WORTHINGTON INDUSTRIES

LS Series

Liquid Nitrogen Refrigerators

Safety

Before using any cryogenic refrigerator, read the *Handle with Care* booklet provided with the unit. It details safety precautions that must be understood before using the equipment. If a replacement booklet is needed, order publication *Handle with Care* from your supplier. Following are a few of the safety precautions described in the Handle with Care booklet. Please be sure to read the entire booklet.

Store and use these containers only in well ventilated areas. In a confined area, nitrogen gas from these units may cause suffocation by displacing air needed for breathing. Install a suitable oxygen monitor.

Do not touch liquid or cold metal surfaces with your bare skin. The liquid nitrogen refrigerant is **extremely cold:** -196°C (- 320°F). Exposure to skin or eyes to liquid, cold gas or frosted parts could result in a severe frostbite-like injury. Because of the extremely low temperature, a face shield and gloves must be worn when transferring liquid nitrogen and material into or out of these containers.

Use only the necktube covers supplied with this unit or a listed replacement part. A tight fitting plug or stopper will cause a pressure increase in the container that may damage the container and/or cause personal injury.

Operation

Filling: Adding liquid nitrogen to a warm container may cause splashing and will generate a significant volume of nitrogen gas as cold liquid contacts warm refrigerator surfaces. Add liquid slowly to minimize these effects. Be sure there is adequate ventilation. Keep your head clear of the heavy volume of vapor that may be produced. It is extremely cold and could cause personal injury.

WARNING

DO NOT OVERFILL. Over-filling may result in personal injury due to liquid spillage, and damage to the refrigerator.

Determining Liquid Level

Liquid level must be checked at regular intervals – refrigeration depends on the presence of liquid nitrogen. The liquid level in the container can be determined with a dipstick. Insert the dipstick straight into the container so that it rests on the rack positioning fixture on the bottom of the unit. After 5 to 10 seconds, withdraw the dipstick and wave it back and forth in the air. A frost line will form representing the depth of the liquid in the container. The frost line will typically be u-shaped; read the bottom of the u-shaped line to determine liquid level.

WARNING

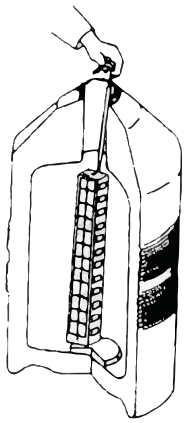
Never use a hollow rod or tube as a measuring rod. When a warm tube is inserted into liquid nitrogen, liquid will exit from the top of the tube and may cause personal injury.

The liquid level chart shows volume of liquid nitrogen vs. depth for LS Series refrigerators. These values are approximate and are based on standard conditions with no stored material in the container. With stored material, the liquid volume will be slightly less than the value of the chart.

MODEL	LITERS/INCH	LITERS/CM
LS750	2.6	1
LS3000/LS4800/ LS6000	6.6	2.6

Inserting Or Removing Racks

To prevent unnecessary loss of liquid nitrogen and accumulation of ice, the necktube core (the stopper) should remain in the container when the stored material is not being accessed. When accessing stored material, the necktube should be removed as briefly as possible.



When removing material from the racks, withdraw the rack just far enough to remove contents. Completely withdrawing the rack will unnecessarily expose the stored material to warm room temperature conditions.

WARNING

Some boxes have liquid drain openings, some do not. If racks are completely removed from the container, liquid nitrogen may remain in the either rack and boxes, or simply drain from the bottom. When removing racks, stop briefly at the necktube to allow liquid to drain completely, then handle the rack carefully to prevent personal injury. Avoid direct rack contact with bare skin. The use of proper personal protective gear is strongly urged – cryogenic gloves, face shield and gown – to protect against splashing.

When room temperature is added, slowly lower the rack into the refrigerator to reduce the boiling of refrigerant and the surge of cold nitrogen gas. When inserting the rack, tilt the bottom of the rack in the direction of the index ring notch. The numbers and colors on the rack handles are a convenient aid to inventory control

Securing Contents

The contents of all models may be secured with a seal or lock through tabs on the edge of the lid opposite the hinge.

Routine Care & Maintenance

If ice accumulates inside the necktube, a general cleaning of the refrigerator should be scheduled as soon as the stored material can be conveniently transferred to another refrigerator. To clean the unit, first remove stored material, and then pour out the liquid, disposing of it out-of-doors where the cold liquid will not damage driveways and other surfaces. Warm the container by purging it with air even after the container has warmed to room temperature to evaporate any collected moisture. When the container is ice-free and dry, rinse the inner vessel with household bleach. Wash the inner vessel with a 40 to 1 ratio of water to laundry detergent solution. Rinse and dry inside and out thoroughly before placing the container back into service. Do not use sharp instruments to chip ice; permanent damage to the container could result. DO NOT attempt to fasten any service to the container. Welding, brazing, or piercing of the container in any manner will cause permanent damage and will void the limited warranty.

Refrigeration depends on the presence of liquid nitrogen in the refrigerator. Be sure to maintain correct refrigerant levels to prevent loss of stored material. **Check liquid levels regularly.** If high evaporation rates are apparent under normal operating conditions, the refrigerator may be losing its vacuum. Sweating and the formation of frost on the outer casing are indications that the vacuum integrity of the refrigerator is not normal. All necessary steps should be taken to protect the refrigerator's contents. If these conditions persist, contact your supplier or Worthington Industries at 844-273-7517 or +1 614-438-7968 or e-mail us at customerservice@worthingtonindustries.com for information on how to conduct a normal evaporation rate (NER) test in the field.

Transportation

The LS Series is designed for stationary laboratory use. **They are not designed for transport service.** Although these refrigerators are rugged, they can be damaged if abused or otherwise mishandled. When moving a refrigerator in the laboratory setting, take every precaution to prevent sliding, tipping, bumping, or dropping the unit. Use only the roller base designed for the refrigerators. **All refrigerators must be kept upright.**

WARNING

Ventilation MUST BE assured to prevent the displacement of air and the related suffocation hazard.

Returns

Manufacturing defects are covered under the containers' limited warranty. Evidence of mishandling, such as dents on the outer vessel or misalignment of the inner vessel are not considered manufacturing defects. If you would like to return goods to Worthington Industries for any reason, you must first obtain a Material Return Authorization (MRA) number for tracking purposes. Please have a description of your symptoms and the refrigerator's serial number ready.

Accessories

The following accessories are available for LS Series refrigerators:

ROLLER BASE	P/N	MODEL
With ball bearing swivel casters to provide convenience and portability within a working area where frequent container movement is necessary or desirable.	366783	LS750
	366864	LS3000, LS4800, LS6000

LOW LEVEL ALARM	P/N	MODEL
For passive monitoring of liquid nitrogen levels. This AC powered alarm is available for units that may be used for long term storage, where a low liquid level could go unnoticed.	366833	LS750
	366644	LS3000
	366867	LS4800
	366658	LS6000

LIQUID LEVEL MEASURING ROD	P/N	MODEL
Graduated in both inches and centimeters. This accessory is inserted into the cryogenic refrigerant to determine actual liquid level.	366784	All Units

INVENTORY CONTROL BOXES	P/N	MODEL
Made of cardboard or plastic to hold 2ml vials. Can be used to store samples.	366642 Cardboard, 25 cell box	LS750
	366641 Plastic, 25 cell box	LS750
	366995 Plastic, 100 cell box	LS3000, LS4800, LS6000

REPLACEMENT PARTS				
REFRIGERATORS	LS750	LS3000	LS4800	LS6000
Shelf Rack	366841	366651	366879	366667
Necktube Core	366839	366648	366876	366662
Cap, Hinged	366792	N/A	N/A	N/A

Ordering Information

Order all replacement parts and accessories from your local distributor. Please include the part and model number, quantity, and each part requested. For more information or the name of your local distributor, contact Worthington Industries at the phone number or email listed below.

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