

**ULVAC**

**INSTRUCTION MANUAL**

**OIL MIST TRAP**

**(CARTRIDGE FILTER ELEMENTS)**

**MODEL**

**TM-2**

**TM-3**

**TM-4**

**TM-4S**

Read this manual before operation and keep it at your hand for immediate reference
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**ULVAC, Inc.**

**Components Division**

**<http://www.ulvac.co.jp/>**

# Table of Contents

1. Before Using This Product .....	1
1.1 Warning Label Types and Display Positions .....	2
1.2 Warning Label Display Positions .....	2
2. General Description.....	3
2.1 Features.....	3
2.2 Specifications.....	3
2.3 Dimensional Drawings.....	4
2.4 Structure.....	6
3. Method of use.....	7
3.1 Examination .....	7
3.2 Installation to the Pump .....	7
3.3 Ducting.....	7
3.4 How to Handle Trapped Oil .....	7
3.5 Oil return mechanism (Option) .....	8
4. Inspection and Maintenance .....	11
4.1 Periodical Inspection.....	11
4.2 Replacement of Filter Element .....	11
4.2.1 Dismounting a Filter Element.....	11
4.2.2 Mounting of a Filter Element.....	11
4.2.2 Continuity check of the filter element.....	13
5. Caution .....	14
5.1 Clogging of Filter Element .....	14
5.2 Pressure-releasing Device .....	14
5.3 Exhaust of Inflammable Gas and Gas having property of increase the susceptibility of substances to burn .....	14
6. Warranty .....	15
7. Major Replacement Parts.....	16

Request Form for Repair/Inspection of ULVAC Components /Certificate of Contamination  
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## Attached Tables and Illustrations

Fig.1 TM-2, TM-3, TM-4, TM-4S dimensional drawing .....	4
Fig.2 TM-2F, TM-3F, TM-4F dimensional drawing .....	5
Fig.3 Structures .....	6
Fig.4 Oil return mechanism A installation (VD, VS) .....	9
Fig.5 Oil return mechanism A installation (PKS).....	9
Fig.6 Oil return mechanism B installation (VD, VS).....	9
Fig.7 Oil return mechanism B installation (PKS).....	9
Fig.8 Oil return mechanism C installation (VD).....	10
Fig.9 Oil return mechanism C installation (VS).....	10
Fig.10 Exploded view of filter element .....	12
Fig.11 Continuity check of the filter element .....	13
Table.1 Specifications.....	3
Table.2 Oil return mechanism models.....	8
Table.3 Major replacement parts list (TM-2) .....	16
Table.4 Major replacement parts list (TM-3) .....	16
Table.5 Major replacement parts list (TM-4) .....	16
Table.6 Major replacement parts list (TM-4S).....	16
Table.7 Making format for names and contents of hazardous substances or elements .....	17

## 1. Before Using This Product

Thank you for purchasing the oil mist trap (hereafter, "this trap") made by ULVAC (hereinafter, "we"). To ensure safety, upon receiving the trap, confirm that it matches the details of your order and has not been damaged in transit or for another reason.

This instruction manual (hereinafter, "this document") describes appropriate handling and maintenance procedures to safely use this trap and to maximize its performance. Read this document in advance to properly use this trap.

Install and operate this trap according to the safety-related laws and regulations (such as fire prevention laws and electrical wiring regulations) in your country or region. To this end, you must first attend a publicly recognized general safety training (including on electrical and loading safety topics) in your country or region. Never handle this trap without first undergoing safety training. The operator must attend such training. The operator must have expertise, skills, and certifications related to electricity, machinery, loading, vacuum usage, and other fields.

This trap has been designed to conform to the rules in place when this document was created. Conformity is not guaranteed because the applicable standards may change in the future.

Performance and safety may not be ensured if equipment connected to this trap does not conform to the same rules or if the trap is altered. In such cases, we cannot guarantee (take responsibility for) performance or safety. Product alterations made by the customer are not covered by the warranty, and we cannot take responsibility for them.

Before installing or removing this trap, separate all energy sources (including power and cooling water) from the product.

None of this trap's parts may continue to be used permanently while maintaining the performance upon delivery. Performance inevitably degrades after a certain amount of time elapses, thus increasing the likelihood of product problems even in assumed common usage scenarios. We ask that our customers perform preventive maintenance to avoid problems in accordance with their usage scenarios.



By performing preventive maintenance measures, you can lower the probability of problems with this trap due to parts failures caused by parts becoming worn out as well as the probability of other risks, such as downtime caused by trap problems, fire, or effects on other processes.

From the viewpoint of preventive maintenance, we also ask our customers to prepare maintenance and inspection plans and to replace parts and perform overhauls according to such plans.

If you have any questions about handling or other matters, please contact our nearest sales office or dealer.

## 1.1 Warning Label Types and Display Positions

Attach warning labels to the warning locations on this pump. Before operating this pump, be sure to confirm the warning contents.

	<p>Do not operate this trap while equipment is attached that prevents gas from moving to the exhaust port (e.g., that blocks the exhaust port). The trap's internal pressure may rise, causing the casing or level gauge to rupture, oil leakage, or motor overload.</p> <p>Explosive or flammable gas, gas that increases the susceptibility of substances to fire, or other gas may ignite inside the trap, thus increasing the trap's internal pressure. Do not exhaust gas that has these characteristics.</p>
	<p>Before use, read through the instruction manual and fully understand its contents.</p>

## 1.2 Warning Label Display Positions

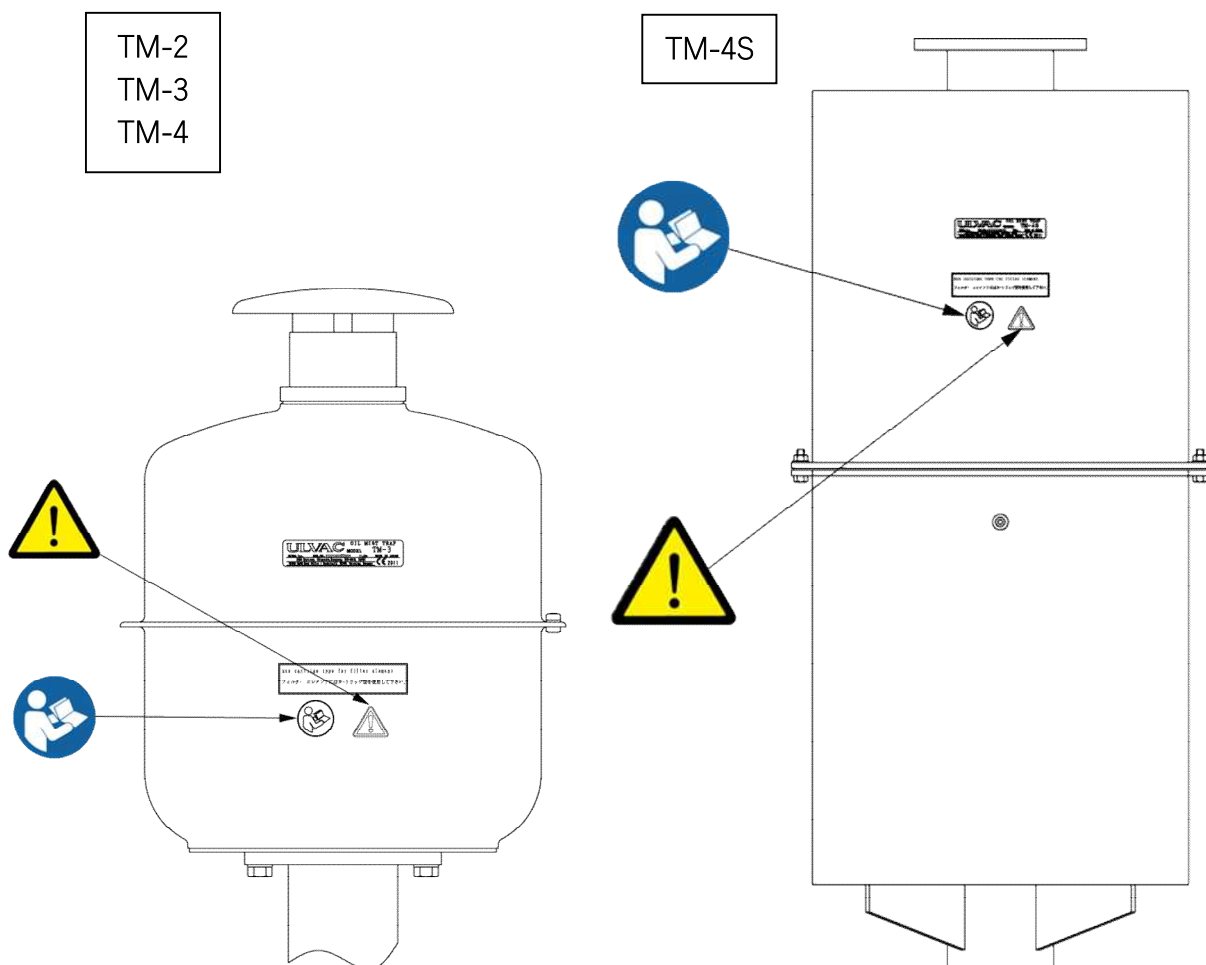


Fig.0 Warning label display positions

## 2. General Description

### 2.1 Features

(1) Oil mist (oil smoke) removal

This oil mist trap, which removes about 90% of oil mist exhausted from an oil sealed rotary vacuum pump, will keep the work environment from being contaminated with oil mist; as well as serve as a silencer.

(2) Adoption of cartridge filter elements

The cartridge filter elements have facilitated the replacement of filter elements when clogged or corroded.

### 2.2 Specifications

Table.1 Specifications

Model		TM-2	TM-3	TM-4	TM-4S
Adopted filter element		TM-2E	TM-3E	TM-4E	TM-4SE
Maximum procession flow $\text{m}^3/\text{h}$ <sup>*1</sup> (L/min)		96 (1600)	180 (3000)	420 (7000)	420 (7000)
Connecting parts dia. <sup>*2</sup>	Pump side	VG50	VG80	VG100	VG100
	Exhaust side	G2 internal thread <sup>*3</sup> [VG50] <sup>*4</sup>	G3 internal thread <sup>*3</sup> [VG80] <sup>*4</sup>	G4 internal thread <sup>*3</sup> [VG100] <sup>*4</sup>	VG100
Outside dimensions (mm)	Total height	475 [450] <sup>*4</sup>	735 [700] <sup>*4</sup>	1160 [1120] <sup>*4</sup>	1387
	Total width	Φ287	Φ362	Φ442	Φ450
Weight (kg)		9.3 [9.8] <sup>*4</sup>	17 [18] <sup>*4</sup>	35 [36] <sup>*4</sup>	64

\*1) Flow at atmospheric pressure.

\*2) JIS vacuum flange (JIS B 2290) are adopted.

\*3) The G corresponds to the PF in former coding.

\*4) Codes in [ ] show specifications for TM-2F, 3F and 4F.

# 2.3 Dimensional Drawings

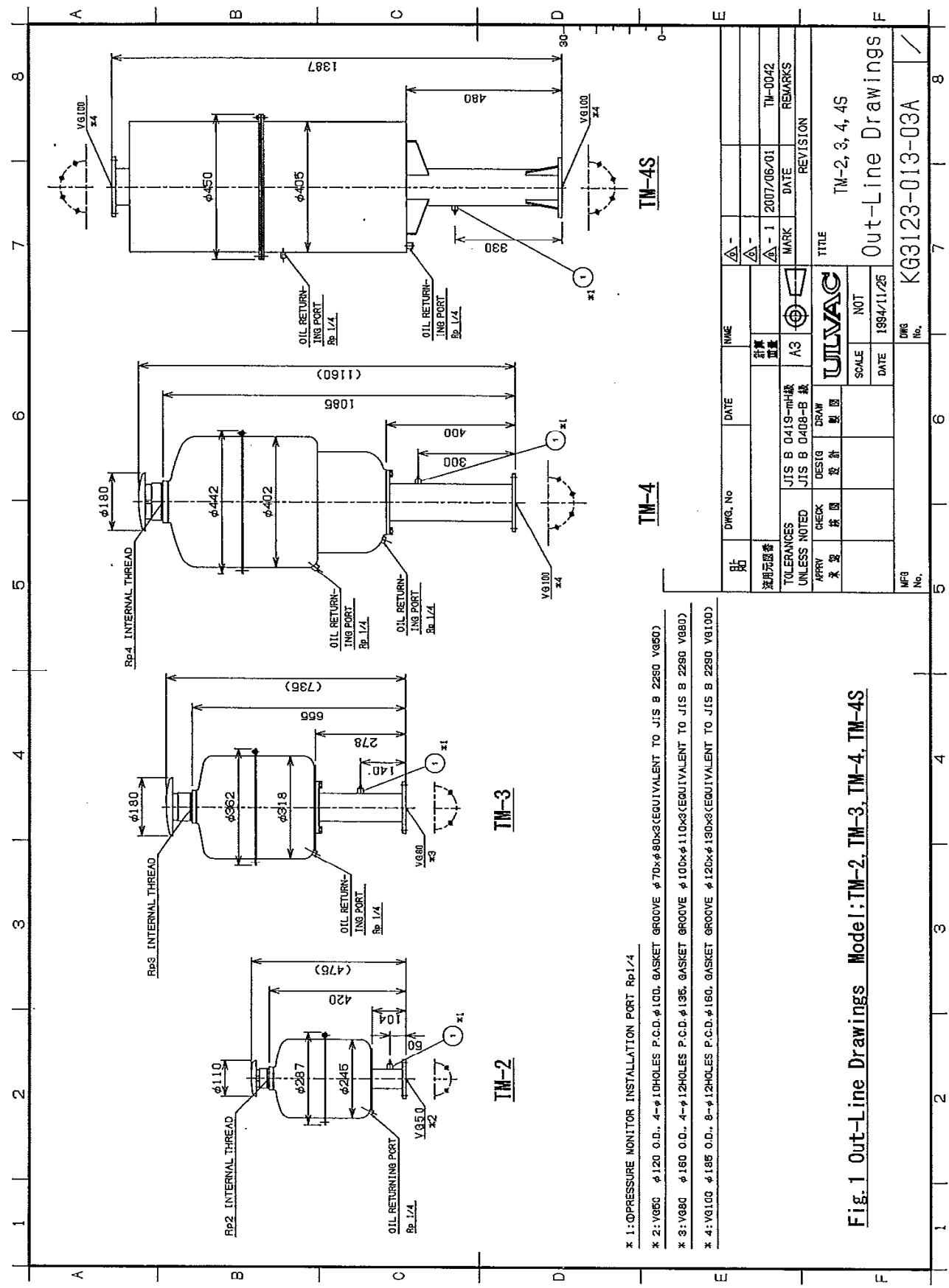


Fig.1 TM-2, TM-3, TM-4, TM-4S dimensional drawing

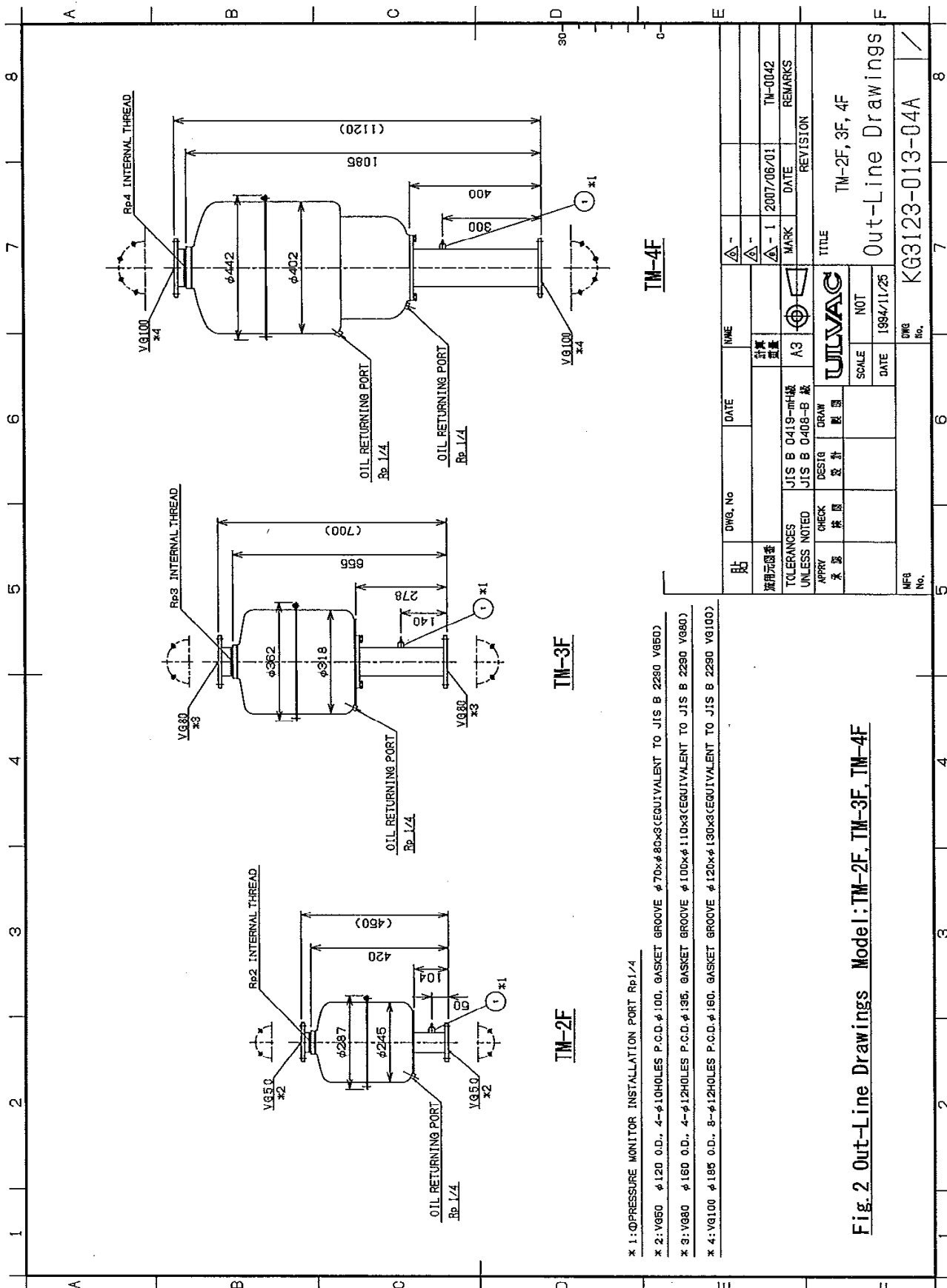


Fig.2 TM-2F, TM-3F, TM-4F dimensional drawing



## 2.4 Structure

(1) Gas (air, nitrogen, etc.) exhausted from an oil sealed rotary vacuum pump blows up the oil inside and enters an oil mist trap along with particles of misted oil. These fine oil particles (oil mist) get trapped when going through a filter element.

Rather large aggregated oil particles are collected between the main body of the oil mist trap and the filter element, and get exhausted from an oil returning port. Most of the oil mist will be removed before the gas comes out from the outlet.

(2) This unit has a pressure-releasing device.

Clogging of a filter element may cause hazardous pressure rise at start-up or during evacuation of a vacuum chamber. A pressure-releasing device, which opens a mechanical valve to release internal pressure when it reaches 0.04MPa (0.4kg/cm<sup>2</sup>) (gauge pressure), is a standard equipment. With this device, internal pressure will never rise too rapidly.

(Note) When starting a pump, especially when the oil temperature is low, the pressure-releasing device which functions for a moment to meet the temporary rise of internal pressure may let out a little smoke. Nevertheless, it is not attributed to filter element clogging.

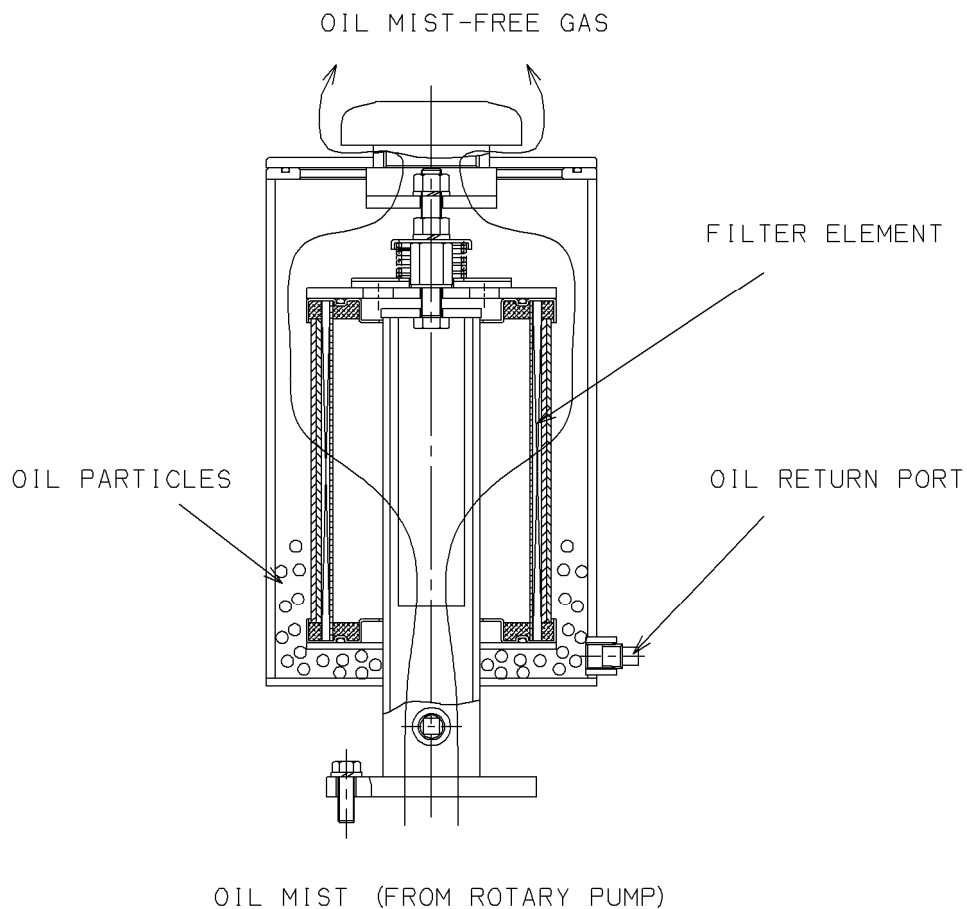


Fig.3 Structures

### 3. Method of use

#### 3.1 Examination

The products are delivered with maximum care, but for reassurance, confirm the followings after unpacking.

- (1) That the product is what you have ordered.
- (2) That it has proper accessories (an instruction manual, other ordered parts, etc.)
- (3) That there was no damage, or loosening of screws or nuts during the transportation. If there was any problem, contact our sales department or the specified dealer.

#### 3.2 Installation to the Pump

To install the unit to the pump:

- (1) Confirm that there is no flaw or adhesion of dusts on flanges of the pump and the TM, or on the O-ring ditch.
- (2) Attach an O-ring to the O-ring ditch of the flange at the lower part of the TM, and fasten it to the outlet port of the pump with a hexagon bolt.

#### 3.3 Ducting

The exhaust side of nl-2, 3, and 4 has a shade as a standard equipment. When ducting, detach it and use an internal thread. For TM-2F, 3F, 4F, and 4S, a JIS ducting flange (JIS vacuum flange) is useful.

(Note) When ducting, be careful not to put too much force on the main body of the oil mist trap. Too much force may damage the product.

#### 3.4 How to Handle Trapped Oil

TM-series products structurally exhaust trapped oil out of the main body through an oil returning port. Connect a nylon hose to the oil returning port and collect the exhausted oil in a separate container. You can return it to the pump from the oil filler port when the pump is operating without load or not operating at all. However, oil contaminated with water, dust, or some agent such as acid that deteriorates the oil may cause mechanical troubles, and hence shall not be returned to the pump.

(Note) Do not connect the oil returning port and the pressure monitor installation port with a nylon hose, etc. Oil mist will not be trapped under such condition.

### 3.5 Oil return mechanism (Option)

Oil return mechanism is designed to return the trapped oil in oil mist trap to the pump. 3 models of oil return mechanism are available according to the operating pressure and conditions.

Table.2 Oil return mechanism models

	Details	Recovery method	Effect on ultimate pressure	Recommended pressure range				
Oil return mechanism A	Oil returns into the pump case through the check valve when the pump stops.	Semi-auto	Low					
Oil return mechanism B	Oil returns from the gas ballast port through the needle valve.	Manual	Some					
Oil return mechanism C	Oil returns from the inlet port side through the needle valve.	Manual	High					
Atmospheric pressure				[Pa] 1	10	100	1000	10000
				[Torr / mbar] 0.01	0.1	1	10	100
				Continuously-workable pressure range				
				Repeatable working pressure range				

#### Oil return mechanism A

Oil returns into the pump case through the oil filling plug. The oil back to the oil mist trap is prevented by the check valve.

CAUTION: The oil doesn't returns to the pump when the gas flows in the pump case. Only when the pump is operated under no load or at stop.

#### Oil return mechanism B

Oil returns into the pump compression process through the gas ballast port.

CAUTION: Oil return mechanism B shall cause to rise the ultimate pressure. The gas ballast cannot be performed unless the oil is completely recovered since using the gas ballast port. On the other hand, the ability of oil returns is reduced because the pump compression process time is increased for the operation under the high pressure.

#### Oil return mechanism C

Oil returns into the inlet port.

CAUTION: At the oil recovery, Oil return mechanism C causes to rise the ultimate pressure because the same as a leak at the inlet port.

Oil return mechanism installation

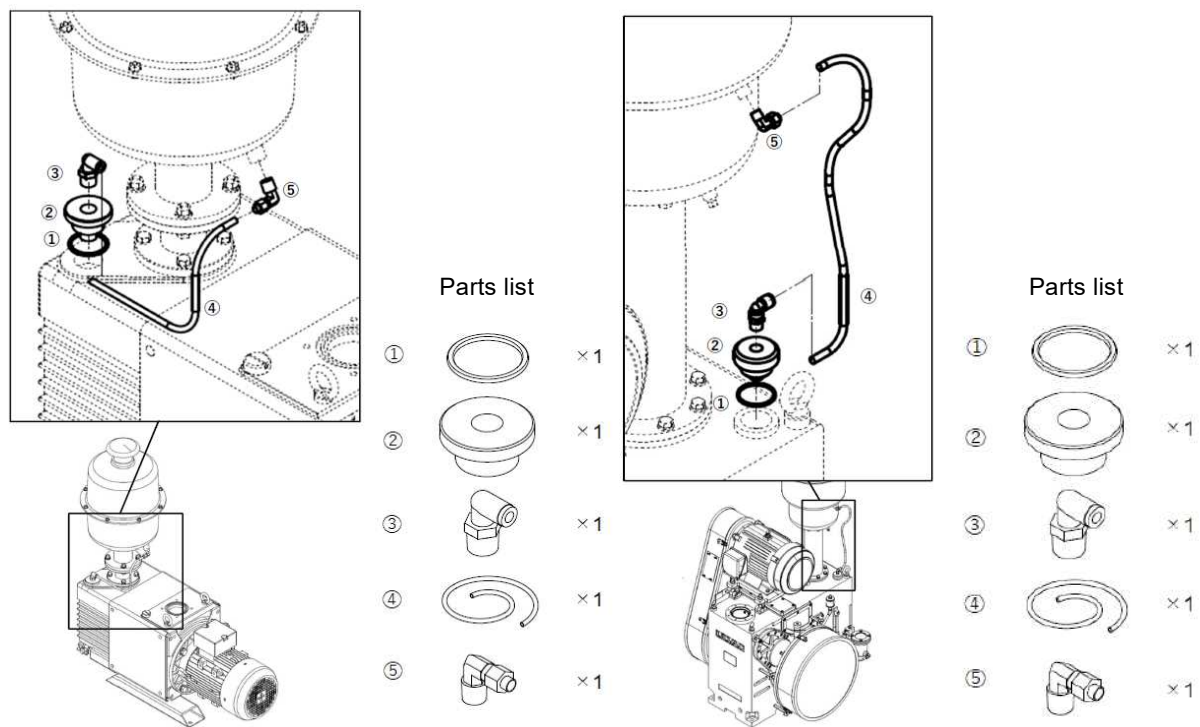


Fig.4 Oil return mechanism A installation (VD, VS)

Fig.5 Oil return mechanism A installation (PKS)

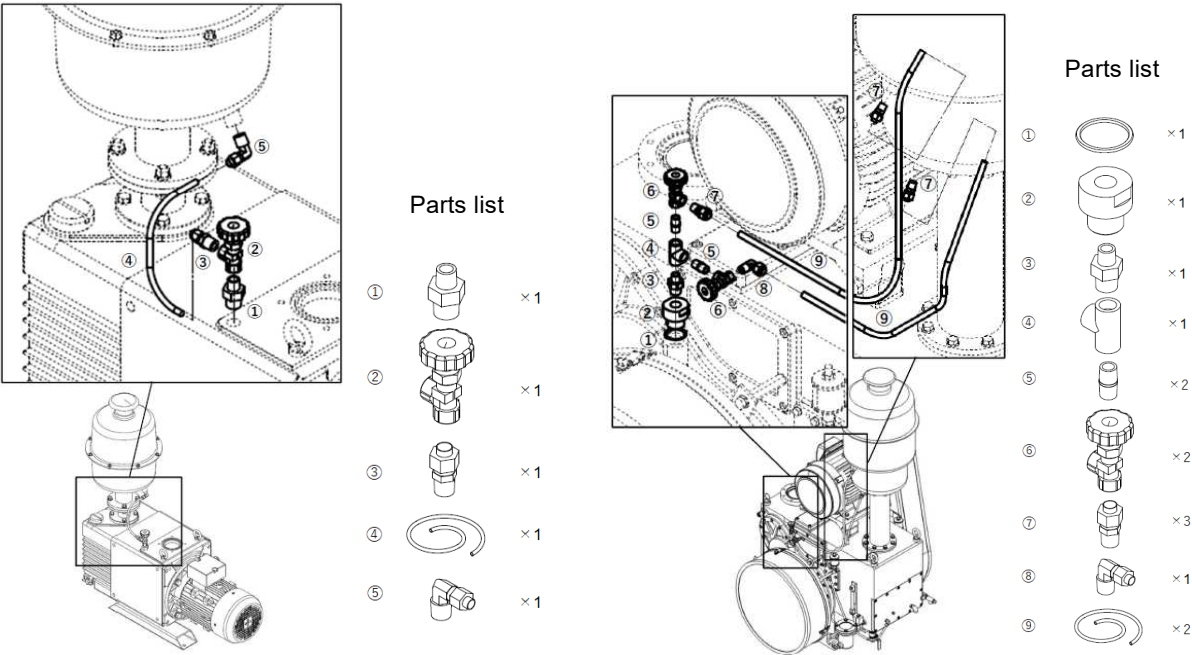


Fig.6 Oil return mechanism B installation (VD, VS)

Fig.7 Oil return mechanism B installation (PKS)

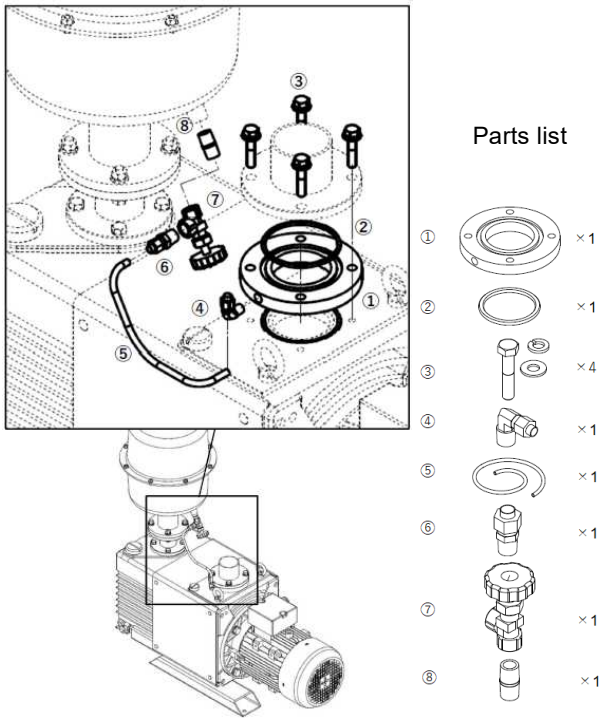


Fig.8 Oil return mechanism C installation (VD)

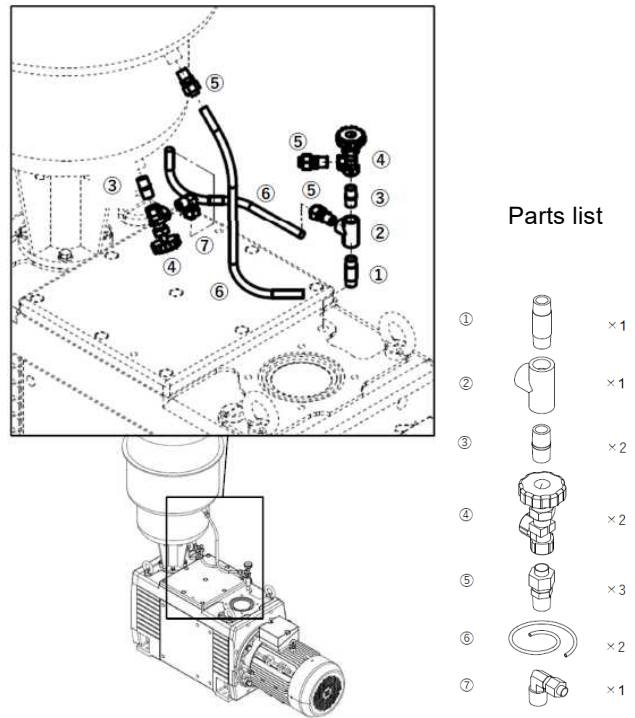


Fig.9 Oil return mechanism C installation (VS)

## 4. Inspection and Maintenance

### 4.1 Periodical Inspection

Install a pressure gauge (option) to the pressure monitor installation port to measure the pressure inside pump. The filter element is recommended to be replaced under the following conditions.

- (1) If the pressure is constantly 0.03MPa (0.3kg/cm<sup>2</sup>) (gauge pressure) or higher.
- (2) If the element is used for more than 3000 hours.

### 4.2 Replacement of Filter Element

#### 4.2.1 Dismounting a Filter Element

- (1) Stop the pump. Disconnect the pipe on the exhaust side if connected.
- (2) Loosen the ⑥ hexagon nut and remove the ① upper lid.
- (3) Loosen the ⑨ hexagon nut and remove the ⑩ seal washer.
- (4) Remove the ③ Filter holder (with a pressure-releasing device).
- (5) Remove the ④ filter elements.

Dismounting of the filter element is completed.

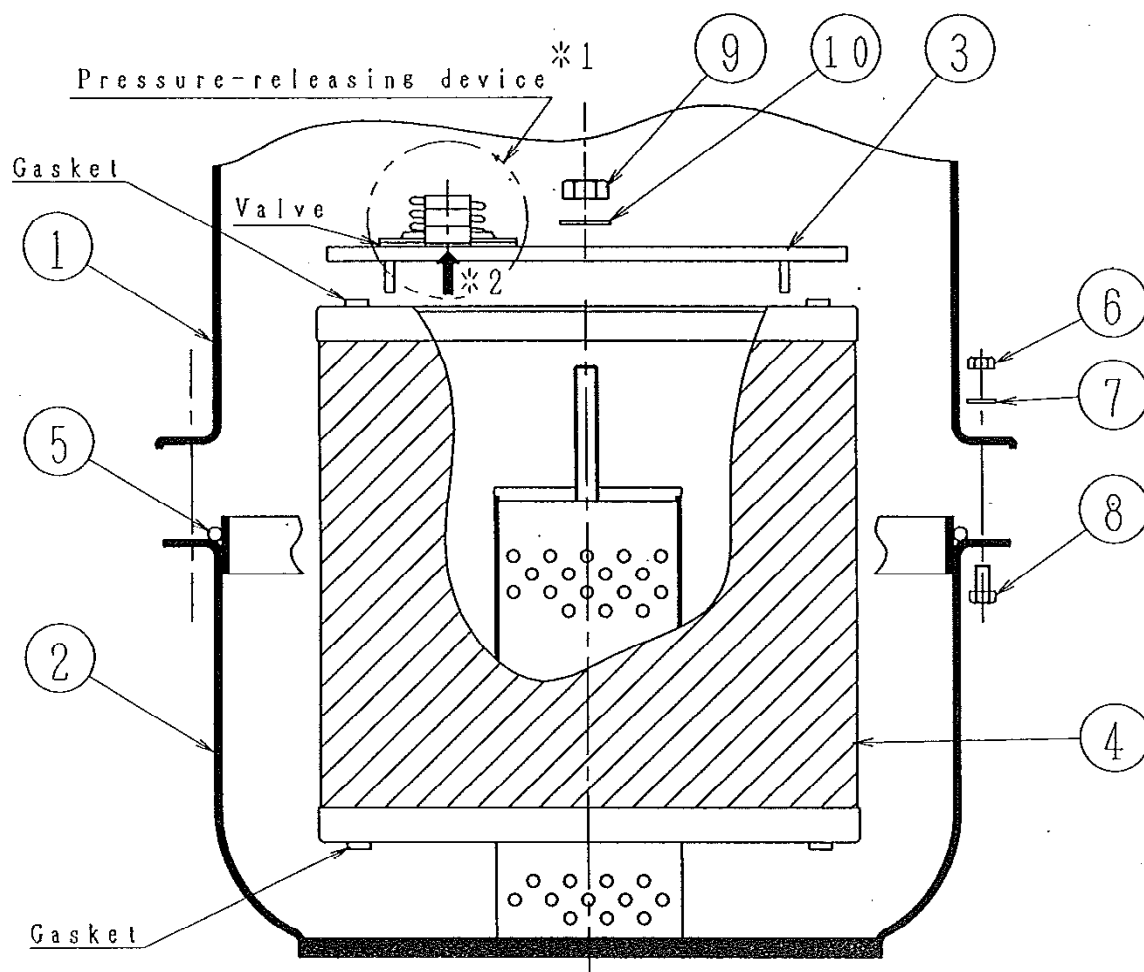
(Note) In replacing a filter element, wash off the dust adhering inside the main body or the pressure-releasing device if any. Also, check the operation of the pressure-releasing device (that the valve is lifted when pushed with a finger). If it does not operate properly (if not lifted), replace the filter holder (with an pressure-releasing device) when remounting.

#### 4.2.2 Mounting of a Filter Element

- (1) Confirm there is no dust adhering or flaw on the ④ filter element installation surface.
- (2) Attach the ④ filter elements in the ② lower lid. Vacuum grease (ULVOIL G-100) on the gaskets on the top and bottom ends of the filter element will facilitate the next dismounting.
- (3) Attach the ③ filter holder (with a pressure-releasing devise). The holder shall be placed so that the gaskets of the ④ filter element do not shift out from it.
- (4) Put a new ⑩ seal washer and fasten the ④ filter element with a ⑨ hexagon nut.
- (5) Fasten the ① upper lid with a ⑥ hexagon nut, a ⑦ plain washer, and a ⑧ hexagon head bolt. The ⑤ packing between the ① upper lid and the ② lower lid shall be replaced when there is any flaw on the ⑤ packing.

Mounting of the filter element is completed.

(Note) ⑩ seal washer cannot be used repeatedly.



\*1: If it does not operate properly, replace the filter holder (with an pressure-releasing device) when remounting.

\*2: The valve is lifted when pushed with a finger.

No.	Model Description	TM-2		TM-3		TM-4		TM-4S	
		Remarks	Q'ty	Remarks	Q'ty	Remarks	Q'ty	Remarks	Q'ty
1	Upper lid	for TM-2	1	for TM-3	1	for TM-4	1	for TM-4S	1
2	Lower lid	for TM-2	1	for TM-3	1	for TM-4	1	for TM-4S	1
3	Filler holder	for TM-2	1	for TM-3	1	for TM-4	1	for TM-4S	1
4	Filter element	TM-2E	1	TM-3E	1	TM-4E	1	TM-4SE	1
5	Packing	O-ring G240	1	O-ring G300	1	O-ring V380	1	Flange gasket	1
6	Hexagon nut	M6	8	M6	12	M6	16	M8	12
7	Plain washer	M6	8	M6	12	M6	16	M8	12
8	Hexagon head bolt	M6×12	8	M6×12	12	M6×12	16	M8×30	12
9	Hexagon nut	M10	1	M10	1	M12	1	M12	1
10	Seal washer	DT-1-10	1	DT-1-10	1	DT-1-12	1	DT-1-12	1

Fig.10 Exploded view of filter element

#### 4.2.2 Continuity check of the filter element

The filter element has a leaf spring that conducts with the lower lid of the main body to prevent static electricity. After replacing the filter element, check the continuity between the following parts with a tester.

- (1) Filter holding plate ~ Main body lower lid
- (2) Filter element upper plate ~ main body lower lid

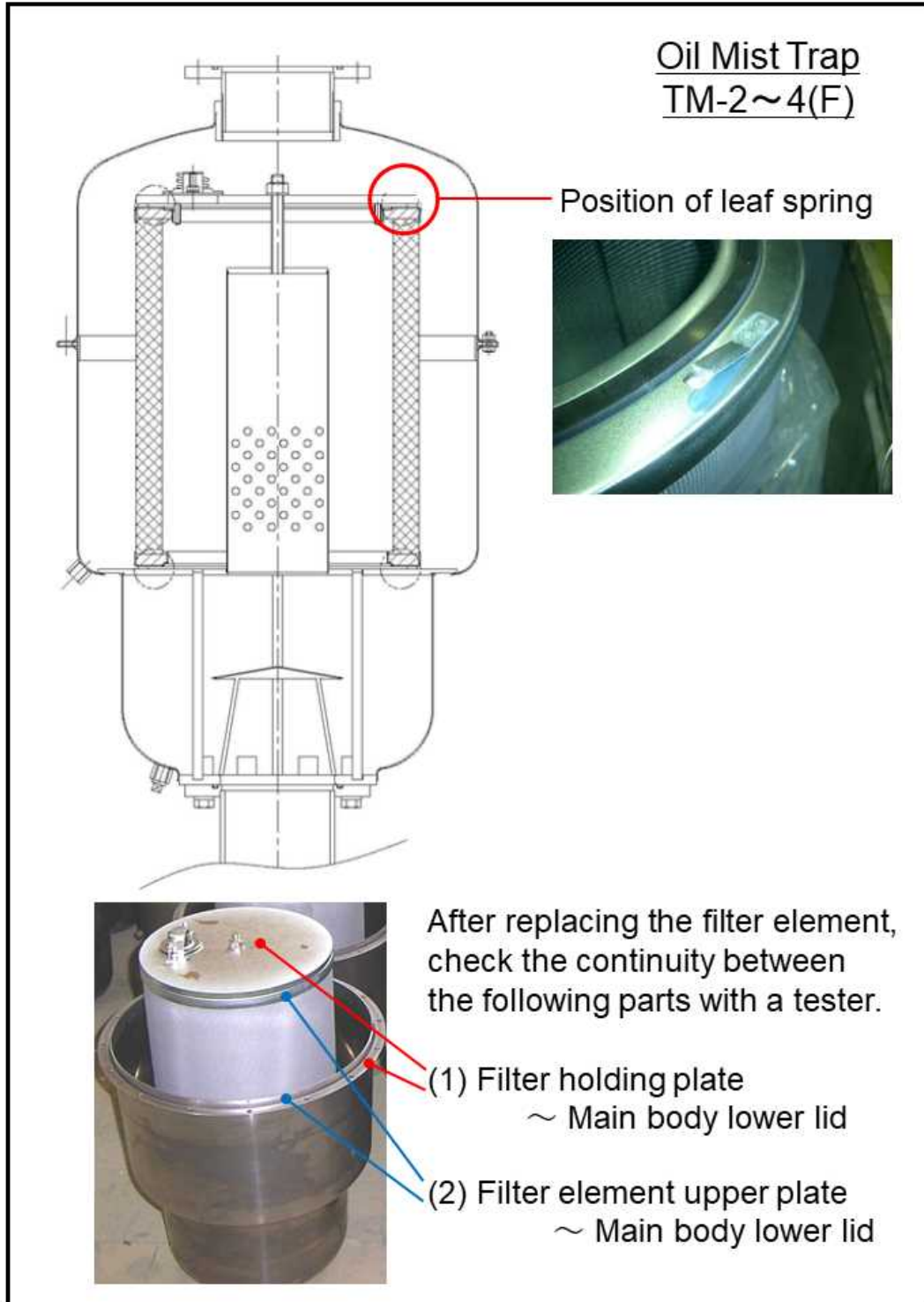


Fig.11 Continuity check of the filter element



## 5. Caution

### 5.1 Clogging of Filter Element

Clogged filter elements will raise the pressure inside the pump, and cause damage to pump parts or filter elements. The pressure must be watched with a pressure gauge (option) in usage such as;

- (3) When making the pump operate under high intake pressure, or evacuating high temperature gas continuously.

Such usage raise the pump temperature and deteriorate the oil to sludge. Sludgy oil adheres to the filter element and causes clogging. Moreover, in continuous usage under such conditions, a great amount of oil mist will be trapped in the filter element and make an oil film on its fibers and cause being clogged even with non-deteriorated oil.

- (4) When evacuating high-viscosity Liquid at fine particles in normal temperature.
- (5) When there is a reaction product.

To control the timing of filter element change, we recommend installation of pressure gauge for other usage, too. Moreover, frequent need for filter element change suggests the use of an oil mist trap one rank higher.

### 5.2 Pressure-releasing Device

The Pressure-releasing devices are designed to prevent rapid pressure rise inside a pump. If this device constantly operates, it is dangerous to keep the pump running. In such cases, stop the pump immediately and change the filter element. Also, while this device is operating, oil mist exhausted from the pump will not be trapped in the filter element, but be exhausted directly from the air outlet of the oil mist trap.

### 5.3 Exhaust of Inflammable Gas and Gas having property of increase the susceptibility of substances to burn

In case of the process for the inflammable gas such as hydrogen or the gas having a property of increase the susceptibility of substances to burn such as the oxygen, following countermeasure shall be taken. Otherwise, oil mist trap explosion may occur.

- (1) Please use duct piping made of electrically conductive materials (electricity conducting) without exception. If non-electrically conductive materials are used, static electricity shall be generated when the exhaust gas passes that results in an origin of ignition by charged electricity and generation of sparks. Ground the duct piping appropriately.
- (2) The exhaust outlet shall be in a flammable status by filling oil mist at atmospheric pressure. Please fill dilution gas from the space between the pump and the oil mist trap.
- (3) Please flow dilution gas from the aspiration side, if necessary. (Decide the volume of dilution gas by confirming the pump performance because it may decline the pump performance. )

## 6. Warranty

- (1) The equipment is guaranteed against defects in material or workmanship for one year after delivery.
- (2) Should any failure occur by normal operating procedure as defined below within this period, replacement of defective parts or repair shall be done at no charge.
  - a) Temperature of operating atmosphere is 10~40°C.
  - b) Evacuation gas is dry air or dry nitrogen 0~40°C.
  - c) Operation is done according to this instruction manual.
- (3) However, the following is not covered by this warranty.
  - a) Failure due to force majeure, such as a natural calamity and fire.
  - b) Failure due to unusual atmosphere such as salty or polluted air.
  - c) Failure due to operation under conditions not specified in this instruction manual.
  - d) Failure that may be regarded by our engineer as caused by not complying with the operating conditions of this equipment.

## 7. Major Replacement Parts

Table.3 Major replacement parts list (TM-2)

No.	Description	Material	Q'ty	Remarks
1	Filter element		1	TM-2E
2	O-ring (G240)	NBR	1	JIS B 2401
3	Seal washer (M10)		1	DT-1-10

Table.4 Major replacement parts list (TM-3)

No.	Description	Material	Q'ty	Remarks
1	Filter element		1	TM-3E
2	O-ring (G300)	NBR	1	JIS B 2401
3	Seal washer (M10)		1	DT-1-10

Table.5 Major replacement parts list (TM-4)

No.	Description	Material	Q'ty	Remarks
1	Filter element		1	TM-4E
2	O-ring (V380)	NBR	1	JIS B 2401
3	Seal washer (M12)		1	DT-1-12

Table.6 Major replacement parts list (TM-4S)

No.	Description	Material	Q'ty	Remarks
1	Filter element		1	TM-4SE
2	Flange gasket	Non-asbestos	1	
3	Seal washer (M12)		1	DT-1-12



This mark is applied to the electronic information product sold in the People's Republic of China. The figure at the center of the mark is the validity date of environmental protection. This product does not influence the environment, the human body and the property during the period reckoning the manufacturing date as long as the caution for safe use regarding the products are observed.

\*The environmental protection validity date is not the product warranty period.

Table.7 Making format for names and contents of hazardous substances or elements

Name of parts	Hazardous substances or elements					
	Pb	Hg	Cd	Cr <sup>6+</sup>	PBB	PBDE
Body	○	○	○	○	○	○
Element	○	○	○	○	○	○

○: indicating that content of the hazardous substance or element in all homogeneous materials of the part does not exceed the requirements for concentration limits specified by SJ/T11363-2006.

× : indicating that content of the hazardous substance or element in, at least one kind of, homogeneous materials of the part exceeds the requirements for concentration limits specified by SJ/T11363-2006. Producer may further explain the technical excuse to the items marked with “X” perspecific conditions here.