



HSE APPROVED SPECIFICATION

HSE-LHe-TPR

**CRYOGENIC INSULATED TRANSPORTABLE PRESSURE
RECEPTACLES FOR LIQUID HELIUM**

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1.0 SCOPE

This specification applies to cryogenic transportable receptacles with a capacity between 30 to 1000 litres, designed for the transportation and use of liquid helium at pressures above atmospheric pressures. This specification is not applicable to open dewars. The requirements for design, manufacture and testing of the receptacles shall be as specified in ASME VIII, Division 1 and the requirement of the relevant marginals in ADR for Class 2 Item 3°A gases.

2.0 MANUFACTURER

The manufacturer shall be technically able and shall possess all suitable means required for the satisfactory manufacture of receptacles; this relates in particular to qualified personnel.

The manufacturer shall have an quality assurance system in conformance with ISO 9001. ||

3.0 CERTIFICATE OF COMPLIANCE

The approved Verification Body shall certify that the manufacture, inspection and testing of || the receptacle was carried out in compliance with the requirements of this Specification.

Before manufacture commences, two copies of detailed design drawings, together with the design calculations shall be submitted to the Verification Body for approval. Design || drawings shall carry an unique identifying number. No alteration shall be made to the design after approval unless such alteration has received prior agreement of the Verification Body. ||

4.0 RECEPTACLE DESIGN AND MANUFACTURE

As a minimum, the pressure retaining parts shall be designed, manufactured, tested and inspected in accordance with the appropriate parts of ASME VIII for low temperature receptacles. The weld procedures and qualification shall be in accordance with ASME IX.

The complete receptacle, pipework and fittings shall be designed, calculated, manufactured, tested and equipped in such a way as to withstand all conditions to which they will be subjected during normal use and during normal transport conditions.

In the design of the receptacle, all relevant factors are to be taken into account, such as:-

- Internal pressure.
- Ambient and operational temperatures during transport and use.
- Dynamic loads.

The inner receptacle design pressure (or maximum allowable working pressure) shall not be less than 2.76 barg (40 psig). This is equivalent to 1.72 barg (25 psig) under vacuum.

Test pressures shall be in accordance with the above design code. It shall not be less than 1.3 times the maximum allowable working pressure, increased by 1 bar (to cover the vacuum in the interspace).

If not covered by the receptacle design code, the piping may be designed and constructed in accordance with ANSI B31.3.

The receptacle piping system shall be designed with due consideration to operability and maintainability. Fill valves and gauges shall be easily accessed by operators.

5.0 OUTER JACKET

The outer jacket shall be designed to withstand, without deformation an external pressure of at least 1 barg.

The outer jacket shall be provided with a pressure relief device to prevent any dangerous pressure from developing within the interspace in the event of a leak developing in the inner receptacle or fittings.

There shall be provision for measurement of vacuum to allow a periodic leakproofness test to be carried out to demonstrate the inner receptacle integrity.

6.0 MATERIALS OF CONSTRUCTION

The inner receptacle, outer receptacle and piping of the receptacle shall be manufactured from suitable materials for service across the design temperature range of 4K(-269°C) to 323K(50°C).

The inner receptacle and piping of the receptacle shall be manufactured from austenitic chrome-nickel (stainless) steel.

A certified material test report shall be obtained by the manufacturer for each lot of material. The test report shall certify compliance with the applicable specification and shall include results of the required tests.

The material of construction shall be identified by suitable means so as to permit traceability to the material lot and the certificate for that lot. The certificate shall be checked by the Verification Body and retained by the manufacturer. ||

7.0 GENERAL REQUIREMENTS AND SAFETY

The receptacle shall be thermally insulated so that it cannot become coated with dew or hoarfrost.

The receptacle shall be fitted with a minimum of 2 safety relief devices, one of which may be a bursting disc.

The primary spring loaded relief device shall be set at 0.55 barg (8 psig).

The valves shall be constructed as to work perfectly across the temperature range.

The degree of filling at the filling temperature and at a pressure of 1 bar (14.7psi) shall not exceed 98% of the capacity of the vessel.

The receptacles and all components specified shall be capable of safe, continuous outdoor operation with minimal service and attention.

The inner receptacle shall be constructed to prevent a frozen air blockage in the neck tube from blocking the safety relief device(s) that protect the inner receptacle from overpressure failure.

Any fastenings of the receptacles shall be designed so that when the receptacle is at its lowest working temperature, they still possess the necessary mechanical properties.

Valves shall be effectively protected from damage which could cause gas release if the receptacle falls, or is damaged during carriage.

Valves shall be protected by a frame, shroud or guard.

8.0 INSPECTIONS AND TESTS

8.1 General

The inspection and testing of receptacles shall be carried out to the satisfaction of the Verification Body, who shall certify that the receptacles comply with the requirements of this Specification.

The purchaser and the Verification Body shall have reasonable access to those parts of the manufacturer's works engaged on the order, for purposes of ensuring that the receptacles comply with the requirements of this Specification.

Adequate notification of, and facilities for inspecting and testing shall be provided by the manufacturer to the Verification Body.

8.2 At least one receptacle per batch (up to a batch number of 20) shall be subjected to initial inspection covering:-

- Testing of the inner receptacle materials of construction.
As a minimum, figures for yield stress, tensile strength and permanent elongation at fracture shall be available
- Measurement of wall thickness at the thinnest point, calculation of the stress.
- Checking of the homogeneity of the material for each manufacturing batch, and inspection of the external and internal condition of the receptacles.
- Satisfactory operation of relief devices at their lowest working temperature.

8.3 All receptacles shall be subjected to:-

- A strength pressure test of inner receptacle in accordance with ASME VIII.
(Water, if used for a hydrostatic pressure test shall contain less than 50 ppm chloride. The inner receptacle shall be thoroughly dried following the test.)
Note. With the agreement of the testing and certifying Inspection Body approved by the competent authority, a hydrostatic pressure test may be replaced by a test using gas, where such an operation does not entail danger.
- A 100% vacuum leak test of inner receptacle using a helium mass spectrometer leak detector. (The inner vessel shall normally be filled with helium and any leakage detected using a mass spectrometer detector on the outlet of an interspace vacuum pump.)
- A pneumatic leak test of the completed receptacle assembly at around 0.5 barg to check for leaking joints and seals particularly on the accessories and pipework.
- An inspection of the markings on the receptacles.

8.4 The following tests are not required:-

- No material impact testing is required on austenitic chrome-nickel (stainless) steel sheets less than 5 mm thick or on their seams.
- No bending coefficient confirmation is required on austenitic chrome-nickel (stainless) steel welds.

9. CLEANLINESS

Wetted parts of the receptacle and piping system shall be cleaned to oxygen standards. A cleanliness level of 100mg/m² maximum hydrocarbon shall be met.

10. MARKING

In addition to any requirements of the design standard, the receptacle shall be clearly and durably marked on its exterior with the following information:

- i) The manufacturer's name and address.
- ii) A serial number and model to identify the receptacle.
- iii) The date of manufacture of the receptacle.
- iv) The design standard to which the receptacle was built.
- v) The design pressure (or maximum allowable working pressure) of the inner receptacle when under full vacuum.
- vi) The design temperature of the inner and outer receptacles.
- vii) Inner receptacles nett and gross volume (litres).
- viii) "Liquid Helium Receptacle" and "Keep Upright - Handle with Care".
- ix) "Non-Magnetic" if applicable.

- x) Pressure building device operating instructions, if applicable.
- xi) A simple process and instrumentation diagram (all operating controls shall be correspondingly labeled).
- xii) Mark of the Verification Body.

11. DOCUMENTATION

Two copies of the following documentation shall be supplied :-

For Initial Design Approval.: ||

- i) General assembly drawing (schematic).
- ii) Process and instrumentation drawing (i and ii may be combined in one drawing).
- iii) Receptacle height and diameter.
- iv) Dimensioned positions of valves and instrumentation.
- v) Actual and maximum allowable relief valve and bursting disc settings in accordance with the design code.
- vi) Calculations supporting inner receptacle wall thickness.
- vii) Receptacle design (or maximum allowable working) pressure and temperature.
- viii) System valves and instrumentation.
- ix) The guaranteed daily evaporation loss rate.

For Unit Production Approval: ||

- i) Receptacle tare, nett and gross weight.
- ii) Inner receptacle and piping system design code(s).
- iii) Liquid volume versus liquid level contents chart.
- iv) Material certificate for inner receptacle and certificates of conformity for the piping.
- v) Hydrostatic strength test certificate for inner receptacle.
- vi) Inner receptacle and interspace leak test certificate.
- vii) Test certification for the receptacle relief valve.
- viii) Cleanliness certificate.
- ix) Operating and maintenance manual.
- x) Spare parts list.
- xi) Certificate of Warranty.

12. PACKAGING

The receptacle shall be delivered with the inner receptacle pressurized with clean dry nitrogen to 0.3 barg.

All valves shall be closed and outlets shall be capped.

The receptacle shall be packaged to ensure it is not damaged in transit.

No labels (other than as specified by the design code or this specification) shall be fixed to the receptacle.

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