HOTDIVE

Hotdive T2

Second Stage

Service & Repair Manual

for Authorized Service Centers

CONTENT

INTRODUCTION

This manual is intended only to guide experienced maintenance personnel on the procedures for the proper service and repair of Hotdive regulator products described in this manual. It should not be used as an instruction manual for regulator repair by untrained personnel or consumers. Servicing and repair mainly include cleaning, inspection, adjustment and replacement of worn parts. If you do not fully understand all the procedures listed in this manual, please contact Hotdive to speak directly with the Technical Advisor before proceeding further.

SAFETY PRECAUTIONS

This manual provides step-by-step instructions on the removal, inspection, cleaning, reassembly and testing of the Hotdive S2 primary regulator. It is recommended to perform all steps in the order given. Please read this section in its entirety before starting the work described in this section. This will familiarize the maintenance technician with the important precautions to be taken during each service.

Pay close attention to all WARNINGS, CAUTIONS, and NOTES that are intended to draw your attention to items of importance.

Definition of Warnings, Cautions, and Notes:

> ⚠ WARNING
>
> Indicates a procedure or situation that may result in serious injury or death for either the technician or

> ⚠ CAUTION
>
> Indicates any situation or technique that may result in potential damage to the product, or render the

> NOTE
>
> Is used to emphasize important points and tips.

GENERAL PROCEDURES

MAINTENANCE SCHEDULES

Regulators are subject to a variety of environmental factors that may affect product performance over time. If the regulator dives less than 50 times per year, it is allowed to be inspected every other year and in "non-" years. Such as:

Year 1: Inspection

Year 2: Overhaul

Year 3: Inspection

Year four: Overhaul, and so on.

Inspections and overhauls need to be documented in the Annual Service and Inspection Record at the end of the Manual to maintain the limited life warranty. If the regulator dives more than 50 times a year, it should be overhauled.

A formal inspections include:

1. Carry out pressure immersion test on the whole unit to check whether there is air leakage.
2. Check stable medium pressure within acceptable range.
3. Check whether the opening force is within the acceptable range.
4. Check that the control knob and venturi switch operate smoothly.
5. Visually inspect filter for debris or discoloration.
6. Visually check the exhaust valve to see whether it is in good condition and whether the surface is clean.
7. Visually inspect the bite for cracks or holes.
8. Open the hose protector and check whether the hose is securely connected.

If a regulator fails after items 1, 2, 3, or 4, the entire regulator should be overhauled. If the regulator fails at 4, 5, 6 or 7, it is at the discretion of the technician whether a complete overhaul is required.

An infrequently used regulator

Do not assume that the regulator is in good condition because it is not used often or because it has been well stored. In this case, deterioration and corrosion of o-rings may still occur.

Work area and tools required

Regulators should be serviced and repaired in a clean, well-lit work area. Since each regulator is disassembled, all parts should be separated from those of the other regulator. Proper disassembly and reassembly require some special tools. For a list of these tools, see Table 2(page 5).

Remove o-ring

When removing the O-ring, care must be taken not to damage the adjustment in contact with the O-ring

On the surface. Tools used to remove o-rings must not have any sharp edges or points that could scratch the metal sealing surface. Hotdive strongly recommends that all O-ring removal tools be made of brass or plastic.

Lubrication

O-rings shall be lubricated with approved compounds. O-rings should be lubricated with very thin grease film only. Do not use spray (aerosol) lubricants under any circumstances. Aerosol propellants can damage the regulator's plastic and rubber components, and the lubricant evaporates quickly with little lasting benefit.

> ⚠ WARNING Hotdive regulator is designed for use in water temperatures above 45° F(7° C). Cooler water may cause the regulator to be more sensitive to free-flow conditions and may result in situations that require an appropriate response to prevent serious injury or death. Users of Hotdive modulators are advised to ensure that they are adequately trained to handle modulators in free flow or hypoxia emergencies before attempting to dive in cold water environments.

> ⚠ CAUTION Note: Before any disassembly, refer to the disassembled parts diagram, which covers all parts that must be replaced. These parts should be replaced with new ones and should not be reused regardless of the age of the regulator or how many times it has been used since the last service.

> NOTE When removing o-rings, use only plastic or brass O-ring removal tools to prevent damage to sealing surfaces. Even a small scratch on the surface of the O-ring can cause a leak. Once the o-ring sealing surface is damaged, it must be replaced with new parts. Do not use toothpicks or any other steel tools.

DISASSEMBLY PROCEDURES

1. Using a properly sized wrench to remove all hoses(28) before removing the the second stage.

2. Using two 11/16 "open end wrenches, secure the heat exchanger (1) with one wrench while loosening the hose connector with the other. Using brass or plastic o-ring removal tool, remove the o-rings (27,29) from inside the hose swivel, being careful not to scratch the o-ring grooves.

3. Inspect the hose crimps.The crimps should be free from damage and the hose should not be \pulling out of the crimp. If it is, the hose must be replaced.

4. Remove the Purge cover (25) and diaphragm (24). Check the diaphragm. The diaphragm should be soft and undamaged. Replace diaphragm if there are any signs of damage.

5. Remove heat exchanger(1) with 11/16 "open end wrench, be careful to secure valve shaft(3) with another wrench to prevent joint rotation.

6. Turn the adjusting knob (13) counterclockwise until it stops.

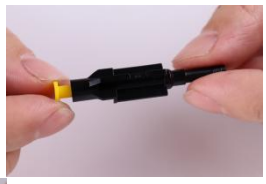
7. Press lever (23) on valve shaft(3). Continue to press the lever and pull the entire shaft assembly out of the case(5).

8. To remove the lever (23), carefully pull one leg out of the valve shaft(3) and release the second leg. Grab venturi tube(11) and remove it from valve shaft. Remove the O-ring (10) from the venturi rod.

9. Push the spring pin (22) out with a tool. Turn the adjusting knob (13) counterclockwise to remove it from the valve shaft.


10. Remove o-ring (12) from adjusting knob with tool. Remove o-ring (4) from valve shaft (3)


11. Remove shuttle valve (17) assembly. Separate the shuttle assembly by pulling both ends. Remove rubber seat (16) and small o-ring (18,19) from shuttle valve with fingernail.

12. Remove seat (14) counterclockwise with a one-tip wrench, push seat out from opposite end with plastic or wooden tool, remove O-ring (15). Inspect seat carefully for any scratches or nicks. If damaged, discard it. Don't try to reuse it. If the seat is reusable, place it on a soft surface to prevent damage to seal edges.



13. Open the Mouthpiece Clamp(8), remove the Mouthpiece (9)


14. Use tool to push Exhaust tee(7) out and inspect the bottom. The surface should be clean and free from damage. Check exhaust valve diaphragm (6). It should be soft and have nice edges. If there are any signs of deterioration, it should be replaced.


<u>The disassembly process is now complete.</u>

Clean and lubricate the parts before starting reassembly

NOTE Before any reassembly, it is important to check all parts (both new and reused) to ensure that every part and component is very clean and free of any dust, corrosion or defects. Before applying silicone oil to each O-ring, check to make sure it is clean, soft, and free of imperfections.

WARNING Only real Hotdive parts, components, and components are used when assembling any Hotdive product. Don't try to replace one. Hotdive is separate from other manufacturers' products, regardless of any similarity in shape, size or appearance. Doing so may make the product unsafe and may result in serious injury or death.

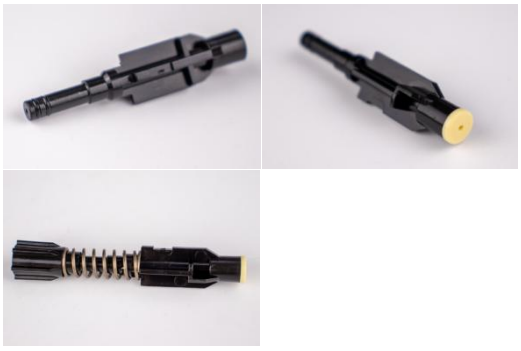
REASSEMBLY PROCEDURES

1. If the exhaust valve diaphragm(6) is replaced, pass the tail through the fixed hole on the outside of the case until the barb meshes with the inside. Use a side knife to cut off the excess stem, leaving about 5 mm of tail.

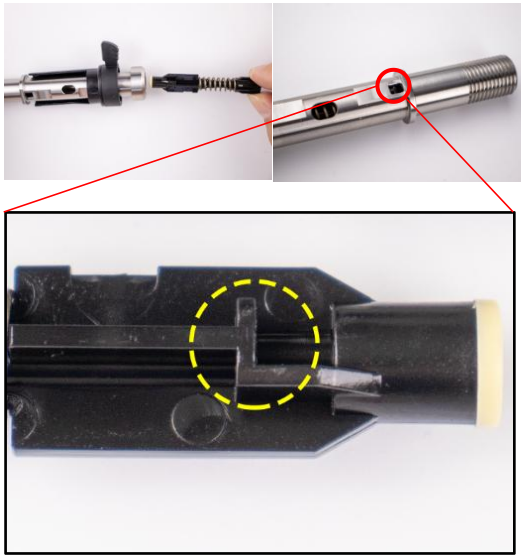
2. Slide the exhaust tee (7) onto the case until the retaining button is in the center of the exhaust valve.

3. Install o-ring (4) to valve shaft (3). Install o-ring (10) onto venturi (11) and insert valve shaft (3).

4. Install o-ring (18,19) to shaft of shuttle valve (17). Place rubber seat (16) in front of shuttle valve. Carefully place the shaft of the shuttle valve through the spring (20) and install the shuttle cap(21).



5. Insert the valve assembly into the valve shaft with the "L" foot of the shuttle valve facing down (perpendicular to the valve shaft)Press the shuttle assembly fully into the valve shaft with your finger until the L-foot is visible in the red box below.



6. If the lever (23) is to be replaced, the threaded end faces you. Insert a one leg to hold the valve shaft before installing the other one.

NOTE Note: Do not twist the lever leg. If necessary, gently press to straighten it.

7. Install the O-ring (12) to the adjusting knob (13).

8. Install adjusting knob (13) on valve shaft (3).

9. Continue to tighten the adjustment knob clockwise until the hole for the spring pin (21) is visible. Install the spring pin, making sure it fits evenly into the hole. Turn the adjusting knob counterclockwise to apply spring tension on the pin to keep it safe.

10. Insert full valve shaft (3) into case(5) while pressing lever (23) down.

> NOTE Note! Do not force the lever up after passing through the housing.

11. Slide o-ring (2) down threaded end of valve shaft. Screw heat exchanger (1) (hexagonal out) to the valve shaft(3) until fingers tighten. Using a 11/16 "fishtail or deep hole sleeve, tighten with 27" lb (3 n m) of torque.

> NOTE Note!After tightening lever (23) must be vertical.

> NOTE Heat exchanger (1) too tightly screwed can damage cover and case.

12. Place o-ring (15) on seat (14). Press seat (threaded end first) into the valve shaft. Then use a wrench or tool to continue pushing it fully into the valve shaft.

13. While holding the edge of the case(5) at eye level, turn the seat (14) clockwise until the lever is lowered about 4mm below the edge of the case. Then turn the seat counterclockwise until the lever is flush with the edge of the case.

14. Place diaphragm (6) into housing (5). Hold the edge of the diaphragm in place with your fingers so that it sits evenly. Place Purge Cover(25) on diaphragm.

> NOTE
>
> Before installing the housing cover, make sure the diaphragm is in place and free of creases.

15. Justify the Purge cover (25) and press it into the case(5) until it snaps into place, then screw on the retaining ring (26).

16. Install the new o-ring (27,29) to the rotary end of the hose.

<u>This Concludes Reassembly</u>

ADJUSTING LEVER HEIGHT

1. Connect adjusting tool to second stage regulator. If additional tools are required, see the form that comes with tools.

NOTE Note!Built-in adjustment tools can be used for crowns with thick cutters or hexagonal holes. Set the tool to the thick slot setting.

2. Connect the rotating end of the low pressure hose to the other end of the adjusting tool, and connect the male end of the hose to the properly adjusted first stage regulator. Finally, connect the first stage head to a calibrated test stand or to a fully charged 3000 psi (206 bar) cylinder. Pressurize stage head slowly to 3000 psi (206 bar).

3. Connect the first stage head to a 3000psi cylinder (206bar). Slowly open the cylinder valve and apply pressure to the regulator.

NOTE Before adjusting and testing the second stage regulator, the attached primary head must be properly serviced and adjusted to a stable MP and thoroughly tested. Please refer to the corresponding technical manual for first stage before attempting to perform adjustments and tests for second stage.

4. Ensure that the adjusting screw (13) is loosened and the Venturi rod (11) is set to the + position.

5. Quickly press the purge cover(25). This will allow the regulator to flow freely. Stop the free flow after a few seconds by placing your hand over the bite.

6. Push the tool towards the second stage until it stops against the front cover and press the purge cover. If no air exits from the second stage, perform Step 7. If air exits the valve, proceed to Step 6.

NOTE

Note: Second stage should not leak during this test. If air leaks, the lever is installed too high.

7. Press the adjustment wheel of the adjustment tool inward. Slowly rotate adjustment wheel until inline tool engages seat(14). Turn the seat clockwise (CW) approximately 1/16 turn, which will lower the lever (23). Repeat Step 5.

8. Push the tool towards the second stage until it stops against the front cover and press the purge cover. If air is coming out of the secondary head, the lever height is set correctly. If no air exits the valve, proceed to Step 8.

NOTE

Note: The second stage should leak during this test. If not, the lever is set too low.

9. Press the adjustment wheel of the tool inward. Slowly rotate adjustment wheel until inline tool engages seat (14). Turning the seat counterclockwise (CCW) approximately 1/16 turn will lift the lever (23). Repeat from step 5.

10. Turn off the air supply and deflate the second stage by pressing the purge button on the second stage. Pull the adjusting wheel of the adjusting tool backward and remove it from the second stage. Remove MP hose from adjusting tool.

NOTE Note: When removing the adjusting tool from the second stage, remember to pull the handwheel back to separate it from the crown hole. It may cause your adjustments to change without this step.

FINAL INSTALLATION

1. If replaced with a new mouthpiece, make sure the "bridge" of the mouthpiece(9) is facing up. Install the mouthpiece on the second stage mouthpiece port. The bottom of the mouthpiece has a groove for the mouthpiece clamp (8). Wrap the clamp around the mouthpiece so that the buckle points towards the hose. Fasten the mouthpiece clamp(8).

CAUTION Caution! Make sure the mouthpiece is properly fastened to the exit port. Or will cause your adjustments to change.

> NOTE Note: Bench testing is recommended prior to installing the mouthpiece. See "Final Test Steps" in the next section.

2. Install hose to second stage and tighten by hand. Secure heat exchanger with 11/16 "open end wrench. Tighten hose connector to 45 in-lb (5 Nm) using a 11/16 "torque wrench.

FINAL TEST STEPS

THE SECOND STAGE OPENING STRENGTH TEST

1. Connect the first stage regulator to the calibrated test bench and pressurize the system to 3,000 psi (206 bar). Slowly open the flow meter control knob (start the vacuum) while observing the magnetometer and MP meter.

2. When the MP gauge begins to descend, indicating that the second stage valve is open, the gauge should indicate opening force: +1.0 "to +1.5" (2.5-3.7 mbar).

3. If the reading is less than or greater than specification, remove the plug and adjust the spring regulator using a 5mm hex wrench. Turn clockwise to reduce opening force or turn clockwise to increase opening force. If a correct reading cannot be given, refer to: Table 1: Troubleshooting Guide for corrective guidance and specific procedures. Replace the plug when finished.

EXTERNAL LEAK TESTING

1. After disconnecting the regulator from the flow bench, connect it to a submersible cylinder inflated to approximately 3,000 psi (206 bar). Open the cylinder valve to re-pressurize the regulator and immerse the entire system in a clean water test tank.

2. Watch for any bubbles generated by the immersion regulator for one minute. The recommended time is necessary because slower bubble formation can occur in smaller leaks. Bubbles indicate a leak, which requires removing the system from the source to check the seal surface, assembly order, and component positioning to correct the problem.

3. Extremely small leaks can be better detected by applying a soapy solution or Snoop™ to the leak area. The bubble flow will indicate the source of the leak. Before disassembly to correct any leaks, flush the entire regulator thoroughly with fresh water and blow out any remaining moisture with filtered low pressure (50 psi) air. To disassemble and resolve the problem, refer to Table 1: Troubleshooting Guide

SUBJECTIVE BREATH TEST

1. Press the second stage purge button to ensure air flow is sufficient to clear the second stage.

2. Breathe deeply through your mouthpiece. A properly serviced and adjusted regulator shall provide smooth, uninterrupted airflow on deep inhalation; Without undue effort, hesitation or randomness. If any exceptions or problems occur, please refer to Table 1: Troubleshooting Guide.

3. When finished, close the cylinder valve and decompress the regulator. Remove first stage from valve and secure dust cover in place.

HOTDIVE T2 second stage regulator maintenance ends here

TABLE 1: TROUBLESHOOTING GUIDE

SYMPTOM	POSSIBLE CAUSE	TREATMENT
Second Stage Air Leak or Free Flow	**1.**Extremely high MP from frst stage.	**1.** Refer to First Stage Troubleshooting Guide
	2. The rubber seat (16) is damaged.	**2.** Replace rubber seat
	3. The seat (16) was adjusted incorrectly or the lever (23) was set too high.	**3.** Reset seat preliminary settings and repeat adjustment procedures
	4. The lever (23) is bent.	**4.** Replace lever
	5. The seat (16) sealing surface is damaged.	**5.** Replace valve seat
	6. The valve spring (20) is damaged.	**6.** Replace valve spring
	7. The shuttle valve o-ring (18,19) is damaged.	**7.** Replace o-ring
	8. The counterbalance cylinder (21) bore is damaged.	**8.** Replace counterbalance cylinder
	9. The venturi lever o-ring (10) is damaged.	**9.** Replace o-ring
Low Purge or Labored Breathing on full cylinder	**1.** The frst stage has low MP.	**1.** Refer to First Stage Troubleshooting Guide
	2. The seat (16) was adjusted incorrectly or the lever (23) was set too high.	**2.** Reset seat preliminary settings and repeat adjustment procedures
	3. The MP hose is clogged or obstructed.	**3.** Clean or replace the MP hose
	4. The lever (23) is bent or catching on the valve spindle (3).	**4.** Replace lever
Water Entering Second Stage	**1.** The mouthpiece (9) is incorrectly ftted or damaged.	**1.** Reft or replace mouthpiece
	2. The diaphragm (24) is damaged.	**2.** Replace diaphragm
	3. The diaphragm (24) is improperly seated in the case (25).	**3.** Remove front cover (14) and diaphragm cover (5), check for any distortions, then properly reassemble diaphragm
	4. The exhaust valve (6) is damaged.	**4.** Replace exhaust valve
	5. The case (5) is damaged.	**5.** Check exhaust valve seating surface. Disassemble and replace case
	6. The heat exchanger o-ring (2) is damaged.	**6.** Replace o-ring
	7. The venturi lever (10) or blanking piece o-ring (10) is damaged.	**7.** Replace o-ring

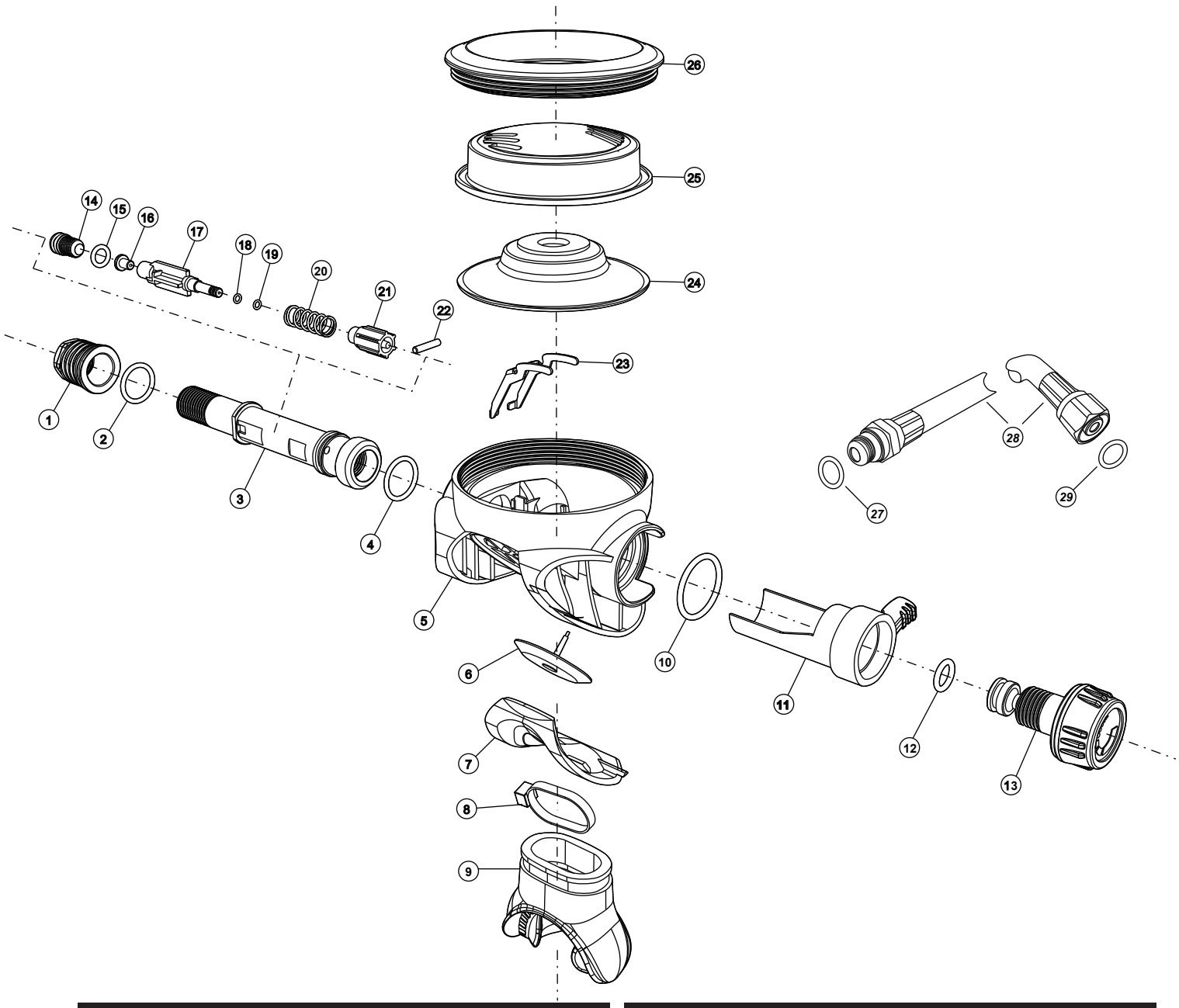
CAUTION Note: This table only lists some possible problems and recommended treatments.

NOTE Any of the above recommended treatments requiring the removal of a regulator must be carried out during a complete overhaul in accordance with the prescribed procedures for scheduled annual service. Do not attempt partial service.

Picture	DESCRIPTION	APPLICATION
	I.P. test gauge	Checking medium pressure
	O-ring Tool	Removing and installation of o-rings
	Hex Key	Loosen/tighten/adjust parts
	Adjusting Tool	Adjusting lever height

Table 2-Recommended Tool List

Hotdive T2 Schematic Drawing&Repair and Replacement Parts



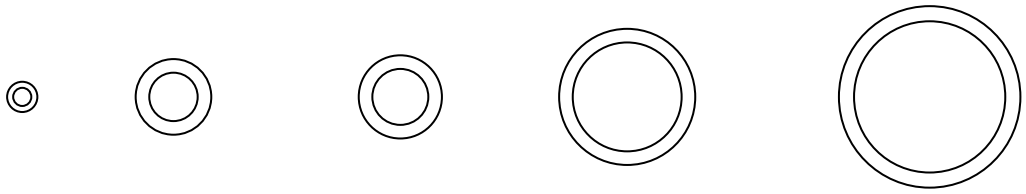
Ref # PN	Qty	Description
1.....T2-01	1	Insert screw
2.....T2-02	**1**	**O-ring**
3.....T2-03	1	Valve Shaft
4.....T2-04	**1**	**O-ring**
5.....T2-05	1	Case
6.....T2-06	1	Exhaust Valve Diaphragm
7.....T2-07	1	Exhaust Grill/Tee
8.....T2-08	**1**	**Mouthpiece Clamp**
9.....T2-09	**1**	**Mouthpiece**
10.....T2-10	**1**	**O-ring**
11.....T2-11	1	Venturi Tube
12.....T2-12	**1**	**O-ring**
13.....T2-13	1	Adjusting Knob
14.....T2-14	1	Seat
15.....T2-15	**1**	**O-ring**

Ref # PN	Qty	Description
16.....T2-16	**1**	**LP Rubber Seat**
17.....T2-17C	1	Balanced Shuttle Valve
18/19.....T2-18/19	**2**	**O-ring**
20.....T2-20	1	Spring
21.....T2-21	**1**	**Balance Shuttle Cap**
22.....T2-22	1	Spring Pin
23.....T2-23	1	Lever
24.....T2-24	**1**	**Diaphragm**
25.....T2-25	1	Purge Cover
26.....T2-26	1	Retaining Ring
27.....T2-27	**1**	**O-ring**
28.....T2-28	1	LP Hose
29.....T2-29	**1**	**O-ring**

*Part numbers in **BOLD** indicate standard overhaul replacement part.

Find the size of the O-rings!

Print this page at 100%. Do not scale to fit. (To make sure you printed at 100%, place the largest O-ring at the bottom. If it's an exact fit, you're good to go.)



x 2	x 1	x 1	x 2	x 1
#18/19	#15	#12	#2/4	#18