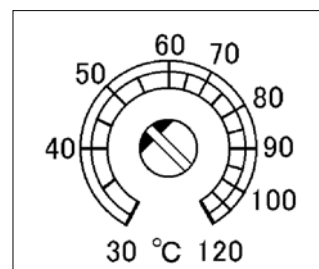


Fig. TEMP. ADJUSTMENT

Do not re-adjust the setting of warning temperature except the special use.

Stable air and oil temperature are realized after 30~60 minutes elapses after the electric power turned on.

Temperature Set of Thermal Controller	Low Air temp. warning ▼		Set temperature of operating air ▼		High Air temp. warning ▼	
	50°C ± 5		70°C ± 5		85°C ± 5	
	ALARM ON		ALARM OFF			
	AIR HEATER ON			AIR HEATER OFF		

Note:

When starting up the Micron-Fog cabinet below 0°C of ambient temperature, thermal controller studies a cut of thermistor, which effects non operation of air-oil heater. In this case, temperature around thermistor (13) is needed increased above 0°C by heating with lamp and so on.

5-4 ADJUSTMENT OF OIL OUTPUT

- Adjustment of oil feed adjusting screw

At the beginning of operation, oil amount adjusting screw should be adjusted at max. position. So, oil flows down from oil tube with max. oil amount.

After 30 minutes or more passed from starting operation, throttle the oil amount adjusting screw within the range of maintaining continuous oil flow.

(Even if adjusting screw adjusted at entirely closed position, oil amount flowed down from oil tube does not become zero. That means, whenever it is, minimum oil amount can be maintained.)

- Oil feed adjustment

1) Adjustment of oil amount adjusting screw

Clockwise rotation → Decrease the oil output amount

Anticlockwise rotation → Increase the oil output amount

2) Adjustment by operating pressure with air regulator

Decreasing the operating pressure → The output oil amount decrease.

Increasing the operating pressure → The output oil amount increase.

Micron-fog is impinged on the bearings by pressure difference between manifold pressure and atmospheric pressure.

Manifold pressure should be kept within 3~15kPa whenever operating pressure is re-adjusted with air regulator.

3) Adjustment of air temperature adjusted by air-oil heater

Increasing the adjusted temperature → Oil output amount increase

Decreasing the adjusted temperature → Oil output amount decrease

- Actual oil consumption is visually indicated by change of oil level in the oil level gauge on the reservoir. Change of oil level by 1cm means oil is consumed about 857cm³.
- Flowing oil from oil tube in the sight dome should be used only for confirmation if the oil is continuously and stably supplied.

6. OIL REPLENISHMENT

Micron-Lub cabinet is furnished with oil level switch which issues electrical signals for automatic oil replenishment.

6-1 Oil replenishment during operation

1) Automatic oil replenishment

Oil fill signal issued by the oil level switch operates the automatic oil replenishing circuit and is used to keep oil amount suitably in the reservoir.

The oil amount switching oil level switches

[Unit: dm³]

Oil amount in the reservoir	Total	0 ~ 5.5 ~ 9.0 ~ 9.8 ~ 16.1 ~
	Effective	0 ~ 3.3 ~ 6.8 ~ 7.6 ~ 13.9 ~
Upper limit level switch		ALARM OFF ALARM ON
Lower limit level switch		ALARM ON ALARM OFF
2-way oil fill valve		OFF ON OFF

* Scale of oil level gauge indicates effective oil amount in the reservoir.

2) Manual oil replenishment

1. The operation of the cabinet is required to stop for manual oil replenishment. Oil replenishment after the closing of or before the opening of operation is recommended.
2. Close the stop valve installed on air supply line. Then wait for about 1 minute until air pressure in the reservoir would be exhausted and pressure gauge (16) indicate no pressure.
3. After completed the oil replenishment, close filler plug tightly. Then supply air-oil output may be sometimes changed due to air flow stop for oil replenishment and etc. Confirm the condition of oil flow in the sight dome if big change is occurred after oil replenishment.

Also confirm operating pressure and manifold pressure. Same care mentioned at “INSTALLATION-Initial manual oil replenishment” is needed.

High viscosity oil is needed some minutes to indicate the correct oil amount on the gauge glass as oil column arises slowly. If oil surface exceeds the max. oil level line, excessive oil should be drained from oil drain port.

3) Confirmation

When the pressure, air and oil temperature become normal operating condition, generation and output of Micron Fog should be confirmed.

1. Confirm if the oil is supplied to fog generator thru oil tube in the sight dome.
2. Confirm if the manifold pressure is proper.
3. Confirm if Micron Fog is flowing by disconnecting one of the feed lines from the manifold system and visually observed the Micron-Fog escaping.
Connect the feed line as before and adjust air pressure finally.

7. OPERATION

Turn the electric power switch “ON” in order to energize the Micron-lub lubrication system. When 2-way solenoid valve is energized and manifold pressure switch issue the signal of normal condition, air-oil heater is turned on. Air will be heated in the heating room of the air-oil heater and flow down toward Micron-Lub lubricator (venturi-nozzle) where micron fog is generated.

Air-oil heater heats the oil in the tank at the same time. Oil viscosity is decreased by this heating, that will make the lubricator (venturi) generate micron fog easily.

The heated air passing through the fog generator causes the oil in the reservoir to flow up thru the siphon tube to sight feed dome and drip into the fog generator.

This oil also is heated by air-oil heater. Oil flowing into fog generator is visible at the sight dome on the lubricator head.

When oil passes the fog generator, the oil is divided into fine oil particles, called Micron-Fog by heated air jet. Heavier oil particles will return to the oil in the reservoir. Only $2\mu\text{m}$ or less oil particles can be delivered to each lubrication point thru Micron Fog outlet of the cabinet.

A nozzle like fitting called reclassifier is installed at each lubrication point. Reclassifier reforms Micron-Fog to convenient form to adhere to sliding surfaces. Because Micron-Fog can not be used for lubrication as it is, as Micron-Fog is featured by fine and light oil particles which are air-borne to each lubrication point without falling even in the long piping.

A timer is furnished to disregard alarm signals of air temperature or manifold pressure issued at the start of operation of the system. Timer should be set suitably to each application, where alarm signals does not issued until the operating condition is settled to normal state after power source turned ON.

8. WARNING

- For the appropriate operation and protection against troubles, various warnings and signal indicating operation state are prepared.
- For manifold Pressure:
 - Abnormally High manifold Pressure → Warning of Over 15kPa
 - Abnormally Low manifold Pressure → Warning of Under 3kPa
 - When issued warning for manifold air pressure, confirm the pressure on manifold pressure gauge and make countermeasure.
- For Oil Level:
 - Abnormally High Oil Level → Warning of Over Max. Oil Level
 - Abnormally Low Oil Level → Warning of Under Min. Oil Level
 - Automatic Oil Replenishment Signal → 2-way solenoid valve is changed ON/OFF for automatic oil replenishment.
 - When issued warning for oil level, confirm the oil level on oil level gauge and make countermeasure.
- For Air Temperature:
 - Warning → Abnormally Low Air temperature of under 50°C
 - When issued warning for temperature, confirm the temperature on air temperature gauge and make countermeasure.

9. A WAY OF CHANGING PRESSURE SETTINGS OF PRESSURE SWITCH

- * Pressure switch capable to adjust the settings.
- * Provided with Single pole double throw contacts, two points-control signals are transmitted at the same time for either ON or OFF at upper limit and lower limit.
- * Pressure sensing element is made of stainless bellows standing against corrosion, creep, hysteresis, etc.

- * Reliable snap action switch mechanism adopted.
- * Accumulative error is minimized by simple construction.

The actuating pressures of the pressure switch unit delivered are adjusted in accordance with the specifications.

When the actuating pressure is to be altered for some reason, observe the following instructions.

- 1) Remove the cover after turning off the switch
- 2) Have a setting screw (A) to plus direction when the whole unit is lifted with the pressure differences in the upper and lower limits fixed.
- 3) Where the upper limit is altered with the lower limit fixed, turn the setting screw (B) to let for increasing the upper limit but to right for decreasing.

(The distance between the junctions should not exceed the maximum of 1.2mm but not less than 0.5mm)

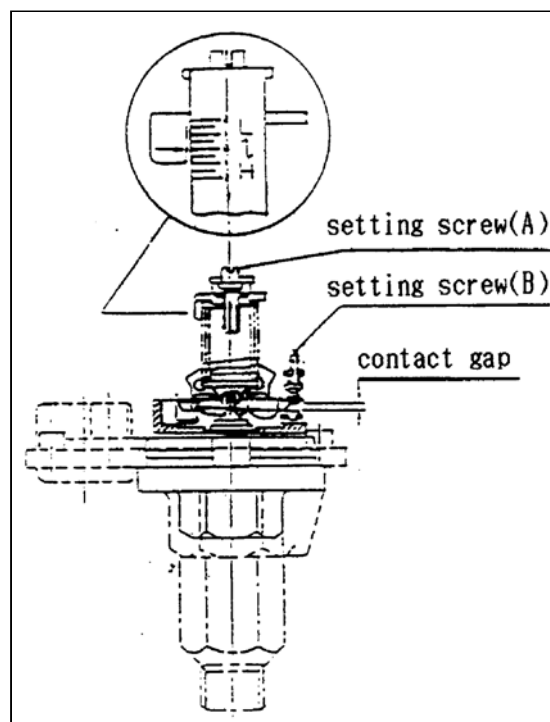


Fig. Adjusting screws for changing pressure settings of pressure switch

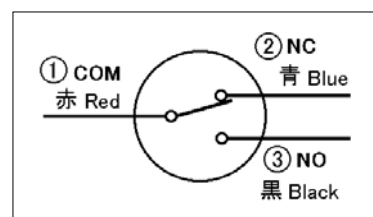
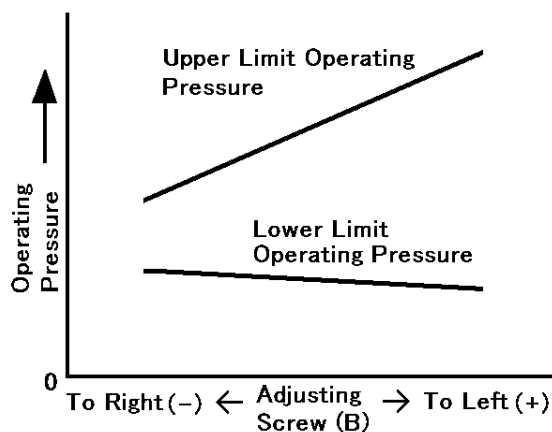
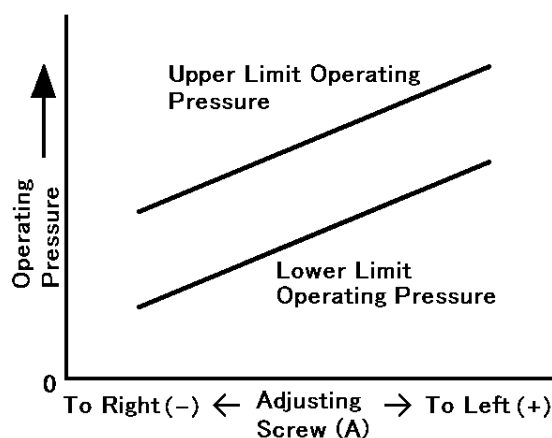


Fig. Terminals of switch

Terminal & Switching action

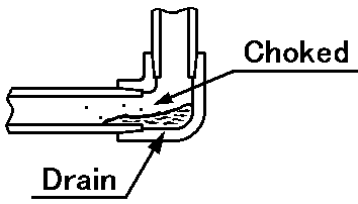
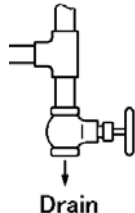
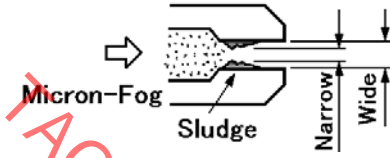
① - ②

ON at the upper limit
OFF at the lower limit

① - ③

OFF at the upper limit
ON at the lower limit

10. TROUBLE & TROUBLE-SHOOTIG

CONDITIONS	CAUSES	COUNTERMEASURES
1) Abnormally high manifold pressure	1. Manifold piping is choked up by drain oil accumulated.	Drain oil may be especially accumulated at straight up portion of manifold piping. Furnish stop valve for drainage.
		
2) Abnormally low manifold pressure	2. Plugging of nozzle by carbon and/or sludge plug or throttle the nozzle.	Replace nozzle or remove carbon and sludge accumulated around the nozzle.
		Remove contaminant.
3) Abnormally high manifold pressure	3. Plugging up of nozzle with contaminant entered at piping.	*Reset air regulator.
	4. Incorrect pressure setting by air regulator	*At impossibility to reset pressure, replace air regulator.
4) Abnormally low manifold pressure	5. Air leakage from manifold piping by slack of screwed portion or defect of welded portion	Prevent air leakage by proper countermeasure.
	Stop valve being left open	*Tighten the screwing portion.
5) Abnormally high manifold pressure	6. Shortage of nozzle	*Repair and/or replace the welded portion.
	7. Incorrect pressure setting by air regulator	*Close the stop valve.
6) Abnormally low manifold pressure	8. Malfunction of 2-way solenoid valve.	*Attach nozzle.
	Breakage of coil	*Reset pressure correctly with observing pressure gauge.
7) Abnormally high manifold pressure		If pressure cannot be corrected, replacement of regulator is needed.
		If pressure setting is correct, but manifold pressure is in correct, check manifold piping and/or Micron-fog generator portion.
8) Abnormally low manifold pressure		*Replace 2-way solenoid valve.
		*Replace coil.

	<p>9. Plugging of Micron-fog generator</p> <p>10. Plugging of filter element (A00916)</p>	<p>*Replace Micron-fog generator. (Refer to procedure 1.)</p> <p>*Replace filter element.</p>
3) Insufficient supply pressure	<p>1. Stop valve in air supply line is not opened sufficiently.</p> <p>2. Plugging of filter element in supply line</p> <p>3. Pressure down in main line</p>	<p>*Open stop valve fully.</p> <p>*Change air supply line to separately prepared supply line.</p> <p>Replace and/or clean filter element as soon as possible after that change air supply line to main line.</p> <p>*Keep minimum pressure for the operation.</p>
4) Pressure indicated on pressure gauge seems normal pressure value.	<p>4. Malfunction of pressure gauge (especially in manifold pressure gauge). Gauge pointer does not indicate "0", when solenoid valve is de-energized.</p> <p>5. Discrepancy of set pressure of low manifold pressure switch.</p>	<p>*If a pointer does not indicate "0" point after the operation is ended, replacement of pressure gauge is needed.</p> <p>*Readjust set pressure of low manifold pressure switch.</p>
5) Abnormal oil level <ul style="list-style-type: none"> • Excess of oil • Lack of oil 	<p>1. Excess of oil caused by leakage from automatic oil replenishment circuit.</p> <p>2. Malfunction of oil level switch</p> <p>3. Lack of oil by missing the oil replenishment</p> <p>4. Leakage of oil from oil reservoir and related piping</p>	<p>*Check the cause of leakage of automatic oil replenishment circuit.</p> <p>Drain excessive oil from oil drain port and keep oil amount under max. oil level line.</p> <p>*Replace oil level switch.</p> <p>*Replenish the oil when oil level reaches to the min. oil level.</p> <p>*Repair and/or replace wrong parts.</p>

6) Abnormal air temperature	<p>*Reset adjusting temperature to the proper value.</p> <ol style="list-style-type: none"> 1. Set temperatures of thermal controller are changed wrongly. For example, adjusting temperature is set in the high or low warning temperature range. 2. Shortage of air amount flowing into manifold piping <p>Low manifold pressure warning is issued simultaneously. Air-oil heater working is stopped automatically by the warning signal of low manifold pressure.</p> <ol style="list-style-type: none"> 3. Malfunction of air-oil heater 4. Malfunction of thermister 5. Malfunction of thermal controller 	<p>*Check the cause of low manifold pressure and remove the cause.</p> <p>*Replace air-oil heater.</p> <p>*Replace thermister.</p> <p>*Replace thermal controller.</p>
-----------------------------	---	--

11. How to replace Micron-fog generator

• Disassembling

1. Unscrew three set screws ①, and remove sight-dome retainer ②.
2. Remove sight-dome ③ dome gasket ④ and O-ring ⑤.
3. Take off drip tube ⑥ and baffle ⑦.
4. Venturi ⑧ can draw off from the body by screwing a M6 bolt on top of the venturi.

• Assembling

Assemble each part in the reverse order of disassembling. When assembling, take care not to enter contaminant.

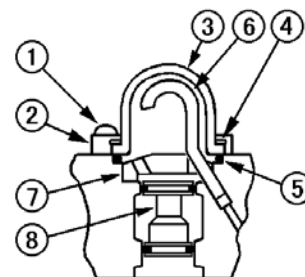


Fig. Micron fog generator