



**TLV.** CO., LTD.



# Instruction Manual

## Condensate Recovery Pump CP-N

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## Introduction

Thank you for purchasing the **TLV** condensate recovery pump, CP-N.

This product has been thoroughly inspected before being shipped from the factory. When the product is delivered, before doing anything else, check the specifications and external appearance to make sure nothing is out of the ordinary. Also be sure to read this manual carefully before use and follow the instructions to be sure of using the product properly.

The **TLV** Condensate Recovery Pump, CP-N is specially developed for the return of condensate directly to the boiler. It combines a centrifugal or multi-stage turbine pump for hot water and an ejector delivering condensate continuously at a high pressure. It contributes to energy conservation to a great extent due to reduction in costs of fuel oil, boiler feed water and water treatment, by the effective return of condensate formed in steam equipment and its heat directly to the boiler.





If detailed instructions for special order specifications or options not contained in this manual are required, please contact **TLV** for full details.


This instruction manual is intended for use with the model(s) listed on the front cover. It is necessary not only for installation, but for subsequent maintenance, disassembly/reassembly and troubleshooting. Please keep it in a safe place for future reference.

## Safety Considerations

- Read this section carefully before use and be sure to follow the instructions.
- Installation, inspection, maintenance, repairs, disassembly, adjustment and valve opening/closing should be carried out only by trained maintenance personnel.
- The precautions listed in this manual are designed to ensure safety and prevent equipment damage and personal injury. For situations that may occur as a result of erroneous handling, three different types of cautionary items are used to indicate the degree of urgency and the scale of potential damage and danger: DANGER, WARNING and CAUTION.
- The three types of cautionary items above are very important for safety: be sure to observe all of them as they relate to installation, use, maintenance and repair. Furthermore, TLV accepts no responsibility for any accidents or damage occurring as a result of failure to observe these precautions.

### Symbols

	<b>Indicates a DANGER, WARNING or CAUTION item.</b>
	Indicates an urgent situation which poses a threat of death or serious injury
	Indicates that there is a potential threat of death or serious injury
	Indicates that there is a possibility of injury or equipment / product damage

	<b>Install properly and DO NOT use this product outside the recommended operating pressure, temperature and other specification ranges.</b> Improper use may result in such hazards as damage to the product or malfunctions that may lead to serious accidents. Local regulations may restrict the use of this product to below the conditions quoted.
	<b>Use hoisting equipment for heavy objects (weighing approximately 20 kg or more).</b> Failure to do so may result in back strain or other injury if the object should fall.
	<b>Take measures to prevent people from coming into direct contact with product outlets.</b> Failure to do so may result in burns or other injury from the discharge of fluids.
	<b>When disassembling or removing the product, wait until the internal pressure equals atmospheric pressure and the surface of the product has cooled to room temperature.</b> Disassembling or removing the product when it is hot or under pressure may lead to discharge of fluids, causing burns, other injuries or damage.

Safety considerations are continued on the next page.

**CAUTION**

**Be sure to use only the recommended components when repairing the product, and NEVER attempt to modify the product in any way.**

Failure to observe these precautions may result in damage to the product and burns or other injury due to malfunction or the discharge of fluids.

**Make sure the power supply is OFF before carrying out work on the wiring or inspections involving disassembly.**

If such work is carried out with the power on, there is a danger that equipment may malfunction or electric shock may occur, leading to injury or other accidents.

**Make sure that wiring work requiring a special license is carried out only by qualified personnel.**

If carried out by unqualified personnel, overheating or short circuits leading to injury, fires, damage or other accidents may occur.

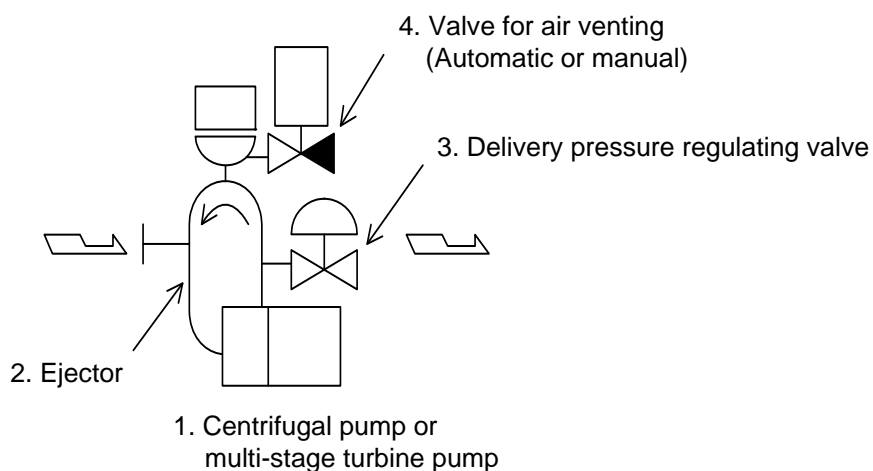
**When using this product, NEVER stand close to, or leave tools anywhere near, moving parts, such as the shaft.**

Contact with moving parts or objects becoming caught in moving parts could lead to injury or damage or other accidents.

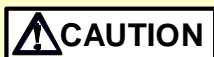
## Configuration

The condensate recovery pump, CP-N consists primarily of a centrifugal or multi-stage pump, ejector and delivery pressure regulating valve.

1. Centrifugal or multi-stage turbine pump  
Pressurizes hot condensate and provides the motive power of ejector jet and pump out force of condensate
2. Ejector  
Mixes the pressurized condensate with the flow-in condensate, giving the required (NPSH req) to the pump
3. Delivery pressure regulating valve  
Maintains the pressure in the loop constant and pumps out condensate at a steady pressure
4. Valve for air venting  
Removes air in the piping and loop at startup



## Installation



Install properly and **DO NOT** use this product outside the recommended operating pressure, temperature and other specification ranges. Improper use may result in such hazards as damage to the product or malfunctions which may lead to serious accidents. Local regulations may restrict the use of this product to below the conditions quoted.



Use hoisting equipment for heavy objects (weighing approximately 20 kg or more). Failure to do so may result in back strain or other injury if the object should fall.



Make sure the power supply is **OFF** before carrying out work on the wiring or inspections involving disassembly. If such work is carried out with the power on, there is a danger that equipment may malfunction or electric shock may occur, leading to injury or other accidents.



Make sure that wiring work requiring a special license is carried out only by qualified personnel. If carried out by unqualified personnel, overheating or short circuits leading to injury, fires, damage or other accidents may occur.



Take measures to prevent people from coming into direct contact with product outlets. Failure to do so may result in burns or other injury from the discharge of fluids.



When using this product, **NEVER** stand close to, or leave tools anywhere near, moving parts, such as the shaft. Contact with moving parts or objects becoming caught in moving parts could lead to injury or damage or other accidents.

## Pump installation

Installation, inspection, maintenance, repairs, disassembly, adjustment and valve opening/closing should be carried out only by trained maintenance personnel.

The preparation of the foundation and the installation of the pump and motor require careful attention.

Incorrect installation and alignment would cause various troubles during operation. On site, install the equipment correctly and check the alignment carefully as shown below, although the equipment has been aligned before shipping.

1. Before installation, prepare packers and a set of shims (1 mm – 0.05 mm) for adjustment.
2. When the foundation is completely solidified, in order to prevent the deformation of the bed, determine the positions of the packers at both sides of the foundation bolt's seats, the pump legs, and motor legs. Put concrete and place the packers as required.  
In this case, the level of the packers should be checked using a spirit level. The level of packers can be adjusted by the use of shims during installation.
3. When the concrete under the packers is solidified, place the bed, pump and motor temporarily. Adjust the level axially and laterally by the use of shims while applying a level.
4. When the position of the pump and the level are established, align the pump and motor temporarily using an alignment tool.
5. After finishing the temporary alignment, fill the foundation bolt holes with concrete.

6. After the concrete around the foundation bolts has solidified, fasten nuts on the foundation bolts tightly. In this case, check the alignment of the coupling.
7. After checking the coupling, fill the interior of the bed with mortar so that no cavities are left.
8. After finishing the above procedure, install the inlet (pump suction side) and outlet (pump delivery side) pipes.

### **Piping (cf. Standard piping diagram)**

Follow the instructions below when piping.

1. When constructing the piping at the pump suction and delivery sides, pay attention not to exert undue force on the pump, as this often causes problems.
2. Hot condensate causes the pipes to expand.  
NOTE: Use flexible pipes to protect the pump from undue force caused by pipe expansion.
3. Vibration of the suction and delivery piping causes problems.  
NOTE: Avoid the transmission of vibration to the pump by the use of flexible pipes.
4. To minimize head losses in the suction pipe, avoid bends and sudden change of cross-sectional area.
5. Install a riser pipe of at least 1 m at the pump suction side excluding the liquid-vapor separator header.
6. Install a pressure gauge at the condensate header.
7. Install a gate valve and a strainer at the pump suction. Select a strainer with a cross-sectional area three or four times that of the suction pipe.
8. Install a check valve and gate valve at the delivery side. It is recommended that the gate valve is installed as close as possible to the pump delivery port and the check valve is located between the delivery port and the gate valve.
9. Small pipes for cooling water, feed water and circulation water should also be carefully installed in the same manner as the main pipe so that the pump is not subjected to undue force. Before installing, check these small pipes for foreign matter. If foreign matter exists, clean the pipe thoroughly by blowing through before connecting the pipe.
10. Also clean the main pipe by blowing through before connecting the pipe.
11. After completing the piping, check the alignment of pump and motor again for misalignment that may have occurred during piping.

NOTE: Please use flexible, vibration-absorbing pipes for pump service.



## Coupling pump and motor

The pump shaft should be in alignment with the motor shaft. Follow the instructions below.

1. Align the pump and motor as shown in Fig. A, using a straight edge applied to the circumferential surfaces of the couplings and a wedge inserted between the flange surfaces.
2. The distance and parallelism should be checked at four points 90 degrees apart and should be within 0.05 mm.
3. Before coupling the pump with the motor, check the rotational direction of the motor. The rotation should be clockwise when viewed from the motor side as shown by the arrow mark on the bearing case.
4. After identifying the rotational direction, couple the pump with the motor. Coupling should be done with help of the tally marks punched on the coupling flanges.
5. After the pump reaches the rated temperature, check the alignment again.

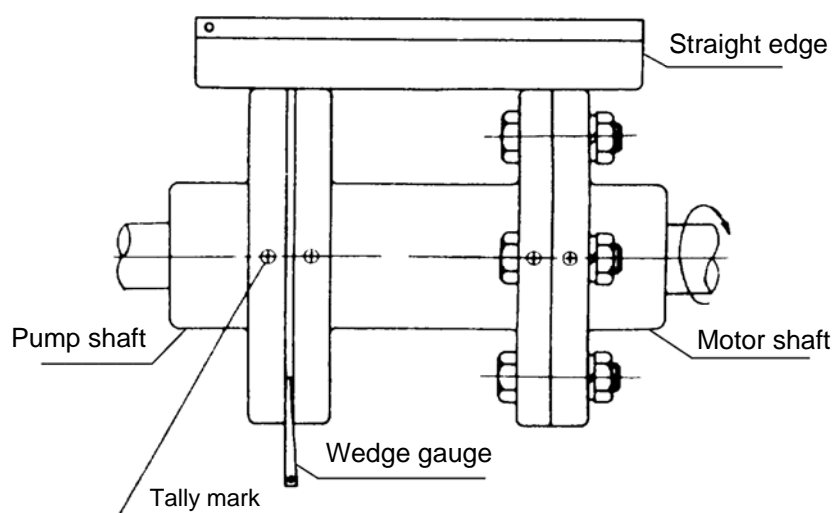


Fig. A

## Cooling of shaft seal

The shaft seal should be cooled when the liquid temperature exceeds 105 °C. Cooling water passes through the jacket formed between the pump casing cover and bracket. The cooling water temperature should be below 35 °C and the difference between inlet and outlet temperatures should be within 10 °C. For ease of identifying the flow and temperature of cooling water, a thermometer and a flow sight (sight glass) are recommended to be installed on the cooling water line. Allow the cooling water to flow for some time after stoppage of the pump.

## Lubrication

If the bearings are oil bath lubricated, fill with oil before start up. Refer the pump unit manual for the recommended lubricant and maintenance of lubricant.

## Operation

Installation, inspection, maintenance, repairs, disassembly, adjustment and valve opening/closing should be carried out only by trained maintenance personnel.

### Checks before startup

When first operating the pump after installation, the following should be checked beforehand. If something wrong is found, correct it based on the instructions in this manual.

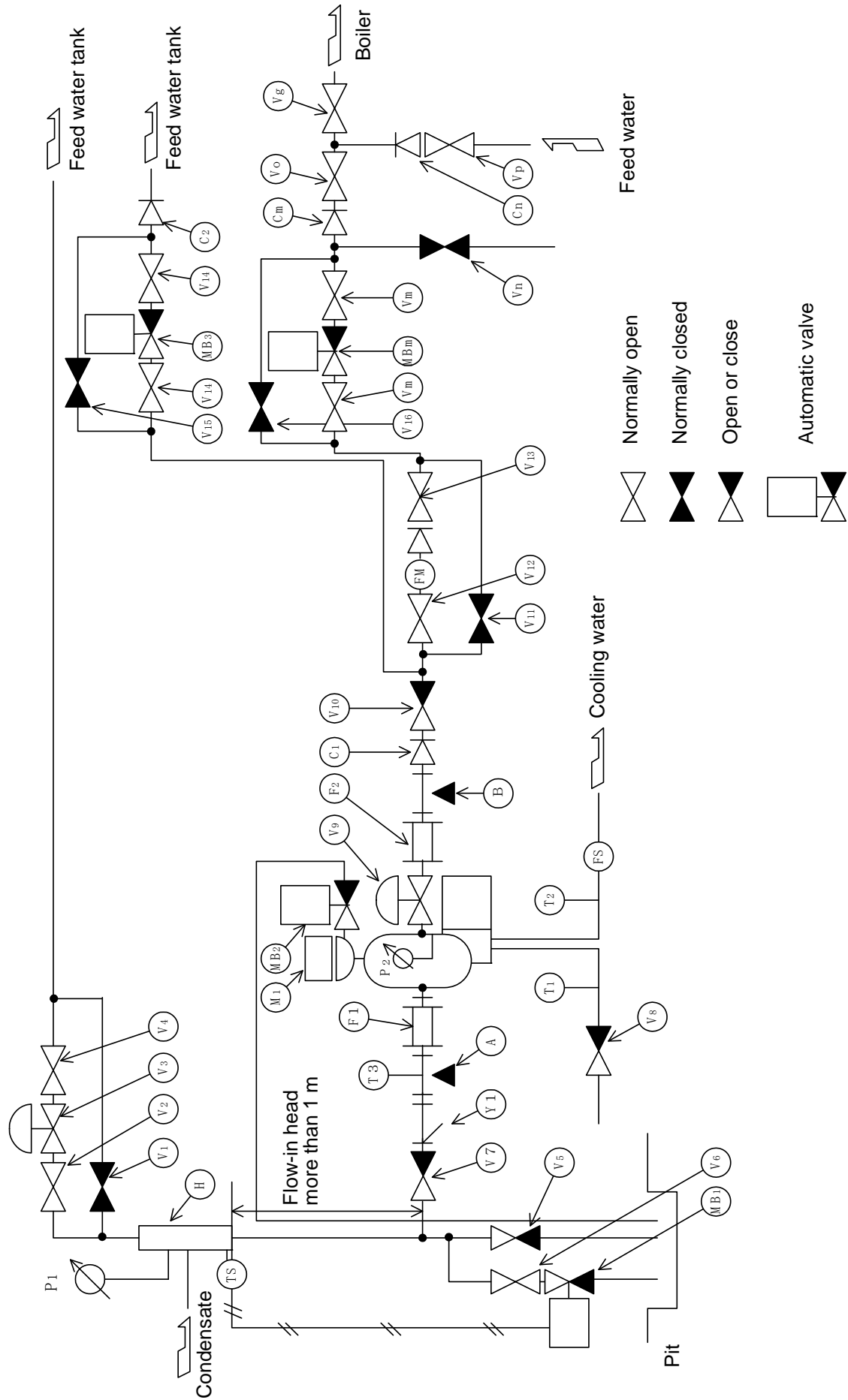
1. Remove the coupling bolts to make sure that the rotational direction of the motor is correct. When viewed from the motor side, the motor rotates clockwise.
2. The electric wiring between the control panel and the equipment attached to the pump should be correct. The wiring in the control panel has been checked before shipment.
3. The alignment of the pump with the motor should be correct. The coupling bolts should be tightly fastened.
4. The pump should not be subjected to undue force caused by inappropriate piping.
5. A riser of 1 m or more should be installed at the pump suction side.
6. Valves, pressure gauges and check valves should be installed at the correct positions.
7. The piping should be just as shown in the system piping layout. The pipes should be flushed.
8. The strainer in the suction pipe should be clean from dirt.
9. The bearing case and constant level oiler should be filled with lubricant. Fill with lubricant if necessary.
10. The cooling water should flow at a predetermined rate.
11. The suction valve should be fully open and the delivery valve fully closed. All other valves should be in their predetermined position.
12. No leakage or abnormality should be found when condensate is allowed to flow into the pump.
13. No leakage should be found at the mechanical seal. The gland should not be unevenly or excessively fastened.
14. The coupling should be able to be turned by hand without difficulty.

The pump should be started only when all the above items have been checked. When starting the pump again, check items 8 to 14 above and thereafter before starting.

### Water quality

The quality of water to be handled by the condensate recovery pump should meet the requirements for feed water given in JIS B8223-1977, EN12952-12, or local regulations if applicable.

Standard piping diagram



Symbol	Part name	Operation	Position	Application
V <sub>1</sub>	Bypass valve for V <sub>3</sub>		Close	
V <sub>2</sub>	Inlet valve for V <sub>3</sub>		Open	
V <sub>3</sub>	Press. Reg. valve		Set	Adjusted in accordance with recovery conditions. Maintains the back pressure of steam trap below the predetermined value.
V <sub>4</sub>	Outlet valve for V <sub>3</sub>		Open	
V <sub>5</sub>	Blow valve	Needed	Open ↔ Close	Serves to blow out condensate when the pump stops.
V <sub>6</sub>	Inlet valve for MB <sub>1</sub>		O	
V <sub>7</sub>	Pump inlet valve	Needed	Open ↔ Close	Full opened before starting the pump. Closed when the pump stops.
V <sub>8</sub>	Cold water inlet valve	Needed	Open ↔ Close	Full opened before starting the pump. Closed when the pump stops.
V <sub>9</sub>	Delivery pressure regulating valve		Set	Maintains constant pump delivery pressure.
V <sub>10</sub>	Pump outlet valve	Needed	Open ↔ Close	Full opened after pump start up. Closed after the pump stops.
V <sub>11</sub>	Bypass valve for flowmeter		Close	
V <sub>12</sub>	Flowmeter inlet valve		Open	
V <sub>13</sub>	Flowmeter outlet valve		Open	
V <sub>14</sub>	Inlet and outlet valves for MB <sub>3</sub>		Open	
V <sub>15</sub>	Bypass valve for MB <sub>3</sub>		Close	
V <sub>16</sub>	Bypass valve for MB <sub>m</sub>		Close	
V <sub>m</sub>	Inlet and outlet valves for MB <sub>m</sub>		Open	
V <sub>n</sub>	Initial blow valve		Close	Serves to flush pipes at the early stage of test run.
V <sub>o</sub>	Valve for condensate feeding		Open	
V <sub>p</sub>	Feed water line valve		Open	Attached to boiler
V <sub>q</sub>	Boiler inlet line		Open	Attached to boiler
A·B	Pipe supports			Fix the piping to protect the boiler from weight and vibration of pipes.
H	Condensate header			
FM	Flowmeter			Integrating flowmeter. Separated display type.
FS	Flow sight (Sight glass)			For checking cold water flow.
MB <sub>1</sub>	Motor valve for start-up blow		Automatic	Discharges cold condensate, co-operating with a thermostat.
MB <sub>2</sub>	Motor valve for air venting		Automatic	Serves to vent air in pump and pipes.
MB <sub>3</sub>	Automatic bypass valve		Automatic	Opens when the boiler water level reaches upper limit.
MB <sub>m</sub>	Automatic condensate feed valve		Automatic	Controls condensate feeding into the boiler in accordance with the boiler water level. Operates on ON-OFF principle.

Table continued on next page

Symbol	Part name	Operation	Position	Application
TS	Thermostat			Detects the condensate temperature and sends signals to open or close MB <sub>1</sub> .
Y <sub>1</sub>	Strainer			Removes dirt and scale in pipes.
T <sub>1</sub>	Thermometer			Measures the inlet temperature of cooling water.
T <sub>2</sub>	Thermometer			Measures the outlet temperature of cooling water.
T <sub>3</sub>	Thermometer			Measures the temperature of flow-in condensate.
P <sub>1</sub>	Pressure gauge			Measures the pressure of the condensate header.
P <sub>2</sub>	Pressure gauge			Measures the pump delivery pressure (combines with pressure switch).
C <sub>1</sub>	Check valve			For pump.
C <sub>2</sub>	Check valve			For automatic bypass valve.
C <sub>m</sub>	Check valve			For automatic condensate feed valve.
C <sub>n</sub>	Check valve			For feed water pump.
F <sub>1</sub>	Flexible tube			Absorbs vibration from, and thermal expansion of, pipes.
F <sub>2</sub>	Flexible tube			Absorbs vibration from, and thermal expansion of, pipes.
▲	Pipe support A			Supports the pump inlet pipe and absorbs vibration.
▲	Pipe support B			Supports the pump outlet pipe and absorbs vibration.
M <sub>1</sub>	Filling detector			Senses whether the pump is filled with water or not.

### Preparation before test run

1. The following points should be confirmed before performing the test run.
  - (1) Piping
    - a. Condensate recovery piping  
All piping between the steam-using equipment and condensate recovery destination must be completed and checked for leaks or abnormalities. All related accessories such as valves, check valves, flowmeters and other sensors should also be properly installed.
    - b. Cooling water piping  
Piping to supply an uninterrupted flow of cooling water should be completed.
    - c. Condensate recovery pump piping  
Outlet of the motor valve for air venting should be piped to a safe location, such as a pit. Outlet of the pump cooling water should be piped to a safe location, such as a pit.
  - (2) Electrical wiring  
Electrical wiring of the power supply and electric-operated instruments should be completed.

## (3) Flushing of pipes

Flushing of the pipes between the steam-using equipment and condensate recovery pump should be completed. Flushing of the pipes between the condensate recovery pump and the condensate recovery destination (e.g. boiler) is recommended to be performed one day before the test run day, or alternatively, on the day of the test run.

## (4) Operation of steam-using equipment

Steam-using equipment should be in operation with designed condensate flow during the test run.

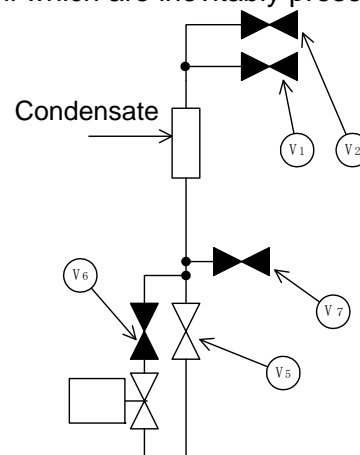
### Valve operation for piping blowdown before test run

#### Purpose

Before the test run of the condensate recovery pump, flushing of pipes for more than 12 hours is required to remove dirt, scale and oil which are inevitably present in pipes during construction.

Flushing should be continued till the condensate contains no foreign matter.

Valve operation for flushing	
Symbol	Operation
V <sub>1</sub>	Close
V <sub>2</sub>	Close
V <sub>5</sub>	Open
V <sub>6</sub>	Close
V <sub>7</sub>	Close

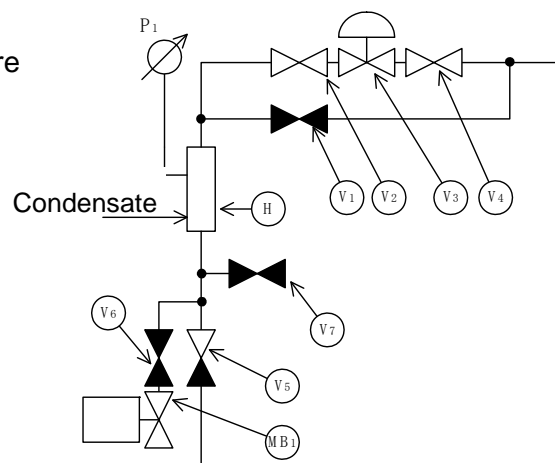


### Test run

#### 1. Operation and stoppage

- (1) Verify the set pressure of the pressure regulating valve before test run of the condensate recovery pump.

Symbol	Operation
V <sub>1</sub>	Close
V <sub>2</sub>	Open
V <sub>3</sub>	Adjust
V <sub>4</sub>	Open
V <sub>5</sub>	Operate
V <sub>6</sub>	Close
V <sub>7</sub>	Close

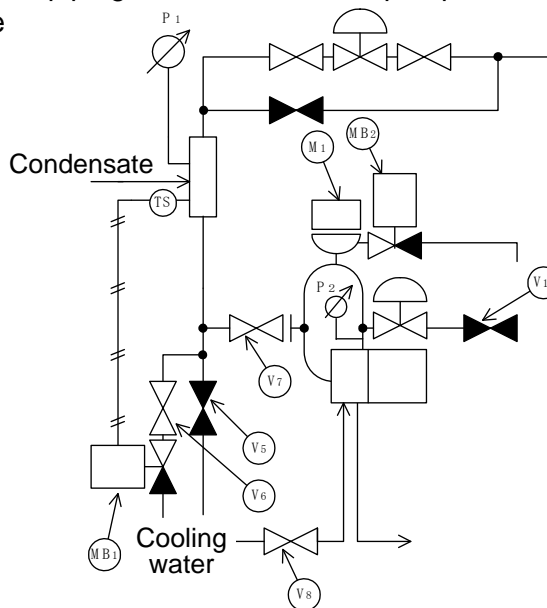


Close V<sub>5</sub> gradually and keep it in a slightly open position, and confirm V<sub>3</sub> operates at the pressure set to maintain the separator header pressure. At this time, it is enough to verify that the pressure regulating valve operates. Final adjustment is to be completed during operation of the condensate recovery pump.

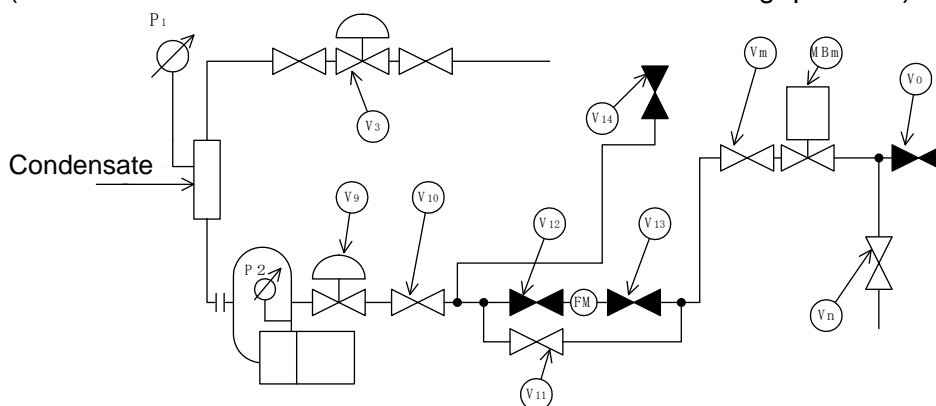
2. Allow condensate to flow into the condensate recovery pump, and operate the pump automatically to blow off the newly-built piping downstream of the pump.

- (1) Allow condensate to flow into the pump in order to prepare it for operation.

Symbol	Operation
V <sub>5</sub>	Close
V <sub>6</sub>	Open
V <sub>7</sub>	Open
V <sub>8</sub>	Open
V <sub>10</sub>	Close



- (2) Switch on the pump control panel. The power lamp will light up.  
 (3) Turn on the breaker switch in the control panel. Put the select switch for pump operation to the "automatic" position.  
 (4) If the condensate temperature is low, the motor valve for start-up blow MB<sub>1</sub> opens by the signal from the thermostat TS to reject the condensate. When the condensate temperature rises, MB<sub>1</sub> closes, allowing the condensate to flow into the pump.  
 (5) The valve MB<sub>2</sub> is in the open position by the signal from the filling water detector M<sub>1</sub> till the pump is filled with water. It closes once the pump is filled.  
 (6) The pump begins to start a few minutes after the motor valve for air venting MB<sub>2</sub> closes. Check the delivery pressure P<sub>2</sub> at operation and record it along with the inlet pressure P<sub>1</sub>.  
 (7) Flush the piping from the pump to the boiler and adjust the delivery pressure P<sub>2</sub>. (Put the select switch for feed water control to the "Feeding" position.)



Symbol	Operation	Symbol	Operation
V <sub>3</sub>	Adjust	V <sub>14</sub>	Close
V <sub>9</sub>	Adjust	V <sub>m</sub>	Open
V <sub>10</sub>	Open	V <sub>n</sub>	Open
V <sub>11</sub>	Open	V <sub>o</sub>	Close
V <sub>12</sub> , V <sub>13</sub>	Close		

- a. Adjust  $V_3$  so that  $P_1$  comes to the designed value. To lower  $P_1$ , turn the pressure adjusting knob of  $V_3$  counter-clockwise. To raise  $P_1$ , turn the knob clockwise.
- b. Adjust  $P_2$  to keep following relation;

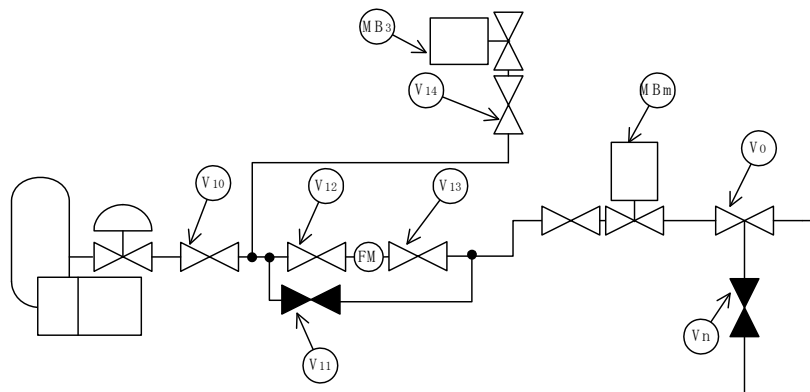
$$P_2[\text{MPaG}] > P_1[\text{MPaG}] + \frac{\text{Pump Head}[\text{mH}] \times \text{Specific Gravity}[\text{kg/m}^3]}{100}$$

To lower  $P_2$ , turn the pressure adjusting knob of  $V_9$  counter-clockwise. To raise  $P_2$ , turn the knob clockwise.

- c. Adjust the pressure switch setting ( $P_2S$ ) as follows.

$$P_2S = \frac{P_1 + P_2}{2}$$

- (8) Feed the condensate into the boiler automatically. To do this, put the select switch for feed water control to the "automatic" position.

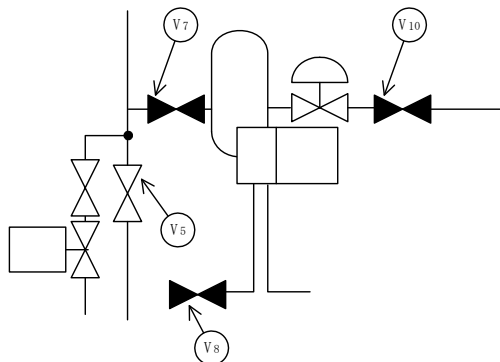


Symbol	Operation	Symbol	Operation
$V_{11}$	Close	$V_n$	Close
$V_{12}$	Open	$V_o$	Open
$V_{13}$	Open	$V_{10}$	Open
$V_{14}$	Open		

- (9) Verify the conditions of the entire system and the recovery conditions.

(10) Stoppage

- a. Put the select switch for pump operation to the "OFF" position.
- b. Close  $V_{10}$ .
- c. Turn off the power switch on the control panel.
- d. Open  $V_5$  and close  $V_7$ .
- e. Close  $V_8$  to stop cooling water (about 10 minutes after the pump stops).



Symbol	Operation
$V_5$	Open
$V_7$	Close
$V_8$	Close
$V_{10}$	Close



## Normal operation and stoppage

1. Before operation, verify the check items 8 to 14 in “Check before startup” on page 9.
2. Operation (for valve positions, refer to the standard piping diagram on page 10)
  - (1) Open  $V_8$  to allow cooling water to flow through.
  - (2) Turn on the switch on the pump control panel.
  - (3) Open  $V_7$  and close  $V_5$ .
  - (4) Put the select switch for pump operation to the “automatic” position.
  - (5) After starting the pump, open  $V_{10}$  slowly.
  - (6) Adjust the cooling water flow rate to keep the temperature difference between inlet and outlet within 10 °C.
  - (7) Verify that all pressure indicators are normal.
  - (8) Verify the position of select switch for feed water control.
3. Stoppage
  - (1) Follow the same procedure as described in “Test run” 2-(10) on page 13.
  - (2) Verify that the pump slows down smoothly and stops quietly.
  - (3) If freeze-up is expected, blow condensate using a valve at the bottom of the pump. Also blow the cooling water line.
4. Emergency  
Stop the pump and operate the valves following the Stoppage procedure above.
5. Operation and maintenance  
Observe the pump operation carefully, keeping the following in mind. If something wrong is found, correct or investigate after stopping the pump. For the check procedure and items, refer to “Maintenance and Part Replacement” on page 18.
  - (1) Verify that each of the pressure gauges around the pump indicates the specified value.  
Delivery pressure = Pressure adjusted during test run
  - (2) Inspect the bearing temperature and lubricant level periodically.
  - (3) Check the pump for smooth running without vibration.
  - (4) Verify that the cooling water flows steadily during operation and the bearing temperature is within the specified range.
  - (5) Verify that there is no leakage from the mechanical seal.

## Pump Troubles, Causes and Remedies



When disassembling or removing the product, wait until the internal pressure equals atmospheric pressure and the surface of the product has cooled to room temperature. Disassembling or removing the product when it is hot or under pressure may lead to discharge of fluids, causing burns, other injuries or damage.

If the pump should be in trouble, stop the pump immediately, investigate the problem in detail and contact the local distributor or TLV.

Possible problems are listed below.

Condition	Causes	Remedies
Repeated start and stop	Air exists in pump and loop.	Stop the pump. Vent air at the pump suction side and check the automatic vent valve.
	The set pressure of the delivery press. reg. valve is too low.	Turn the knob clockwise to raise the set pressure.
	Small condensation rate.	Turn the knob of the press. reg. valve clockwise to raise the set pressure and reduce the pump delivery.
	Wrong setting or failure of control system.	Change the set value of the pressure switch or investigate the function of filling water detector.
Insufficient delivery pressure	The quantity of flow-in condensate is small.	Turn the knob of the press. reg. valve clockwise to raise the set pressure and reduce the pump delivery.
	The set temperature of the press. reg. valve is too low.	
	Reversed rotational direction.	Change any two of the terminal connections at the motor.
Insufficient delivery	Trouble with the pump unit.	For trouble with the pump unit, refer to the instruction manual of pump manufacturer.
	The delivery pressure is too high.	Turn the knob at the delivery regulating valve counter-clockwise to reduce the set value.
	The flow-in head at the riser on the suction side is insufficient.	Correct the piping so that the flow-in head becomes large.
	The separation in the separator header is insufficient.	Change the header for efficient separation.

## Maintenance and Part Replacement



Use hoisting equipment for heavy objects (weighing approximately 20 kg or more). Failure to do so may result in back strain or other injury if the object should fall.



NEVER apply direct heat to the float. The float may explode due to increased internal pressure, causing accidents leading to serious injury or damage to property and equipment.



When disassembling or removing the product, wait until the internal pressure equals atmospheric pressure and the surface of the product has cooled to room temperature. Disassembling or removing the product when it is hot or under pressure may lead to discharge of fluids, causing burns, other injuries or damage.



Be sure to use only the recommended components when repairing the product, and NEVER attempt to modify the product in any way. Failure to observe these precautions may result in damage to the product or burns or other injury due to malfunction or the discharge of fluids.



Make sure the power supply is OFF before carrying out work on the wiring or inspections involving disassembly. If such work is carried out with the power on, there is a danger that equipment may malfunction or electric shock may occur, leading to injury or other accidents.



Make sure that wiring work requiring a special license is carried out only by qualified personnel. If carried out by unqualified personnel, overheating or short circuits leading to injury, fires, damage or other accidents may occur.



When using this product, NEVER stand close to, or leave tools anywhere near, moving parts, such as the shaft. Contact with moving parts or objects becoming caught in moving parts could lead to injury or damage or other accidents.

Installation, inspection, maintenance, repairs, disassembly, adjustment and valve opening/closing should be carried out only by trained maintenance personnel.

### Replaceable parts

Refer to the instruction manual for the pump unit.

On maintenance inspection, alignment of the pump and motor should be checked. The alignment should be within 5/100 mm axially and radially at the coupling.

### Pump unit maintenance

Pump unit maintenance including Bearing, Shaft Seal, Coupling, and Lubricant must be done according to the pump unit manual.

## Product Warranty

1. Warranty Period  
One year following product delivery.
2. Warranty Coverage  
TLV CO., LTD. warrants this product to the original purchaser to be free from defective materials and workmanship. Under this warranty, the product will be repaired or replaced at our option, without charge for parts or labor.
3. This product warranty will not apply to cosmetic defects, nor to any product whose exterior has been damaged or defaced; nor does it apply in the following cases:
  - 1) Malfunctions due to improper installation, use, handling, etc., by other than TLV CO., LTD. authorized service representatives.
  - 2) Malfunctions due to dirt, scale, rust, etc.
  - 3) Malfunctions due to improper disassembly and reassembly, or inadequate inspection and maintenance by other than TLV CO., LTD. authorized service representatives.
  - 4) Malfunctions due to disasters or forces of nature.
  - 5) Accidents or malfunctions due to any other cause (such as water hammer) beyond the control of TLV CO., LTD.
4. Under no circumstances will TLV CO., LTD. be liable for consequential economic loss damage or consequential damage to property.

\* \* \* \* \*

For Service or Technical Assistance:

Contact your **TLV** representative or your regional **TLV** office.

### Manufacturer

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