

Model 7196
Liquid Nitrogen Comparator
User Manual

HART
SCIENTIFIC

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WARNING
EXTREMELY COLD TEMPERATURES PRESENT
in this equipment.
FREEZER BURNS AND FROSTBITE
may result if personnel fail to observe safety precautions.

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1 Introduction

A comparison calibration at the temperature of liquid nitrogen is generally used to calibrate standard platinum resistance thermometers (SPRTs) and other temperature probes below -100°C . Since the lowest temperature limit of a bath is around -100°C , most national and other calibration laboratories use a liquid nitrogen comparator instead of a bath for comparison calibrations at the triple point of argon ($-189.3442^{\circ}\text{C}$). The boiling point of nitrogen (-195.798°C) provides a useful and attractive calibration point. Your new liquid nitrogen comparator has been developed at Hart Scientific according to Xumo Li's many years experience in thermometry. The new liquid nitrogen comparator can be used to calibrate SPRTs, RTDs, various thermocouples and other probes by comparison with a reference thermometer. The new equipment is simple in design and easy to use. No electric power is required for operation.

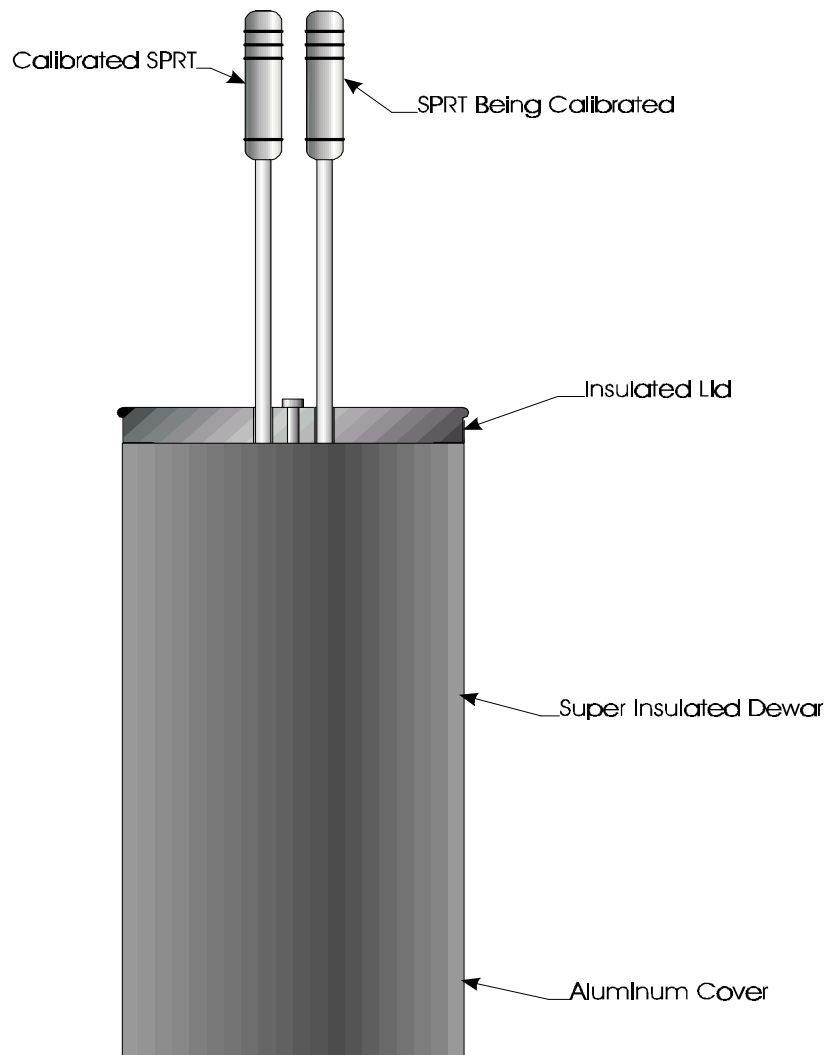


Figure 1: The liquid nitrogen comparator

2 Specification

Temperature: -196 °C (-186 °C if liquid argon is used instead of liquid nitrogen)

The temperature differences among four holes: < 0.4 mK (0.0004 °C)

Temperature stability: Typically < 2 mK / 20 min., the equilibrium temperature will change with the atmospheric pressure ($dt/dp \approx 0.085$ mK/Pa). The actual temperature stability depends on the atmospheric pressure stability.

Outer diameter: 180 mm (7.09")

Height: 385 mm (15.16")

The maximum number of thermometers accommodated: 4

The sizes of wells in oxygen-free copper equilibrium block

Diameter: 8.0 mm (0.315")

Depth: 145 mm (5.71")

3 Description

The Hart Scientific Liquid Nitrogen Comparator Model 7196 (Figure 2) consists of a Pyrex® Dewar Flask, a lid, a connection rod and an oxygen-free copper block with four wells to accommodate thermometers to be calibrated. During use the oxygen-free copper block is completely immersed in liquid nitrogen. Up to four thermometers, including a reference thermometer as the standard for comparison calibration, are directly immersed in the liquid nitrogen inside the block. The boiling temperature of nitrogen depends on the atmospheric pressure. If the pressure is stable, the liquid nitrogen temperature will be stable and uniform also. The oxygen-free copper has extremely good thermal conductivity, therefore, the copper block will enhance the temperature uniformity in the comparator greatly.

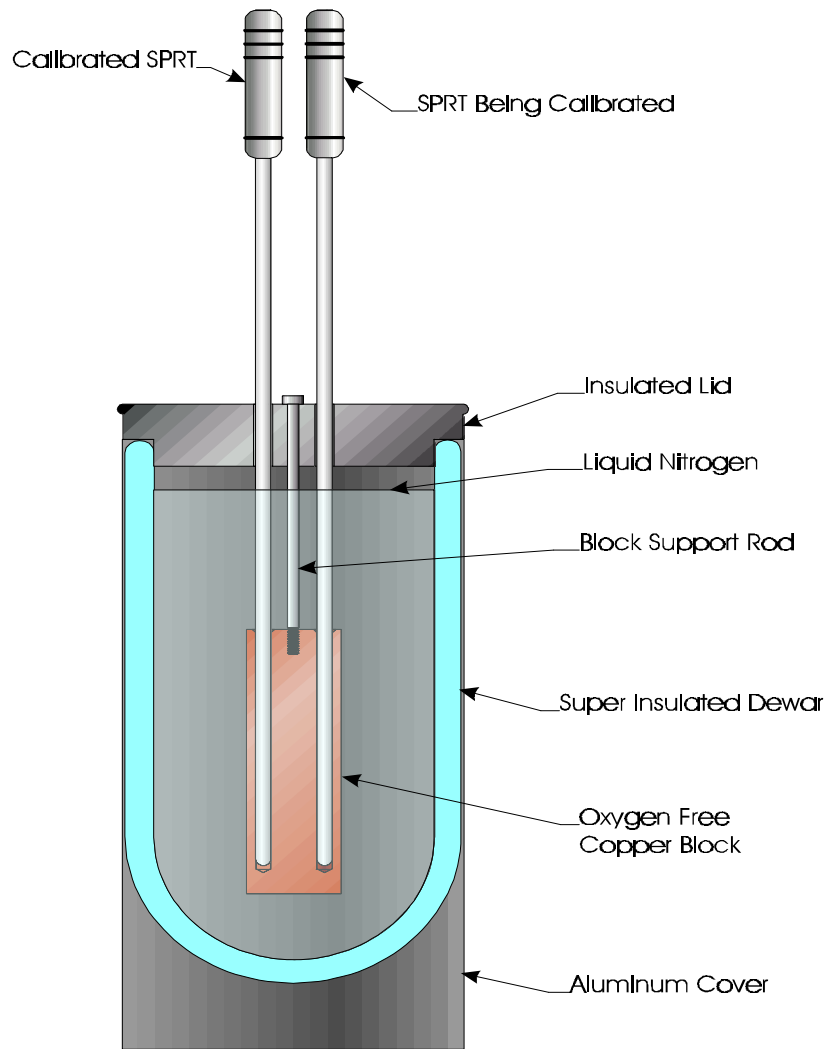


Figure 2: Cut-Away View of Liquid Nitrogen Comparator

4 Operation

1. Remove the lid and fill the Dewar 2/3 full of liquid nitrogen being careful not to splash any on your skin.

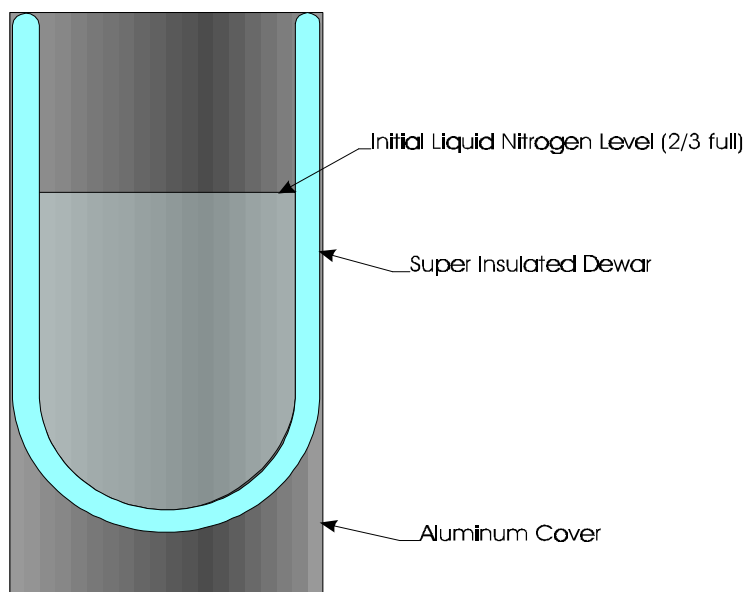


Figure 3: Initial Liquid Nitrogen Level in Comparator

2. Immerse the oxygen-free copper block in the liquid nitrogen slowly over a period of approximately ten minutes. When the room temperature block touches the liquid nitrogen, the liquid nitrogen will boil violently. After insertion, wait until the liquid nitrogen stops boiling before proceeding to Step 3.

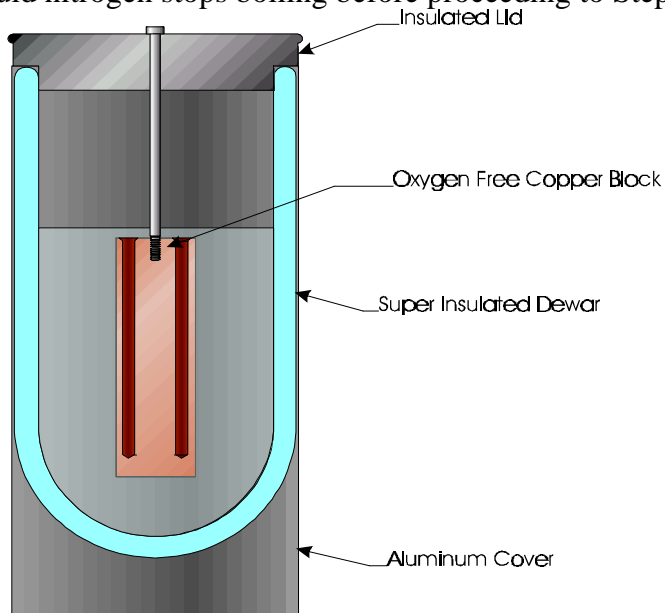


Figure 4: Insert Oxygen Free Copper Block into Comparator

3. Insert SPRTs or other types of temperature probes to be calibrated into the liquid nitrogen and into the wells in the block.. (See Figure 2)
4. Add more liquid nitrogen to the Dewar until the level is about 5 mm below the lid. Put the window cover on the lid. It will take thirty minutes or a little longer to reach equilibrium.
5. When thermal equilibrium is reached, perform the comparison calibrations just as you do with a temperature calibration bath.
6. About every four hours add more liquid nitrogen to the Dewar. Take the window cover off and pour liquid nitrogen into the Dewar through the window to a level about 5 mm below the lid. Be sure to replace the window cover.

