



Manufacturer

**TLV** CO., LTD.

Kakogawa, Japan

is approved by LRDA Ltd. to ISO 9001/14001

# TLV®

## Instruction Manual

# PowerTrap®

**GP10/GT10**  
**GP14/GT14**

Manufacturer

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**TLV** CORPORATION

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## Introduction

Thank you for purchasing the TLV PowerTrap.

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.

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.

The contents of this manual are subject to change without notice.

## 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
	<p><b>NEVER apply direct heat to the float.</b></p> <p>The float may explode due to increased internal pressure, causing accidents leading to serious injury or damage to property and equipment.</p>
	<p><b>Install properly and DO NOT use this product outside the recommended operating pressure, temperature and other specification ranges.</b></p> <p>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.</p> <p><b>Use hoisting equipment for heavy objects (weighing approximately 20 kg (44 lb) or more).</b></p> <p>Failure to do so may result in back strain or other injury if the object should fall.</p> <p><b>Take measures to prevent people from coming into direct contact with product outlets.</b></p> <p>Failure to do so may result in burns or other injury from the discharge of fluids.</p> <p><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></p> <p>Disassembling or removing the product when it is hot or under pressure may lead to discharge of fluids, causing burns, other injuries or damage.</p>

Continued on 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.

**Do not use excessive force when connecting threaded pipes to the product.**

Over-tightening may cause breakage leading to fluid discharge, which may cause burns or other injury.

**Use only under conditions in which no freeze-up will occur.**

Freezing may damage the product, leading to fluid discharge, which may cause burns or other injury.

**Use only under conditions in which no water hammer will occur.**

The impact of water hammer may damage the product, leading to fluid discharge, which may cause burns or other injury.

**Take measures to ensure the proper handling, such as recovery or dilution, of hazardous fluids discharged at product outlets.**

Outflow of fluid or fluid leaks may lead to hazards such as flammable conditions or corrosion, which may result in injury, fires, damage or other accidents.

## General Description



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.

### Application

The PowerTrap is used to discharge liquid from vacuum-pressure or low-pressure areas to high-pressure areas, or from lower to higher elevations.

The GT model is the same as the GP, but with an additional steam trap function, making it suitable for use in instances in which the inlet pressure may alternately be lower than or higher than the outlet pressure. (Note: The GP14/GT14 is designed for higher-pressure.)

There are two types of delivery systems (piping methods): the closed system and the open system. Use of the GT model or the GP model is determined by the type of system.

Check to make sure that the PowerTrap model that has been purchased is suitable for use on the type of system that is being planned for installation.

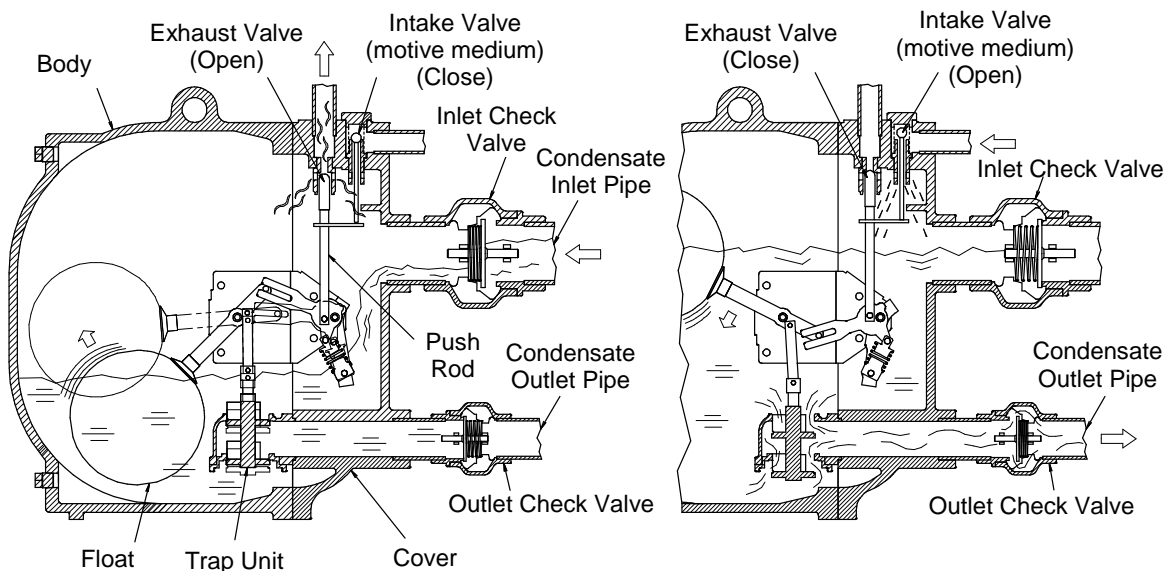
Type of System	Closed System	Open System
System Overview		
Benefits	<ul style="list-style-type: none"> <li>· No need for external steam trap (GT model features built-in trap)</li> <li>· No flash steam discharge</li> <li>· Small reservoir</li> <li>· Use with vacuum equipment possible</li> </ul>	<ul style="list-style-type: none"> <li>· Collection of condensate from multiple equipment possible</li> <li>· Can be used where trap is lower than receiver, such as equipment situated near grade (providing there is sufficient differential pressure)</li> </ul>
Notes	<ul style="list-style-type: none"> <li>· Only one piece of equipment possible per system</li> <li>· Equipment has minimum height requirement to ensure that condensate flows naturally by gravity (approx. 1 m (40 in))</li> </ul>	<ul style="list-style-type: none"> <li>· Separate steam trap required for each piece of equipment</li> <li>· Requires venting pipe to discharge flash steam to atmosphere</li> </ul>
Model	<p>Mechanical pump with built-in trap <b>GT10/GT14</b></p> <p>Where there is <b>ALWAYS</b> a <b>negative</b> pressure differential (e.g. vacuum equipment), <b>GP10</b> or <b>GP14</b> can be used</p>	<p>Mechanical pump <b>GP10/GP14</b></p>

## Operation



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.

- (1) When condensate flows from the condensate inlet pipe through the inlet check valve into the body of the unit, the air in the body escapes through the exhaust valve (which equalizes the internal pump pressure to the pressure of the condensate source) and the float rises, as shown in (1) below.
  - In the case of the GT, the main valve on the trap unit opens as the float rises. When  $P_i > P_b$  (when the equipment pressure ( $P_i$ ) is greater than the back pressure ( $P_b$ )), the condensate passes through the outlet check valve and is discharged through the condensate outlet pipe (normal trapping function).
  - When  $P_i \leq P_b$  for both the GP and the GT, the condensate is not discharged and collects in the body of the unit.
- (2) When the float rises to its high level, the push rod on the snap-action unit rises quickly, simultaneously closing the exhaust valve and opening the intake (motive medium) valve. The pressure supplied by the motive medium causes the internal pressure in the unit to become greater than the back pressure. The inlet check valve closes and the outlet check valve is pushed open, thus discharging the condensate in the unit through the outlet pipe, as shown in (2) below.
- (3) As a result of the condensate in the unit being discharged, the water level in the unit drops and the float descends. When the float reaches its low level, the push rod on the snap-action unit moves down quickly, simultaneously opening the exhaust valve and closing the intake (motive medium) valve and the status reverts to that shown in (1) below.



(1) Condensate Inflow

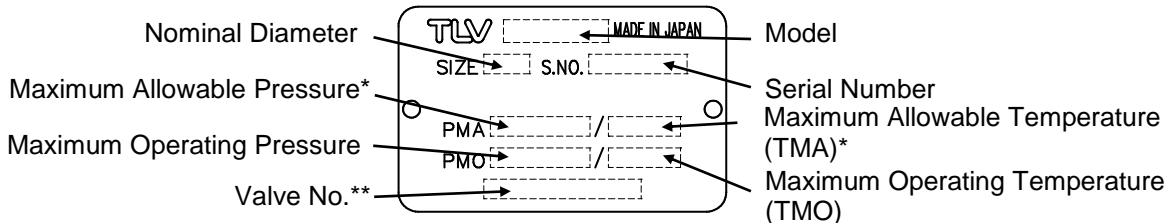
(2) Condensate Discharge

# Specifications

**CAUTION** 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.

**CAUTION** Use only under conditions in which no freeze-up will occur. Freezing may damage the product, leading to fluid discharge, which may cause burns or other injury.

Refer to the product nameplate for detailed specifications.

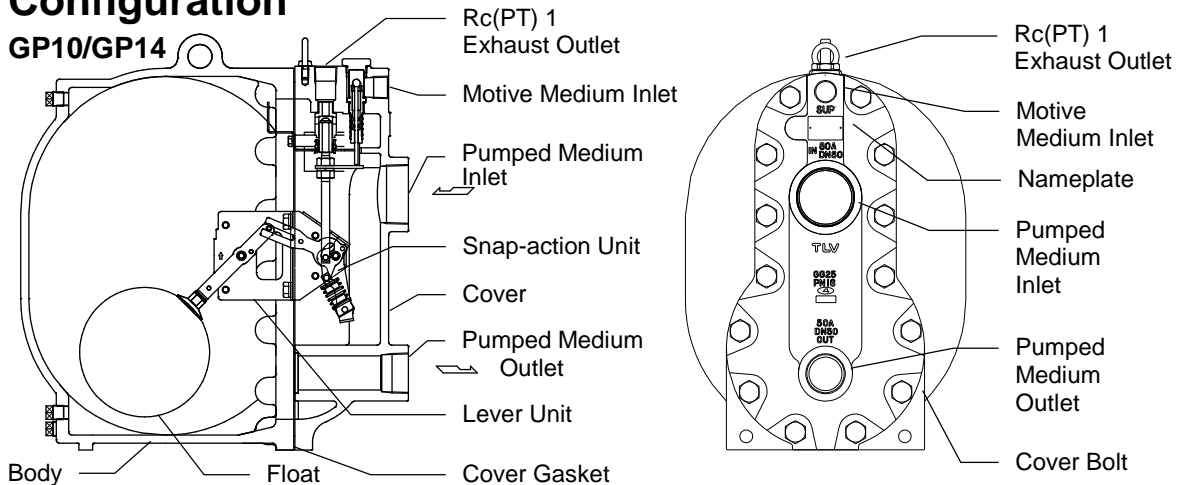


\* Maximum allowable pressure (PMA) and maximum allowable temperature (TMA) are PRESSURE SHELL DESIGN CONDITIONS, **NOT** OPERATING CONDITIONS.  
 \*\* Valve No. is displayed for products with options. This item is omitted from the nameplate when there are no options.

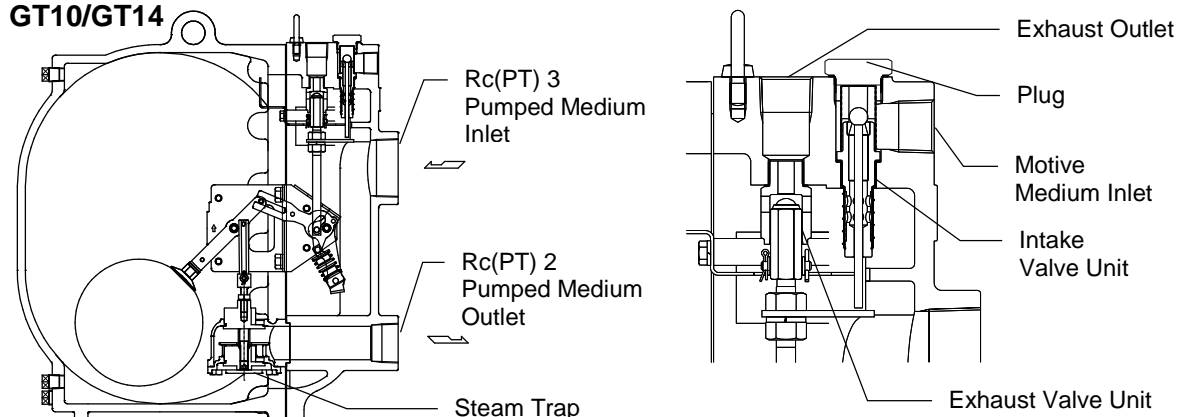
Motive Medium Pressure Range	GP10/GT10	0.03 to 1.05 MPaG	0.3 to 10.5 barg	5 to 150 psig
	GP14/GT14	0.03 to 1.4 MPaG	0.3 to 14 barg	5 to 200 psig
	GP14/GT14 (Cast Iron in Europe)	0.03 to 1.3 MPaG	0.3 to 13 barg	5 to 185 psig
Maximum Allowable Back Pressure	0.05 MPa/0.5 bar/7 psi less than motive medium pressure used (but not to exceed 1.05 MPaG/10.5 barg/150 psig for the GP14/GT14)			

## Configuration

### GP10/GP14



### GT10/GT14





## Installation



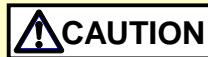
Install properly and **DO NOT** use this product outside the recommended operating pressure, temperature and other specification ranges. Improper use may result in such hazards as damage to the product or malfunctions which may lead to serious accidents. Local regulations may restrict the use of this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



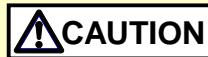
Use hoisting equipment for heavy objects (weighing approximately 20 kg (44 lb) or more). Failure to do so may result in back strain or other injury if the object should fall.



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.

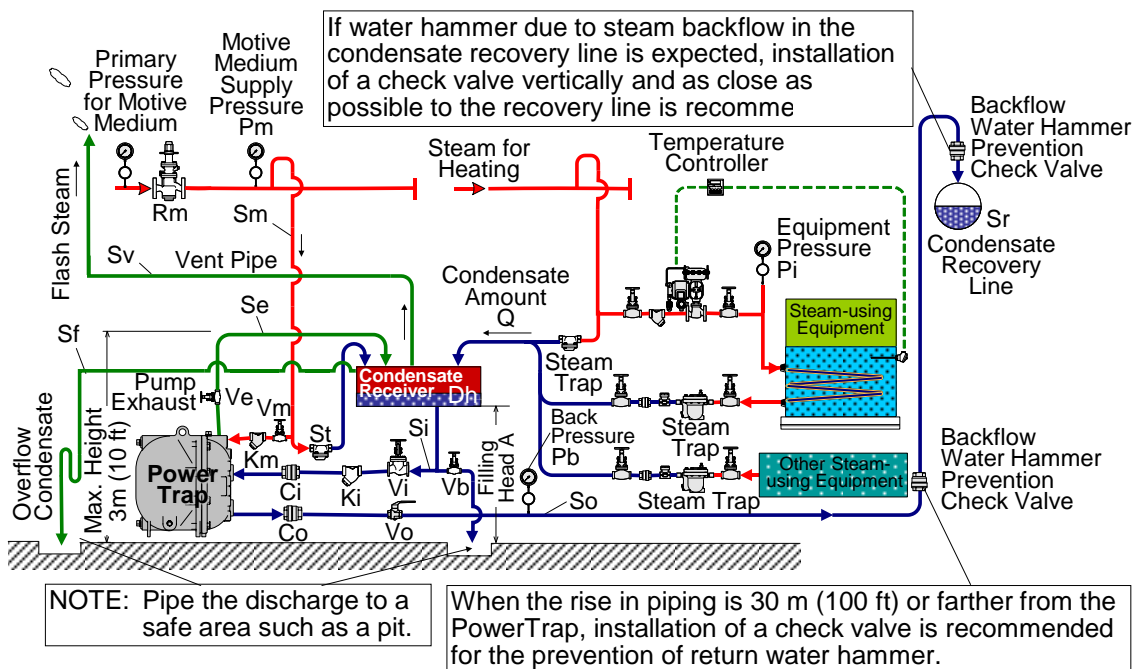


Do not use excessive force when connecting threaded pipes to the product. Over-tightening may cause breakage leading to fluid discharge, which may cause burns or other injury.



Use only under conditions in which no water hammer will occur. The impact of water hammer may damage the product, leading to fluid discharge, which may cause burns or other injury.

### Open System Piping (Steam System Example)



NOTE: This sketch is for explanation purposes only and is not intended as an installation design.

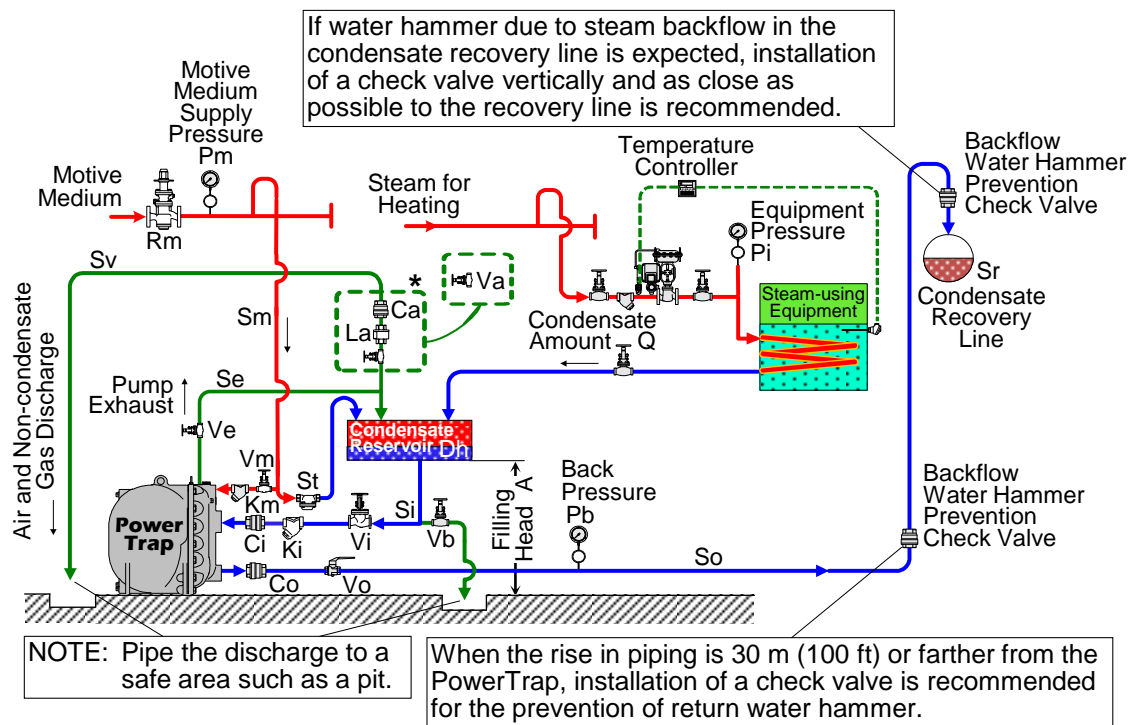
### Necessity of installing a condensate receiver

It is necessary for storing condensate during pumping.

Condensate cannot enter the PowerTrap while condensate is being pumped.

Q	Condensate Amount	Se	Exhaust Pipe	Rm	Motive Medium Pressure Reducing Valve
A	Filling Head	Sv	Vent Pipe	Pi	Equipment Pressure
Pm	Motive Medium Supply Pressure	Sf	Overflow Pipe	St	Steam Trap on Drip leg
Pb	Back Pressure	Dh	Condensate Receiver	Vm	Valve on Motive Medium Supply Pipe
Si	Condensate Inlet Pipe	Ci	Condensate Inlet Check Valve	Ve	Valve on Exhaust Pipe
So	Condensate Outlet Pipe	Co	Condensate Outlet Check Valve	Vb	Blowdown Valve
Sr	Condensate Recovery Line	Ki	Condensate Inlet Strainer		
Sm	Motive Medium Supply Pipe	Km	Motive Medium Strainer		

**Closed System Piping (Steam System Example)**



\*Products shown in the    are the valves, which can be replaced independently.

NOTE: This sketch is for explanation purposes only and is not intended as an installation design. In closed system applications, the motive medium must be compatible with the liquid being pumped. If a non-condensable gas such as air or nitrogen is used as the motive medium, please consult TLV for assistance.

Q	Condensate Amount	Dh	Condensate Reservoir	St	Steam Trap on Drip Leg
A	Filling Head	Ci	Condensate Inlet Check Valve	Vi	Valve on Condensate Inlet Pipe
Pm	Motive Medium Supply Pressure	Co	Condensate Outlet Check Valve	Vo	Valve on Condensate Outlet Pipe
Pb	Back Pressure	Ca	Check Valve for Air Vent		
Si	Condensate Inlet Pipe	La	Air Vent (for Steam)	Vm	Valve on Motive Medium Supply Pipe
So	Condensate Outlet Pipe	Ki	Condensate Inlet Strainer	Ve	Valve on Exhaust Pipe
Sr	Condensate Recovery Line	Km	Motive Medium Strainer	Va	Valve for Air/Gas Discharge
Sm	Motive Medium Supply Pipe	Pi	Equipment Pressure	Vb	Blowdown Valve
Se	Exhaust Pipe	Rm	Motive Medium Pressure		
Sv	Vent Pipe		Reducing Valve		

## Installation Procedure

Refer to the systems outlined in the “General Description” section to select the correct system and model (GT or GP) for the application. Installation, inspection, maintenance, repairs, disassembly, adjustment and valve opening/closing should be carried out only by trained maintenance personnel.

### (1) Pumped Medium:

- Fluids that can be discharged through the PowerTrap are limited to steam condensate and water. PowerTraps that have been constructed for other specific fluids are not limited by this restriction.

### (2) Motive Medium Supply Piping:

- The motive medium supply pipe diameter should be at least 20 mm ( $\frac{3}{4}$  in).
- Install a 40-mesh or finer strainer on the PowerTrap motive medium supply pipe, as close to the PowerTrap as possible, while allowing sufficient space for maintenance of the strainer. Strainers should be angled in the 3 or 9 o'clock positions for horizontal installations.
- See the “Specifications” section for the maximum motive medium inlet pressure.
- **For Open Systems:**  
Steam, compressed air or nitrogen may be used as the motive medium.
- **For Closed Systems:**  
Use steam as the motive medium. Except in special cases, do not use non-condensable gases such as air or nitrogen.
- When the motive medium is steam, if the application will require that the equipment be shut down (non-operating) for periods of 2 months or longer, install piping connecting the motive medium supply line to the receiver/reservoir pipe, being sure to install a drip leg on the motive medium supply line, and a steam trap in the drip leg (between where it branches to go to the PowerTrap and where it enters the receiver/reservoir pipe). (See item [St] in the Open/Closed system Piping drawings.)  
This measure is not necessary when the motive medium is compressed air or nitrogen.

### (3) Pressure Reducing Valve on the Motive Medium Supply Piping:

- When the supply pressure of the motive medium is greater than the maximum operating pressure of the PowerTrap, install a TLV COSPECT series pressure reducing valve. Make sure that the motive medium pressure is lower than the maximum operating pressure of the PowerTrap. Use good piping practices when selecting the installation location for COSPECT.  
In this case, be sure to install a safety valve between the pressure reducing valve and the PowerTrap.
- When the supply pressure of the motive medium is less than the maximum operating pressure of the PowerTrap, if a pressure reducing valve is to be installed to slow the speed of the flow, the installation of a safety valve is not required.
- Install the pressure reducing valve as far away from the PowerTrap as possible.  
When the motive medium pressure is less than 0.5 MPaG (72.5 psig, 5 barg): at least 3 m (10 ft)  
When the motive medium pressure is 0.5 MPaG or greater (72.5 psig or greater, 5 barg or greater): at least 3 m + 1 m for every 0.1 MPaG (1 barg) over 0.5 MPaG (5 barg) (10 ft + 1 ft for every 4.5 psig over 72.5 psig)

- The pressure setting on the pressure reducing valve should be between 0.05 and 0.15 MPa (7 to 20 psi, 0.5 to 1.5 bar) higher than the back pressure. When the discharge capacity of the PowerTrap is insufficient for the set motive pressure, increase this set pressure even further.

#### (4) Exhaust Piping:

- The exhaust pipe diameter should be at least 25 mm (1 in).
- The exhaust pipe should be connected to the top of the receiver/reservoir.
- **For Open Systems:** If the GP exhaust line has to discharge to atmosphere, a sound level of approximately 90 to 100dB (GP10) or 90 to 110dB (GP14) may be emitted from the exhaust pipe discharge outlet for two to three seconds. If soundproofing measures are necessary, install a silencer. (If the exhaust line is connected to the condensate receiver, the sound level will be below 60dB.)
- Make sure that the distance from the ground to the highest point on the exhaust pipe (where it enters the receiver/reservoir) does not exceed 3 m (10 ft). If it exceeds 3 m (10 ft) and steam is used as the motive medium, condensate must be drained from the exhaust pipe in order not to obstruct the exhaust. Implement one of the following countermeasures: (See the figures below.)
  - (a) **For Open Systems only:** Add a float-type steam trap to the exhaust pipe at a point just above where the exhaust pipe exits the unit body. (Figure 1)
  - (b) **For Open and Closed Systems:** Add piping connecting the exhaust pipe to the pumped medium inlet pipe between the reservoir and the strainer, being sure to install a check valve on the piping to prevent backflow of condensate from the pumped medium inlet pipe to the exhaust pipe. (Figure 2)
- **For Closed Systems only:** The exhaust pipe must be connected to the top of the reservoir.

When the exhaust piping height exceeds 3 m (10 ft.)

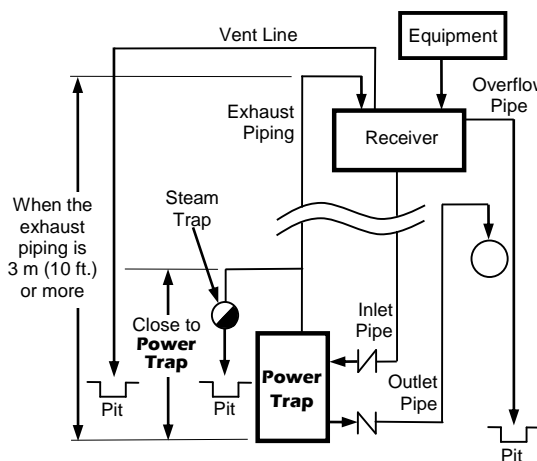


Figure 1: Open Systems

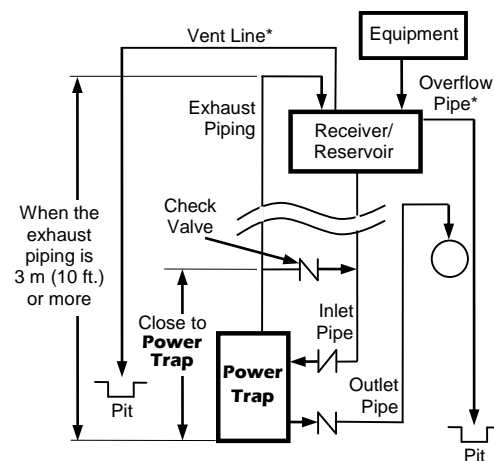


Figure 2: Open & Closed Systems  
\* For Open Systems only

#### (5) Inlet and Outlet Piping

- Install a 40-mesh or finer strainer on the PowerTrap pumped medium inlet pipe. The installation should be in a location that allows sufficient space for maintenance of the strainer.
- Ensure that the inlet and outlet check valves are installed in the correct direction. The check valve on the inlet pipe in particular should be installed right next to the PowerTrap.
- Only TLV check valves (CK3MG, CKF3MG) should be used; proper discharge capacity cannot be guaranteed with other check valves.

## (6) Valves on the Various Pipes

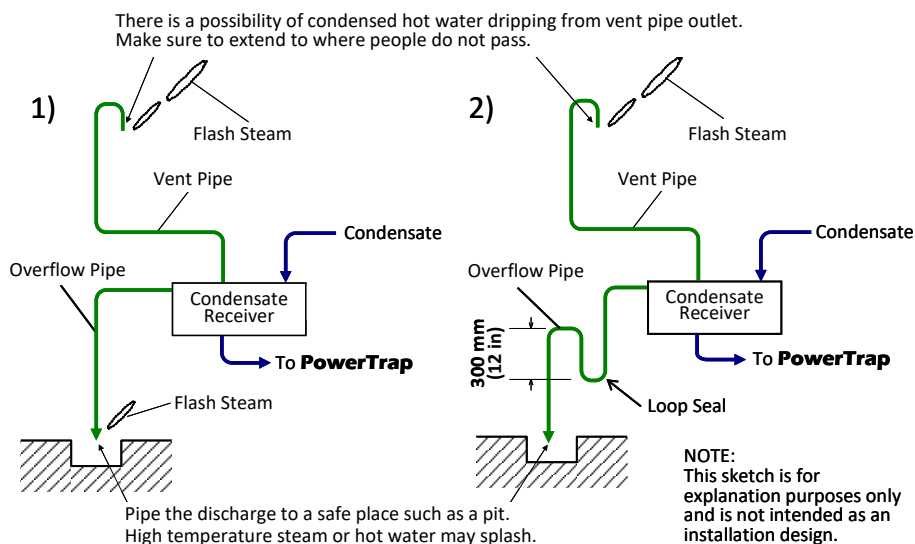
- In order to ensure the proper discharge capacity, use full bore ball valves or gate valves on the pumped medium inlet and outlet lines as well as on the motive medium supply and exhaust lines.  
If it is necessary to reduce the velocity of the motive medium supply, a needle valve can be used. However, be aware that the discharge capacity will be reduced. (Refer to “Operation” (1). e.)
- Install union or flanged joints between the valves and the PowerTrap to allow for easy maintenance.
- Be sure to provide the necessary maintenance space for PowerTrap disassembly and repair (see the “Installation and Maintenance Space” section).

## (7) Receiver/Reservoir Pipe and Filling Head

- Please refer to the “Sizing the Condensate Receiver/Reservoir” section.  
The size and vent pipe aperture are determined by (a) the amount of any flash steam in the in-flowing condensate (pumped medium) and (b) the amount of pumped medium held back while the PowerTrap is discharging.  
If the receiver is small, the flow of flash steam may cause condensate to flow out the vent pipe.  
If the vent pipe size is small, the pressure in the receiver will rise, restricting the pumped medium inflow.  
Be sure to select a receiver/reservoir pipe of the correct size.
- The filling head represents the distance from the bottom of the PowerTrap (from grade) to the bottom of the receiver/reservoir.  
The standard filling head is 860 mm (36 in).  
When an installation calls for a lower filling head, a filling head of less than 860 mm (36 in) is allowable. However, the minimum filling head is 710 mm (30 in).
- **For Open Systems:**
  - If venting flash steam to a high area, an overflow pipe must be installed to discharge condensate to a safe area.
  - Overflow pipe should be installed at the side of the receiver.

**WARNING**

- Be sure to install a vent pipe and an overflow pipe. Failure to install an overflow pipe is dangerous, as condensate may spurt from the vent pipe and could result in burns and other injuries.
- Pipe the vent pipe and the overflow pipe to a safe place such as a pit.
- Piping size of the overflow pipe should be the same or larger than condensate inlet pipe.

**Examples of Overflow Piping for Open Systems**

## Explanations for Overflow Piping for Open Systems

- 1) If flash steam can be discharged from overflow pipe  
Install overflow pipe and vent pipe separately.
- 2) If flash steam should not be released from overflow pipe (prevent flash steam release)  
Install overflow pipe and vent pipe separately. For overflow pipe, install loop seal (approx. 300 mm (12 in)). Flash steam release from overflow pipe can be prevented since water always accumulates at loop seal. Piping size should be the same or larger than condensate supply pipe.

NOTE: • There is a possibility of rust becoming clogged and/or corrosion since water always present in the loop seal. The possibility is greater if the piping diameter is too small (generally 25 mm (1 in) or smaller).

- If the loop seal becomes clogged, hot overflow water will blow from vent pipe. Make sure to install vent pipe to lead to a safe place
- Do not install loop seal on the vent pipe

Contact TLV if neither 1) nor 2) above can be installed.

### (8) Velocity at Outlet Piping

The PowerTrap uses the motive medium supply pressure to push the pumped medium out of the trap.

- The GP10/GT10/GP14/GT14 can discharge approximately 30 liters (8 U.S. gal) of pumped medium for each discharge operation.
- The amount of time required for each discharge operation will be between 3 and 30 seconds, depending on the back pressure and the motive medium pressure. This means that the instantaneous flow through the pumped medium outlet pipe during the discharge operation is between 4 and 40 metric tonnes (1,060 and 10,600 U.S. gal) per hour.
- When a flowmeter is to be installed in the pumped medium outlet piping, it should be selected to reflect the intermittent operation and should be sized to accommodate the maximum and minimum instantaneous flow. Contact TLV for details.

### (9) For Closed Systems:

- An air vent (for steam) [La] or valve for air discharge [Va] is required to discharge the initial air in the equipment and the reservoir pipe or any gas generated in the system. In this case, installing the check valve for air vent [Ca] will prevent air from being sucked in from the outlet of the vent pipe [Sv]. This check valve must be installed when the pressure inside the piping becomes negative. A valve for air discharge [Va] can be installed instead of the air vent (for steam) [La] and check valve for air vent [Ca].

When releasing the initial air using a valve for air discharge, leave the valve for air discharge [Va] slightly open until the PowerTrap has cycled 2 – 3 times. Close the valve for normal operation.

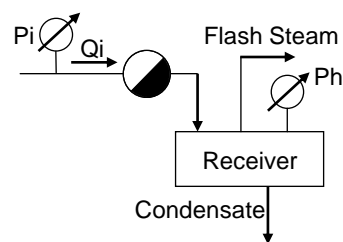
- Select the appropriate PowerTrap model (GT or GP) based on the explanation in “General Description”.
- Refer to “(2) When flash steam is not involved” in “Sizing the Condensate Receiver/Reservoir” for information on condensate reservoir sizing.

For more details, contact TLV.

## Sizing the Condensate Receiver/Reservoir

When selecting the receiver/reservoir for the PowerTrap, select from among the following 3 conditions:

- (1) When large quantities of flash steam are involved  
(For open systems using steam)



- a) Determine the amount of flash steam:

$$\text{Amount of flash steam } Fs = Q \times (hd' - hh') / r$$

$Fs$  : amount of flash steam (kg/h) (lb/h)

$Q$  : amount of condensate (kg/h) (lb/h)

$hd'$  : specific enthalpy (kJ/kg) (Btu/lb) of saturated condensate at condensate inlet set pressure ( $P_1$ )

$hh'$  : specific enthalpy (kJ/kg) (Btu/lb) of saturated condensate at condensate receiver set pressure ( $P_2$ )

$r$  : specific enthalpy (kJ/kg) (Btu/lb) vaporization (latent heat of steam) at condensate receiver set pressure ( $P_2$ )

- b) Determine the **vent pipe diameter** according to the amount of flash steam in Vented Receiver Table - 1 shown on the next page.

- c) Determine the **overflow pipe diameter** ( $D_{op}$ , refer to the figure below).

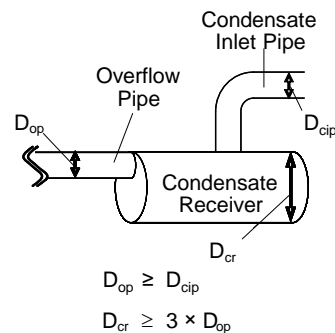
NOTE: The overflow pipe diameter should be at least as large as the condensate inlet pipe diameter ( $D_{cip}$ , refer to the figure below).

- d) Determine the **minimum condensate receiver diameter** ( $D_{cr}$ , refer to the figure below) by selecting the largest value among those from (i), (ii), and (iii) based on a condensate receiver length of 1 m (3.3 ft).

(i) is the overflow pipe diameter multiplied by 3 or more.

(ii) is the minimum receiver diameter according to the amount of flash steam in Vented Receiver Table - 1 shown on the next page.

(iii) is the minimum receiver diameter according to the amount of condensate in Vented Receiver Table - 2 shown on the next page.



NOTE: Receiver length can be reduced by 50% when the motive pressure ( $P_m$ ) divided by the back pressure ( $P_b$ ) is "2" or greater.  
(When  $P_m \div P_b \geq 2$ )

**Vented Receiver Table - 1**  
**(For atmospheric, open system installations, applicable trap – GP10/GP14)**

Flash Steam up to ~ <b>kg/h</b>	Receiver Diameter <b>mm (in)</b> (Length: 1 m)	Vent Line Diameter <b>mm (in)</b>	Flash Steam up to ~ <b>lb/h</b>	Receiver Diameter <b>in</b> (Length: 3.5 ft)	Vent Line Diameter <b>in</b>
25	80 (3)	25 (1)	50	3	1
50	100 (4)	50 (2)	75	4	1½
75	125 (5)	50 (2)	100	4	2
100	150 (6)	80 (3)	200	6	2½
150	200 (8)	80 (3)	300	8	3
200	200 (8)	100 (4)	400	8	4
300	250 (10)	125 (5)	600	10	4
400	300 (12)	125 (5)	800	12	6
500	350 (14)	150 (6)	1000	14	6
700	400 (16)	200 (8)	1400	16	8
800	450 (18)	200 (8)	1600	18	8
1000	500 (20)	200 (8)	2000	20	8
1100	500 (20)	250 (10)	2200	20	10
1400	550 (22)	250 (10)	2800	22	10
1500	600 (24)	250 (10)	3000	24	10

**Vented Receiver Table - 2**  
**(For atmospheric, open system installations, applicable trap – GP10/GP14)**

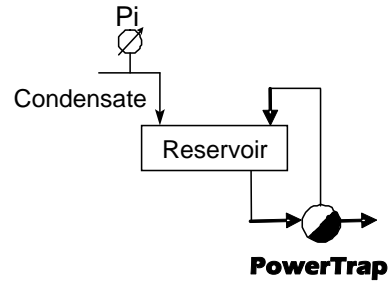
Amount of Condensate <b>kg/h</b>	Receiver Diameter <b>mm (in)</b> (Length: 1 m)	Amount of Condensate <b>lb/h</b>	Receiver Diameter <b>in</b> (Length: 3.5 ft)
1000 or less	80 (3)	2200 or less	3
1500	100 (4)	3300	4
2000	125 (5)	4400	5
3000	150 (6)	6600	6
6000	200 (8)	13000	8
10000	250 (10)	22000	10

NOTE: When amount of flash steam and condensate are between two values in the table, select the larger value (one line below).



(2) When flash steam is not involved  
(For closed systems)

Determining the reservoir diameter and length based on the amount of condensate:



**Reservoir Table**  
(For equalized, closed system installations)

Amount of Pumped Medium (kg/h)	Reservoir Diameter (mm) & Length (m)							Amount of Pumped Medium (lb/h)	Reservoir Diameter (in) & Length (ft)						
	40	50	80	100	150	200	250		1½	2	3	4	6	8	10
300 or less	1.2m	0.7						500 or less	3.0 ft	2.0					
400	1.5	1.0						700	4.0	2.5	1.0				
500	2.0	1.2	0.5					1000	5.5	3.5	1.5				
600		1.5	0.6					1200		4.5	2.0	1.0			
800		2.0	0.8	0.5				1500			2.5	1.5			
1000			1.0	0.7				2000			3.5	2.0			
1500			1.5	1.0				3000			4.5	3.0			
2000			2.0	1.3	0.6			4000			6.5	4.0	1.5		
3000				2.0	0.9	0.5		5000				5.0	2.5		
4000					1.2	0.7		6000				5.5	2.5	1.5	
5000					1.4	0.8	0.5	7000				6.5	3.0	1.5	
6000					1.7	1.0	0.6	8000					3.5	2.0	
7000					2.0	1.2	0.7	9000					4.0	2.5	1.5
8000						1.3	0.8	10000					4.5	2.5	1.5
9000						1.5	0.9	12000					5.0	3.0	2.0
10000						1.7	1.0	14000					6.0	3.5	2.5
								16000					6.5	4.0	2.5
								18000						4.5	3.0
								20000						1.5	1.5

NOTE: Reservoir length can be reduced by 50% when the motive pressure (P<sub>m</sub>) divided by the back pressure (P<sub>b</sub>) is "2" or greater. (When P<sub>m</sub> ÷ P<sub>b</sub> ≥ 2)

(3) When there are small quantities of flash steam and a large amount of condensate (e.g., open systems pumping large amounts of super-cooled condensate)

Consult the sizing tables in sections (1) and (2).

Select the condensate receiver size based on the larger of (1) and (2).

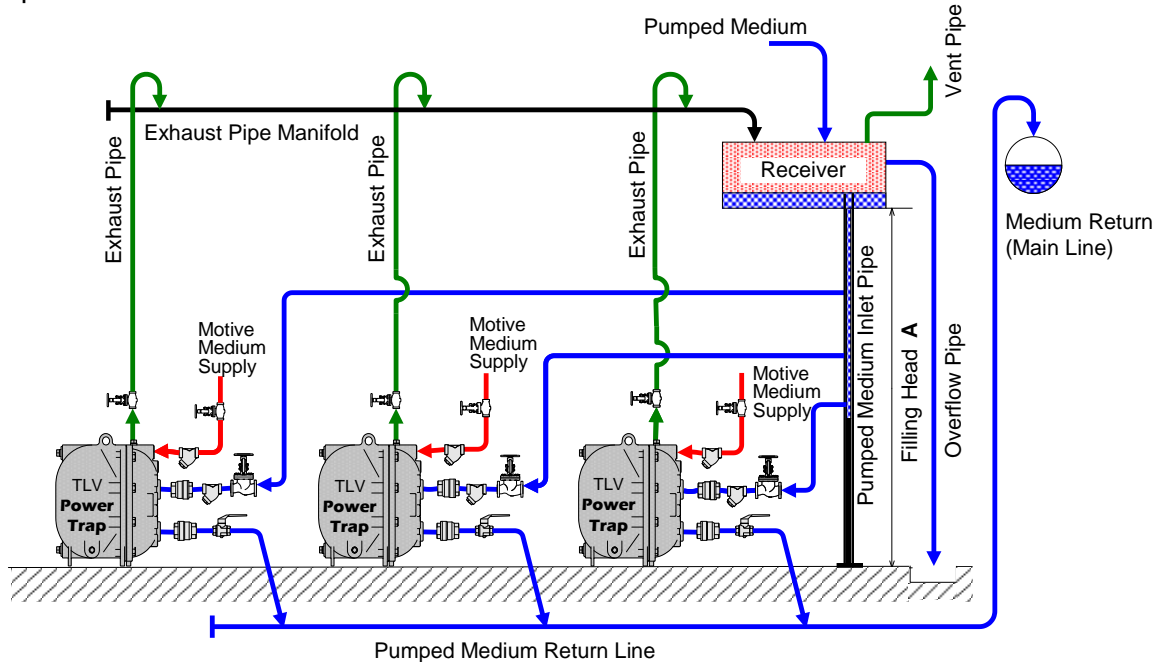
Select the vent pipe diameter and overflow pipe diameter from (1).

## Installing Several PowerTrap Units in Parallel

Refer to the figure below as a general guide for the piping when several PowerTrap units are to be installed after the same pumped medium inlet pipe.

The size of the pumped medium inlet pipe, return line and exhaust pipe manifold is determined by the number of PowerTrap units installed.

When specifications exist separately from the instruction manual, follow the specifications.

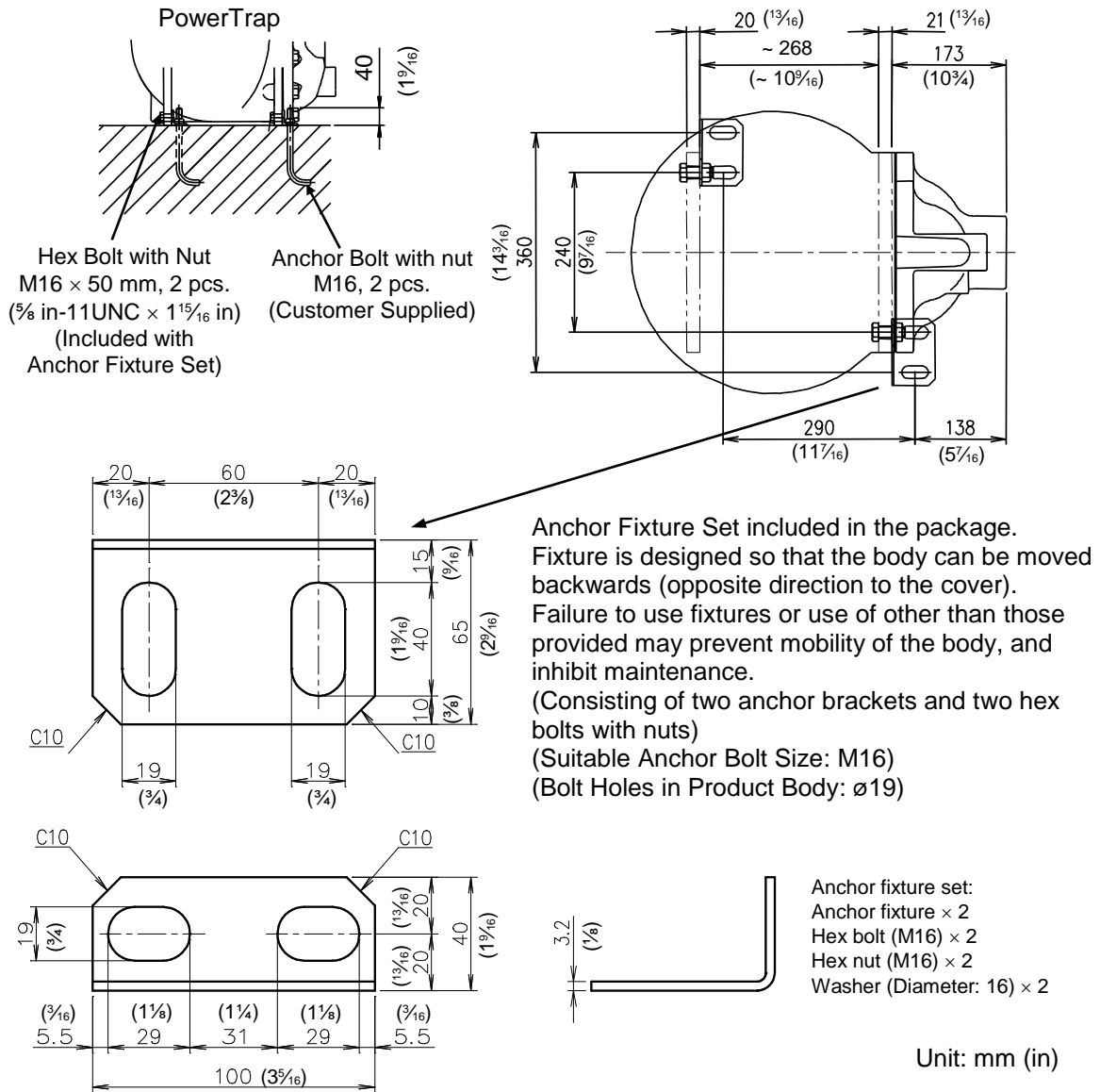


NOTE: This sketch is for explanation purposes only and is not intended as an installation design.

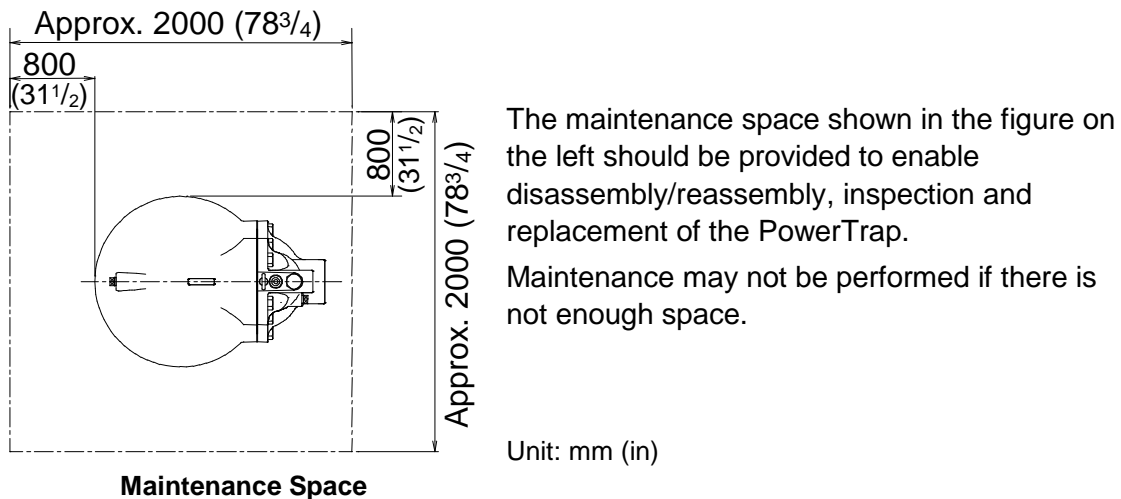
Number of PowerTrap Units Installed	Pumped Medium Inlet Pipe Size	Pumped Medium Return Line Size	Exhaust Pipe Manifold Size	Overflow Pipe Size	Vent Pipe Size
2	125 mm (5 in)	80 mm (3 in)	40 mm (1½ in)	Determine overflow pipe size according to "Sizing the Condensate Receiver/Reservoir"	See the Vent Line Diameter column in Table-1
3	150 mm (6 in)	100 mm (4 in)	50 mm (2 in)		
4	200 mm (8 in)	100 mm (4 in)	65 mm (2½ in)		
5	200 mm (8 in)	125 mm (5 in)	65 mm (2½ in)		
6	200 mm (8 in)	125 mm (5 in)	80 mm (3 in)		

# Installation and Maintenance Space

## Anchoring the Body



## Maintenance Space



## Operation and Periodic Inspection

### WARNING

- After all piping work has been completed in accordance with the specific piping system designed when the decision to utilize the PowerTrap was made, check once again to make sure that all pipe connections have been tightened, gaskets have been inserted where needed and all parts are securely installed.
- When beginning operation, make sure that the operator stays well clear of the release area of the vent line and overflow piping. At the start-up of operation, large quantities of condensate may flow, causing the PowerTrap to momentarily overload. If this occurs in open systems, hot condensate may spurt from the vent piping or overflow piping and could result in burns, other injuries or damage to equipment.

### CAUTION

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.

### CAUTION

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.

### 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 or burns or other injury due to malfunction or the discharge of fluids.

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

## Operation

### (1) Valve Operation

Refer to the drawings in “Installation” to become familiar with the symbols used for the various valves.

If water hammer has occurred, immediately cease operation and close any valves that are operating.

- Slowly open the valve [Ve] on the exhaust pipe.
- Slowly open the valve [Vm] on the motive medium supply pipe.  
Make sure that there is no sound of flow from the exhaust pipe [Se] or the pumped medium inlet pipe [Si].
- Slowly open the valve [Vo] on the pumped medium outlet pipe.
- Slowly open the valve [Vi] on the pumped medium inlet pipe.

When using a valve for air/gas discharge [Va] for venting air on a closed system, leave the valve [Va] slightly open until the PowerTrap has cycled 2 or 3 times in order to release any air inside the system, then close the valve [Va].

- e) The PowerTrap is normal if it operates intermittently; first exhausting the motive medium to fill with pumped medium, then taking in motive medium to force the pumped medium out.
- The interval of operation will vary greatly depending on the amount of pumped medium inflow, the temperature, the motive medium (steam or gas) and the motive pressure. (The interval of operation is considered to be the length of time between the start of one discharge cycle and the start of the next discharge cycle.)  
The interval of operation  $T_c$  (s) can be roughly determined using the following formula:  

$$T_c = 108,000/Q \text{ or } T_c = 238,000/Q_p$$
    - Q: amount of condensate (inflowing pumped medium) (kg/h)
    - $Q_p$ : amount of condensate (inflowing pumped medium) (lb/h)
  - The GP10/GT10/GP14/GT14 can discharge approximately 30 liters (8 U.S. gal) of pumped medium for each discharge operation.  
The amount of time required for each discharge operation will be between 3 and 30 seconds, depending on the back pressure and the motive medium pressure.
- (2) If an error such as a leak or water hammer occurs after beginning PowerTrap operation, shut off the valves immediately in the following order:  
valve [Vm] on motive medium supply pipe → pumped medium inlet valve [Vi] → pumped medium outlet valve [Vo] → valve [Ve] on exhaust pipe
- (3) Whenever any type of malfunction is suspected in the PowerTrap, refer to the “Troubleshooting” section.

## Periodic Inspection and Diagnosis

There are two types of periodic inspection: the visual inspection and the disassembly inspection.

### (1) Visual Inspection

- As a general rule, this inspection should be performed at least once every 3 months.
- Check the following items:
  - a) There should be no leakage from the PowerTrap or from any of the connections.
  - b) The PowerTrap unit should be operating cyclically (one indication being the sharp, mechanical sound of the snap-unit operating at the transition between the filling and the discharge parts of the cycle). Immediately after the end of the discharge part of the cycle and during the filling part of the cycle, the sound of flow in the exhaust pipe should be heard. During the pumping (discharge) part of the cycle, flow in the motive medium supply pipe should be heard.
  - c) Pumped medium should not accumulate in the (steam-using) equipment, and the temperature of the equipment should not be abnormally low.
  - d) For open systems, verify that an overflow pipe from the receiver is installed.
  - e) For open systems, no steam should be seen flowing out through the vent pipe.
  - f) There should not be any abnormal noise from the pumped medium outlet pipe or the pumped medium recovery line when the PowerTrap operates.

## (2) Disassembly Inspection

- Refer to the “Disassembly/Reassembly” section.
- As a general rule, this inspection should be performed at least once every 2 years.
- When inspecting the interior of the unit, check the following items:
  - a) Make sure the push rod does not catch on anything during snap-action (the up-down movement of the push rod) and moves smoothly as the float rises and falls.
  - b) In the case of the GT model, make sure the valve in the trap unit moves up and down smoothly as it opens and closes.
  - c) Make sure the valve shafts in the intake (motive medium) and exhaust valves move up and down smoothly. The gap between the stem of the closed intake (motive medium) valve and the push plate should be within specified range. The exhaust valve will have some movement when open, but should be stable when closed.)
  - d) Make sure the float is not damaged and has not filled with water.
  - e) Make sure all nuts and bolts are properly installed and fastened.
  - f) Check to make sure that there is no foreign matter sticking to the shafts and levers of any of the units, and make sure there is no abnormal wear.
- When reassembling, be sure to replace the body and cover gaskets with new gaskets.
- Also replace any parts that are broken or show serious wear.
- If any parts require replacement, refer to the “Replacement Parts” section.

## Disassembly/Reassembly



### WARNING

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.



### CAUTION

Use hoisting equipment for heavy objects (weighing approximately 20 kg (44 lb) or more). Failure to do so may result in back strain or other injury if the object should fall.



### CAUTION

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.



### CAUTION

Do not use excessive force when connecting threaded pipes to the product. Over-tightening may cause breakage leading to fluid discharge, which may cause burns or other injury.

Use the procedures on the following pages to remove components. Use the same procedures in reverse to reassemble.

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

In cases where sufficient maintenance space has been provided for (see the “Installation and Maintenance Space” section), maintenance can be carried out without disconnecting the inlet and outlet piping. Where there is insufficient maintenance space, first disconnect the inlet and outlet piping, and then move the unit to a spacious area in which maintenance can be carried out safely.

When reassembling:

- Be sure to replace the body and cover gaskets with new gaskets. Also replace any parts that are broken or show serious wear.  
If any parts require replacement, refer to the “Replacement Parts” section.
- When reassembling, coat threads and bolts with anti-seize.  
Tighten the body and cover bolts in a uniform manner left and right, being careful to avoid uneven tightening.
- If drawings or other special documentation were supplied for the product, any torque given there takes precedence over values shown here.

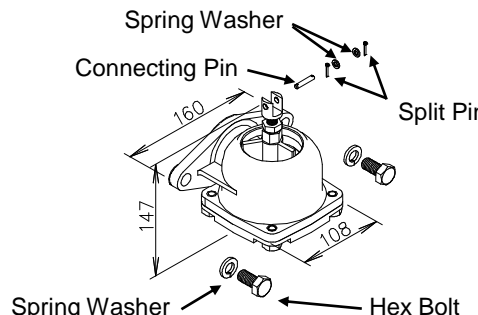
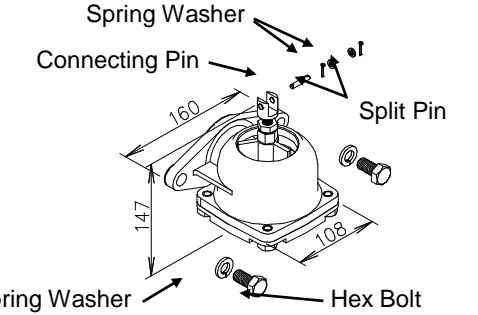
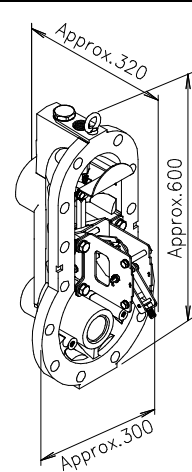
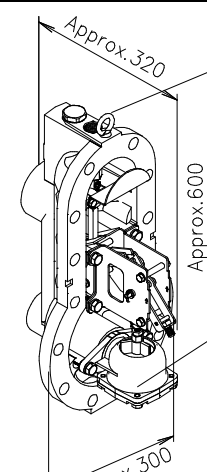
**Replacement Parts**

The following replacement parts kits are available from TLV. Parts are not available individually, only together in kits. (Units: mm)

<p><b>1A Lever Unit (GP10/GP14)</b></p>	<p><b>1B Lever Unit (GT10/GT14)</b></p>	<p><b>2 Float and Spring Washer</b></p>
<p><b>3 Snap-action Unit</b></p>	<p><b>4 Exhaust Valve Unit</b></p>	<p><b>5A Motive Medium Intake Valve Unit (GP10/GT10)</b></p>
<p><b>5B Motive Medium Intake Valve Unit (GP14/GT14)</b></p>	<p><b>6A Cover Gasket (GP10/GT10)</b></p> <p>(Graphite Compound)</p>	<p><b>6B Cover Gasket (GP14/GT14)</b></p> <p>(Graphite / Stainless Steel)</p>

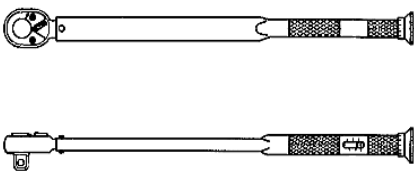
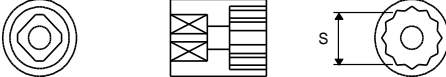

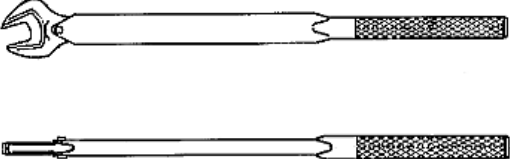
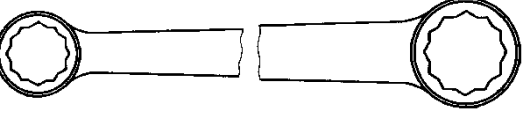
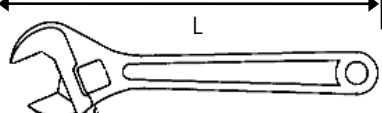
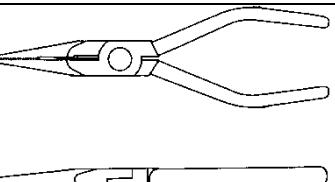
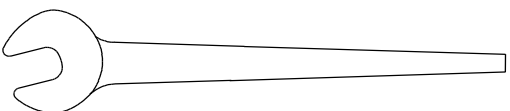
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<p><b>7A Trap Unit (GT10)</b></p>  <p>Spring Washer Connecting Pin Split Pin Hex Bolt Spring Washer</p>	<p><b>7B Trap Unit (GT14)</b></p>  <p>Spring Washer Connecting Pin Split Pin Hex Bolt Spring Washer</p>
<p><b>8A Cover Unit for GP10 (Cast Iron)</b></p> <p><b>8C Cover Unit for GP14 (Cast Iron)</b></p> <p><b>9A Cover Unit for GP10 (Cast Steel)</b></p> <p><b>9C Cover Unit for GP14 (Cast Steel)</b></p> 	<p><b>8B Cover Unit for GT10 (Cast Iron)</b></p> <p><b>8D Cover Unit for GT14 (Cast Iron)</b></p> <p><b>9B Cover Unit for GT10 (Cast Steel)</b></p> <p><b>9D Cover Unit for GT14 (Cast Steel)</b></p> 

When ordering cover units, be sure to indicate PowerTrap model, connection type and size.

## Recommended Tools List for Disassembly/Reassembly

No.	Tool Name	Step Used		Tool
		GP	GT	
1	Torque Wrench (Ratchet) 30 – 200 N·m (22 – 150 lbf·ft)	1	1	
		3	3	
		4	4	
		5	5	
		6	6, 8	
2	Sockets Distance across flats = S 13 mm (1/2 in) 17 mm (21/32 in) 19 mm (3/4 in) 27 mm (1 1/16 in) 30 mm (1 3/16 in) 38 mm (1 1/2 in)	3	3	
		6	6	
		4	4, 8	
		5	5	
		1	1	
		6	6	
3	Extension Bar L = 150 mm (5 7/8 in)	6	6, 8	
4	Open-end Torque Wrench 30 – 60 N·m (22 – 44 lbf·ft) 14 mm (9/16 in) 17 mm (21/32 in) 19 mm (3/4 in) 22 mm (7/8 in)	1 2 5a	1	
			1	
			8a	
			2	
5	Offset Wrench 13 mm (1/2 in) 19 mm (3/4 in) 27 mm (1 1/16 in) 30 mm (1 3/16 in) 38 mm (1 1/2 in)	3 4 5 1 6	3	
			3	
			4	
			5	
			6	
6	Adjustable Wrench L = 300 mm (12 in)	1 2	1	
			2	
7	Needle-Nose Pliers	5 6	5	
			5	
8	Open-end Wrench 22 mm (7/8 in) 17 mm (21/32 in)	5a	5a	
			8a	

(1 N·m ≈ 10 kg·cm)

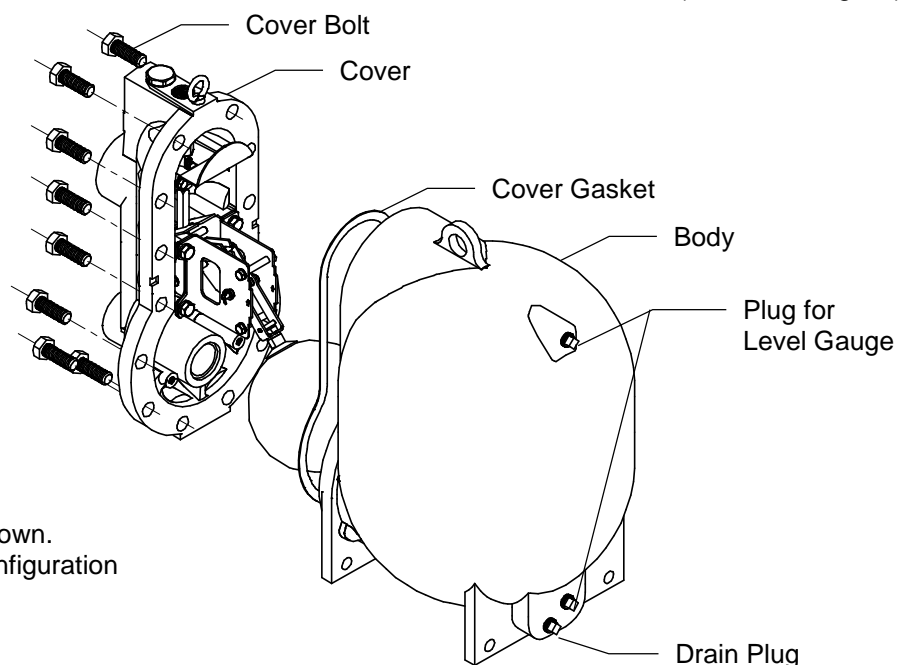
NOTE: If drawings or other special documentation were supplied for the product, any torque given there takes precedence over values shown here.

## 1. Removing/Reattaching the Body from/to the Cover

Prepare a new, replacement cover gasket before beginning this step.

Part	Disassembly	Reassembly
Drain Plug	<ul style="list-style-type: none"> <li>Discharging condensate is carried out with intake (motive medium), exhaust, inlet and outlet piping still connected to the unit.</li> <li>Using a 300 mm (12 in) long adjustable wrench, slowly loosen plug to release pressure and discharge fluid; take care to avoid being burned by fluid discharge.</li> </ul>	<ul style="list-style-type: none"> <li>Wrap threads with 3 to 3.5 turns of sealing tape or apply sealing compound.</li> <li>Tighten to a torque of 30 N·m (22 lbf·ft).</li> </ul>
Cover Bolts	<ul style="list-style-type: none"> <li>Using a 30 mm (1<sup>3</sup>/<sub>16</sub> in) socket wrench, loosen each bolt slowly one turn in an alternating diagonal pattern.</li> <li>Once all bolts have been loosened, verify that there is no internal pressure before completely removing the bolts.</li> </ul>	<ul style="list-style-type: none"> <li>Reverse steps in disassembly.</li> <li>Tighten to a torque of 200 N·m (150 lbf·ft).</li> </ul>
Anchors	<ul style="list-style-type: none"> <li>Remove the bolts that hold the anchor brackets to the body and rotate the anchor brackets on their base bolts so that they will not interfere with removal of the body from the cover.</li> </ul>	<ul style="list-style-type: none"> <li>Reverse steps in disassembly.</li> </ul>
Body / Cover	<ul style="list-style-type: none"> <li>Make sure to secure sufficient space around the body to allow it to be pulled straight off.</li> <li>As the body weighs approximately 90 kg (200 lb), use a block and tackle hoist to assist in its removal.</li> <li>When moving the body away from and clear of the cover, lift the body only about 1 cm (<sup>3</sup>/<sub>8</sub> in), to avoid contact with the float and other internal parts.</li> <li>In addition, to avoid contact with the float when removing the body, lift the float and the float lever slightly.</li> <li>Do not tilt the body more than 15° in any plane.</li> </ul>	<ul style="list-style-type: none"> <li>Reverse steps in disassembly.</li> </ul>
Cover Gasket	<ul style="list-style-type: none"> <li>The gasket will be destroyed upon disassembly, adhering to both body and cover; using a scratch-free scrapper, carefully scrape the gasket from both body and cover surfaces.</li> </ul>	<ul style="list-style-type: none"> <li>Check that all pieces of old gasket have been removed, then install a new gasket.</li> </ul>

(1 N·m ≈ 10 kg·cm)



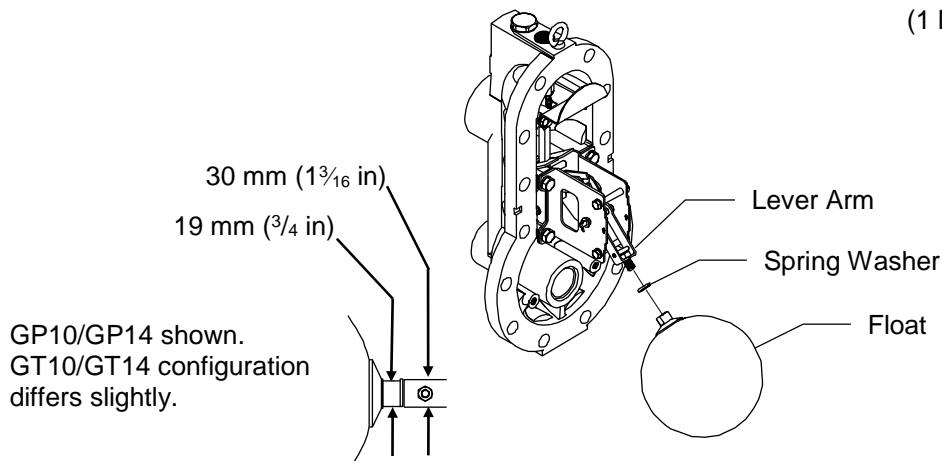
GP10/GP14 shown.  
GT10/GT14 configuration  
differs slightly.

## 2. Removing/Reattaching the Float

It is not necessary to remove the float if only the intake (motive medium) and exhaust valves are to be serviced or replaced. It is not always necessary to replace the float when replacing the snap-action unit. The float should be replaced only when there are irregularities such as damage to its exterior or condensate found inside the float.

Part	Disassembly	Reassembly
Float	<ul style="list-style-type: none"> <li>Using a 300 mm (12 in) long adjustable wrench and a 19 mm (<math>\frac{3}{4}</math> in) open-end torque wrench and an adjustable wrench, disengage the float from the lever arm. The adjustable wrench is applied and held to the bolt head welded to the float end of the lever arm, and the open-end torque wrench is applied to the float connector. The purpose of the two tools is to stabilize the bolt in order to loosen the float without twisting the lever arm.</li> <li>Loosen the float only one turn with the two wrenches.</li> <li>Complete the removal of the float with both hands, being careful not to drop the float or lose the spring washer.</li> </ul>	<ul style="list-style-type: none"> <li>Be sure to reassemble with the spring washer.</li> <li>Using two wrenches, as described in disassembly, tighten to a torque of 60 N·m (44 lbf·ft).</li> </ul>

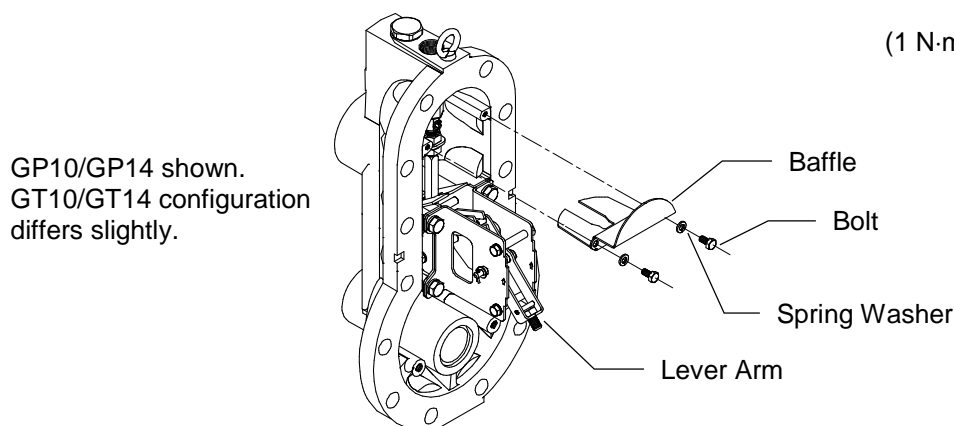
(1 N·m  $\approx$  10 kg·cm)



## 3. Removing/Reattaching the Baffle

Part	Disassembly	Reassembly
Bolts	<ul style="list-style-type: none"> <li>Push the lever arm to its down position.</li> <li>Using a 13 mm (<math>\frac{1}{2}</math> in) socket wrench, loosen the two bolts holding the baffle to the cover.</li> <li>Finish unscrewing the bolts by hand, then remove.</li> <li>Take care not to lose the 13 mm (<math>\frac{1}{2}</math> in) spring washers.</li> </ul>	<ul style="list-style-type: none"> <li>Reassemble spring washers and bolts, then finger-tighten.</li> <li>Tighten to a torque of 30 N·m (22 lbf·ft).</li> </ul>
Baffle	<ul style="list-style-type: none"> <li>Remove the baffle.</li> </ul>	<ul style="list-style-type: none"> <li>Push the lever arm to its down position, and then replace the baffle.</li> </ul>

(1 N·m  $\approx$  10 kg·cm)



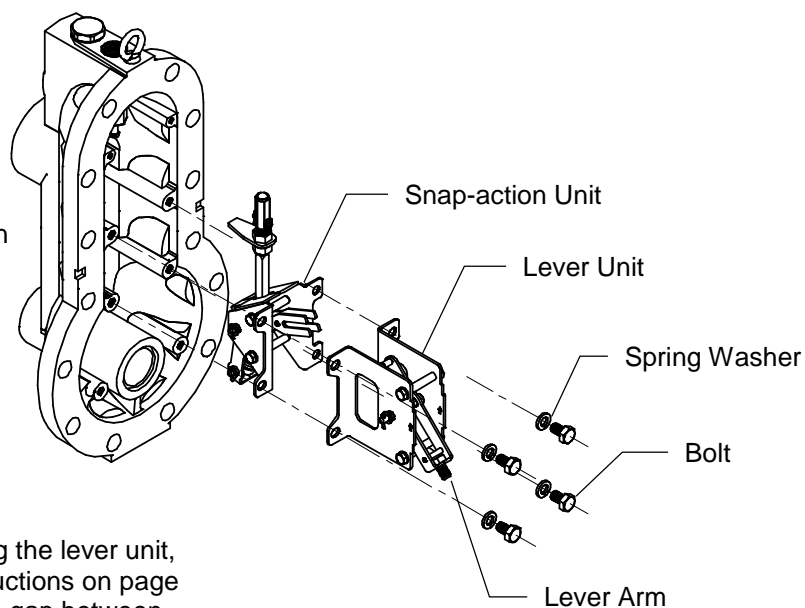
#### 4. Removing/Reattaching the Snap-action and Lever Units

It is not necessary to remove the float before removing the snap-action and lever units. When working with the snap-action unit, take care not to pinch fingers, etc.

Part	Disassembly	Reassembly
Lever Arm	<ul style="list-style-type: none"> <li>Pull the end of the lever arm down until the snap-action unit snaps over and the float end of the lever arm is at its lowest position.</li> </ul>	<ul style="list-style-type: none"> <li>See disassembly.</li> </ul>
Bolts	<ul style="list-style-type: none"> <li>Using a 19 mm (<math>\frac{3}{4}</math>in) socket wrench, loosen the four bolts that hold the snap-action and lever units to the cover.</li> </ul>	<ul style="list-style-type: none"> <li>Assemble the bolts and spring washers, then finger-tighten.</li> <li>Tighten to a torque of 60 N·m (44 lbf·ft), following an alternating cross-wise pattern.</li> </ul>
Snap-Action Unit / Lever Unit	GP10/GP14: <ul style="list-style-type: none"> <li>Support the snap-action and lever units with one hand while removing the loosened bolts from the cover with the other.</li> <li>Remove the snap-action and lever units.</li> </ul>	<ul style="list-style-type: none"> <li>Align the snap-action and lever units, then position them by carefully aligning the snap-action and lever unit bolt holes to the bolt holes in the cover.</li> </ul>
	GT10/GT14 – To remove only the snap-action unit, leaving the lever unit still attached to the trap unit: <ol style="list-style-type: none"> <li>Support the snap-action unit and lever units in one hand while removing the four bolts.</li> <li>Remove the snap-action unit, then carefully tip the lever unit forward until it rests on the trap unit.</li> </ol>	<ul style="list-style-type: none"> <li>Align the snap-action unit to the lever unit, then position them by carefully aligning the snap-action and lever unit bolt holes to the bolt holes in the cover.</li> </ul>
	GT10/GT14 – To remove both snap-action and lever units: <ol style="list-style-type: none"> <li>Remove the pin that connects the lever unit to the trap unit (see step 7).</li> <li>Supporting the snap-action unit and lever units in one hand, remove the four bolts.</li> <li>Remove the snap-action and lever units.</li> </ol>	<ul style="list-style-type: none"> <li>Align the snap-action and lever units, then position them (bottom-first, in order to clear the trap) by carefully aligning the snap-action and lever unit bolt holes to the bolt holes in the cover.</li> </ul>

(1 N·m  $\approx$  10 kg·cm)

GP10/GP14 shown.  
GT10/GT14 configuration differs slightly.

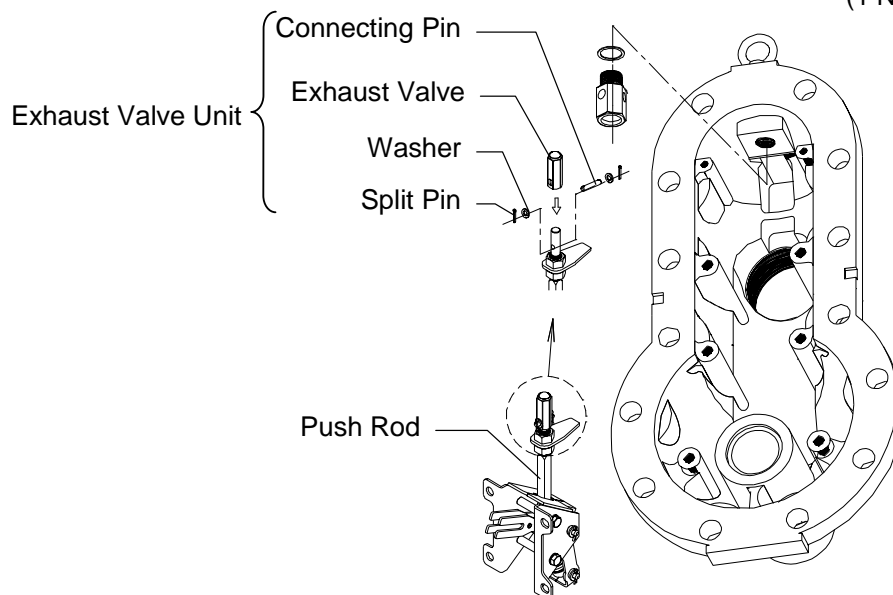


NOTE: When replacing the lever unit, follow the instructions on page 33 to adjust the gap between the lever unit arm and pivot pin. (GT10/GT14 only)

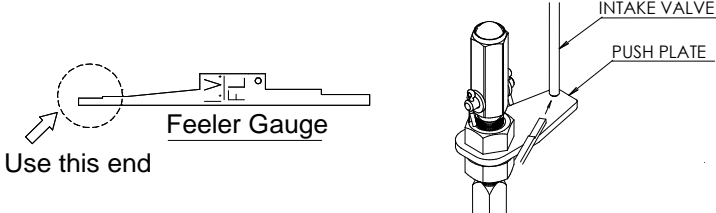
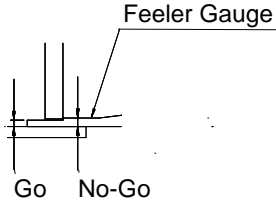
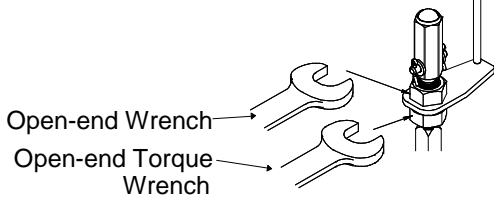
5. Removing/Reinstalling the Exhaust Valve and Exhaust Valve Seat

Part / Step	Disassembly	Reassembly
Exhaust Valve	<ul style="list-style-type: none"> <li>To replace the exhaust valve, first remove the snap-action unit (see Step 4). The exhaust valve is attached to the top of the snap-action unit.</li> <li>To remove the exhaust valve from the snap-action unit:               <ol style="list-style-type: none"> <li>Use needle-nose pliers to straighten one of the split pins, and then remove it and its washer from the connecting pin.</li> <li>Remove the connecting pin and the second washer from the valve and push rod, then lift the exhaust valve up and off the push rod.</li> </ol> </li> </ul>	<ul style="list-style-type: none"> <li>When replacing the exhaust valve and connecting pin, be sure to reinstall the washers and to use a new stainless steel split pin.</li> <li>Bend the ends of the split pin to secure it in place.</li> </ul>
Adjustment of the gap between the push plate and intake valve (motive medium)		<ul style="list-style-type: none"> <li>When a snap-action unit that has been removed from the cover is reinstalled without being overhauled, it is not necessary to adjust the gap between the push plate and the intake valve (motive medium).</li> <li>It is necessary to inspect and adjust the gap (<math>3 \pm 0.3</math> mm, <math>0.118 \pm 0.012</math> in) <b>only</b> when installing a new snap-action unit or an overhauled snap-action unit (from this or another unit). (See following page for instructions.)</li> </ul>
Exhaust Valve Seat	<ul style="list-style-type: none"> <li>Using a 27 mm (<math>1\frac{1}{16}</math> in) socket wrench, loosen the exhaust valve seat. Finish unscrewing by hand, and then remove the exhaust valve seat and its gasket from the cover.</li> </ul>	<ul style="list-style-type: none"> <li>Be sure to reinstall the gasket.</li> <li>Coat the threads of the exhaust valve seat with anti-seize before reassembling in the opposite order of disassembly.</li> <li>Tighten to a torque of 160 N·m (115 lbf·ft).</li> </ul>

(1 N·m  $\approx$  10 kg·cm)



## 5a. Checking/Adjusting the Gap between the Push Plate and Intake Valve (Motive Medium)

Part / Step	Disassembly	Reassembly
<p>Checking the gap between the push plate and intake valve (motive medium)</p>	<ul style="list-style-type: none"> <li>No action required</li> </ul>	<ul style="list-style-type: none"> <li>It is necessary to inspect the gap to determine whether adjustment is necessary <b>only</b> when installing a new snap-action unit or an overhauled snap-action unit (from this or another PowerTrap).</li> <li>The snap-action unit must be installed before the gap inspection can be carried out. A feeler (go/no-go) gauge to be used in gap inspection is supplied with each spare snap-action unit and with each spare trap unit for the GT10/GT14 (see step 8a). To check the gap, carefully slide the thin end of the feeler gauge (marked I.V.) into the gap between the push plate and intake valve (motive medium).</li> </ul>  <p style="text-align: center;">Use this end</p> <ul style="list-style-type: none"> <li>If the gap is already adjusted properly (<math>3 \pm 0.3</math> mm, <math>0.118 \pm 0.012</math> in), the gauge will stop when the valve contacts the no-go lip.</li> </ul>  <ul style="list-style-type: none"> <li>The valve is free to move vertically, so be certain to hold the base of the gauge flush with the push plate, and do not force the gauge past the no-go lip.</li> </ul>
<p>Adjusting the gap between the push plate and intake valve (motive medium)</p>	<ul style="list-style-type: none"> <li>No action required</li> </ul>	<ul style="list-style-type: none"> <li>When a snap-action unit that has been removed from the cover is reinstalled without being overhauled, do not loosen the holder nuts from the push plate.</li> <li>If the previous inspection reveals that the gap is out of the accepted range (<math>3 \pm 0.3</math> mm <math>0.118 \pm 0.012</math> in), proceed with gap adjustment.</li> <li>Loosen the holder nuts with two 22 mm (<math>\frac{7}{8}</math> in) wrenches, one an open-end wrench, and one an open-end torque wrench.</li> </ul>  <ul style="list-style-type: none"> <li>Set the position with the upper nut, then finger-tighten the lower nut.</li> <li>Recheck the gap with the feeler gauge.</li> <li>When adjustment is complete, hold the upper nut steady with the open-end wrench and tighten the lower nut with the open-end torque wrench to a torque of 60 N·m (44 lbf·ft).</li> <li>Recheck the gap, and, if necessary, repeat the adjustment procedure.</li> </ul>

(1 N·m  $\approx$  10 kg·cm)

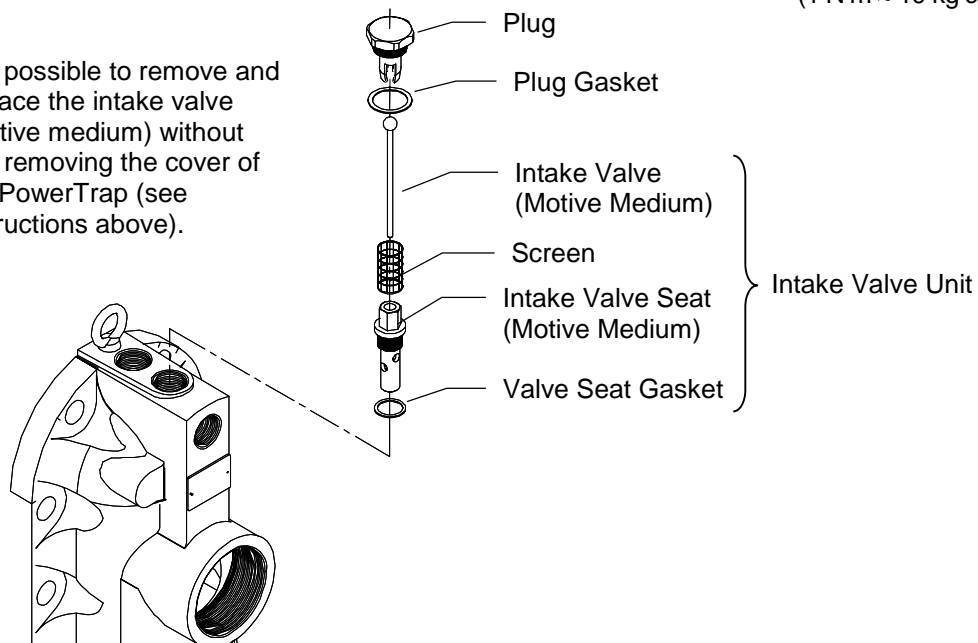
## 6. Removing/Reinstalling the Intake Valve and Intake Valve Seat (Motive Medium)

The following procedure can be used to remove and replace the intake (motive medium) valve without first removing the cover of the PowerTrap.

Part	Disassembly	Reassembly
Plug / Plug Gasket	<ul style="list-style-type: none"> <li>Using a 38 mm (1½ in) socket wrench, loosen the plug.</li> <li>Finish loosening by hand, and remove the plug and plug gasket.</li> </ul>	<ul style="list-style-type: none"> <li>Coat plug threads with anti-seize and reinstall plug and plug gasket.</li> <li>Tighten to a torque of 160 N·m (115 lbf·ft).</li> </ul>
Intake Valve (motive medium) / Screen	<ul style="list-style-type: none"> <li>Using needle-nose pliers, remove the intake valve and screen.</li> </ul>	<ul style="list-style-type: none"> <li>Replace the screen and valve with new, and assemble in reverse order of disassembly.</li> </ul>
Intake Valve Seat (motive medium) / Valve Seat Gasket	<ul style="list-style-type: none"> <li>Using a 17 mm (2⅓ in) socket wrench with an extension bar, loosen the valve seat.</li> <li>Using needle-nose pliers, grasp and remove the valve seat.</li> <li>Using a needle tool, dislocate the valve gasket, then catch and lift it out with either the needle or needle-nose pliers.</li> </ul>	<ul style="list-style-type: none"> <li>Make sure you have removed the old valve gasket. Insert and position a new gasket.</li> <li>Coat threads of valve seat with anti-seize.</li> <li>Using needle-nose pliers, insert the valve seat.</li> <li>Tighten to a torque of 160 N·m (115 lbf·ft).</li> </ul>

(1 N·m ≈ 10 kg·cm)

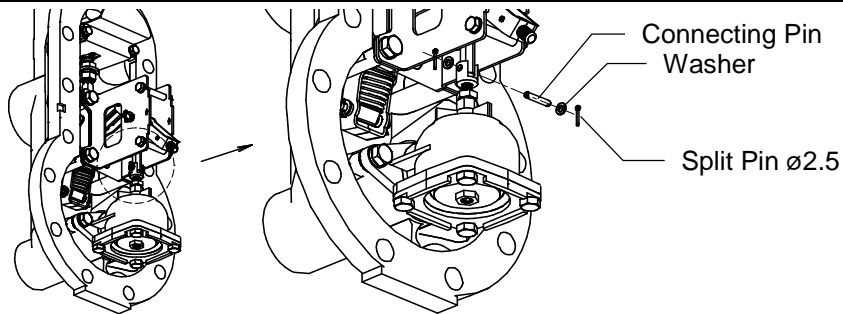
NOTE: It is possible to remove and replace the intake valve (motive medium) without first removing the cover of the PowerTrap (see instructions above).





## 7. Separating/Rejoining the Lever Unit and Trap Unit (GT10/GT14 only)

Part	Disassembly	Reassembly
Split Pins / Washers / Connecting Pin	<ul style="list-style-type: none"> <li>• Pull the end of the lever arm up until the snap-action units snaps over, making the connecting pin accessible.</li> <li>• Using needle-nose pliers, open one split pin and remove it and its washer from the connecting pin.</li> <li>• Remove the connecting pin, being careful to keep it and the washers in a safe place for reassembly.</li> </ul>	<ul style="list-style-type: none"> <li>• Make certain that the lever arm has been raised.</li> <li>• Align the trap rod to the trap connector, and then align the pin holes.</li> <li>• Place one washer on the connecting pin, and reinsert into the pin holes.</li> <li>• Place the second washer on the opposite end of the connecting pin, and insert a new stainless steel split pin.</li> <li>• Bend the ends of the split pin with needle-nose pliers to secure in place.</li> </ul>

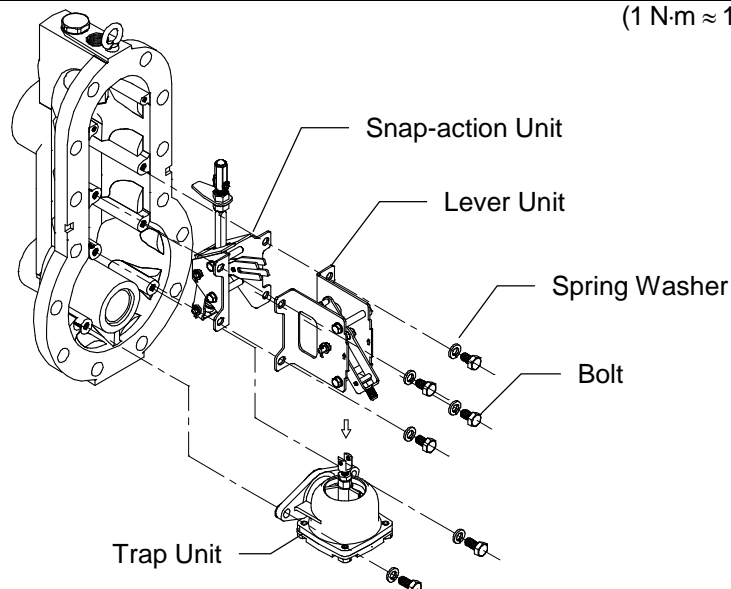


## 8. Removing/Reattaching the Trap Unit (GT10/GT14 only)

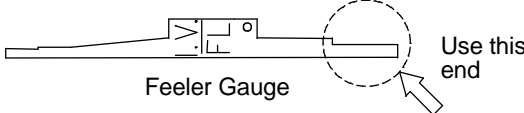
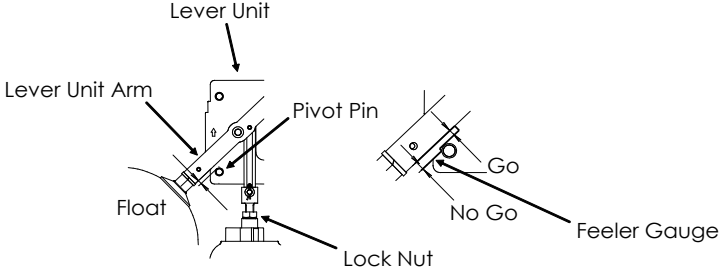
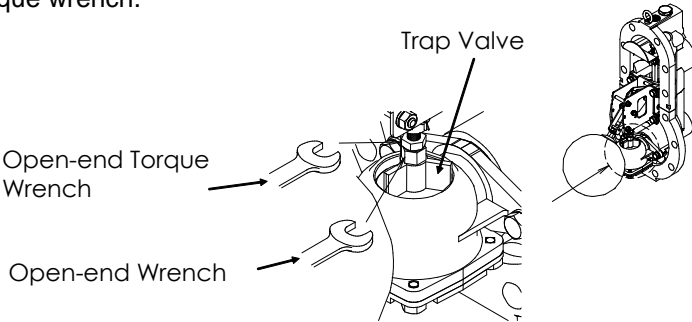
It is possible to remove the snap-action and lever units without removing the trap unit (see step 4). Remove the connecting pin (step 7) before proceeding.

Part	Disassembly	Reassembly
Bolts / Spring Washers	<ul style="list-style-type: none"> <li>• Using a 19 mm (<math>\frac{3}{4}</math> in) socket wrench with an extension bar, loosen the bolts holding the trap unit to the cover.</li> </ul>	<ul style="list-style-type: none"> <li>• Coat the bolt threads (trap unit bolts are longer than snap-action unit bolts) with anti-seize.</li> <li>• Insert bolts and washers, then finger tighten.</li> <li>• Tighten to a torque of 60 N·m (44 lbf·ft)</li> </ul>
Trap Unit	<ul style="list-style-type: none"> <li>• Finish removing the bolts by hand, then remove the trap unit.</li> </ul>	<ul style="list-style-type: none"> <li>• Align the boss inside the discharge port in the cover, as shown below.</li> </ul>
Gasket	<ul style="list-style-type: none"> <li>• The gasket should remain on the trap unit. If the gasket adheres to the cover, gently remove it.</li> </ul>	<ul style="list-style-type: none"> <li>• If the gasket remained on the trap unit, check for damage and reuse if no damage is found; if it adhered to the cover (came out of its groove), replace with a new gasket.</li> </ul>

(1 N·m  $\approx$  10 kg·cm)



## 8a. Checking/Adjusting the Gap between the Lever Unit Arm and Pivot Pin (GT10/GT14 only)

Part/Step	Disassembly	Reassembly
<p>Checking the gap between the lever unit arm and the pivot pin</p>	<ul style="list-style-type: none"> <li>No action required</li> </ul>	<ul style="list-style-type: none"> <li>It is necessary to inspect the gap to determine whether adjustment is necessary <b>only</b> when installing a new trap unit or an overhauled trap unit (from this or another PowerTrap).</li> <li>The trap unit must be installed before the gap inspection can be carried out. A feeler (go/no-go) gauge to be used in gap inspection is supplied with each spare trap unit and with each spare snap-action unit (see step 5a.). To check the gap, carefully slide the thick end of the feeler gauge (marked FL) into the gap between the lever unit arm and pivot pin.</li> </ul>  <ul style="list-style-type: none"> <li>If the gap is already adjusted properly, the gauge will stop when it touches the support bracket (it will also be touching the float).</li> </ul> 
<p>Adjusting the gap between the lever unit arm and pivot pin</p>	<ul style="list-style-type: none"> <li>No action required.</li> </ul>	<ul style="list-style-type: none"> <li>When a trap unit that has been removed from the cover is reinstalled without being overhauled, <b>do not loosen</b> the lock nuts.</li> <li>If the previous inspection reveals that the gap is out of the accepted range, proceed with gap adjustment.</li> <li>Using two 17 mm (<math>2\frac{1}{32}</math> in) wrenches (one an open-end wrench, and one an open-end torque wrench), hold the lower nut steady with the open-end wrench while loosening the lock nut with the open-end torque wrench.</li> </ul>  <ul style="list-style-type: none"> <li>To increase the gap, lift the float and rotate the trap valve counterclockwise.</li> <li>To decrease the gap, rotate the trap valve clockwise.</li> <li>Finger tighten the lock nut and use the feeler (go/no-go) gauge to recheck the gap.</li> <li>When adjustment is complete, hold the lower nut steady with the open-end wrench and tighten the lock nut with the open-end torque wrench to a torque of 40 N·m (29 lbf·ft).</li> <li>Recheck the gap, and, if necessary, repeat the adjustment procedure.</li> </ul>

(1 N·m  $\approx$  10 kg·cm)

## Troubleshooting



### WARNING

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.



### CAUTION

DO NOT OPERATE the PowerTrap with piping disconnected. When it is absolutely necessary to operate with a portion of the outlet piping removed in order to examine an operational failure, open the motive medium and condensate inlet valves slowly, standing a safe distance from the open pipe section until the safety of this action is confirmed.



### CAUTION

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.

When the desired performance is not attained with the system, in many cases it is due to the following:

- (1) Loose chips from pipe cutting and tapping, welding scraps or sealant, which catch in the intake valve (motive medium) or check valve and prevent them from closing/operating properly.
- (2) Changes in the amount of condensate inflow, motive pressure or back pressure that are in excess of the original design.

Since successful operation of the PowerTrap system depends on proper design and installation of the system, investigate the entire system to locate the source of problems when they occur. When no source can be identified, inspect the PowerTrap and take whatever action is necessary.

### Determining the Problem from the Symptoms

Use the “Types of Failure and their Causes” table on the following page to determine the cause of the problem from the type of abnormality that has occurred. Apply the corrective measures listed in the “Causes and Corrective Measures” table.

## Types of Failure and their Causes

Detailed explanations of the meanings of the numbers listed in the “Types of Failure” column are found in the “Causes and Corrective Measures” table.

	Has the PowerTrap operated at least once?	Has pumped medium collected in the PowerTrap?	Is there a continuous flowing sound from the motive medium supply pipe?	Is there a continuous flowing sound from the exhaust pipe?	Types of Failure (Category A – G) and Corrective Measures (Causes 1 – 6)							
					A	B	C	D	E	F	G	
PowerTrap Does Not Operate	NO	NO	NO	NO	1,2,3			1		3		
		YES	YES	YES					1			
	NO	NO	NO	NO	1,4			1,2		6		
		YES	YES	YES							1	
	YES	NO	NO	NO		2			1			
		YES	YES	YES						2	1	
	YES	NO	NO	NO					1			
		YES	YES	YES						3		
	YES	NO	NO	NO		1		1,2	1	3,4,5,6		
		YES	YES	YES							1	
PowerTrap Operates	Has the pumped medium accumulated in the receiver/reservoir and backed up in the equipment?						2	1,2,3,4			2,4	1
	Is there any abnormal noise from the check valves?						3					
	Is there any abnormal noise from the pumped medium outlet pipe?						4					
	Is steam escaping from the exhaust pipe or reservoir/receiver?											1

## Causes and Corrective Measures

Category	Cause	Procedure
A. A valve on the pipeline is closed	<ol style="list-style-type: none"> <li>1. The valve on the motive medium supply pipe is closed</li> <li>2. The valve on the exhaust pipe is closed</li> <li>3. The valve on the condensate inlet pipe is closed</li> <li>4. The valve on the condensate outlet pipe is closed</li> </ol>	- Slowly open the valve, using the proper procedure
B. The strainer is clogged	<ol style="list-style-type: none"> <li>1. The strainer on the motive medium supply pipe is clogged</li> <li>2. The strainer on the condensate inlet pipe is clogged</li> </ol>	- Clean the strainer
C. Faulty motive, back or pumped medium inlet pressure	1. The motive medium supply pressure is less than the back pressure	<ul style="list-style-type: none"> <li>- When the motive medium pressure is decreasing, adjust the pressure reducing valve on the supply pipe or connect to a separate high-pressure line</li> <li>- If the back pressure has increased, check to see if a steam trap connected to the pumped medium recovery line [Sr] is blowing (see drawings on pages 8 and 9) and check for any valves that have been left closed on the pumped medium recovery line</li> <li>- The motive medium pressure must be about 0.1 MPa (15 psi, 1 bar) higher than the back pressure (see (2) in the "Installation Procedure" section)</li> </ul>
	2. Insufficient motive medium	- If the motive medium supply pipe is too small, change to a larger size pipe; the pipe should be at least 20 mm (¾ in)
	3. When using the GP10/ GP14, the pumped medium inlet pressure exceeds the back pressure  (See G.1.)	<ul style="list-style-type: none"> <li>- When the pumped medium inlet pressure exceeds the back pressure, "blowthrough" occurs, i.e., steam flows into the pumped medium outlet pipe; in some cases, chattering on the outlet check valve or water hammer may also occur</li> <li>- The same thing will occur when the back pressure has decreased in a closed system</li> <li>- Check the reason that the pumped medium inlet pressure has increased and the back pressure has decreased and make any necessary repairs</li> </ul>
	4. When using the GP10/ GP14, motive medium supply pressure is too high	<ul style="list-style-type: none"> <li>- If the motive medium supply pressure is twice the back pressure or greater, "blowby" occurs, i.e., residual pressure at the end of the GP motive medium supply process flows into the outlet pipe; when the temperature of the pumped medium in the recovery pipe is low, water hammer may also occur</li> <li>- The motive medium supply pressure should be reduced to a range within which the discharge flow does not drop below the required level</li> </ul>

Category	Cause	Procedure
D. Faulty piping	1. The exhaust is abnormal	<ul style="list-style-type: none"> <li>- Air-locking or vapor-locking has occurred; in the case of a closed system, the exhaust pipe is connected to the reservoir, but the pumped medium may not be exchanged for the medium inside the PowerTrap for the following reasons:               <ul style="list-style-type: none"> <li>(1) There is a U-shaped pipe between the exhaust port and the reservoir</li> <li>(2) The exhaust pipe has a diameter of less than 25 mm (1 in)</li> <li>(3) There is no air vent for steam on top of the reservoir or the steam equipment</li> </ul> </li> <li>If (1), (2), or (3): Change the pipe or install an air vent</li> <li>- The distance from the ground to the highest point on the exhaust pipe is too great (over approx. 3 m [10 ft])</li> <li>For the GP10/GP14: Add a steam trap to the exhaust pipe at a point just above where the exhaust pipe exits the body of the unit</li> <li>For the GT10/GT14: Add piping connecting the exhaust pipe to the pumped medium inlet pipe between the reservoir and the strainer, being sure to install a check valve on the piping to prevent backflow of pumped medium from the pumped medium inlet pipe to the exhaust pipe</li> </ul>
	2. The filling head is insufficient 3. The pumped medium inlet pipe is too small 4. Not enough pumped medium is flowing through the pumped medium inlet valve	<ul style="list-style-type: none"> <li>- Normal pumped medium flow will not be obtained if the filling head is smaller than that in the original design; the recommended filling head is 860 mm (36 in)</li> <li>- Normal pumped medium flow may not be obtained if the pumped medium inlet pipe is too small or the valve on the pumped medium inlet pipe is a needle valve or one with a small Cv value</li> <li>- The pipe and stop valve size must be increased to the design pipe size, and a full bore ball valve or gate valve must be used</li> </ul>

Category	Cause	Corrective Measure
E. Faulty PowerTrap	<ol style="list-style-type: none"> <li>1. Dirt or scale is caught in the motive medium intake valve or the valve is worn</li> <li>2. Dirt or scale is caught in the exhaust valve or the valve is worn</li> <li>3. The snap-action unit is obstructed by dirt or scale or its operation is otherwise faulty</li> <li>4. The lever unit is obstructed by dirt or scale or its operation is otherwise faulty</li> <li>5. The float is broken</li> <li>6. Dirt or scale is caught in the GT10/ GT14 main valve (steam trap) unit, resulting in faulty valve opening/closing</li> </ol>	<ul style="list-style-type: none"> <li>- The PowerTrap does not operate for long periods of time, in spite of the fact that pumped medium has collected in the receiver/reservoir; if there is no sound at all of the operating medium flowing in the motive medium intake valve and the exhaust valve, it is possible that the PowerTrap is faulty Note, however, that this phenomenon will also occur when the motive medium pressure is less than the back pressure</li> <li>- If the PowerTrap does not operate for long periods of time and the sound of the operating medium can be heard continuously in the motive medium supply pipe, the PowerTrap is faulty</li> </ul> <p>Disassemble the PowerTrap, and inspect the following items:</p> <ol style="list-style-type: none"> <li>(1) Raise and lower the float and check to make sure the snap-action unit operates properly</li> <li>(2) Check the motive medium intake and exhaust valves to make sure there is no dirt or scale caught or any other abnormality</li> <li>(3) Check other possible factors that might hinder operation</li> </ol> <p>After performing the above inspection, repair any defects discovered or replace the PowerTrap</p>
F. Faulty check valve	<ol style="list-style-type: none"> <li>1. Dirt or scale is caught in the pumped medium inlet check valve or the valve is worn or getting hung up</li> </ol>	<ul style="list-style-type: none"> <li>- The operating medium that has been supplied is leaking from the inlet check valve, preventing the pressure inside the trap from increasing; as a result, the pumped medium is not discharged</li> </ul> <p>Disassembly and inspection is required</p>
	<ol style="list-style-type: none"> <li>2. Dirt or scale is caught in the pumped medium outlet check valve or the valve is worn or getting hung up</li> </ol>	<ul style="list-style-type: none"> <li>- The discharged pumped medium has flowed back into the PowerTrap, causing the interval at which the unit operates to grow shorter and reducing its discharge capacity</li> </ul> <p>Disassembly and inspection is required</p>
	<ol style="list-style-type: none"> <li>3. The pumped medium inlet or outlet check valves have been installed in the wrong direction</li> </ol>	<ul style="list-style-type: none"> <li>- Correct the installation so that the check valve is facing the right way to allow the desired flow of pumped medium</li> </ul>
	<ol style="list-style-type: none"> <li>4. The pumped medium inlet or outlet check valves are too small</li> </ol>	<ul style="list-style-type: none"> <li>- The pumped medium flow capacity is insufficient</li> </ul> <p>Use a larger size</p>
G. There is a problem with other equipment	<ol style="list-style-type: none"> <li>1. A large quantity of steam is flowing into the receiver/ reservoir</li> </ol>	<ul style="list-style-type: none"> <li>- When a large quantity of steam is discharged from the exhaust pipe or vent pipe, it may be because steam from a blowing steam trap or an open valve has flowed into the pumped medium inflow pipe system of the receiver/reservoir; check these traps and the valves on the pumped medium inflow pipe system</li> </ul>

## TLV EXPRESS LIMITED WARRANTY

Subject to the limitations set forth below, TLV Corporation, a North Carolina corporation (“**TLV**”) warrants that products which are sold by it, TLV CO., LTD., a Japanese corporation (“**TLVJ**”) or TLV International, Inc., a Japanese corporation (“**TII**”), (hereinafter the “**Products**”) are designed and manufactured by TLVJ, conform to the specifications published by TLV for the corresponding part numbers (the “**Specifications**”) and are free from defective workmanship and materials. With regard to products or components manufactured by unrelated third parties (the “**Components**”), TLV provides no warranty other than the warranty from the third party manufacturer(s), if any.

### Exceptions to Warranty

This warranty does not cover defects or failures caused by:

1. improper shipping, installation, use, handling, etc., by other than TLV or service representatives authorized by TLV; or
2. dirt, scale or rust, etc.; or
3. improper disassembly and reassembly, or inadequate inspection and maintenance by other than TLV or service representatives authorized by TLV; or
4. disasters or forces of nature or Acts of God; or
5. abuse, abnormal use, accidents or any other cause beyond the control of TLV; or
6. improper storage, maintenance or repair; or
7. operation of the Products not in accordance with instructions issued with the Products or with accepted industry practices; or
8. use for a purpose or in a manner for which the Products were not intended; or
9. use of the Products in a manner inconsistent with the Specifications; or
10. use of the Products with Hazardous Fluids (fluids other than steam, air, water, nitrogen, carbon dioxide and inert gases (helium, neon, argon, krypton, xenon and radon)); or
11. failure to follow the instructions contained in the TLV Instruction Manual for the Product.

### Duration of Warranty

This warranty is effective for a period of the earlier of: (i) three (3) years after delivery of Products to the first end user in the case of sealed SST-Series Products for use in steam pressure service up to 650 psig; (ii) two (2) years after delivery of Products to the first end user in the case of PowerTrap® units; or (iii) one (1) year after delivery of Products to the first end user in the case of all other Products. Notwithstanding the foregoing, asserting a claim under this warranty must be brought by the earlier of one of the foregoing periods, as applicable, or within five (5) years after the date of delivery to the initial buyer if not sold initially to the first end user.

ANY IMPLIED WARRANTIES NOT NEGATED HEREBY WHICH MAY ARISE BY OPERATION OF LAW, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE AND ANY EXPRESS WARRANTIES NOT NEGATED HEREBY, ARE GIVEN SOLELY TO THE INITIAL BUYER AND ARE LIMITED IN DURATION TO ONE (1) YEAR FROM THE DATE OF SHIPMENT BY TLV.

### Exclusive Remedy

THE EXCLUSIVE REMEDY UNDER THIS WARRANTY, UNDER ANY EXPRESS WARRANTY OR UNDER ANY IMPLIED WARRANTIES NOT NEGATED HEREBY (INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE), IS **REPLACEMENT**; PROVIDED: (a) THE CLAIMED DEFECT IS REPORTED TO TLV IN WRITING WITHIN THE APPLICABLE WARRANTY PERIOD, INCLUDING A DETAILED WRITTEN DESCRIPTION OF THE CLAIMED DEFECT AND HOW AND WHEN THE CLAIMED DEFECTIVE PRODUCT WAS USED; AND (b) THE CLAIMED DEFECTIVE PRODUCT AND A COPY OF THE PURCHASE INVOICE IS RETURNED TO TLV, FREIGHT AND TRANSPORTATION COSTS PREPAID, UNDER A RETURN MATERIAL AUTHORIZATION AND TRACKING NUMBER ISSUED BY TLV. ALL LABOR COSTS, SHIPPING COSTS, AND TRANSPORTATION COSTS ASSOCIATED WITH THE RETURN OR REPLACEMENT OF THE CLAIMED DEFECTIVE PRODUCT ARE SOLELY THE RESPONSIBILITY OF BUYER OR THE FIRST END USER. TLV



RESERVES THE RIGHT TO INSPECT ON THE FIRST END USER'S SITE ANY PRODUCTS CLAIMED TO BE DEFECTIVE BEFORE ISSUING A RETURN MATERIAL AUTHORIZATION. SHOULD SUCH INSPECTION REVEAL, IN TLV'S REASONABLE DISCRETION, THAT THE CLAIMED DEFECT IS NOT COVERED BY THIS WARRANTY, THE PARTY ASSERTING THIS WARRANTY SHALL PAY TLV FOR THE TIME AND EXPENSES RELATED TO SUCH ON-SITE INSPECTION.

#### **Exclusion of Consequential and Incidental Damages**

IT IS SPECIFICALLY ACKNOWLEDGED THAT THIS WARRANTY, ANY OTHER EXPRESS WARRANTY NOT NEGATED HEREBY, AND ANY IMPLIED WARRANTY NOT NEGATED HEREBY, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, DO NOT COVER, AND NEITHER TLV, TII NOR TLVJ WILL IN ANY EVENT BE LIABLE FOR, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING, BUT NOT LIMITED TO LOST PROFITS, THE COST OF DISASSEMBLY AND SHIPMENT OF THE DEFECTIVE PRODUCT, INJURY TO OTHER PROPERTY, DAMAGE TO BUYER'S OR THE FIRST END USER'S PRODUCT, DAMAGE TO BUYER'S OR THE FIRST END USER'S PROCESSES, LOSS OF USE, OR OTHER COMMERCIAL LOSSES. WHERE, DUE TO OPERATION OF LAW, CONSEQUENTIAL AND INCIDENTAL DAMAGES UNDER THIS WARRANTY, UNDER ANY OTHER EXPRESS WARRANTY NOT NEGATED HEREBY OR UNDER ANY IMPLIED WARRANTY NOT NEGATED HEREBY (INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE) CANNOT BE EXCLUDED, SUCH DAMAGES ARE EXPRESSLY LIMITED IN AMOUNT TO THE PURCHASE PRICE OF THE DEFECTIVE PRODUCT. THIS EXCLUSION OF CONSEQUENTIAL AND INCIDENTAL DAMAGES, AND THE PROVISION OF THIS WARRANTY LIMITING REMEDIES HEREUNDER TO REPLACEMENT, ARE INDEPENDENT PROVISIONS, AND ANY DETERMINATION THAT THE LIMITATION OF REMEDIES FAILS OF ITS ESSENTIAL PURPOSE OR ANY OTHER DETERMINATION THAT EITHER OF THE ABOVE REMEDIES IS UNENFORCEABLE, SHALL NOT BE CONSTRUED TO MAKE THE OTHER PROVISIONS UNENFORCEABLE.

#### **Exclusion of Other Warranties**

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, AND ALL OTHER WARRANTIES, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSLY DISCLAIMED.

#### **Severability**

Any provision of this warranty which is invalid, prohibited or unenforceable in any jurisdiction shall, as to such jurisdiction, be ineffective to the extent of such invalidity, prohibition or unenforceability without invalidating the remaining provisions hereof, and any such invalidity, prohibition or unenforceability in any such jurisdiction shall not invalidate or render unenforceable such provision in any other jurisdiction.

### **TLV CORPORATION**

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