

Instruction Manual

RVT100, RVT400, RVT4104 Refrigerated Vapor Traps



128-3000-00 Rev. C

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1.0 DESCRIPTION

RVT-series Refrigerated Vapor Traps are reliable, easy-to-use, compact benchtop traps for solvent vapor condensation and collection. Mechanically refrigerated vapor traps replace dry ice/methanol traps, and are the easiest, most practical, and safest way to protect high-vacuum, rotary vane oil pumps in a vacuum system.

Solvents are removed from samples during vacuum evaporation with a SpeedVac® Concentrator or during rotary evaporation and are collected in the CFC-free Refrigerated Vapor Trap. Solvent vapors pass into a Glass Insert Trap or Glass Condensation Flask and condense on its walls. This prevents the vapors from reaching and potentially damaging the oil-sealed vacuum pump. When used in conjunction with the Thermo VaporNet® controller, RVT-series traps provide levels of solvent recovery equal to the most elaborate liquid nitrogen traps.

The three models differ in trap chamber capacity and in approximate operating temperature as follows:

	<u>Trap Chamber Capacity</u>	<u>Approximate Operating Temperature</u>
RVT100	1 Liter	-50 °C
RVT400	4 Liter	-50 °C
RVT4104	4 Liter	-104 °C

All three are controlled simply by an on/off (I/O) switch. The RVT4104 additionally displays the trap temperature, and can control power to a vacuum pump through an auxiliary power outlet. Using this outlet provides an extra measure of protection for your pump. The RVT4104 employs a cascade (dual compressor) refrigeration system to achieve its low operating temperatures. The RVT100 and RVT400 have a single-stage refrigeration system.



CAUTION: *To assure safe operation and best results, read this manual in its entirety before operating this instrument. Improper operation can damage the trap or your vacuum pump.*

2.0 INSTALLATION

Receiving. Inspect the shipping carton upon receipt. If the carton is damaged in anyway, call Thermo Electron or your local distributor.

Unpacking. Carefully remove the instrument from its shipping carton. **Lift and carry with two people, holding the unit securely underneath with both hands.** Compare the packing list to the box contents. If there is a discrepancy, call Thermo or your distributor.

Inspection. Inspect the unit for any damage that may have occurred during shipment. Should there be damage, report it to the carrier and contact Thermo immediately. Make sure the carrier inspects the damage and leaves an inspection report. Register claims for shipping damage against the carrier or his agent. Save the shipping carton in the event a return is necessary.

2.1 SITE PREPARATION

The trap is typically placed on a bench top at least 26 inches (66 cm) deep and located near a power outlet of the required voltage. The outlet must have a rating of at least 15 A for 120V operation, or 10 A for 240 V operation. The trap draws high current when first switched on; therefore, other high-powered equipment, or equipment that will be affected by a momentary drop in power, should not be placed on the same circuit as the trap. The refrigerated trap and SpeedVac® may also be installed on a sturdy mobile cart, such as Thermo Electron's Deluxe Convenience Cart, (CC120/DX).

Provide adequate ventilation. Thermo refrigerated traps are air-cooled and require at least 4 inches (10 cm) of clearance for ambient air suction. The RVT100 and RVT400 draw air inward from the right side. The RVT4104 draws air from the left side. Ambient temperature must not exceed +90 °F (+32 °C) during operation.

2.2 OTHER COMPONENTS

The following accessories are ordered separately:

Glass Insert Trap and Flasks. Order GIT100 (1-liter Glass Insert Trap) for the RVT100; order wide-mouth GCF400 flask (4-liter Glass Condensation Flask) for the RVT400 and RVT4104. The glass insert traps and flasks are quickly exchanged between runs and are easy to clean. Having several available permits uninterrupted refrigerated trap operation while the used vessel is being defrosted, cleaned and dried for next time.

Vapor Trap Upgrade Kit (CAFS400). Kit includes two wide-mouth GCF400 Glass Condensation Flasks, along with all the tubing, fittings, and clamps needed for the typical SpeedVac® System set up. Also includes rubber Flask Cover, tubing cutter and instructions. For use with RVT400 and RVT4104 only.

CryoCool® Heat Transfer Fluid. A permanent, safe, efficient, and economical alternative to methanol or ethanol. CryoCool does not evaporate, has very low water absorption, is odorless, and non-toxic. Order SCC1 for a 1-liter bottle; order SCC5 for a 5-liter bottle.

In addition, Thermo offers a complete line of other components required for drying, including vacuum tubing kits, Quick-Fit Connectors to enable rapid changing of GIT100 and GIT400 Glass Insert Traps, and replacement Flask Covers for the GCF400.

2.3 PREPARING FOR OPERATION

Switch the trap OFF. Connect the power cord to the receptacle on the right side of the instrument. Plug the trap into an appropriate wall outlet.



CAUTION: *Before connecting the Refrigerated Vapor Trap to an outlet, check voltage, frequency, and amperage to be sure they match the power requirements indicated on the label on the right side (left side for RVT4104) of each instrument. (RVT100, RVT400: 120 VAC/60 Hz, 4A; 240 VAC/50 Hz, 2 A, RVT4104: 120 VAC/60 Hz, 12 A, 240 VAC/50 Hz, 6 A.) If there are any questions, please consult an electrician.*

As a safety feature, units are equipped with a three-prong grounded plug that fits a grounding-type power outlet. Consult an electrician to replace outlet if necessary. **Do not defeat this safety feature by modifying the plug.**

These units are "FOR INDOOR USE ONLY". Avoid operating in areas of excessive humidity or extremes of temperature. RVT4104 users can plug the vacuum pump into the outlet on the left side of the RVT4104 and leave the vacuum pump switched on; the RVT4104 will control power to the vacuum pump, insuring that the pump is ON only when the trap has reached its operating temperature.

Pour CryoCool® Heat Transfer Fluid into the stainless steel trap chamber. For the RVT100, use 200 ml; for the RVT400 and RVT4104, use 800 ml. A line scribed in the wall of the stainless steel chamber indicates the minimum appropriate level of CryoCool when the glass vessel is not present. Before each use, be sure the chamber is filled to the correct level. If necessary, add more CryoCool until the level reaches the scribed line.

Installation of Glass Insert Traps (GIT100, GIT400)

These are ordered separately. Glass Insert Traps are enclosed glass vessels with integral glass ports for vacuum connections. Tubing attaches to the glass ports by means of quick-disconnect compression fittings. This forms the vacuum connections to the SpeedVac system. A glass extension ("trumpet") inside the GIT directs vapors from the SpeedVac into the center of the vessel. An insulating foam cover fits over the GIT to seal in the cold and seal out atmospheric condensation from the refrigerated chamber. The GIT100 is used with the 1-liter RVT100, and the GIT400 is used with the 4-liter RVT400 and RVT4104.

Carefully place a clean Glass Insert Trap into the chamber with the glass elbow (ports) facing upward. As you press the glass trap into the chamber, the level of CryoCool rises. Verify that the final CryoCool level is 10 to 15 mm below the rubber seal. If the level is low, carefully pour more CryoCool into the chamber while holding down the Glass Insert Trap.

Immediately wipe clean any CryoCool that spills onto the rubber seal.

Fit the white insulating cover over the Glass Insert Trap to secure the trap in the chamber. Attach the vacuum tubing of the drying apparatus (SpeedVac or rotary evaporator) to the intake port of the Glass Insert Trap. (The elbow that leads to the glass tube down the center of the trap is the intake port.)

Tubing Connection. Quick-Fit Connectors are used on each port of the Glass Insert Trap. These fittings are the black assemblies at the end of the clear plastic vacuum tubing (QFK120-3 tubing kit). Unscrew and remove the hexagonal clamping nut (Figure 1). Remove the spacer from the hexagonal clamping nut, noting its orientation. Slide the hexagonal clamping nut onto the glass elbow so that its hollow end faces outward. Insert the spacer so that its flat face faces outward. This flat face will press against the O-ring to form an air-tight compression seal. Slide the O-ring over the port and into the hex nut. Now slide the rest of the Quick-fit assembly over the port and screw it together with the hex clamping nut. Hand-tightening is adequate; **DO NOT** use a wrench. **Never simply loosen the hexagonal nut and force the Quick-Fit fitting onto the glass elbow. This can damage the O-ring and prevent a good vacuum seal, which in turn could cause poor sample drying in the SpeedVac®.**

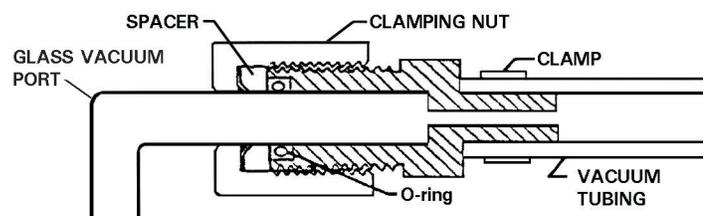
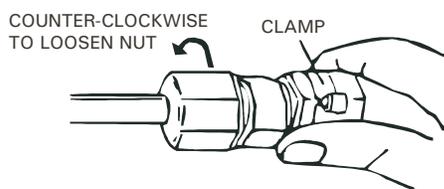


Figure 1. Quick-Fit Connector

Installation of Glass Condensation Flasks (GCF400)

These are ordered separately. The GCF400 is an open-mouth flask used with the 4-liter traps RVT400 and RVT4104. The wide mouth facilitates easier cleaning and removal compared to a GIT-type flask. A rubber Flask Cover (FC400) fits over the top, and tubing attaches to this by means of fittings pushed into molded ports on the rubber cover. This forms the vacuum connection. An insulating foam cover fits over the flask to seal in the cold and seal out atmospheric condensation from the refrigerated chamber.

Installation. Place a clean, dry Glass Condensation Flask into the stainless steel chamber. Fit the insulating cover (white foam ring) over the flask. Seal flask mouth with the black rubber Flask Cover. Press down flask and insulating cover so that the level of CryoCool® rises around the flask, and so that the flask, its cover, and insulation are seated to operating position. This will fully seal the chamber. Withdraw the flask again and verify that the level of CryoCool came to within about a half-inch (12–15 mm) from the top (shoulder) of the flask. If the level is low, carefully pour more CryoCool into the chamber while holding down the flask.

Immediately wipe clean any CryoCool that spills onto the rubber chamber seal or Flask Cover.

Tubing connection. A 1/2-inch O.D. fitting is required to connect tubing to the rubber Flask Cover. If tubing from the SpeedVac concentrator (or other drying apparatus) is wider (for example, SC250DDA or SPD131DDA), a reducer fitting (such as the 3/4 –1/2 inch M60-0044-24 included with these units) is needed. Fit the fitting to the tubing, and press the fitting into the molded port on the rubber cover. Fit the suction line from the pump end of the system in a similar manner.

Note: It does not matter which molded port is used for the SpeedVac and which is used for the pump. The best setup will have the shortest, straightest line of tubing with the fewest amount of bends. It should achieve a convenient and comfortable lay of tubing, with little stress on the fittings. The rubber cover and flask should be easy to remove for system maintenance.

Note: Previous SpeedVac users may note that the GCF400 does not have an internal funnel like the older GIT-type trap. In many cases, this is not needed to assist in vapor collection. However, if desired, an extender fitting (such as the M60-0044-14 straight fitting included with the CAFS400 kit) can be inserted under the rubber cap, so that vapors from the concentrator enter toward the center of the flask.

3.0 OPERATION

All models. After preparing the unit as described in Section 2.3, switch it ON. The power switch, located on the front panel (RVT100, RVT400) or on the left side (RVT4104) of the instrument, illuminates when on.

Immediately verify by touch that the trap is drawing air through the vent on the right side (left side for RVT4104). If you cannot feel the air suction, switch the trap OFF (O) at once. Operating the trap without a working fan, or with the air flow blocked, will damage the refrigeration system.

It may take up to 30 minutes (90 minutes for RVT4104) for the trap fluid to reach its operating temperature. When this occurs, you may begin drying operations as outlined in the instruction manual of your drying apparatus.

The RVT100, RVT400, and RVT4104 Refrigerated Vapor Traps are designed to operate continuously and may be left on for extended periods. Be sure to regularly check the glass trap or flask and empty it as required. For maximum efficiency, replace with clean vessel when not more than half full (see Section 3.1).

RVT4104. The RVT4104 displays trap temperature and pump power status. When you switch the RVT4104 ON, all front panel display LED segments are lighted for a few seconds as a test. When the unit starts up, the trap temperature is displayed. On start-up, the display typically indicates the ambient temperature. When the trap temperature reaches -85 °C, the RVT4104 activates the vacuum pump. The RVT4104 features a "Pump On" light that illuminates whenever power is being applied to the vacuum pump. Ultimately, the trap temperature typically indicates a temperature of -104 °C or colder. **During operation, the trap temperature may rise because condensing and freezing solvent vapors transfer heat into the trap.**

The RVT4104 occasionally displays "CO" (Compressor Off) in place of the trap temperature. This indicates that the RVT4104 has deactivated its compressors for several minutes to equalize refrigerant pressures. This feature provides safety and optimum trap operation.

3.1 EMPTYING THE GLASS VESSEL

Vessels are available separately and are described in Sections 2.2 and 2.3. During system operation, solvent vapors from the SpeedVac will collect in the glass vessel. The vessel must be regularly emptied to keep the entire system operating at peak efficiency. If the vessel is not maintained, it may become so full that sample drying rate is adversely affected. Another consequence of a full vessel is that solvent vapors are more likely to contaminate and possibly damage an oil-sealed vacuum pump that may be used with the SpeedVac system.

Empty the glass vessel before it is half full. Often it is convenient and good practice to change the vessel at the end of the workday or workweek, no matter the depth of fill. For aggressive solvents, you may wish to remove the vessel at the end of each run for maximum protection of the system components.

3.1 EMPTYING THE GLASS VESSEL (cont'd)



CAUTION: Refrigerated Vapor Traps reach low operating temperatures that can cause severe damage to unprotected skin. Wear protective gloves and clothing when removing glass vessels.

GCF400 Glass Condensation Flask: To remove the GCF400 for cleaning, bleed the system back to atmospheric pressure. Remove rubber Flask Cover from flask, leaving tubing attached to cover. Withdraw the flask partially from the chamber and allow CryoCool to drain briefly. Fully remove flask and insulating foam ring. Avoid thermal shock by placing the flask on several thicknesses of absorbent paper toweling and allow to come to room temperature. Insert a spare GCF400, which is clean and dry, into the chamber. Cover with insulating foam ring, and seal with rubber Flask Cover. Make sure rubber cover is seated firmly for a good vacuum seal. This easy system maintenance can be done in a matter of minutes; the Refrigerated Vapor Trap need not be shut off during this process. When the used flask has defrosted, dispose of contents in an environmentally responsible manner. Clean and dry flask for next use.

GIT100/GIT400 Glass Insert Traps: Bleed system to atmospheric pressure. Loosen the hexagonal nuts and remove the Quick-Fit Connectors from the glass vacuum ports as indicated in Installation of Glass Insert Traps (Section 2.3). Withdraw the glass trap and follow instructions as above for GCF400. Make sure Quick-Fit Connectors are installed on the clean Glass Insert Trap as described in Section 2.3, for a good vacuum seal.

Note: If the Refrigerated Vapor Trap is not needed for several weeks, you may wish to shut it off between uses. Before switching on again, always remove the used glass vessel and replace with a clean, dry trap. Check the condition of the CryoCool; if a layer of water is visible under the CryoCool, remove with a pipette. Failure to follow these precautions may cause the glass vessel to break when the trap returns to operating temperature.

4.0 SPECIFICATIONS

COLD TRAPS	RVT100	RVT400	RVT4104
Operating Temperature*	-50 °C	-50 °C	-104 °C
Capacity	1 Liter	4 Liter	4 Liter
Dimensions (W x D x H)			
Inches	13.5 x 23.5 x 12.0	13.5 x 23.5 x 12.0	20.0 x 26.0 x 13.0
Centimeters	34.3 x 59.7 x 30.5	34.3 x 59.7 x 30.5	50.8 x 66.0 x 33.0
Weight (Shipping, net)			
Pounds	85, 55	91, 60	138, 150
Kilograms	38, 25	41, 27	62, 68
Power Requirements	120 VAC/60 Hz, 4 A 240 VAC/50 Hz, 2 A	120 VAC/60 Hz, 4 A 240 VAC/50 Hz, 2 A	120 VAC/60 Hz, 12 A 240 VAC/50 Hz, 6 A

* Depends on ambient temperature, line voltage fluctuations, and load capacity.

5.0 ACCESSORIES

GIT100	Glass Insert Trap for RVT100
GTC100	Glass Trap Cover (white foam) for GIT100
CP100	Closure Plate for RVT100 when not using GIT100
GIT400	Glass Insert Trap for RVT400 and RVT4104
GTC400	Glass Trap Cover (white foam) for GIT400
CP400	Closure Plate for RVT400 or RVT4104 when not using GIT400/GCF400
QFK120-3	Quick Fit Tubing Kit (for use with GIT100 and GIT400)
GCF400	Glass Condensation Flask (wide-mouth) for RVT400 and RVT4104
FC400	Flask Cover (black rubber) for GCF400
145-6012-00	Insulating Cover (white foam) for GCF400
CAFS400	Vapor Trap Upgrade Kit for RVT400 and RVT4104
SCT120	Chemical Trap
DC120A	Disposable Cartridge for SCT120 when trapping acid and water vapors.
DC120R	Disposable Cartridge for SCT120 when trapping radioactivity and organic solvent vapors.
FDC206	Freeze Drying Chamber with 6 intake ports and 6 valves
SCC1	CryoCool® Heat Transfer Fluid (1 Liter)
SCC5	CryoCool Heat Transfer Fluid (5 Liters)
VN100DDA	VaporNet® (Controller for SpeedVac® component systems)
CC120/DX	Deluxe Convenience Cart

6.0 WARRANTY AND LIABILITY STATEMENTS

All Thermo Electron products mentioned in this manual (excluding glassware) are warranted against defects in material and workmanship for one year after the date of delivery to the original purchaser. Thermo's warranty is limited to defective materials and workmanship, and does not cover incidental or consequential damages.

Thermo Electron will repair free of charge any apparatus covered by this warranty. If a new component fails to work, Thermo will replace it, absorb all charges, and continue the one-year warranty period. Warranty work is subject to our inspection of the unit. No instruments, equipment, or accessories will be accepted without a Return Material Authorization (RMA) number issued by Thermo. Costs of shipping the unit are not covered under warranty. The warranty obliges you to follow the precautions in this manual.

When returning apparatus that may contain hazardous material, you must pack and label them following U.S. Department of Transportation (DOT) regulations applying to transportation of hazardous materials. Your shipping documents must also meet DOT regulations. **All returned units must be decontaminated (free of radioactivity, biological, or chemical contamination.)**

Use of this equipment in manners other than those specified in this manual may jeopardize personal safety. Under no circumstances shall Thermo Electron be liable for damages due to the improper handling, abuse, or unauthorized repair of its products. Thermo Electron assumes no liability, express or implied, for use of this equipment.

APPENDIX 1 TROUBLESHOOTING AND MAINTENANCE

Replenishing CryoCool® Heat Transfer Fluid. When cold, CryoCool condenses water vapor from the air and develops a build-up of ice. This process is accelerated in humid environments. Loose crystals may be removed with a strainer. Periodically, the CryoCool must be refreshed if:

You see an ice build-up on the stainless steel chamber walls; the glass vessel rises above its usual position, indicating an ice build-up beneath; or the refrigerated trap seems to be losing efficiency.

Shut off the unit in the case of ice build-up and allow the ice to melt. Remove the fluid by aspiration or pipetting, and add fresh CryoCool to the trap, as described in Section 2.3, **PREPARING FOR OPERATION.**

To reuse CryoCool that has a layer of water, transfer it to a container and allow to settle again into a bilayer. Place in a freezer until the water layer freezes. The liquid fraction is CryoCool, which can be reused. Decant off the CryoCool and dispose of the ice.



CAUTION: *Refrigerated Vapor Traps reach low operating temperatures that can cause severe damage to unprotected skin. Wear protective gloves and clothing when removing CryoCool, ice, and glass vessels from the trap.*

Vibration. If the trap vibrates excessively, have the line voltage checked with a voltmeter. The voltage should be above 108 V for 120 V unit and above 209 V for 240 V units.



CAUTION: *Low line voltage may cause thermal overload of the unit.*

Maintenance. Thermo Refrigerated Vapor Traps require proper air flow for ventilation. At least every 3 months, clean the condenser grille on the right side of the unit (left side for RVT4104). Dust and dirt on the grille can block air flow. **Turn the trap off before cleaning so that dust and dirt are not drawn into the unit.** Use a vacuum cleaner with a brush attachment, or purge the condenser with compressed air.

The refrigeration system in the trap is hermetically sealed and does not require maintenance.



Thermo Electron Corporation

Bioscience Technologies

450 Fortune Boulevard
Milford, MA 01757
866.9.THERMO (866.984.3766) • Fax: 508.634.2199
www.thermo.com

Laboratory Pipetting and Consumables

info.pipettes@thermo.com

Molecular Biology

info.molbio@thermo.com

Microplate Instrumentation

info.microplateinstruments@thermo.com

Sample Preparation

info.sampleprep@thermo.com

Laboratory Automation & Integration

info.labautomation@thermo.com

New Labs

newlabs@thermo.com

Controlled Environment

info.controlenv@thermo.com

Services

services.biosciencetech@thermo.com

Bioscience
Technologies

International Sales Office Locations

Belgium

Brussels
+32 2 482 30 30
Fax: +32 2 482 30 31

France

Cergy Pontoise Cedex
+33 1 34 32 51 51
Fax: +33 1 34 32 51 59

Germany

Dreieich
+49 6103 408 0
Fax: +49 6103 408 1222

Netherlands

Breda
+31 76 571 4440
Fax: +31 76 587 9757

Russia

Saint-Petersburg
+7 812 325 8045
Fax: +7 812 186 1194

Moscow

+7 095 755 9045
Fax: +7 095 755 9046

Spain

Barcelona
+34 93 2233154
Fax: +34 93 2230857

Sweden

Stockholm
+46 8 742 03 90
Fax: +46 8 742 09 47

Lund

+46 46 90 96 60
Fax: +46 46 32 87 70

United Kingdom

Basingstoke, Hampshire
+44 01256 81782
Fax: +44 01256 81792

China

Beijing
+8610 5850 3588
Fax: +8610 6621 0847

Shanghai

+8621 5465 7588
Fax: +8621 6445 7830

Hong Kong

Wanchai
+852 2885 4613
Fax: +852 2567 4447

India

Bangalore
+91 22 2778 1101
Fax: +91 22 2778 1103

Japan

Yokohama-City
+81 45 453 9122
Fax: +81 45 453 9222

Thermo
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