

The logo for Thermo, featuring the word "THERMO" in a blue, serif font. The letter "O" is replaced by a blue circular icon with a white center. To the right of the "O" is a blue icon of a valve handle with horizontal ridges.

**THERMO**

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***Thermo Valve Service Manual***









This manual covers the service and repair of all Thermo Valve products sold by XS Scuba, including, but not limited to, K Valves, PRO Valves, DIN Valves, Modular Valves and Manifolds. A complete list of specific models is found below.

**Document Change Notice (DCN)**

Page #	Rev. Date	Revision Made
All	02/01/2018	First Release
11, 27-29	06/07/2018	PG 11 - p/n VP25 changed to VP26, PG 27-29 - corrected key #s in ( )'s

**Products Covered By This Manual:**

Part Number	Description	Image
VA100	Deluxe K Valve	
VA200	PRO Valve	
VA300	DIN Valve	
VH200L, VH200R	PRO H Adapter	

Part Number	Description	Image
VH300L-A	DIN H Adapter	
VA200L, VA200R	Modular PRO Valve	
VA300L, VA300R	Modular DIN Valve	
VC0V0	Crossbar with Isolator	
VC0S0	Short Crossbar w/o Isolator	
VMT200	Isolation PRO Manifold	
VMT300	Isolation DIN Manifold	
VMT500, VMT500J	PVD One-Piece Manifold with optional "J" Reserve valve	

## Introduction

This manual outlines manufacturer prescribed servicing procedures for the Thermo Valve products described within. It covers disassembly, cleaning, inspection, reassembly, adjusting and testing of said valve products. This publication assumes that the technician performing the service is experienced, mechanically inclined, is using the proper tools, parts and procedures prescribed within. If you do not fully understand all of the procedures

outlined in this manual, contact XS Scuba and speak with a Technical Advisor before proceeding any further. There are many Thermo Valve products. They use common parts and common procedures. This manual does not attempt to go step by step through each individual product; rather, it focuses on different parts of the valves that require service. You must apply the appropriate knowledge found within this manual to the particular model that you are servicing.

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## Warnings, Cautions and Notes

Pay special attention to information provided in warnings, caution and notes that are accompanied by one of these symbols:



**WARNING** indicates a procedure or situation that may result in serious injury or death if instructions are not followed correctly



**CAUTION** indicates any situation or technique that will result in potential damage to the product, or render the product unsafe if instructions are not followed correctly



**NOTE** is used to emphasize important points, tips or reminders

## Maintenance Schedules

How often a scuba valve should get serviced is very subjective. Scuba valves are subjected to a variety of environmental elements that, over time, can affect their performance. Salt, sand, sediment, chlorine and other chemicals all take their toll on a scuba valve. Soft parts wear out and lubricants break down and wash away. While it would be easy just to say, "Service your valves once a year", it would not be very forthcoming. Using a calendar to determine servicing intervals is not appropriate. Servicing depends upon the amount of use, the environmental conditions and whether prescribed care was met.

The preferred method is to evaluate the valve annually and service it when one or more of the following indicators are present:

- Air leaking from the handwheel / bonnet area
- Air leaking from the valve / cylinder interface
- Air leaking between modular valve and crossbar
- Corrosion on the exterior finish
- The handwheel does not spin true on its axis. It has a wobble to it.
- The handwheel has to be closed more than "lightly" snug to stop the air flow.
- The handwheel becomes difficult to rotate
- The handwheel does not operate smoothly and quietly

Since burst plugs weaken over time, soft parts wear and lubricants wash away, it is required that you service the valve at least once every 5 years whether it has seen much use or not. Since most scuba cylinders require hydrostatic testing every 5 years, it is recommended that you service the valve while the cylinder is out getting hydrostatically tested.

## Standard Procedures

1. Preview the list of tools and parts required to perform the prescribed service outlined in this manual. Follow each step in the sequence provided. Have this manual open next to you for reference. Do not rely upon memory.
2. Numbers found in parenthesis reference the KEY numbers in the exploded diagrams. If you are not sure what a part is by its description, use this number to cross reference it in the exploded diagrams.
3. All valve and manifold services should be performed on a workbench specifically set up and equipped for this purpose. Adequate lighting and cleanliness along with easy access to the required tools should be considered mandatory.
4. Only use factory authorized parts provided by XS Scuba. Do not attempt to substitute other manufacturer's parts regardless of any similarity in appearance. This is especially true for o-rings!


5. Do not attempt to reuse mandatory replacement parts regardless of how much use those parts were subjected to.
6. When reassembling, it is important to follow factory mandated torque values using a calibrated torque wrench. To do otherwise could lead to damage or failure of the product.
7. Unless otherwise instructed, the following is assumed:
  - When instructed to remove, unscrew or loosen a threaded part, turn the part counterclockwise. The manual abbreviates counterclockwise with CCW.
  - When instructed to install, screw in or tighten a threaded part, turn the part clockwise. The manual abbreviates clockwise with CW.

## Nitrox Compatibility

Depending upon the model, when Thermo Valves are sold new, they are designated for either Compressed Air Only service or for Maximum 40% Oxygen Premixed service. The service designation is shown in the XS Scuba catalog, the XS Scuba website and on the valve itself.

A valve model designated for Compressed Air Only service is manufactured and prepared for use only with breathing air (21% oxygen and 79% nitrogen by volume) that is of quality Grade E or better.

A valve model designated for Maximum 40% Oxygen Premixed service may be used for either oxygen enriched breathing air with a maximum oxygen content of 40% (premixed), or for standard breathing air (21% oxygen and 79% nitrogen by volume) with a purity rating as low as Grade E\*. If the valve is used for standard breathing air where the hydrocarbons exceed 0.1 mg/m<sup>3</sup>, such as Grade E, then the valve must be dedicated to breathing air service and MAY NOT be used for oxygen enriched breathing air until such time as the valve is disassembled, properly cleaned and lubricated, and assembled for Maximum 40% Oxygen Premixed service again.

 **WARNING:** For the valve to remain Maximum 40% Oxygen Premixed compatible, only use hyper-filtered compressed gas (hydrocarbons < 0.1 mg/m<sup>3</sup>). Ordinary compressed breathing air (Grade E) usually does not meet this criterion. Once ordinary breathing air is used, the valve is no longer Maximum 40% Oxygen Premixed compatible until it is cleaned and serviced again.

Valves that are designated for Maximum 40% Oxygen Premixed and are being used with elevated oxygen percentages between 21% and 40% by volume, must be installed in cylinders which have been cleaned and tested for oxygen use. All other equipment attached to the valve, which comes in contact with the oxygen enriched breathing air (regulator, BC, pressure gauge etc.) must also be approved by the manufacturer of that equipment for use with oxygen enriched breathing air and must be maintained in an oxygen clean condition as set forth by the manufacturer.

In all cases, if a lubricant is used on the o-rings or upon insertion of the valve into a cylinder, only use lubricants approved for oxygen use.














Before attaching the regulator to the valve, open the valve slightly for an instant to clear the opening of particles of dust, dirt and to remove any moisture.

**ALWAYS OPEN VALVE SLOWLY UNTIL PRESSURE BUILDS UP THROUGHOUT THE REGULATOR!**

All Thermo Valves scuba valves and scuba valve parts are to be used, installed and maintained per Compressed Gas Association Pamphlet V-9 "STANDARD FOR COMPRESSED GAS CYLINDER VALVES".

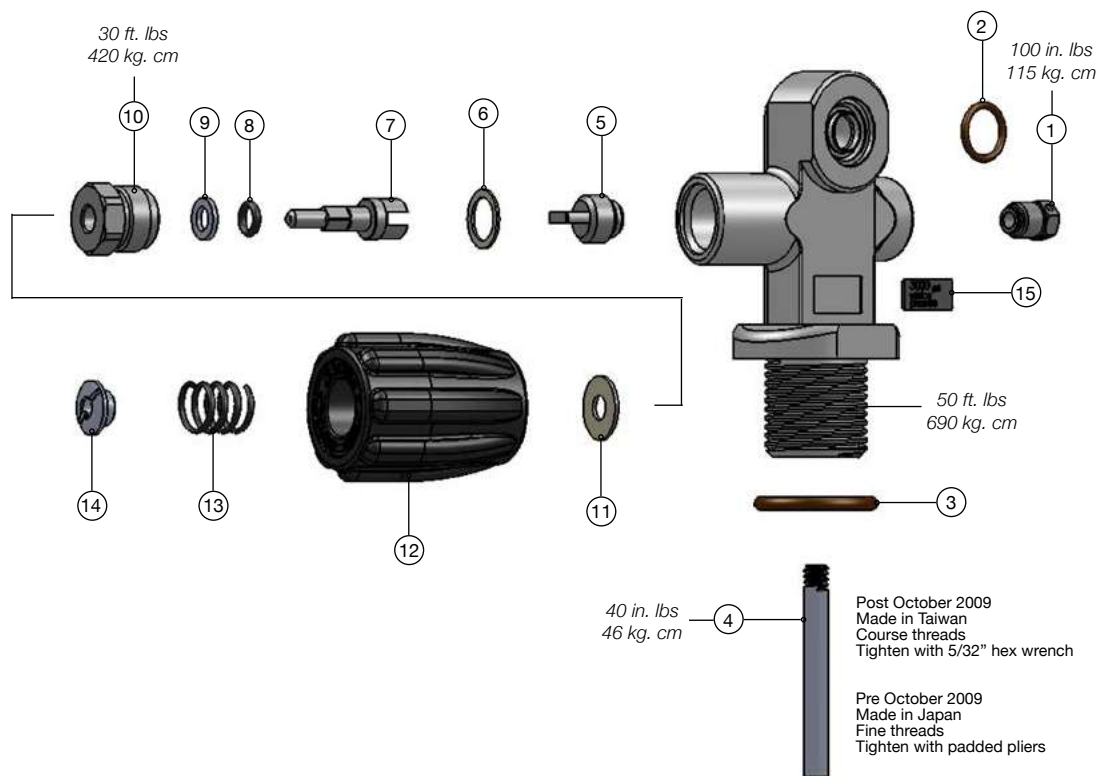
\*At the time of this publication, The Compressed Gas Association (CGA 7.1) states that Grade E air can have up to 5 mg/m<sup>3</sup> of condensed hydrocarbons.

## Required Tool List

Part #	Description	Application
TL119	Scuba Valve Tester 	Holds valve while servicing. Pressurizes valve for leak checks.
TL113	Valve Handwheel Tool 	Removal and installation of handwheel retaining nut (4)
n/a	11/16" wrench 	Bonnet removal
TL111	O-ring pick set 	Removing o-rings and washers
n/a	Needle nose pliers 	Removal and installation of washer(s).
n/a	Torque Wrench in/lbs and ft/lbs 	Apply proper torque values
n/a	3/8" socket 	Removal and torquing the Safety Assembly
n/a	1/4" hex socket 	Removal and torquing the DIN insert.
n/a	11/16" deep socket or crow's foot 	Torquing down the bonnet
n/a	Large Crescent Wrench at least 15 in. 	Removing the valve from the cylinder
n/a	Rubber mallet 	Rapping crescent wrench during valve removal.
n/a	Large 1.5" Crow's Foot 	Torquing valve back into the cylinder
AC368	Tank Muffler 	Used to quietly drain a cylinder for valve removal

# THERMO

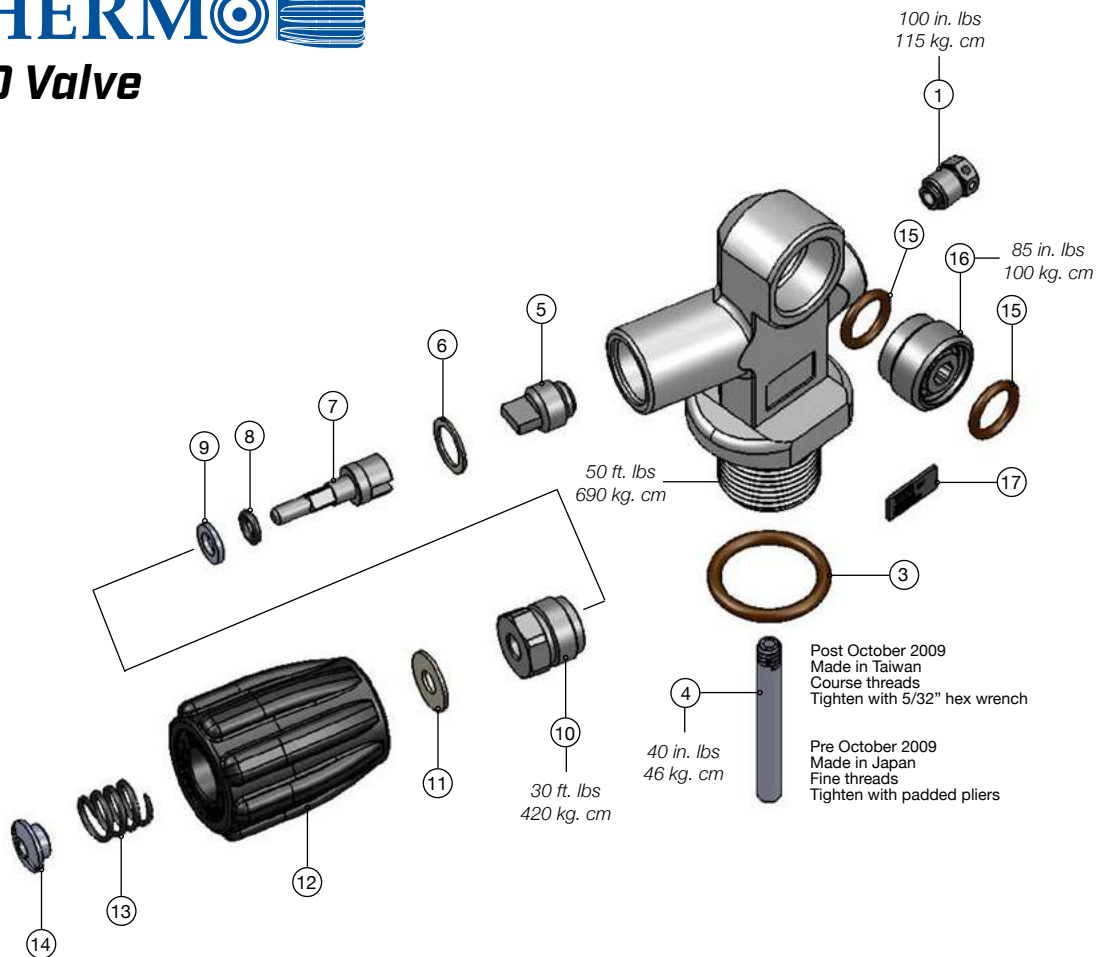
## Deluxe K Valve



#	Part #	Description	#	Part #	Description
	<b>VKT-K</b>	<b>SERVICE KIT - THERMO DELUXE K</b>	7	VP07	Stem
1	VP01-20	Safety Assembly - 2015 psi (3358 burst)	8	<b>VP08-E</b>	<b>O-ring - EPDM (Stem)</b>
1	VP01-22	Safety Assembly - 2250 psi (3750 burst)	9	<b>VP09</b>	<b>Teflon Washer (Stem)</b>
1	VP01-24	Safety Assembly - 2400 psi (4000 burst)	10	VT10	Bonnet - Thermo
1	VP01-27	Safety Assembly - 2730 psi (4550 burst)	11	VP11	Teflon Washer (Handwheel)
1	VP01-30	Safety Assembly - 3000 psi (5000 burst)	12	VP12-BK	Handwheel - Black
2	<b>VP02-B</b>	<b>O-ring - BunaN (Outlet)</b>	12	VP12-GN	Replacement Handwheel - Green
2	VP02-V	O-ring - Viton (Outlet)	13	VP13	Spring
2	VP02-P	O-ring - Polyurethane (Outlet)	14	VP14	Nut
3	<b>VP03-B</b>	<b>O-ring - BunaN (3/4"-14 NPSM Inlet)</b>	15	VP01S-20	Sticker - 2015 psi
3	VP03-V	O-ring - Viton (3/4"-14 NPSM Inlet)	15	VP01S-22	Sticker - 2250 psi
4	VT04	Dip Tube - (Pre 10/09) - Fine Threads	15	VP01S-24	Sticker - 2400 psi
4	VP04	Dip Tube - (Post 10/09) - Course Threads	15	VP01S-30	Sticker - 3000 psi
5	<b>VP05</b>	<b>Seat</b>	<b>Part numbers in bold italics are standard replacement parts and are included with VKT-K service kit</b>		
6	<b>VT06</b>	<b>Copper Crush Washer</b>			

# THERMO

## PRO Valve

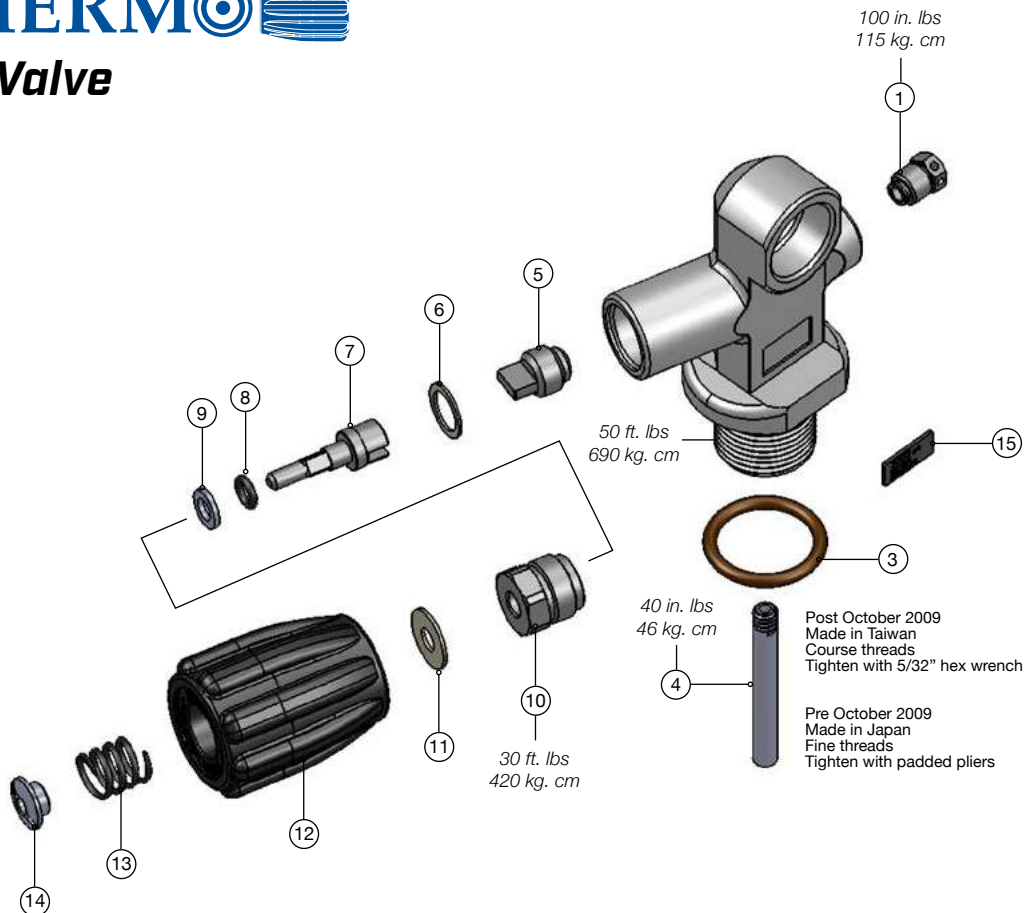


#	Part #	Description	#	Part #	Description
	<b>VKT-P</b>	<b>SERVICE KIT - THERMO PRO VALVE</b>			
1	VP01-20	Safety Assembly - 2015 psi (3358 burst)	10	VT10	Bonnet - Thermo
1	VP01-22	Safety Assembly - 2250 psi (3750 burst)	11	VP11	Teflon Washer (Handwheel)
1	VP01-24	Safety Assembly - 2400 psi (4000 burst)	12	VP12-BK	Handwheel - Black
1	VP01-27	Safety Assembly - 2730 psi (4550 burst)	12	VP12-GN	Replacement Handwheel - Green
1	VP01-30	Safety Assembly - 3000 psi (5000 burst)	13	VP13	Spring
1	VP01-31	Safety Assembly - 3130 psi (4694 burst)	14	VP14	Nut
1	VP01-33	Safety Assembly - 3300 psi (5500 burst)	<b>15</b>	<b>VP15-V</b>	<b>O-ring - Viton (Outlet)</b>
1	VP01-34	Safety Assembly - 3442 psi (5250 burst)	15	VP15-P	O-ring - Polyurethane (Outlet)
<b>3</b>	<b>VP03-V</b>	<b>O-ring - Viton (3/4"-14 NPSM Inlet)</b>	16	VP16-V	DIN Insert With Both O-rings Viton
4	VT04	Dip Tube - (Pre 10/09) - Fine Threads	17	VP01S-20	Sticker - 2015 psi
4	VP04	Dip Tube - (Post 10/09) - Course Threads	17	VP01S-22	Sticker - 2250 psi
<b>5</b>	<b>VP05</b>	<b>Seat</b>	17	VP01S-24	Sticker - 2400 psi
<b>6</b>	<b>VT06</b>	<b>Copper Crush Washer</b>	17	VP01S-30	Sticker - 3000 psi
7	VP07	Stem	17	VP01S-33	Sticker - 3300 psi
<b>8</b>	<b>VP08-E</b>	<b>O-ring - EPDM (Stem)</b>	17	VP01S-34	Sticker - 3442 psi
<b>9</b>	<b>VP09</b>	<b>Teflon Washer (Stem)</b>			

**Part numbers in bold italics are standard replacement parts and are included with VKT-P service kit**



**DIN Valve**

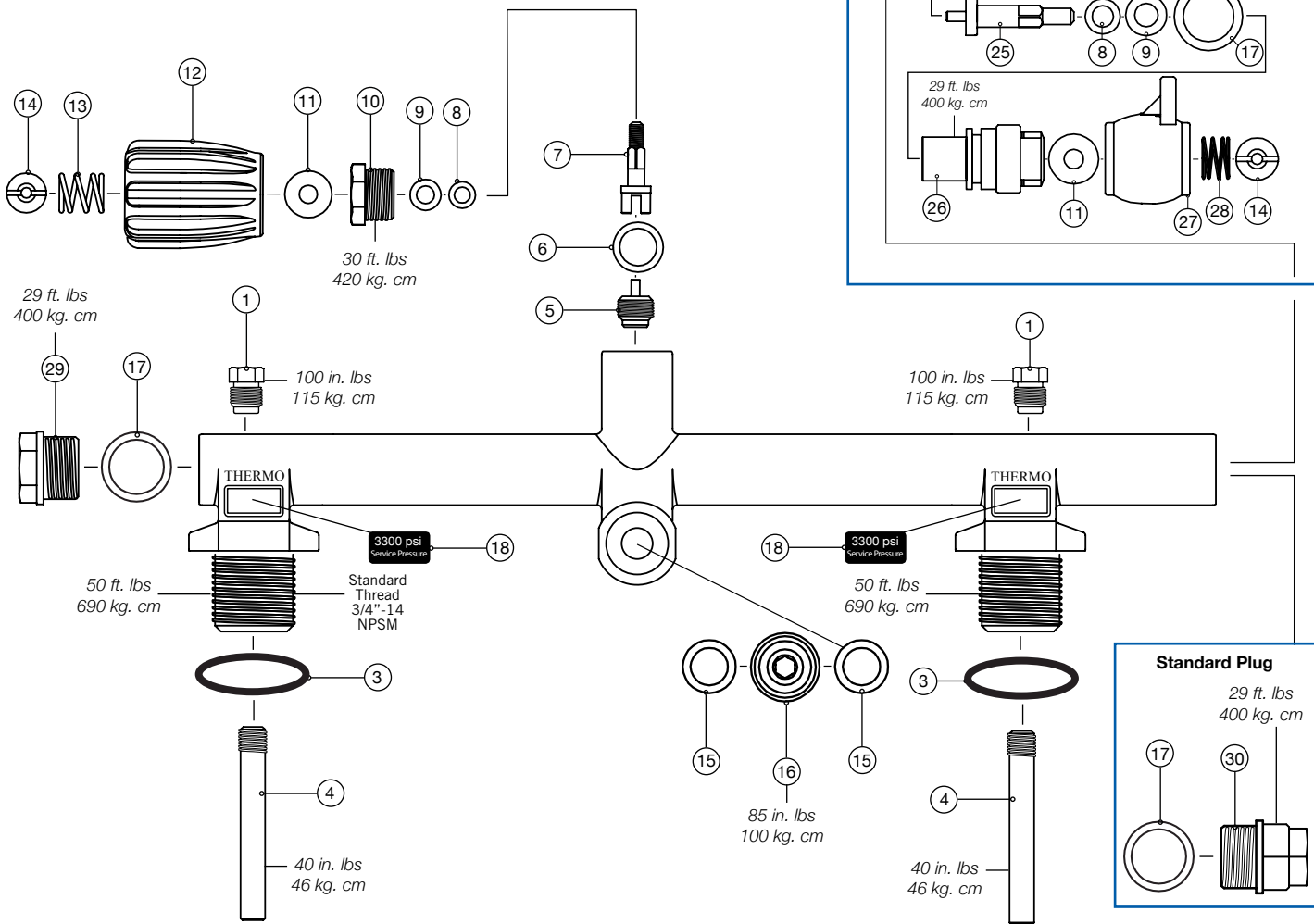


#	Part #	Description	#	Part #	Description
<b>VKT-D SERVICE KIT - THERMO DIN VALVE</b>					
1	VP01-20	Safety Assembly - 2015 psi (3358 burst)	<b>8</b>	<b>VP08-E</b>	<b>O-ring - EPDM (Stem)</b>
1	VP01-22	Safety Assembly - 2250 psi (3750 burst)	<b>9</b>	<b>VP09</b>	<b>Teflon Washer (Stem)</b>
1	VP01-24	Safety Assembly - 2400 psi (4000 burst)	10	VT10	Bonnet - Thermo
1	VP01-27	Safety Assembly - 2730 psi (4550 burst)	11	VP11	Teflon Washer (Handwheel)
1	VP01-30	Safety Assembly - 3000 psi (5000 burst)	12	VP12-BK	Handwheel - Black
1	VP01-31	Safety Assembly - 3130 psi (4694 burst)	12	VP12-GN	Replacement Handwheel - Green
1	VP01-33	Safety Assembly - 3300 psi (5500 burst)	13	VP13	Spring
1	VP01-34	Safety Assembly - 3442 psi (5250 burst)	14	VP14	Nut
1	VP01-43	Safety Assembly - 4350 psi (7250 burst)	15	VP01S-20	Sticker - 2015 psi
<b>3</b>	<b>VP03-V</b>	<b>O-ring - Viton (3/4"-14 NPSM Inlet)</b>	15	VP01S-22	Sticker - 2250 psi
3	VP024-V	O-ring - Viton (7/8" UNF Inlet)	15	VP01S-24	Sticker - 2400 psi
4	VT04	Dip Tube - (Pre 10/09) - Fine Threads	15	VP01S-30	Sticker - 3000 psi
4	VP04	Dip Tube - (Post 10/09) - Course Threads	15	VP01S-33	Sticker - 3300 psi
<b>5</b>	<b>VP05</b>	<b>Seat</b>	15	VP01S-34	Sticker - 3442 psi
<b>6</b>	<b>VT06</b>	<b>Copper Crush Washer</b>	15	VP01S-43	Sticker - 4350 psi
7	VP07	Stem			

**Part numbers in bold italics are standard replacement parts and are included with VKT-D service kit**



**One Piece Manifold**

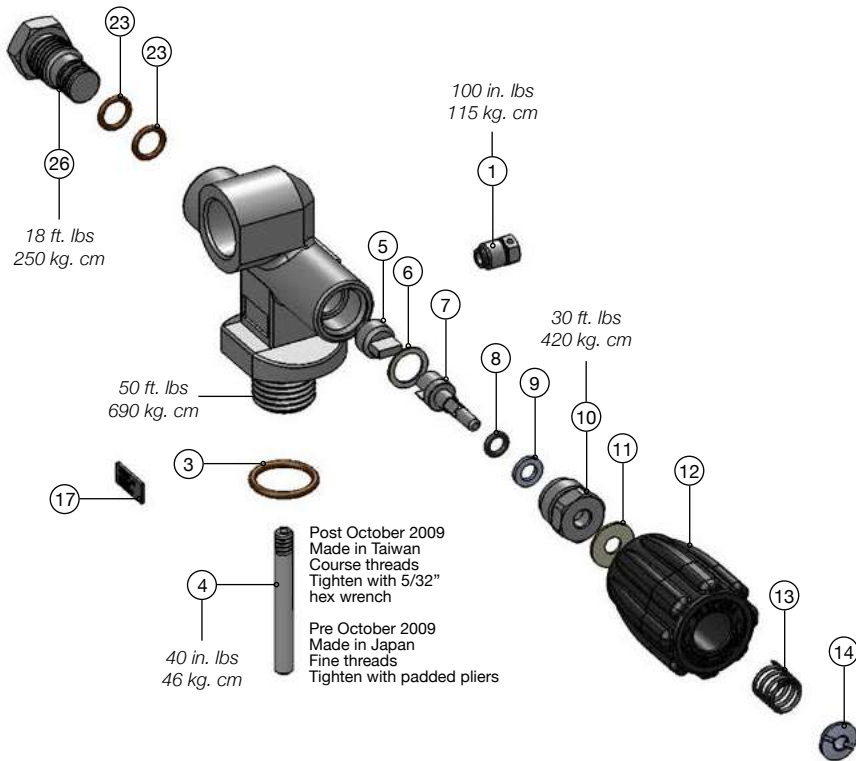


#	Part #	Description	#	Part #	Description
	<b>VKT-1M</b>	<b>SERVICE KIT - MANIFOLD W/O J RESERVE</b>			
	<b>VKX-J</b>	<b>SERVICE KIT - J RESERVE ASSEMBLY</b>			
1	VP01-24	Safety Assembly - 2400 psi (4000 burst)	15	<b>VP15-V</b>	<b>O-ring - Viton (Outlet)</b>
1	VP01-30	Safety Assembly - 3000 psi (5000 burst)	15	VP15-P	O-ring - Polyurethane (Outlet)
1	VP01-33	Safety Assembly - 3300 psi (5500 burst)	16	VP16-V	DIN Insert With Both O-rings Viton
1	VP01-34	Safety Assembly - 3442 psi (5250 burst)	<b>17</b>	<b>VX17-E</b>	<b>O-ring - EPDM</b>
<b>3</b>	<b>VP03-V</b>	<b>O-ring - Viton (3/4" NPSM Inlet)</b>	18	VP01S-24	Sticker - 2400 psi
4	VP04	Dip Tube	18	VP01S-30	Sticker - 3000 psi
<b>5</b>	<b>VP05</b>	<b>Seat</b>	18	VP01S-33	Sticker - 3300 psi
<b>6</b>	<b>VT06</b>	<b>Copper Crush Washer</b>	18	VP01S-34	Sticker - 3442 psi
7	VP07	Stem	23	VP23	Reserve Assembly
<b>8</b>	<b>VP08-E</b>	<b>O-ring - EPDM (Stem)</b>	24	VP24	SS Washer
<b>9</b>	<b>VP09</b>	<b>Teflon Washer (Stem)</b>	25	VP26	Reserve Stem
10	VT10	Bonnet - Thermo	26	VP29-PVD	Reserve Bonnet
11	VP11	Teflon Washer (Handwheel)	27	VP30	Reserve Lever
12	VP12-BK	Handwheel - Black	28	VP31	Reserve Spring (Color Black)
12	VP12-GN	Replacement Handwheel - Green	29	VT29	End Plug - Right Hand
13	VP13	Spring	30	VT30	End Plug - Left Hand
14	VP14-PVD	Nut			

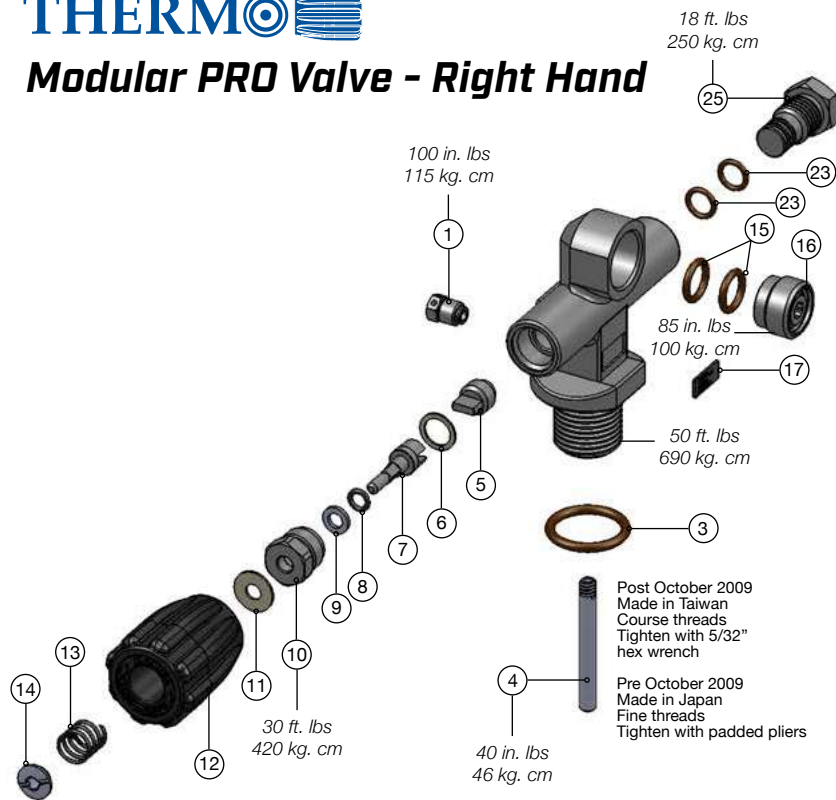
**Part numbers in bold italics are standard replacement parts**



## Modular DIN Valve - Left Hand



## Modular PRO Valve - Right Hand



#	Part #	Description
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**VKT-D** Service Kit - Thermo DIN Valve, + 2 ea. VP25-V o-rings req'd to service each Modular DIN Valve

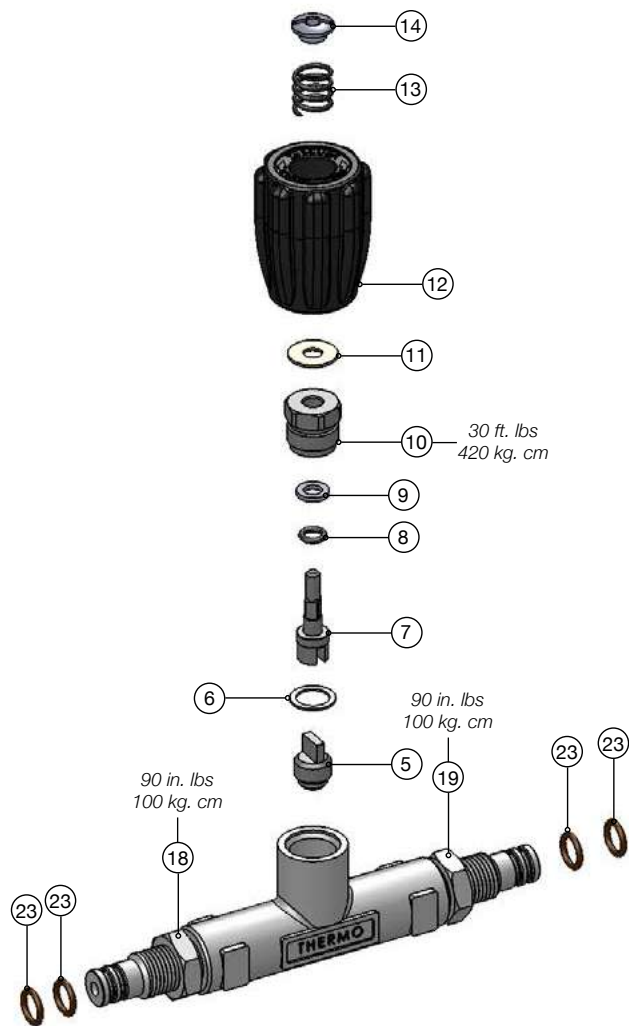
**VKT-P** Service Kit - Thermo PRO Valve, + 2 ea. VP25-V o-rings req'd to service each Modular PRO Valve

1	VP01-20	Safety Assembly - 2015 psi (3358 burst)
1	VP01-22	Safety Assembly - 2250 psi (3750 burst)
1	VP01-24	Safety Assembly - 2400 psi (4000 burst)
1	VP01-27	Safety Assembly - 2730 psi (4550 burst)
1	VP01-30	Safety Assembly - 3000 psi (5000 burst)
1	VP01-31	Safety Assembly - 3130 psi (4694 burst)
1	VP01-33	Safety Assembly - 3300 psi (5500 burst)
1	VP01-34	Safety Assembly - 3442 psi (5250 burst)
1	VP01-43	Safety Assembly - 4350 psi (7250 burst)
<b>3</b>	<b>VP03-V</b>	<b>O-ring - Viton (3/4"-14 NPSM Inlet)</b>
3	VP24-V	O-ring - Viton (7/8" UNF Inlet)
4	VT04	Dip Tube - Pre 10/09 - Fine Threads
4	VP04	Dip Tube - Post 10/09 - Course Threads
<b>5</b>	<b>VP05</b>	<b>Seat</b>
<b>6</b>	<b>VT06</b>	<b>Copper Crush Washer</b>
7	VP07	Stem
<b>8</b>	<b>VP08-E</b>	<b>O-ring - EPDM (Stem)</b>
<b>9</b>	<b>VP09</b>	<b>Teflon Washer (Stem)</b>
10	VT10	Bonnet - Thermo
11	VP11	Teflon Washer (Handwheel)
12	VP12-BK	Handwheel - Black
12	VP12-GN	Replacement Handwheel - Green
13	VP13	Spring
14	VP14	Nut
<b>15</b>	<b>VP15-V</b>	<b>O-ring - Viton (Outlet)</b>
15	VP15-P	O-ring - Polyurethane (Outlet)
16	VP16-V	DIN Insert with both o-rings Viton
17	VP01S-20	Sticker - 2015 psi
17	VP01S-22	Sticker - 2250 psi
17	VP01S-24	Sticker - 2400 psi
17	VP01S-30	Sticker - 3000 psi
17	VP01S-33	Sticker - 3300 psi
17	VP01S-34	Sticker - 3442 psi
17	VP01S-43	Sticker - 4350 psi
<b>23</b>	<b>VP25-V</b>	<b>O-ring - Viton (Barrel)</b>
25	VP19-R	Modular Access Plug-Right (with notches)
26	VP19-L	Modular Access Plug - Left

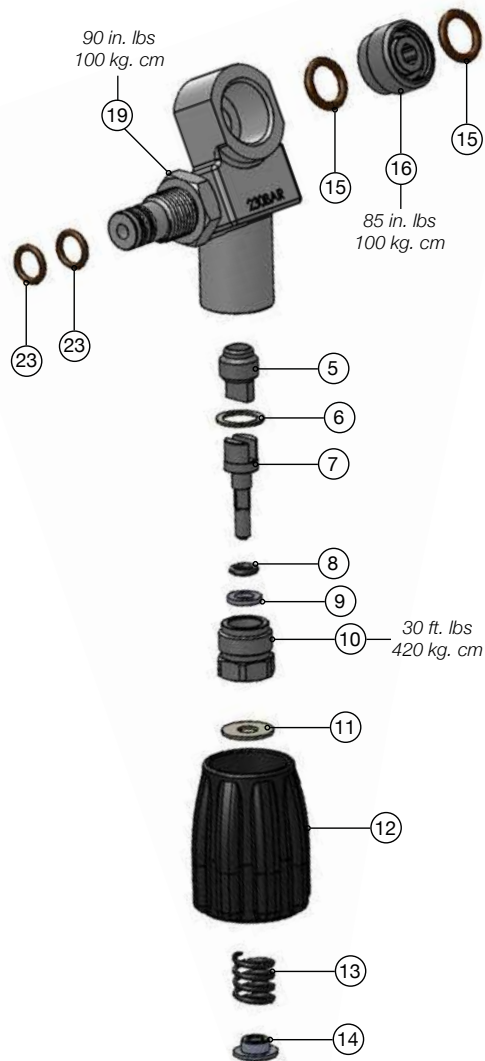
**Part numbers in bold italics are standard replacement parts**



### Modular Valve Crossbar



### H Adapters PRO - Left Hand



#	Part #	Description
	<b>VKT-K</b>	<b>Service Kit – Thermo K Valve, + 4 ea. VP25-V O-rings req'd to service each Crossbar</b>
	<b>VKT-P</b>	<b>Service Kit – Thermo PRO Valve, + 2 ea. VP25-V O-rings req'd to service each H Adapter</b>
5	<b>VP05</b>	<b>Seat</b>
6	<b>VT06</b>	<b>Copper Crush Washer</b>
7	VP07	Stem
8	<b>VP08-E</b>	<b>O-ring - EPDM (Stem)</b>
9	<b>VP09</b>	<b>Teflon Washer (Stem)</b>
10	VT10	Bonnet - Thermo
11	VP11	Teflon Washer (Handwheel)

#	Part #	Description
12	VP12-BK	Handwheel - Black
12	VP12-GN	Replacement Handwheel - Green
13	VP13	Spring
14	VP14	Nut
<b>15</b>	<b>VP15-V</b>	<b>O-ring - Viton (Outlet)</b>
15	VP15-P	O-ring - Polyurethane (Outlet)
16	VP16-V	DIN Insert with both o-rings Viton
18	VP18-R	Barrel Jam Nut - Right (with notches)
19	VP18-L	Barrel Jam Nut - Left
<b>23</b>	<b>VP25-V</b>	<b>O-ring - Viton (Barrel)</b>

Part numbers in bold italics are standard replacement parts

## Annual Inspection and Pre-Test Prior to Disassembly

**NOTE:** Prior to inspection, please note that the Thermo K valve is designed with an “upset” in the bottom of the o-ring groove. This allows air to escape from behind the o-ring when removing your regulator so that the o-ring doesn’t blowout of the groove.



- Inspect the valve for bent, deformed, corroded or worn parts.
- Check the exterior of the valve for damaged, corroded or worn surfaces. This includes the outlet, the valve body, handwheel and any visible areas of the valve.
- Check for any contamination in the outlet of the valve.
- Confirm that the service pressure of the valve and safety assembly rating is correct for the cylinder in which it is installed.

### Leak Inspection Procedure

- Start with full working pressure in cylinder and a properly functioning regulator attached to the outlet.
- Open and close the valve while it is installed in the cylinder and feel for smooth operation. If the valve seems to be difficult to operate or any roughness is felt, the valve must undergo full maintenance.
- Slowly open the valve fully.
- Remove handwheel from valve body by turning handwheel screw in a counterclockwise direction and remove handwheel. **DO NOT REMOVE BONNET NUT!**

**WARNING:** Removing a bonnet nut (10) while the valve is pressurized will result in a rapid and violent release of air. This can lead to serious injury.

- Apply a non-ammonia soap and water solution (or a recognized leak detection agent such as

“Snoop”), to the valve bonnet nut area, the inlet neck o-ring area, the safety assembly area and the outlet area.

- Allow the soap solution to sit for at least 15 seconds and check for signs of leakage. If you find leaks, the valve **MUST** undergo full maintenance.
- Turn the valve off. Purge and remove the regulator from the valve. Apply the soap solution to the valve outlet and check for leakage.
- If after performing all the items shown above and finding no irregularities or leakage, the valve may be returned to service. If any irregularities or leakage is found, the valve must undergo full maintenance.

## Disassembly Procedure

### 1. Remove the Valve from the Cylinder

A. Drain cylinder completely

**NOTE:** Using an XS Scuba AC368 Tank Muffler is a quick and quiet way to drain a scuba cylinder.

B. Secure a large crescent wrench (at least 15 in.) to the wrench flats at the base of the valve so that the fixed jaw of the crescent wrench is on the far side of the valve.

C. Hit the end of the crescent wrench handle with a rubber mallet



D. Spin out the valve

### 2. Remove Inlet O-ring

A. Using your fingers or a brass or plastic pick, remove inlet (neck) o-ring (3)



### 3. Mount the Valve

A. While you can mount the valve in an empty scuba cylinder, it is much more effective to mount it in a built-for-purpose Scuba Valve Tester, p/n TL119.



**NOTE:** The TL119 Scuba Valve Tester is a threaded sleeve that mounts to a bench vise. The sleeve attaches to a scuba cylinder by means of a high-pressure hose. Insert your valve into the sleeve for disassembly and reassembly. Once reassembled, you can pressurize your valve and submerge it into a bucket of water to conduct leak checks.

### 4. Remove Outlet O-ring(s)

A. K valve - Using a brass or plastic pick, remove outlet oring (2)

B. Pro Valve – Using a ¼” hex key, remove the DIN insert assembly (16) by turning CCW

i. Using a brass or plastic pick remove the front and back o-rings (15) from the DIN insert (16)



C. DIN Valve – There is not an outlet o-ring

### 5. Remove Handwheel (12)

A. Using the Valve Handwheel Tool, remove the handwheel from the valve by turning the handwheel nut (14) CCW. Locate and identify the nut (14), spring (13), handwheel (12), and handwheel washer (11).



**⚠ WARNING:** If you are working on a valve that is located in a cylinder, you must insure that the cylinder is completely empty before the next step: loosening the bonnet nut.

**⚠ WARNING:** Removing a bonnet nut (10) while the valve is pressurized will result in a rapid and violent release of air. This can lead to serious injury.



## 6. Remove Bonnet Assembly

A. Using a 11/16" wrench, remove the bonnet nut (10), by turning it CCW. Remove the bonnet nut (10) / stem (7) assembly from the valve body. Separate the pieces and locate the bonnet nut (10), stem washer (9), stem o-ring (8) and stem (7).



## 7. Remove Copper Crush Washer (17)

A. Using a brass or plastic pick, remove the copper crush washer (17) from inside the valve body. This copper crush washer (17) must be removed before removing the seat assembly (5) (next step).

**⚠ CAUTION:** Be very careful not to scratch the inside wall of the valve body when removing the copper crush washer (17). Doing so may result in a leak around the outside of the valve bonnet.



## 8. Remove Seat Assembly (5)

A. Using the stem (7) as a removal tool or a pair of needle nose pliers, remove the seat assembly (5) by rotating it CCW.





## 9. Remove Safety Plug (1)

A. Using a 3/8" socket, remove the safety plug assembly (1) by turning it CCW



**10. There is no need to remove the diptube. Unless it is damaged, it can remain in place.**

**This completes the Thermo Valve Disassembly.**

## Cleaning and Inspection Procedures

All reusable parts, metallic and soft, should be cleaned in a warm (not over 120°F / 50°C) dish soap and water solution. Use a soft, nylon bristle brush to remove any stubborn deposits. The dish soap helps to remove grease and old lubricant.

### Plastic and Rubber Parts

After cleaning, rinse in fresh water. If your local tap water is hard, consider using distilled water. Dry with hyper-

filtered compressed air.

### Metallic Parts

**⚠ CAUTION:** Be sure to use hand and eye protection when handling chemical cleaning solutions.

While dish soap is an excellent degreaser, it may not remove corrosion and mineral build up on metallic parts. That is where acid is effective. Metal parts may be immersed in a sonic cleaner with a diluted acetic acid (vinegar) and water solution (50:50)

If you really want your metal parts to sparkle, consider using a diluted solution of Oakite 31 in your sonic cleaner. Be sure to follow the manufacturer's instructions for dilution.

After cleaning, rinse in fresh water. If your local tap water is hard, consider using distilled water. Dry with hyper-filtered compressed air.

**⚠ CAUTION:** Never place soft parts e.g. rubber, plastic, urethanes, silicones into any acidic solutions. Doing so may alter their physical properties, causing them to break, degrade prematurely or no longer fit.

**👤 NOTE:** Many technicians find that a solution of diluted dish soap and diluted vinegar in their sonic cleaner is all they need to clean the metal parts. It is inexpensive and effective.

## Preparing and Inspecting Parts

### Nitrox Preparation

If you are preparing the valve to place back into nitrox service (O<sub>2</sub> not to exceed 40%), you should use powderless latex or nitrile gloves to keep finger oils off of the clean parts.

**O-rings:** All O-rings should be replaced at every servicing. New O-rings should be inspected for contamination and/or imperfections, and lightly dressed with a thin film of approved lubricant prior to installation. See Recommended Cleaner and Lubricant Table below.

**⚠ CAUTION:** Do not use any petroleum based lubricants or products, or any aerosol silicone sprays on any part of the valve.

**Crown Orifice:** The crown orifice is machined into the valve body. It mates up against the seat assembly (5). The critically machined sealing edge of the crown orifice is important to reducing sealing force. The sealing edge must be free from nicks or scratches and square with the centerline of the orifice. Any imperfection can allow small amounts of air to leak between the crown orifice and the seat assembly, and require an excessive amount of hand torque on the handwheel to make an airtight seal. The sealing edge of the crown orifice should be inspected under magnification whenever possible.

**Stem (7):** The stem will normally get reused. Roll it on a hard surface and confirm that it is true. If it is bent, it must get replaced.

**Bonnet (10):** Inspect the hex head and the threads on the bonnet. If all are good, the bonnet may be reused.

**Mandatory Replacement Parts:** The following parts are considered mandatory replacement parts during a routine servicing:

- Outlet o-ring (2) or (15)
- Inlet (neck) o-ring (3)
- Seat assembly (5)
- Stem o-ring (8)
- Stem washer (9)
- Copper Crush Washer (17)
- Safety Assembly (1)

**Service Kits:** The best way to service a valve is to use the appropriate Thermo Valve service kit. It contains all the mandatory replacement parts that go into a routine servicing of the valve except the Safety Assembly (1) which must get ordered separately.

## *Recommended Cleaners and Lubricants*

Lubricant / Cleaner	Application	Source
Liquid dishwashing detergent diluted with warm water	Degreaser for all metallic parts; general cleaning solution for plastic and rubber parts	Household grade - "Dawn" works very well
Vinegar (acetic acid)-diluted	Removes corrosion and mineral build up from metallic parts	Household grade
Oakite31 diluted with water	Use in sonic cleaner to clean metal parts	Oakite Products, Inc. 50 Valley Road Berkeley Heights, NJ 07922 <a href="http://www.chemetallna.com">www.chemetallna.com</a>
Christo-lube MCG 111	o-ring dressing	XS Scuba 4040 W. Chandler Ave. Santa Ana, CA 92704 866.977.2822 <a href="http://www.XSscuba.com">www.XSscuba.com</a>
Tribolube 71	o-ring dressing	Aerospace Lubricants 1600 Georgesville Road Columbus, Ohio 43228 614.878.3600 <a href="http://www.aerospacelubricants.com">www.aerospacelubricants.com</a>

## Reassembly Procedure

### 1. Install Inlet (Neck) O-ring (3)

- a. Install a lubricated inlet o-ring onto the valve neck. A Buna-N o-ring is good for "compressed air use" only, a viton o-ring is required for oxygen enriched mixtures 21.5% - 40% pre-mixed.



### 2. Mount the Valve

- a. Mount the valve into the valve tester or an empty scuba cylinder

### 3. Insert Seat Assembly (5)

- a. Using the stem (7) as a tool or needle nose pliers, install the seat assembly (5) CW until it contacts the crown orifice inside



### 4. Install Copper Crush Washer (17)



### 5. Install Stem O-ring (8)

- a. Install a lubricated stem o-ring (8) on to the stem (7)



## 6. Install Stem Washer (9)

- a. Install the stem washer (9) on to the stem (7)



## 7. Insert Stem (7) into the Bonnet (10)

- a. Insert the stem (7), with its o-ring (8) and stem washer (9), shaft first, into the bonnet (10)



## 8. Insert Bonnet Assembly

- a. Insert bonnet assembly into the valve body, insuring that the slot in the stem (7) engages the tang on the seat assembly (5). Tighten bonnet nut (10) by hand.



## 9. Torque Bonnet Nut (10)

- a. Using a calibrated torque wrench, tighten the bonnet nut (10) to 30ft.lbs (420kg.cm) (40Nm)



**⚠ WARNING:** Failure to provide proper torque on the bonnet nut could lead to the bonnet nut backing out, which in turn could lead to a catastrophic loss of cylinder contents

## 10. Install Safety Assembly (1)

- a. Thread a new Safety Assembly into place by hand
- b. Use a 3/8th in. socket on a calibrated torque wrench to torque the safety assembly (1) to 100in. lbs (115kg.cm) (11Nm)





c. DIN Valve – There is not an outlet o-ring

**⚠ WARNING:** If a safety assembly is loosened or removed from the valve, it must get replaced. A safety assembly, which uses a copper sealing gasket, is designed to be tightened just one time only.

### 11. Install Outlet O-ring(s)

- a. K Valve - Using your thumb or the backside of a TL136 Multi-purpose tool, install an unlubricated outlet o-ring (2) into its groove
- b. Pro Valve – Using your thumb or the backside of a TL136 Multi-purpose tool, install outlet o-rings (15) into their respective grooves on the front and the back of the DIN insert (16). Only the back o-ring gets lubricated.



- i. Using a calibrated torque wrench and a 1/4" hex socket adapter, install the DIN insert assembly CW, applying a torque of 85 in.lbs (100kg.cm) (10Nm)

### Testing

#### 12. Pressurize The Valve

- a. Temporarily slide handwheel on to stem (no spring or nut required) and make sure that the valve is closed



- b. Pressurize the Scuba Valve Tester to the working pressure of the valve or install the valve into a cylinder. Using a 1.5 in. crow's foot applied to the valve's base, torque the valve to 50ft.lbs (690kg.cm) (68Nm). Pressurize the cylinder to its working pressure.
- c. Apply a proper functioning regulator to the outlet of the valve

#### 13. Inspect for Leaks

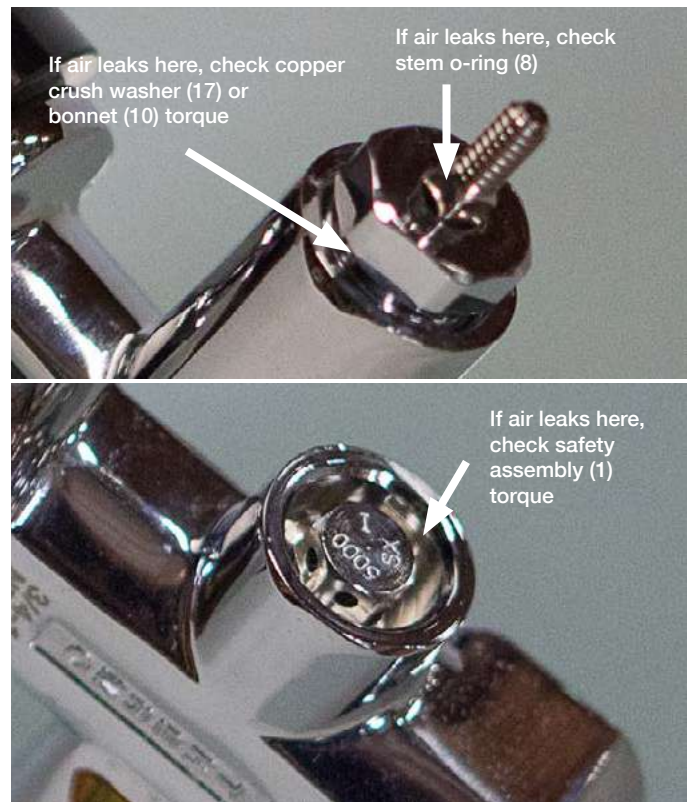
- a. Submerge the valve with regulator attached into a tub of water



no leaks or irregularities are found, the valve passes and may go back into service

b. If any leaks or irregularities are found, use the Troubleshooting Guide to go back and make the necessary repairs until the valve passes all the tests

**NOTE:** If a tub of water is not readily available, apply a soap and water solution, or a recognized leak detection solution such as “Snoop”, to the bonnet nut area, the inlet neck o-ring area, the safety assembly area and the outlet area.



Allow soap solution to sit for at least 15 seconds

- b. Slowly open the valve
- c. Remove handwheel from stem
- d. Inspect for leaks around the bonnet nut area, the inlet neck o-ring area, the safety assembly area and the outlet area.
- e. Remove from water
- f. Temporarily install the handwheel and turn the valve off until lightly snug
- g. Purge the regulator and remove it
- h. Lower valve back into the water and check to make sure that there is no leakage from the valve outlet

## Final Assembly

### 15. Assemble Hand Wheel Assembly

- a. Install the handwheel washer (11) over the stem, followed by, the handwheel (12), the spring (13) and the nut (14). Reference the exploded diagram if necessary.



### 14. Results

- a. If, after performing all the steps outlined above,



b. Using the TL113 Valve Handwheel Tool, tighten the nut (14) until the top of the stem (7) is flush with the top of the nut.



**⚠ CAUTION:** Over-tightening the handwheel nut (14) will make it very difficult to turn the handwheel. Only tighten the nut until it is flush with the end of the stem (7).

### Servicing Thermo LH and RH Modular Valves

Perform the Inspection and Pre-Test prior to the Disassembly Procedure, as outlined earlier in this

manual. If disassembly is required, follow the Disassembly Procedure outlined earlier in this manual.

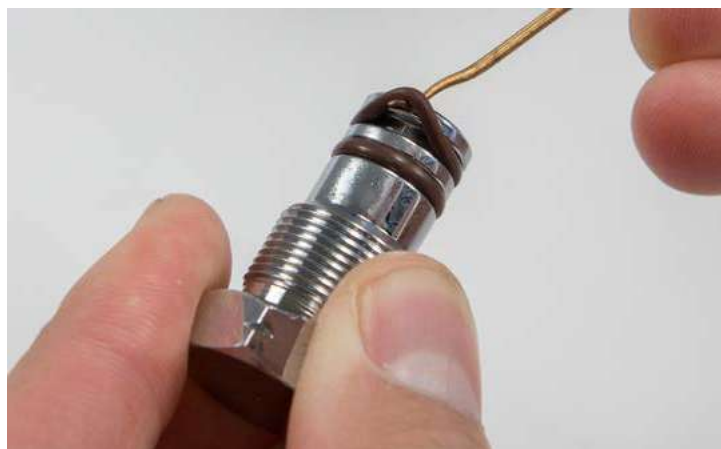
During the Disassembly:

1. Using a 13/16" wrench, remove the Modular Valve's side access plug (25 and/or 26).

**⚠ NOTE:** The side access plug found on the RH Modular Valve has notches machined into the plug's wrench flats. The notches indicate reverse threads.



2. Remove the o-rings (23) from the access plug (s) (25 and/or 26).



3. Inspect the access plug's (25 and/or 26) thread for any sign of damage. If any damage is found to the access plug's threads, you must replace the access plug and do not reuse it.
4. Clean the plug and install new, lubricated o-rings (23).

During the Reassembly:

1. Thread the access plug into the valve in the

appropriate direction, CW for LH valve, CCW for RH valve (notched). Using a 13/16" crows foot or socket, torque the access plug(s) to 18ft.lbs (250kg.cm) (24.5Nm)



2. After disassembling the main valve, remove the two, side connector o-rings (23).


Test the valve as outlined in the preceding section titled "Testing". Pay special attention for any leaks that may be originating from the access plug(s) (25 and/or 26).

### Servicing Thermo H-Valves


With the Thermo H-Valve still attached to the Thermo Modular Valve, perform the Inspection and Pre-Test prior to disassembly as outlined earlier in this manual.

If disassembly is necessary,

#### Remove the H-Valve from the Modular Valve

 **NOTE:** The barrel Jam Nut on the right-hand H-Valve has notches on it indicating reverse threads.

- a. Loosen the barrel Jam Nut with a 7/8" wrench.
- b. Unthread the H-Valve from the Modular Valve by hand. The right-hand H-Valve has reverse threads and is removed by turning it CW.

 **CAUTION:** Do not attempt to disassemble a H-Valve while it is still attached to a modular Valve. Doing so may bend the side connector bar of the H-Valve rendering the valve useless.

Mount the H-Valve in a bench vise as shown. Disassemble the valve as per previous disassembly directions.



3. Remove the jam nut for cleaning if necessary.
4. Inspect the side connector threads for damage. If damage is found, the valve must be condemned.

Reassembly:

1. Reassemble the valve as per previous assembly instructions.
2. Install the Jam Nut as far up the connector as possible.
3. Install two, new, side connector o-rings.
4. Thread the H-Valve, as far as it will go, into the Modular Valve. Back it out a partial revolution until it is in the position desired.
5. Engage the Jam Nut.

- a. Using a 7/8" wrench crow's foot, apply a torque of 85 in.lbs (100 kg.cm) (10Nm).

Testing:

1. **Test the Modular Valve / H-Valve Assembly as outlined in the previous section titled “Testing”. Pay special attention for any leaks that may be originating from the side connector on the H-Valve.**

### Servicing Thermo Crossbar with Isolator Valve

**⚠ CAUTION:** This manual does not provide instruction on how to disassemble and reassemble twin cylinder set ups. This manual assumes that the technician is familiar with how to do this. If you do not know how to disassemble and reassemble twin cylinder set ups, please refer to the support document, “Assembling Twin Cylinders”, found at [www.xsscuba.com](http://www.xsscuba.com) under the “Support” header.

With the Crossbar and the two Thermo Modular Valves still installed in the twin cylinders, perform the Inspection and Pre-Test prior to disassembly as outlined earlier in this manual.

If disassembly is necessary,

1. **Remove the Crossbar from the Modular Valves.**



**👉 NOTE:** The barrel Jam Nut (18) on the right-hand side of the Crossbar has notches on it indicating reverse threads.

**⚠ CAUTION:** Do not attempt to disassemble the Isolator Valve on the Crossbar while it is still attached to a Modular Valves. Doing so may compromise the Cross Bar, rendering it useless.

2. **Mount the Crossbar in a bench vise as shown. Disassemble the Isolator Valve as per previous disassembly directions.**
3. **After disassembling the Isolator Valve, remove the four, side connector o-rings.**



4. **Remove both jam nuts (18 & 19) for cleaning if necessary.**
5. **Inspect the side connector threads for damage. If damage is found, the Crossbar must be condemned.**

Reassembly:

1. **Reassemble the Isolator Valve as per previous assembly instructions.**
2. **Install the jam nuts (18 & 19) as far up the connector as possible.**
3. **Install four, new, side connector o-rings (23).**
4. **Install the Crossbar.**
  - a. Thread the Isolator Valve into the two Modular Valves, pulling the Modular Valves together until the proper center-to-center distance is reached between the two dip tubes. Position the isolator handwheel to the desired position.
5. **Engage the jam nuts (18 & 19).**
  - a. While holding the handwheel (12) in the desired position, spin the two jam nuts (18 & 19) until they snug up against the Modular Valves. Use a 7/8” crow’s foot,

apply a torque of 85 in.lbs (100 kg.cm) (10Nm) to each.

Testing:

1. **Test the entire twin manifold assembly as outlined in the previous section titled "Testing". Pay special attention for any leaks that may be originating from Crossbar connectors entering the Modular Valves.**

## Servicing the "J" Reserve Mechanism on the One-Piece Manifold

**NOTE:** For this section, the numbers found in parenthesis reference the KEY numbers in the One-Piece Manifold Exploded Diagram.

Disassembly

### 1. Remove Reserve Lever (27)

A. Using the TL113, Valve Handwheel Tool, remove the Reserve Lever (27) from the manifold by turning the handwheel nut (14) CCW. Locate and identify the nut (14), reserve lever (27), spring (28) and washer (11).



**WARNING:** If you are working on a valve that is in a cylinder, you must insure that the cylinder is completely empty before the next step: loosening the reserve bonnet (26).

**WARNING:** Removing reserve bonnet (26) while the valve is pressurized will result in a rapid and violent release of air. This can lead to serious injury.

### 2. Remove the Reserve Bonnet (26) Assembly.

A. Using a 5/8" wrench, remove the reserve bonnet (26) by turning it CCW.

- i Remove the stem (25)
- ii Remove the stem o-ring (8) from the stem (25)
- iii Remove the stem washer (9). This is the white washer that is usually found inside the reserve bonnet (26).
- iv Remove the o-ring (17) found on the outside of the reserve bonnet (26)



### 3. Remove Reserve Mechanism (23)

A. Grasp the back end of the reserve mechanism (23) with needle nose pliers and pull straight up.

B. Separate the stainless-steel washer (24) from the reserve mechanism (23).



**NOTE:** Sometimes the stainless-steel washer (24) gets swedged into place on the reserve mechanism (23). Removal may require the use of pliers. If the stainless-steel washer (24) is bent, it must get replaced.

This concludes disassembly of the reserve mechanism. Before beginning reassembly, perform the necessary cleaning and lubrication procedures outlined earlier in this manual.

**Reassembly**

Prior to inserting the reserve mechanism (23), study the two images below to understand whether it is in the “disengaged” position or the “engaged” position. Knowing which position it is in will be important when you install the reserve lever (27).



**1. Install Reserve Assembly (23 & 24)**

A. Place the stainless-steel washer (24) on the back of the reserve assembly (23).

B. Lower the reserve assembly (23), head first, into the valve body. Be sure that the square portion of the reserve assembly (23) engages the square cut out inside the valve body.



**⚠ CAUTION:** The reserve assembly (23) has a square portion that must engage the square cutout in the valve body.

**2. Install the stem o-ring (8)**

A. Install a lubricated stem o-ring (8) on to the stem (25)

**3. Install Stem Washer (9)**

**4. Install a Lubricated O-ring (17) on to the Reserve Bonnet (26)**

**5. Insert Stem (25) into the Reserve Bonnet (26)**



**6. Insert the Reserve Bonnet Assembly (26)**

A. Tighten by hand

**7. Torque Reserve Bonnet (26)**

A. Apply a torque wrench using a 5/8” crow’s foot or deep socket. Apply a torque of 29ft.lbs (400kg.cm) (39Nm)



**8. Place the Reserve Lever Washer (11) over the Stem (25)**

**9. Add the Reserve Lever (27)**

A. The reserve lever (27) faces inboard, towards the diver

If the reserve mechanism (23) was disengaged, the reserve lever (27) orients in the up position

B. If the reserve mechanism (23) was engaged, the reserve lever (27) orients to the down position.

## 10. Test the Reserve Lever Positioning

A. Perform the following simple test to ensure that the reserve lever (27) is positioned correctly.

- i Open the on/off handwheel CCW.
- ii Pull the reserve lever (27) down to engage the reserve mechanism (23). Try blowing through the dip tube. Air should pass through the valve.
- iii Lift the reserve lever (27) up to disengage the reserve mechanism (23). Try blowing through the dip tube (4). No air should pass through.
- iv If you are getting the opposite results, slide to reserve lever (27) off the stem (25) and reposition it accordingly.
- v Test again to confirm proper results.



## 11. Pressurize the Valve. Check for leaks

A. Check for leaks using the same procedure as described for the on/off side of the valve, found earlier in this publication.

## 12. Final Assembly

- A. Add the spring (28) to the reserve lever (27)
- B. Using the TL113, Valve Handwheel Tool, tighten the handwheel nut (14) to the stem (25) until the top of the stem (25) is flush with the top of the nut (14)

This concludes reassembly of the reserve side of the Reserve Valve

## Dip Tube Instructions

The dip tube is an important safety feature on a scuba valve. When the diver, and the scuba cylinder on his back, are inverted, the dip tube, prevents particulate matter in the cylinder, from cascading down into the valve inlet. If this were to happen, partial or complete blockage of the breathing gas could occur

**⚠ WARNING:** Never install a scuba valve into a scuba cylinder that does not have a dip tube.

In October of 2009, two changes were introduced to the Thermo Valve dip tubes.

- a. The threads were changed from fine threads to course threads
- b. The entry hole (opposite the threads), was changed from circular to hex so that a 5/32" hex wrench could be inserted.

Installing dip tubes made prior to October 2009 is accomplished with padded pliers.

- Dedicate a pair of pliers to this task and keep in an oxygen clean condition for use on EAN ready valves
- Wrap white medical tape around the serrated end of the pliers.
- Insert the dip tube hand tight.
- Grip the tube with the pliers so that the white medical tape on each side of the pliers is the only item touching the tube. While firmly holding the pliers in the closed position, tighten the tube until it slips through the white medical tape.
- Replace white medical tape often to insure that it remains in an oxygen clean condition.

Installing dip tubes made after October 2009 is accomplished with a 5/32" hex wrench.

- Insert the dip tube hand tight.
- Insert a 5/32" hex adapter attached to a torque wrench. Tighten the dip tube to a torque of 40 in.lbs (46 kg.cm) (4.5Nm).



## **Important Information Regarding Safety Assemblies (Burst Plugs)**

All safety assemblies, aka burst plugs, sold by XS Scuba / Sea Pearls are engineered products designed for use in cylinder valves branded Thermo or XS Scuba only. Use of XS Scuba safety assemblies in products other than cylinder valves branded Thermo or XS Scuba, is done at the user's own risk.

**⚠ WARNING:** These safety assemblies must be installed according to XS Scuba specifications as shown below. Incorrect installation may result in potentially life-threatening situation due to the safety assembly not activating at the intended pressure. These safety assemblies should only be installed by individuals knowledgeable in correct installation procedures.

When replacing a safety assembly, always insure that the safety assembly you are installing is the correct safety assembly for the cylinder according to the test pressure of the cylinder. If you are unsure if the safety assembly is the correct one for the cylinder in question, DO NOT replace the safety assembly.

Since the safety assembly uses copper as a sealing gasket, it is designed to be tightened one time only, and may not be reused if the safety assembly is removed, loosened or unscrewed for any reason.

The safety assembly must be installed using a calibrated torque wrench and the safety assembly tightened to 100 in.lbs (115 kg.cm) (11Nm).

## Troubleshooting Guide

SYMPTOM	POSSIBLE CAUSE	SOLUTION
Air leak between stem (7) and bonnet (10)	Bad stem o-ring (8)	Replace o-ring (8)
	Bent stem (7)	Replace stem (7)
Air leak between bonnet(10) and the valve body	Bad copper crush washer (6)	Replace copper crush washer (6)
	Bonnet(10) not torqued to proper setting	Apply torque of 30 ft.lbs (420kg.cm) (40Nm)
Air leak from valve outlet when valve is closed	Worn valve seat (5)	Replace valve seat (5)
	Debris or particulate matter on the valve seat / crown orifice interface	Remove valve seat (5) and blow compressed air into valve inlet as well as the valve seat chamber
	Damaged crown orifice	Replace the entire valve. Cannot be repaired.
Air leak from safety assembly(1)	Bad copper sealing gasket on the safety assembly (1)	Replace the safety assembly (1)
	The wrong safety assembly (1) is being used	Only safety assemblies originating from XS Scuba / Sea Pearls will work in Thermo Valves.
	Safety assembly (1) not torqued to proper setting	Apply a torque of 100 in.lbs (115kg.cm) (11Nm)
	Damaged seating surface inside valve body	Relace the entire valve. Cannot be repaired.
Air leak between valve and cylinder	Valve not torqued to proper setting	Apply torque of 50 ft.lbs (690kg.cm) (68Nm)
	O-ring (3) not lubricated	Lubricate o-ring
	O-ring (3) damaged	Replace o-ring (3)
	O-ring sealing surface on cylinder dirty, corroded or damaged.	On aluminum cylinders only, refinish o-ring sealing area with the TL101 Tank Tool (see XS Scuba)

## Torque Specifications

PART #	DESCRIPTION / KEY ITEM #	TORQUE		
VP01-xx	Safety Assembly (1)	100 in.lbs	115 kg.cm	11 Nm
VT10	Bonnet (10)	30 ft.lbs	420 kg.cm	40 Nm
VP29-PVD	Reserve Bonnet	29 ft.lbs	400 kg.cm	39 Nm
VP04	Dip Tube (4) Post 10/09-Course Threads	40 in.lbs	46 kg.cm	4.5 Nm
VP16-V	DIN Insert with both o-rings (16)	85 in.lbs	100 kg.cm	10 Nm
VT29	End Plug, Right Hand, One-Piece Manifold	29 ft.lbs	400 kg.cm	39 Nm
VT30	End Plug, Left Hand, One-Piece Manifold	29 ft.lbs	400 kg.cm	39 Nm
VP19-R	Modular Access Plug, Right, w/ Notches (25)	18 ft.lbs	250 kg.cm	24.5 Nm
VP19-L	Modular Access Plug, Left (26)	18 ft.lbs	250 kg.cm	24.5 Nm
VP18-R	Barrel Jam Nut, Right, w/ notches (18)	85 in.lbs	100 kg.cm	10 Nm
VP18-L	Barrel Jam Nut, Left (19)	85 in.lbs	100 kg.cm	10 Nm
n/a	Valve into the cylinder	50 ft.lbs	690 kg.cm	68 Nm

*Notes*



**WARNING**

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