

Gamma Gage II™
Portable Cryostat/Dewar
User Manual

Advanced Measurement Technology, Inc.

a/k/a/ ORTEC®, a subsidiary of AMETEK®, Inc.

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If it becomes necessary to return this instrument for repair, it is essential that Customer Services be contacted in advance of its return so that a Return Authorization Number can be assigned to the unit. Also, ORTEC must be informed, either in writing, by telephone [(865) 482-4411] or by facsimile transmission [(865) 483-2133], of the nature of the fault of the instrument being returned and of the model, serial, and revision ("Rev" on rear panel) numbers. Failure to do so may cause unnecessary delays in getting the unit repaired. The ORTEC standard procedure requires that instruments returned for repair pass the same quality control tests that are used for new-production instruments. Instruments that are returned should be packed so that they will withstand normal transit handling and must be shipped PREPAID via Air Parcel Post or United Parcel Service to the designated ORTEC repair center. The address label and the package should include the Return Authorization Number assigned. Instruments being returned that are damaged in transit due to inadequate packing will be repaired at the sender's expense, and it will be the sender's responsibility to make claim with the shipper. Instruments not in warranty should follow the same procedure and ORTEC will provide a quotation.

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Shipments should be examined immediately upon receipt for evidence of external or concealed damage. The carrier making delivery should be notified immediately of any such damage, since the carrier is normally liable for damage in shipment. Packing materials, waybills, and other such documentation should be preserved in order to establish claims. After such notification to the carrier, please notify ORTEC of the circumstances so that assistance can be provided in making damage claims and in providing replacement equipment, if necessary.

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SAFETY INSTRUCTIONS AND SYMBOLS

This manual contains up to three levels of safety instructions that must be observed in order to avoid personal injury and/or damage to equipment or other property. These are:

DANGER Indicates a hazard that could result in death or serious bodily harm if the safety instruction is not observed.

WARNING Indicates a hazard that could result in bodily harm if the safety instruction is not observed.

CAUTION Indicates a hazard that could result in property damage if the safety instruction is not observed.

Please read all safety instructions carefully and make sure you understand them fully before attempting to use this product.

GAMMA GAGE II™ USER MANUAL

1. INTRODUCTION

The Gamma Gage II is a portable cryostat and dewar combination for PopTop or non-PopTop detectors. There are two dewar type options:

- The “all-attitude” type (Fig. 2) gives you complete all-attitude no-spill operation. It has a single port on the rear of the dewar and can be attached to a Model DWR-S/F gravity-feed storage/fill dewar (available as an accessory; see Section 2.6). This dewar type has a single fill/vent tube that extends to the geometrical center of the LN2 reservoir. Thus, no matter the orientation of the dewar, the fill/vent tube is above the level of the liquid. The dewar is never more than 50% full. Available in 1.2 L, 3 L, and 5 L sizes.
- In some cases, size constraints are more important, and a dewar that can be filled completely is required, even at the expense of restricting the orientations allowed without some venting of refrigerant. The MOD (“multi-orientation” dewar; Fig. 1) option allows this. It can be operated looking up or down, or in any other orientation in which the FILL tube is *above* the VENT tube (otherwise, the LN2 will siphon out). The MOD dewar cannot be used with the Model DWR-S/F storage/fill dewar. Available in 3 L and 7 L sizes.



Fig. 1. MOD Dewar (showing FILL and VENT tubes).



Fig. 2. All-Attitude Dewar (showing FILL/VENT tube with plug partially removed).

The Gamma Gage II is optional for all GEM, GMX, GLP, SLP, and LX type detectors. The standard preamplifier and high voltage filter are supplied, as with any of our HPGe or SLP type detectors. The preamplifier electronics include automatic high-voltage shutoff protection that prevents FET damage if the detector begins to warm up. In addition, a high-count-rate LED lights when a prohibitively high count rate results in preamp overrange.

A threaded LN2 plug with o-ring seal and 1 psig pop-off relief valve is provided for each port on the dewar (i.e., one for the all-attitude dewar, two for the MOD dewar); see Section 2.2. In addition, each standard Gamma Gage II system comes with a manual fill funnel assembly; see Fig. 8.

The Gamma Gage II is also provided with a horizontal base plate, which includes a handle and two stainless-steel straps, and four feet that allow the cryostat to be oriented in an up-looking orientation for measuring Marinelli beakers and other typical laboratory samples. For operations such as mounting the cryostat/dewar system, you can remove the handle or both the handle and base plate; see Section 1.4.

When not in use, the Gamma Gage II may be stored at room temperature (*maximum storage time at room temperature is 1 month*); or the all-attitude unit may be attached to a Model DWR-S/F storage/fill dewar that keeps it continuously filled with LN2 and always ready for use. The storage/fill dewar is shown in Fig. 10.

Table 1 gives the choice criteria between all-attitude and MOD dewar types; the basic tradeoff is between minimum size/weight for a given holding time and avoidance of LN2 loss. Hold times will vary depending on specific dewar, cryostat, and detector. The Q, Y, and Z dimensions are keyed to the all-attitude and MOD dewars shown respectively in Figs. 3 and 4.

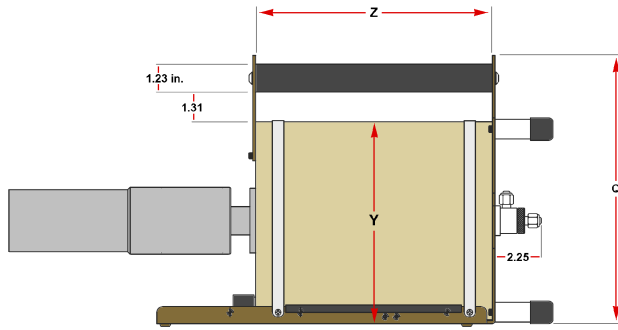


Fig. 3. All-Attitude Dewar Dimensions.

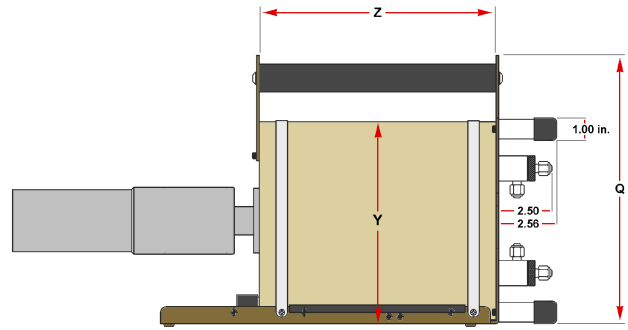


Fig. 4. MOD Dewar Dimensions.

Dewar Type ¹							
	Designation		All-Attitude			Multi-Orientation (MOD)	
	LN2 Volume >		1.2 L	3 L	5 L	3 L	7 L
	Unit	Tolerance					
Q	mm	±13	229	302	302	229	302
	(in.)	±0.5	(9.0)	(11.9)	(11.9)	(9.0)	(11.9)
Y	mm	±5	157	229	229	157	229
	(in.)	±0.2	(6.2)	(9.0)	(9.0)	(6.2)	(9.0)
Z	mm	±5	229	267	419	292	320
	(in.)	±0.2	(9.0)	(10.5)	(16.5)	(11.5)	(12.6)

1.1. GENERAL INFORMATION

1.1.1. Orientation

As noted in the introduction, units with the all-attitude dewar can be operated at any angle. Units with the MOD dewar can be operated vertically (i.e., looking up or down), or in any other orientation in which the FILL tube is *above* the VENT tube. *If the VENT tube is higher than the FILL tube, the LN2 will siphon out.*

¹All specifications subject to change without notice.

1.1.2. Protection from Moisture, Dirt, and Radioactive Contamination

The electronics housing and cable connectors on the standard Gamma Gage II are not completely impervious to moisture, dirt, sand, or other contaminants. Therefore, it is important to protect the unit if it is exposed to contaminants during field use.

The Gamma Gage II can be operated in a high-humidity atmosphere provided condensation does not occur on any cryostat surfaces. Since the temperature of the outer surfaces may be 2°C to 5°C colder than ambient temperature, the detector can be operated without protection only if the dew point is at least 6°C lower than ambient temperature.

1.2. INPUT AND OUTPUT CABLES

Preamp power and detector bias inputs, signal outputs, and other inputs/outputs are made through a single, bundled, rear-panel cable:

- **SIGNAL OUT** One or two 18 in. RG174 coaxial cables with female BNC connectors provide identical but isolated preamp output signals. These cables are used for separate energy and timing outputs. Use 93 Ω coaxial cable, such as RG62, to connect these to the main amplifier or timing amplifier inputs.
- **HIGH-VOLTAGE DETECTOR BIAS** One 18 in. RG59 coaxial cable with female SHV connector is used for input bias voltage. Use another RG59 cable with SHV connectors to connect this first cable to the output of an ORTEC detector bias supply.
- **HIGH-VOLTAGE SHUTOFF** One 18 in. RG174 coaxial cable with female BNC connector provides a bias supply shutdown condition if the detector begins to warm up. This cable connects to the remote Shutdown input of the detector bias supply. **Connect this cable and the preamp power cable before applying detector bias.**
- **PREAMPLIFIER POWER CABLE** One 18 in. shielded cable supplies power to the preamp. This cable has a multi-pin connector which fits the preamp power output on the rear panel of an ORTEC spectroscopy amplifier. **Connect this cable and the high-voltage shutoff cable before applying detector bias.**
- **TEST INPUT CABLE** One 18 in. RG174 coaxial cable with female BNC connector is used to introduce a test signal into the preamp through capacitive coupling to the gate of the input FET. Suitable test pulses that simulate gamma-ray detection can be provided by an ORTEC pulse generator.

CAUTION WITH CABLES

Gamma Gage II cables have strain relief provided. However, these cables and their connectors are not strong enough to withstand excessive tension. **Do not attempt to hang, raise, or lower the Gamma Gage II by its cables.** Moreover, if you attach long lengths of cable to your Gamma Gage II, *additional strain relief must be provided.* **Do not attempt to pull long lengths of cable by the Gamma Gage II cables alone.** When using the Gamma Gage II in handheld operation, long cables can be secured to the user's belt or pulled along by hand to relieve strain.

1.3. USING THE BOLT CIRCLE ON THE DEWAR'S TOP SURFACE

Note the circle of threaded mounting holes around the neck of the dewar.

CAUTION

If using these to attach your own apparatus to the dewar's top surface, ***the mounting screws must not be so long that, when tightened, they penetrate the inner dewar and destroy its vacuum. Choose a screw length that does not exceed 0.25 in. (6 mm) engagement.***

Penetrating the inner dewar with screws that are too long voids your warranty.

For assistance, contact your ORTEC representative or our Global Service Center.

1.4. REMOVING THE BASE PLATE AND HANDLE

You can remove the handle, if you wish, or both the handle and base plate. Before doing either, place the Gamma Gage II horizontally on a secure surface.

To remove the handle, unscrew the two screws that attach to the top of the dewar (Fig. 5) and the two screws that attach to the base plate.

To remove the base plate, first remove the handle. Note that the base plate is secured to the Gamma Gage II dewar by two metal straps. Unscrew the screws that hold the straps to one side of the base plate (Fig. 6), and lift the Gamma Gage II away.

To reattach the base plate, place it horizontally on a secure surface, and set the Gamma Gage II on top of it. *The cable must be placed beside the dewar in the spaces between the dewar and the base plate, with the high-voltage cable on one side and all other cables together on the other side.* Position the straps around the dewar and screw down each strap while holding it tightly over the dewar.

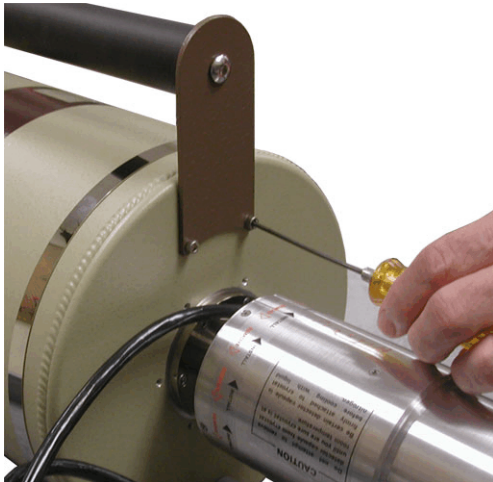


Fig. 5. Unscrewing the Handle (showing the two screws on the top of the dewar).



Fig. 6. Unscrewing the Metal Straps.

2. FILLING THE GAMMA GAGE II

After the detector and cryostat are connected, the detector can be cooled.

Safely filling your dewar with LN₂ is easy. However, proper procedures must be followed to avoid personal injury or detector system damage. In addition to the following filling instructions, please read Section 2.1 on LN₂ safety, and the cautions and instructions in the manual for your detector.

2.1. LN₂ SAFETY

Users of cooled detectors should be aware of the hazards associated with LN₂. These hazards are well-documented and readily available on the internet. Other sources of information are safety manuals such as the "CRC Handbook of Laboratory Safety," The Chemical Rubber Company, Cleveland, Ohio; and material codes such as the American Society of Mechanical Engineer's "Boiler and Pressure Vessel Code, Section VIII."

DANGER	Because of LN ₂ 's large expansion ratio from liquid to gas (692-to-1), if the dewar does not have adequate venting or pressure relief, <i>it can fail with explosive force.</i>
DANGER	Although nitrogen gas is nontoxic, it can displace air and cause asphyxiation. TRANSFER LN₂ ONLY IN A WELL-VENTILATED AREA.
WARNING	Physical contact with LN ₂ causes burns similar to burns from high temperature contact. Eyes are especially vulnerable to this type of exposure.
CAUTION	Some materials become brittle and fracture when exposed to LN ₂ temperatures (77 K). For advice when selecting materials for use in storing and transferring LN ₂ , contact our Global Service Center or your LN ₂ supplier.

LN₂ is safely used everyday in factories such as ORTEC and laboratories all over the world. For safety reasons, the following precautions should be followed when working with LN₂:

1. Use only dry nitrogen gas to pressurize the supply dewar. Do not use air or oxygen because they may contain moisture and oil, which could freeze and cause blockage of the filling and/or vent tube. Use a pressure relief of 5 psi on the supply dewar to avoid over-pressurization in the event of ice blockage.
2. Personnel should avoid wearing anything capable of trapping or holding spilled LN₂ close to their flesh. An impermeable apron or coat, cuffless trousers, and high-topped shoes are recommended. Wear safety glasses or, better yet, full-face protection. Remove all watches, rings, bracelets, or other jewelry. When gloves are used to handle containers or cold metal parts, they should be impervious and sufficiently large to be easily tossed off the hand in case of a spill.
3. Piping or transfer lines should always be constructed so as to avoid trapping LN₂ in the line. Evaporation can result in pressure build-up and eventual explosion of the line. If it is not possible to empty all lines, install safety relief valves and rupture discs.
4. Vent storage containers to a well ventilated area or to the outside to avoid build-up of nitrogen gas in the work area.

2.2. DEWAR POP-OFF VALVES

Each opening in the bottom of the dewar (i.e., one opening on the all-attitude dewar and two on the MOD dewar) has a 1 psig pressure-relief pop-off valve. In addition, the neck for each of these openings has a 10 psig pop-off valve. These are shown in Fig. 7, which illustrates a MOD dewar with the FILL and VENT

plugs partially removed. Under normal circumstances, the 1 psig valve relieves the inner dewar pressure and maintains it at this level. If this valve should become blocked, the 10 psig valve serves as a backup to prevent the buildup of dangerous pressure. Since the 10 psig valve is normally closed, it is not likely to become blocked by ice or dirt.

These pop-off valves are important to the safety and function of your detector system. They must be protected from damage. Do not pry them open with a screwdriver or pliers. Do not insert an object into a valve to prop it open. It is normal for these valves to periodically make a sputtering or vibrating noise as pressure is released.

Under some circumstances (e.g., if the Gamma Gage II is enclosed in a small space), it may be advisable to vent your Gamma Gage II's dewar to a remote location. To do this, you may push clear plastic tubing over the 1 psig valve and route the other end to a suitable location. If this tubing is too small in diameter and fits too tightly, it may block the pop-off valve. Be sure that the tubing used is large enough to avoid blocking the valve. Look at the valve through the tubing to check that it is venting properly.

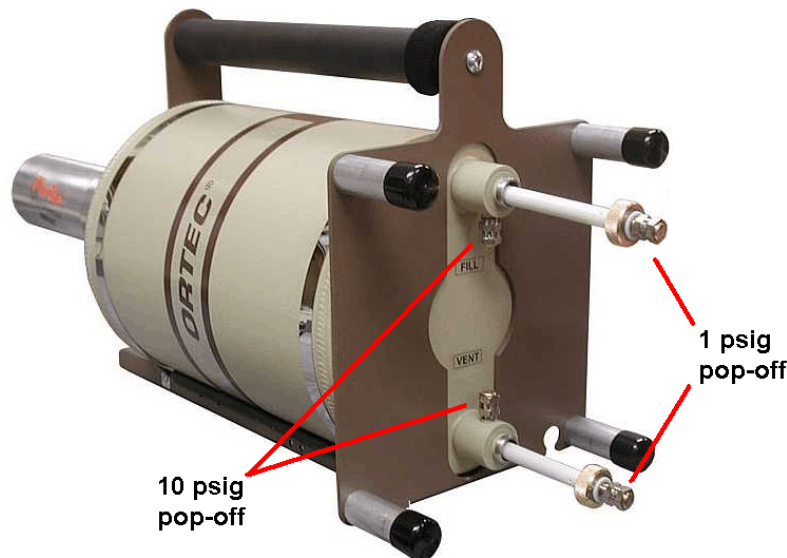


Fig. 7. Location of Pop-Off Valves (showing MOD dewar).

2.3. IN CASE OF ICE BLOCKAGE

Under certain conditions, the LN2 valve seat of the storage/fill dewar may become blocked by ice. If this happens, it will prevent complete closure of the valve. LN2 may continue to drip, and the ice blockage may worsen. This problem can usually be prevented by following these precautions:

- Use only clean LN2.
- Keep the FILL plug in place on all Gamma Gage II dewars except when filling.
- Whenever the Gamma Gage II has been warmed up, purge its dewar with dry, room temperature nitrogen gas for 5–10 minutes before filling with LN2. This will remove moisture from the dewar.

If an ice blockage occurs, remove it as follows:

1. Empty the storage/fill dewar of all LN2 and allow it to warm up for about 2 days.
2. Open the fill valve completely and blow dry nitrogen gas through the fill spout for 20–30 minutes.

2.4. KEEPING THE DEWAR CLEAN AND DRY

Ice forms with an excessive accumulation of moisture, and can cause serious problems. Always keep the Gamma Gage II's FILL neck plug in place except during filling or attachment to a storage/fill dewar. This helps prevent dirt and moisture from entering the dewar, and provides insulation in the FILL neck for increased holding time.

If the Gamma Gage II has warmed up, we recommend that you purge the dewar with dry, room-temperature nitrogen gas for 5–10 minutes to remove any moisture before filling with LN2. The FILL neck plug must be wiped free of any dirt, ice, or moisture before it is reinserted after filling. A layer of ice in the dewar could prevent the detector from reaching its operating temperature. In addition, a severe ice blockage of the dewar FILL neck could result in explosion of the dewar.

2.5. FILLING THE GAMMA GAGE II WITH THE FILL FUNNEL

As noted in the preceding section, this operation requires low-temperature gloves and other appropriate personal safety equipment.

DANGER	Each port on the Gamma Gage dewar is provided with a pressure relief valve, which allows the expanding gas to escape from the dewar as LN2 vaporizes. The relief valve must not be blocked in any way. Take care to avoid exposure to the escaping gases since they are at near cryogenic temperatures. Using a pressure relief valve as a vent channel can cause ice buildup, resulting in blockage, overpressure, and possible explosive failure of the dewar.
CAUTION	In all cases, you must prevent the electronics and the outside of the cryostat from becoming excessively cold, otherwise the vacuum seals and/or electronics could be damaged. Specifically, avoid spilling liquid nitrogen on the cryostat or electronics, and vent cold gas away from the system being filled. A Gamma Gage II can also be damaged by filling it with LN2 while it is enclosed in thermally insulating materials (such as packing materials) or any other wrapping or covering that could trap LN2 against the unit. Never fill a Gamma Gage II while it is enclosed in any way. Even if a cold system is later packed in insulating materials, damage is likely to occur. A cold Gamma Gage II must not be enclosed in thermally insulating materials at any time.

1. Place the Gamma Gage II in a horizontal position.
2. Unscrew the FILL plug (it should be tightened only enough to compress its o-ring seal) and pull it from the end of the dewar (refer back to Fig. 2). If the unit is cold, hold the plug firmly while removing it, because the dewar normally operates at a positive pressure of 1–2 psig.
3. Insert the funnel's FILL tube into the dewar, place the funnel support bracket over the FILL tube neck, and tighten the rectangular plastic nut on the FILL tube neck threads.² See Fig. 8.

²The nut is long and rectangular so it can be removed more easily when it is cold. This nut can be reversed if the threads become damaged.

- Pour LN2 into the funnel. MOD dewars are most easily filled if you elevate the bottom of the dewar about 5 degrees, as shown in Fig. 9.

WARNING When the dewar is full, LN2 will pour out of the FILL tube on all-attitude models, and out of the VENT tube on MOD dewars.



Fig. 8. Fill Funnel Assembly (showing MOD dewar, fill tube inserted, plastic nut being tightened on FILL tube neck threads).



Fig. 9. Slightly Elevate the Bottom of MOD Dewars for Easier Filling.

- Remove the fill funnel, reinsert the plug, and finger-tighten it just enough to compress the o-ring seal.
- If the system was initially warm, it should be topped off after approximately 30 minutes. Wait an additional hour and top off the dewar again. This will replace LN2 that has boiled off rapidly during the first several minutes of cooldown.
- Wait an additional 1.5 hours for the detector to reach operating temperature. Top off the dewar with liquid nitrogen.
- Wait 15 minutes before connecting the Gamma Gage II to the external electronics. This will allow time for evaporation of any small amount of moisture condensed within the Gamma Gage II electronics. Note that you can avoid such condensates if the electronics housing is protected from LN2 and cold nitrogen gas by shielding or by using a fan or vacuum to remove cold gases during filling.

2.5.1. Filling A Cold Gamma Gage II

CAUTION Before filling a cold Gamma Gage II, remove all electrical connections to avoid electrical shorts or arcing due to temporary moisture condensation on cold surfaces.

If the dewar is still fully cold, only Steps 1–5 and 8 above are required to fill the Gamma Gage II.

2.6. USING THE STORAGE/FILL DEWAR WITH THE ALL-ATTITUDE GAMMA GAGE II (Optional)

The all-attitude Gamma Gage II can be filled for immediate use or stored in a ready condition for several days by mounting it on a Model DWR-S/F storage/fill dewar. Figure 10 illustrates a Gamma Gage II mounted on the storage/fill dewar.

2.6.1. Preparing the Storage/Fill Dewar

First, remove the storage/fill dewar's fill cap and fill it with LN₂. If the storage/fill dewar is completely warm, fill it only 20–30% full. Initially, LN₂ will boil off vigorously. In 15 minutes, the dewar should be sufficiently cold to fill completely. Be sure only clean, dry (ice-free) LN₂ is used. After the storage/fill dewar has been completely filled and more vigorous boiling has subsided, it is ready to use with a Gamma Gage II.

2.6.2. Mounting the Gamma Gage II

CAUTION Before mounting the Gamma Gage II on the storage/fill dewar, be sure to note that *the pressure relief pop-off valves on the Gamma Gage II FILL tube must not be propped open or adjusted in any way*. Otherwise, LN₂ may drain over the instrument and freeze the vacuum seals, seriously damaging the detector.

WARNING Be sure to wear gloves to protect your hands from cold surfaces and LN₂ (see Section 2.1).

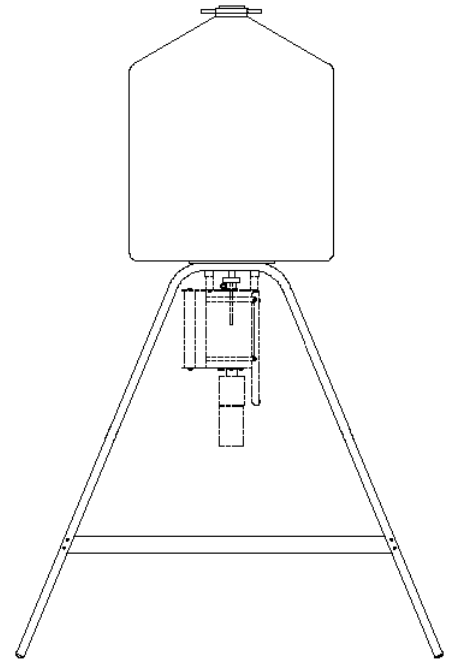


Fig. 10. Gamma Gage II Refilling from a DWR-S/F Storage/Fill Dewar.

1. Remove the protective sleeve from the fill spout that projects from the bottom of the storage/fill dewar. The sleeve is released by unscrewing the brass locking ring from the sleeve's threaded end. See Fig. 11.
2. Remove the FILL plug from the all-attitude Gamma Gage II dewar (refer back to Fig. 2). Hold the plug firmly while removing it, because the dewar normally operates at a positive pressure of 1 psig to 2 psig.
3. With the detector pointed downward, carefully lift the Gamma Gage II under the storage/fill dewar so that the fill spout enters the FILL neck. Raise the Gamma Gage II until the o-ring at the top of the fill spout (under the brass locking ring) is engaged in the dewar FILL neck opening. Then screw the brass locking ring onto the threads of the Gamma Gage II dewar. Tighten the locking ring until the Gamma Gage II is securely mounted on the storage/fill dewar.
4. Turn the storage/fill dewar's LN₂ valve counterclockwise to the fully open position. See Fig. 12.
5. If the Gamma Gage II is cold, it will require only 5–10 minutes on the storage/fill dewar to refill.
6. If the Gamma Gage II is warm, it should be left attached for a minimum of 4 hours to allow the detector to fully cool.



Fig. 11. Removing the Fill Spout's Protective Sleeve.

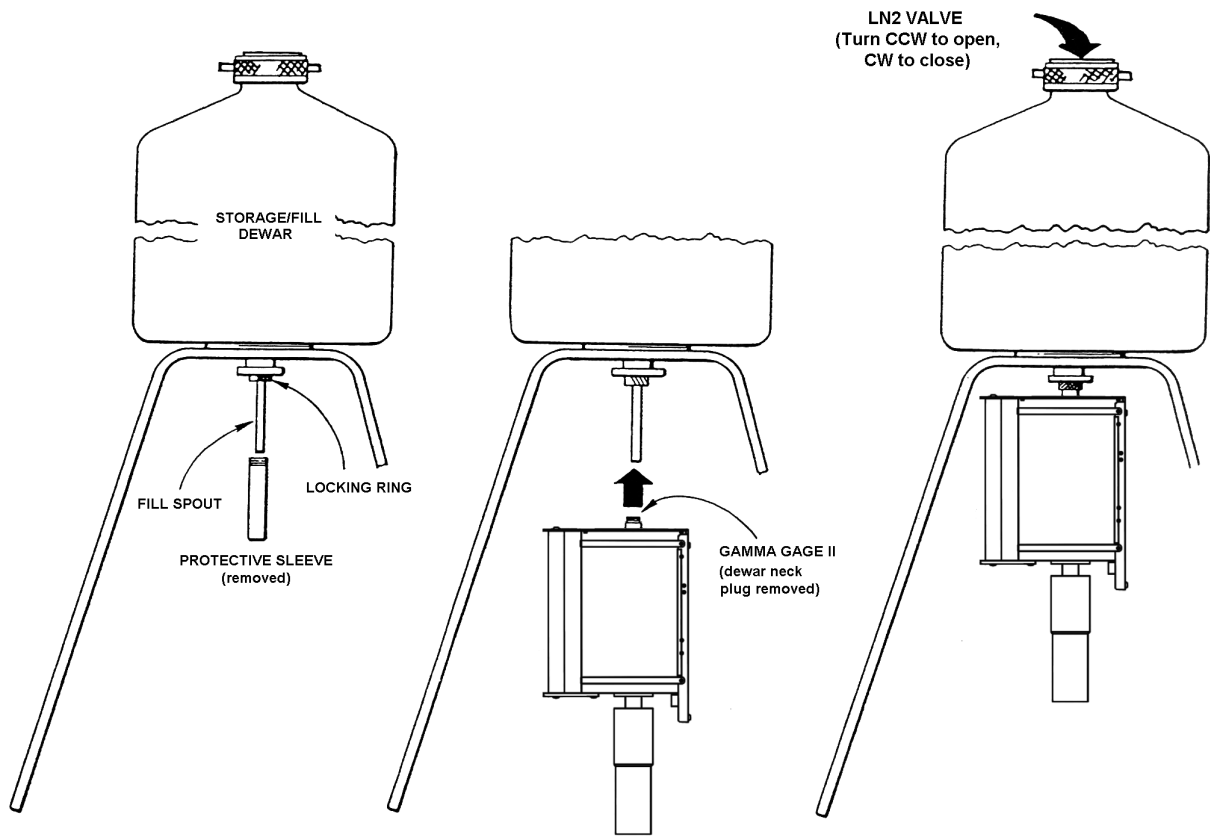


Fig. 12. Connecting the Gamma Gage II to the Storage/Fill Dewar.

2.6.3. Removing the Gamma Gage II from the Storage/Fill Dewar

1. Turn the storage/fill dewar's LN2 valve clockwise to the fully closed position.
2. Carefully loosen the brass locking ring from the Gamma Gage II dewar. Support the Gamma Gage II until it is free, and lower it straight down until it is clear of the fill spout. **Be careful not to exert force on the fill spout.**
3. Reinsert the FILL neck plug and finger-tighten it just enough to compress the o-ring seal.
4. Replace the protective sleeve over the fill spout of the storage/fill dewar.

2.7. ALTERNATE FILL SYSTEMS

We offer LN2 transfer lines that will fit most low-pressure LN2 vessels from liquid nitrogen suppliers, as well as self-pressurizing withdrawal devices for transferring LN2 from our 30 L and 50 L dewars. For more detailed information, visit the Detector Accessories page on our website, www.ortec-online.com, or consult your ORTEC representative.

No matter which fill system you use, be sure to follow the basic LN2 filling and safety precautions discussed in the preceding sections.

3. TRANSPORTING THE GAMMA GAGE II

3.1. GENERAL PRECAUTIONS

As noted earlier in this manual, a cold Gamma Gage II must **never** be confined in insulating materials. Before packing, we recommend that the inner components be allowed to warm up for at least 6 hours after the dewar is emptied of LN2. This will prevent the outer surfaces from cooling to a temperature that would damage the vacuum seals or electronics.

Note, however, that with proper precautions, a Gamma Gage II can be enclosed in a loose-fitting plastic bag for protection during heldheld use in the field. The bag can be taped shut **but not airtight** around the cables coming from the Gamma Gage II. The nitrogen evolved from the dewar will soon fill the bag with clean, dry gas. Unless the ambient temperature is unusually low (<0°C), there should be sufficient heat transfer through the bag to prevent the Gamma Gage II from getting too cold. The bag should be single-layer and no more than 0.15 mm (0.006 in.) thick to ensure against excessive insulation. **When cold, the Gamma Gage II must not be filled or stored in this bag or any other enclosure.**

3.2. PACKING FOR SHIPMENT

The Gamma Gage II arrives from the factory packed in a crate which should be used any time the Gamma Gage II is shipped or otherwise transported. *All precautions against confining the Gamma Gage II to insulating materials must be strictly followed.* If you have questions, contact your ORTEC representative or our Global Service Center.

If you are packing the unit for return to the factory, be sure to read the warranty and contact our Global Service Center for detailed instructions on returning a detector to ORTEC.

3.3. FOR FIELD USE

If the Gamma Gage II is completely warm, the primary concern is that it not be subjected to excessive shock. To prevent this, we suggest carrying it in its original packing materials, or wrapping it in other protective packing and placing it in a box.

If the Gamma Gage II is cold (even if its LN2 is exhausted) it must not be wrapped or enclosed in any way. Protection from excessive shock is even more important when the dewar is full than when it is empty.

The detector should not be transported in a precisely horizontal position while being subjected to vibration or bouncing. Under these conditions, a full dewar may occasionally expel drops of LN2. The ideal arrangement for extended transportation of a cold dewar is an open, shock-mounted support to hold the Gamma Gage II vertically, detector-end down. For short trips in a car or truck, the detector can simply be held by the handle. It can also be carried firmly secured on a car seat. However, if the unit is nearly full of LN2 and being transported over rough terrain, it should be positioned with the dewar-end slightly elevated.