



**Thermo Dewars**  
**5, 10, 20, 30 & 50**  
OPERATION MANUAL  
AND PARTS LIST  
*SERIES 509*

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## IMPORTANT INFORMATION

This manual contains important operating and safety information. The user must carefully read and understand the contents of this manual prior to the use of this equipment.

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# Safety Information

## Alert Signals



### Warning

Warnings alert you to a possibility of personal injury.



### Caution

Cautions alert you to a possibility of damage to the equipment.



### Note

Notes alert you to pertinent facts and conditions.



### Warning

The venting of nitrogen vapors will create a dilution of the air's oxygen concentration necessary to support life. Exposure to this diluted atmosphere can cause asphyxiation or even death. To avoid personal injury or death DO NOT store or use liquid container in areas that have poor ventilation. Use in a well ventilated area. Place liquid containers outdoors or in a well ventilated area. Failure to comply with this warning may cause serious personal injury or even death.



### Warning

Extreme temperature and pressure are associated with the Thermo 50. To avoid serious personal injury, observe caution when removing parts or fittings. Wear eye protection and insulated, loose fittings gloves when removing parts or fittings. Failure to comply with this warning may result in serious personal injury.



### Caution

DO NOT use regulators, valves, gauges, hoses, etc. that have been used in compressed air service. Failure to observe this warning could cause serious damage to your container and possible personal injury.

Your Thermo<sup>®</sup> Dewar has been designed with function, reliability, and safety in mind. It is the user's responsibility to install it in conformance with local electrical codes. For safe operation, please pay attention to the alert signals throughout the manual.

## Warning

**Liquid nitrogen is extremely cold; it boils at -196°C. To avoid injury caused by frostbite:**

1. Use extreme care whenever handling liquid nitrogen, liquid nitrogen storage or transfer vessels, or any objects which have come in contact with liquid nitrogen.
2. Leave no areas of skin exposed.
3. Use in a well ventilated area.
4. Always wear proper safety attire over clothing: face shield, cryogenic gloves and apron.
5. Do not wear pants with cuffs.
6. Never overfill liquid nitrogen vessels.
7. Always keep liquid nitrogen vessel in an upright position.
8. Do not tightly seal liquid nitrogen containers or prevent nitrogen gas from escaping.
9. Use extreme care to prevent spilling and splashing of liquid nitrogen during transfer.
10. Immediately remove any clothing or safety attire on which liquid nitrogen has been spilled.
11. Read all filling instructions carefully.
12. Release pressure and remove liquid nitrogen before working on a vessel.
13. Get immediate medical attention for any frostbite injuries caused by liquid nitrogen.

**The venting of nitrogen vapors will create a dilution of the air's oxygen concentration necessary to support life. Exposure to this diluted atmosphere can cause asphyxiation or even death. To avoid personal injury or death:**

1. DO NOT store or use liquid container in areas that have poor ventilation. Use in a well ventilated area. Place liquid containers outdoors or in a well ventilated area. Failure to comply with this warning may cause serious personal injury or even death.

**Extreme temperature and pressure are associated with the Thermo 50. To avoid serious personal injury:**

1. Observe caution when removing parts or fittings until the liquid has been removed from the container and the pressure has been safely released. Wear eye protection and insulated, loose fittings gloves when removing parts or fittings. Failure to comply with this warning may result in serious personal injury.
2. DO NOT use regulators, valves, gauges, hoses, etc. that have been used in compressed air service. Failure to observe this warning could cause serious damage to your container and possible personal injury.

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# General Description

**Mechanical failure is the major cause of problems associated with liquid nitrogen storage vessels. The vessel neck tube supports the full weight of the inner vessel and the liquid nitrogen it contains.** A side or corner blow to the vessel causes the inner vessel to swing in a pendulum motion, damaging the neck. Any storage vessel which has been exposed to an accident, dropped, or lowered to hit on one corner, is more susceptible to failure. The Thermo 50 have a support (top and bottom), but mishandling the vessel may still cause problems.

Carefully inspect your new Thermo vessel prior to use. Check for signs of damage which may have occurred during shipment. It is advisable to fill all new units with liquid nitrogen and watch the liquid nitrogen loss rate for a few days. If there are any problems, call Barnstead International as soon as possible.

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# Operation



## Warning

Liquid nitrogen is extremely cold; it boils at  $-196^{\circ}\text{C}$ . Extreme caution should be exercised when handling cryogenic liquids. Always wear proper safety attire when transferring liquid nitrogen into or out of Thermo cylinders. Contact with a cryogenic liquid or cold gas may cause frostbite to unprotected areas of the body. Protect eyes and skin when transferring liquid. Stand clear of vent during filling. Loose fitting, insulated gloves and long sleeves are recommended for arm protection. Cuffless pants should be worn outside boots or over shoes to shed spilling liquid. Goggles or face shields should be worn if the possibility of splashing liquid exists. Failure to observe this warning may lead to severe burns or eye injuries.



## Caution

Never overfill your Thermo dewar with liquid nitrogen. Filling the tank up to or above the bottom of the neck tube may cause immediate or premature vacuum failure.

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## Filling Instructions (For Thermo<sup>®</sup> 5, 10, 20 and 30)

To avoid damage to your Thermo cryogenic vessel, which may result in premature vacuum loss, it is important that the following procedure be used during the addition of liquid nitrogen to a warm vessel and on subsequent additions.

1. Add only a small amount of liquid nitrogen (5-10 liters) to new or warm vessels.
2. Allow this small amount of liquid nitrogen to sit in the covered vessel for a minimum of 2 hours. This will limit stress caused by the sudden temperature change associated with adding liquid nitrogen to a warm vessel.
3. Fill your vessel to the desired level.
4. If you are filling your Thermo dewar from a pressurized source, make sure that the source tank is at a low pressure (22 PSI or below).
5. If the transfer hose is used for extracting liquid nitrogen from a pressurized liquid source, always use a phase separator at the end of the hose (see "Parts List" for transfer hoses and phase separators).
6. Remember to always wear proper safety attire over clothing, including: face shield, cryogenic gloves and apron.

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## Withdrawal Device (For Thermo<sup>®</sup> 5, 10, 20 and 30)

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### General:

The liquid discharge device provides liquid nitrogen for filling cold traps and smaller dewars without having to scoop out or pour liquid nitrogen from the vessel. The liquid dis-

charge device utilizes the normal evaporation of the cryogenic liquid to pressurize a container by plugging the neck of the vessel and forming a hermetic seal. The pressurized vessel can then decant product through the liquid discharge device. Figure 1 shows a drawing of the liquid discharge device. The primary components of the liquid discharge device are listed below:

Rubber Stopper: Provides a seal against the walls of the neck tube. Tightening the wing nut expands the rubber stopper.

Pressure Gauge: Indicates the pressure inside the container.

Relief Valve: Relieves pressure inside the container automatically when excessive pressure is reached. The relief valve is a safety device and cannot be adjusted.

Vent Valve: Provides means to vent product. The vent valve can be closed to pressurize the vessel or opened to depressurize the vessel.

Discharge Valve: Allows product to flow out of the vessel through the discharge device spout.

Safety Cable: Prevents discharge device from accidentally exiting completely from vessel.

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## Installation:

Perform the following steps to install the liquid discharge device on a vessel:

1. Attach the discharge device spout to the liquid discharge device (refer to Figure 1 for location). A transfer line can be used in place of the discharge device spout.
2. Verify that the rubber stopper is dry and free from grease and other contaminants. Check for nicks and gouges that may impair normal operation.
3. Verify that the cable is in good working condition.

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## OPERATION

4. Verify that the vent and discharge valves turn freely.
5. Loosen wing nut.
6. Lower discharge device into vessel. As the discharge device is lowered, the nitrogen in the vessel will boil until the dip tube has cooled down. The boiling action is normal. Continue lowering until the rubber stopper fits snugly.
7. Tighten the wing nut until it contacts the washer. Tighten wing nut another 1-1/2 to 2 turns (EXT RBR versions 4-5 turns).  
*CAUTION: Tighten the wing nut with hands only, do not use any tools. Tightening the wing nut expands the rubber stopper against the neck tube of the vessel. Excessive tightening may damage the neck tube.*
8. Clip the safety cable to the vessel handle.
9. Close the vent valve and the discharge valve. Pressure will slowly begin to build. Several hours will be required to achieve sufficient pressure to operate the liquid discharge device. Pressure buildup can be accelerated by gently tipping the vessel at 45° angle.  
*CAUTION: Excessive pressure can rupture the vessel.*

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### Operation:

Perform the following steps to withdraw liquid from the vessel with the liquid discharge device:

1. Turn the discharge valve fully open and then turn back the valve a half turn. Do not leave the valve in the fully open position.
2. Close the discharge valve to end liquid withdrawal.

*WARNING: Cryogenic liquids are extremely cold and can cause severe burns similar to frostbite. See CGA Bulletin No. P-12 **Safe Handling of Cryogenic Liquids**. (This bulletin may be ordered from Compressed Gas Ass'n., 4221 Walney Road, 5th floor, Chantilly, VA 20151.*

**WARNING:** Nitrogen vapors in air may dilute the concentration of oxygen necessary to support or sustain life. Exposure to such oxygen deficient atmosphere can lead to unconsciousness and serious injury, including death.

**WARNING:** Modifying safety valves on discharge devices causes potentially hazardous conditions.

### Replacement Parts:

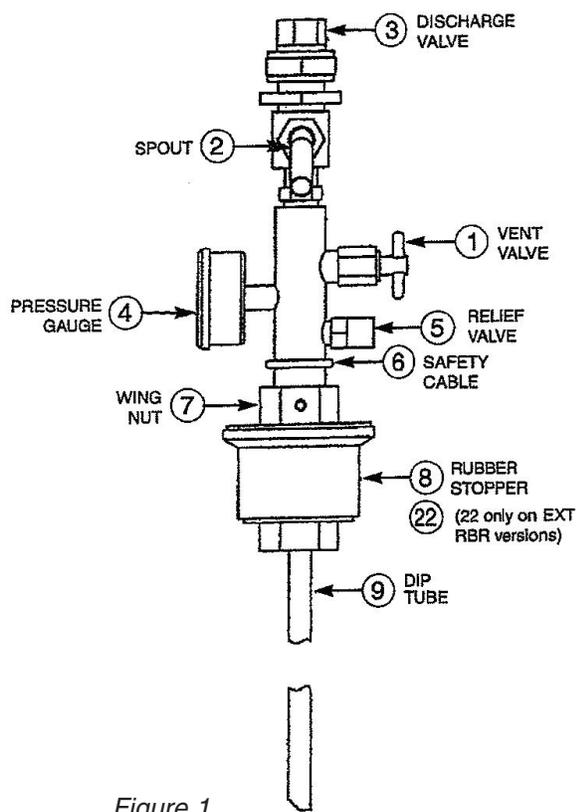


Figure 1

### Removal of Liquid Discharge Device:

Perform the following steps to remove the liquid discharge device from the vessel:

1. Open the vent valve to remove all pressure.
2. Verify that the pressure gauge reads 0.  
**WARNINGS:** Vessel must be completely vented before removing the discharge device. Any attempt to remove the discharge device before the vessel is completely vented may result in serious personal injury.
3. Release wing nut.
4. Rock discharge device from side to side to free stopper.
5. Pull discharge device from vessel.
6. When stopper has passed rim of vessel, unclip safety cable.
7. Store liquid discharge device in a clean and dry area.
8. Cover vessel.

### Measuring Liquid Nitrogen Quantity (for Thermo<sup>®</sup> 5, 10, 20 and 30)

1. Use a wooden dipstick. Never use a hollow tube or plastic dipstick to measure liquid nitrogen.
2. The liquid level will be indicated by a frostline which develops when the dipstick is removed.



**Warning**

Liquid nitrogen is extremely cold; it boils at -196°C. Extreme caution should be exercised when handling cryogenic liquids. Always wear proper safety attire when transferring liquid nitrogen into or out of Thermo cylinders. Contact with a cryogenic liquid or cold gas may cause frostbite to unprotected areas of the body. Protect eyes and skin when transferring liquid. Stand clear of vent during filling. Loose fitting, insulated gloves and long sleeves are recommended for arm protection. Cuffless pants should be worn outside boots or over shoes to shed spilling liquid. Goggles or face shields should be worn if the possibility of splashing liquid exists. Failure to observe this warning may lead to severe burns or eye injuries.

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## Liquid Withdrawal (For Thermo<sup>®</sup> 5, 10, 20 and 30)

1. Liquid withdrawal for Thermo 5 through Thermo 30 is always performed by pouring or utilizing a withdrawal device (for withdrawal device, see “Parts List”). The withdrawal device pressurizes to approximately 4 PSI; the pressure, forces liquid up the withdrawal tube and out the valve.
2. Always wear proper safety attire.

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## Filling Instructions (for Thermo<sup>®</sup> 50)

To avoid damage to your dewar, it is important that only the two following methods be used to fill your Thermo 50. Failure to follow each step may result in damage which is not covered under the warranty. Read all instructions carefully. Should questions arise, please contact Thermo Scientific 1-800-553-0039.

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### Funnel Filling Method

Thermo 50 cylinders can be filled by removing the brass plug on the top center of the tank and inserting a funnel through the hole. Liquid nitrogen can then be poured directly into the cylinder through this hole. Be sure to stand clear of the vent during filling and always wear proper safety attire while handling liquid nitrogen.

1. Open vent valve completely, releasing any pressure built up inside the cylinder.
2. Remove brass plug located on the top center of the cylinder.
3. Insert funnel into hole.

4. Pour liquid nitrogen into cylinder until level gauge reads 7/8 full or until liquid nitrogen begins spitting from the vent valve.
5. Reinsert and tighten the brass plug.
6. Close vent valve completely.

**Caution**

Overfilling cylinders may result in damage to the level and pressure gauges. If overfilling should occur, remove excess liquid nitrogen by opening the liquid nitrogen withdrawal valve immediately.

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## Filling From Low Pressure Liquid Nitrogen

### Supply

The Thermo 50 liquid nitrogen cylinders can be filled from a pressurized source of liquid nitrogen by attaching a transfer hose to the liquid withdrawal valve on the Thermo cylinders. The liquid nitrogen source pressure must not exceed 45 psi. Please read all instructions carefully before filling.

1. Attach transfer hose from liquid nitrogen source to the liquid withdrawal valve on the Thermo cylinder.
2. Open withdrawal valve on Thermo cylinder completely.
3. Open withdrawal valve on liquid nitrogen source. Liquid nitrogen source pressure must not exceed 45 psi, since damage to Thermo cylinder gauges will occur. Optimum feed pressure is 35 psi.
4. Open vent valve on Thermo cylinder until the pressure gauge on Thermo cylinder reads 22 psi.
5. Continue to fill until Thermo cylinder weight is 180 pounds for the Thermo 50. If the scale method is not possible, fill until liquid nitrogen begins spurt-ing from vent valve.
6. Shut liquid nitrogen source valve completely.
7. Shut liquid nitrogen withdrawal valve on Thermo cylinder completely.
8. Carefully remove transfer hose from the Thermo cylinder. Some liquid nitrogen will remain in the hose under pressure after filling
9. Close vent valve completely.



**Caution**

If the liquid or vent valves are not closed, the container can become contaminated once it is emptied.

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## Liquid Withdrawal (from Thermo<sup>®</sup> 50)

The Thermo 50 are to be used only for low pressure liquid withdrawal. The primary relief valve is factory set at 22 psi. The secondary safety relief is set at approximately 35 psi. Transferring liquid at higher pressures increases the flash-off rate of the liquid and adds to the risk of sparking.

To transfer liquid, attach the transfer hose or withdrawal spout to the liquid connections (see accessory sheet). Slowly open the liquid valve to flow the liquid. The liquid will vaporize at first until the transfer line or withdrawal valve cools down. If using a transfer hose to extract liquid from the Thermo 50 into an open dewar, a phase separator is recommended on the end of the transfer line.

Transfer pressure should be kept to a minimum. The normal evaporation of the liquid will usually maintain enough pressure for transferring.

# Specifications

## Thermo<sup>®</sup> Series Specifications

	Thermo 5	Thermo 10	Thermo 20	Thermo 30	Thermo 50
Vessel Specifications for Thermo Dewars and Cylinders					
Diameter (inches)	8.8	10.3	14.5	17.0	16.0
Height (inches)	18.2	21.5	24.7	24.0	35.5
Neck Diameter (inches)	2.2	2.2	2.0	2.5	-
Full Weight (pounds)	17.0	31.0	56.0	84.0	180
Empty Weight (pounds)	8.0	13.0	19.0	27.0	90
Static Evaporation Rate (liters/day)	.15	.18	.18	.25	2.0
Static Holding Time (days)	33.3	55.6	116.7	128.0	25
Liquid Nitrogen Capacity (liters)	5.0	10.0	21.0	32.0	50
Relief Valve Setting (psi)	-	-	-	-	22

# Parts List

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## Plumbing and Labels for Thermo<sup>®</sup> 50

1	DIFF PG 0-20" H2O Full Scale	AY509X17	1.0
2	BRACKET DIFF PG	not supplied	1.0
3	HHMS SS 1/4-20 5/8*LG	not supplied	3.0
4	WASHER SPLIT LOCK SS 1/4 18-8	not supplied	3.0
5	O-RING .9241D*1.130OD	GSX70	1.0
6	PLUG KNUCKLE (7/8"-14UNF)	PMX217	1.0
7	PHPNHMS SS #8-32*3/8"LG	not supplied	2.0
8	TUBE CU .125" OD D&S Soft	TUX81	2 ft.
9	CONN BRS 1/8OD*1/4MPT	PMX216	1.0
10	ELBOW BRS 90D 1/8ODT*1/8MPT	PMX219	3.0
11	CROSS BRS 1/4FPT FORGED	PMX218	1.0
12	RV BRS 1/422PSI	PM509X2	1.0
13	RV BRS 1/432PSI	PM509X3	1.0
14	PG 2"DIAL 0-100PSI 1/4"CBM	MEX184	1.0
18	LABEL THERMO 50LP	not supplied	1.0
19	CAP BRS 1/4FPT	PMX215	1.0
20	CONN BRS 1/2ODT*3/8MPT 45D FL	PM509X7	1.0
21	CAP INERT SVC FILL & VENT FTG	PMX220	2.0
22	LABEL NITROGEN 5*7 W/HAZARD	not supplied	2.0

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## Thermo<sup>®</sup> Accessories

AY509X5	Withdrawal device for Thermo 10
AY509X4	Withdrawal device for Thermo 20
AY509X3	Withdrawal device for Thermo 30
AY509X7	6 ft. transfer hose for Thermo 50
AY509X8	Spout for Thermo 50
AY509X6	12 ml Dipper
AY509X9	Adjustable Cart for Thermo 20, 30 and 50
AY509X11	Phase separator for transfer hose

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## Thermo<sup>®</sup> Dewars and Cylinders

TY509X1	Thermo 5
TY509X2	Thermo 10
TY509X3	Thermo 20
TY509X4	Thermo 30
TY509X6	Thermo 50

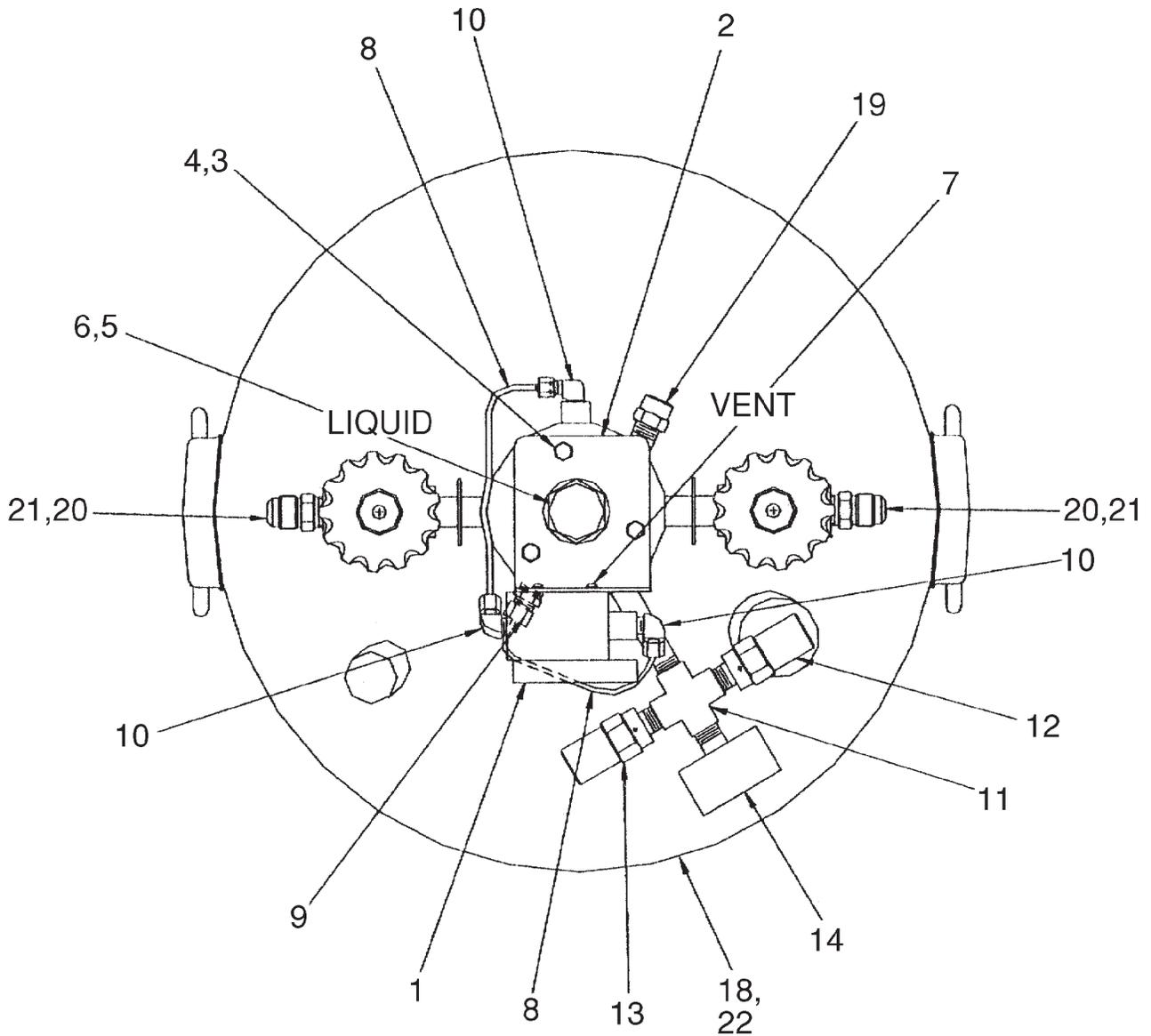
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## Replacement Parts

AY509X14	Globe Valve for Thermo 50
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The valves that are used on the Thermo 50 have a spring-loaded rotary stem. This automatically compensates for thermal shrinkage and wear.

Drawing for Thermo<sup>®</sup> 50



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# Valve Maintenance and Repair

When a defective valve is suspected, follow this procedure to repair it:

1. Void the tank of liquid product and release any pressure that is in the container.
2. If the vent valve must be repaired, allow it to warm up before disassembling.
3. Remove the valve handle screw, washer, retainer cap and spring assembly.
4. Remove the valve handle and teflon thrust washer.
5. Unscrew the bonnet to remove the stem and stem seal.
6. Pull out the body insert and plug assembly.
7. Clean the seat.
8. Replace parts as needed and reassemble in reverse order.

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# Ordering Procedures

Please refer to the Specification Plate for the complete model number, serial number, and series number when requesting service, replacement parts or in any correspondence concerning this unit.

All parts listed herein may be ordered from the **Thermo Scientific** dealer from whom you purchased this unit or can be obtained promptly from the factory. When service or replacement parts are needed we ask that you check first with your dealer. If the dealer cannot handle your request, then contact our Customer Service Department at 563-556-2241 or 800-553-0039.

Prior to returning any materials, please contact our Customer Service Department for a "Return Materials Authorization" number (RMA). Material returned without an RMA number will be refused.



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# One Year Limited Warranty

This Thermo Scientific product is warranted to be free of defects in materials and workmanship for one (1) year from the first to occur of (i) the date the product is sold by the manufacturer or (ii) the date the product is purchased by the original retail customer (the "Commencement Date"). Except as expressly stated above, the MANUFACTURER MAKES NO OTHER WARRANTY, EXPRESSED OR IMPLIED, WITH RESPECT TO THE PRODUCTS AND EXPRESSLY DISCLAIMS ANY AND ALL WARRANTIES, INCLUDING BUT NOT LIMITED TO, WARRANTIES OF DESIGN, MERCHANT ABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

An authorized representative of the manufacturer must perform all warranty inspections. In the event of a defect covered by the warranty, we shall, as our sole obligation and exclusive remedy, provide free replacement parts to remedy the defective product. In addition, for products sold within the continental United States or Canada, the manufacturer shall provide free labor to repair the products with the replacement parts, but only for a period of ninety (90) days from the Commencement Date.

The warranty provided hereunder shall be null and void and without further force or effect if there is any (i) repair made to the product by a party other than the manufacturer or its duly authorized service representative, (ii) misuse (including use inconsistent with written operating instructions for the product), mishandling, contamination, overheating, modification or alteration of the product by any customer or third party or (iii) use of replacement parts that are obtained from a party who is not an authorized dealer of Thermo Scientific products.

Heating elements, because of their susceptibility to overheating and contamination, must be returned to the factory and if, upon inspection, it is concluded that failure is due to factors other than excessive high temperature or contamination, the manufacturer will provide warranty replacement. As a condition to the return of any product, or any constituent part thereof, to the factory, it shall be sent prepaid and a prior written authorization from the manufacturer assigning a Return Materials Number to the product or part shall be obtained.

IN NO EVENT SHALL THE MANUFACTURER BE LIABLE TO ANY PARTY FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, OR FOR ANY DAMAGES RESULTING FROM LOSS OF USE OR PROFITS, ANTICIPATED OR OTHERWISE, ARISING OUT OF OR IN CONNECTION WITH THE SALE, USE OR PERFORMANCE OF ANY PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, TORT (INCLUDING NEGLIGENCE), ANY THEORY OF STRICT LIABILITY OR REGULATORY ACTION.

For the name of the authorized Thermo Scientific product dealer nearest you or any additional information, contact us:

2555 Kerper Blvd., Dubuque, Iowa, 52004-0797

Phone: 563-556-2241 or 1-800-553-0039

Fax: 563-589-0516

Web: [www.thermo.com](http://www.thermo.com)