
**Cryogenic vessels — Large transportable
vacuum-insulated vessels —**

**Part 2:
Operational requirements**

*Réipients cryogéniques — Grands réipients transportables, isolés,
sous vide —*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 20421-2 was prepared by Technical Committee ISO/TC 220, *Cryogenic vessels*.

ISO 20421 consists of the following parts, under the general title *Cryogenic vessels — Large transportable vacuum-insulated vessels*:

— *Part 1: Design, fabrication, inspection and tests*

— *Part 2: Operational requirements*

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Introduction

Elements of this part of ISO 20421 support the requirements of the UN-Recommendations on the Transport of Dangerous Goods and other international, national or local requirements.

Large transportable cryogenic vessels are often partly equipped by the manufacturer, but may be installed or re-installed by another party, such as the operator or owner. For this reason some of the scope of this part of ISO 20421, which includes putting into service, inspection, filling, maintenance and emergency procedures, overlaps with ISO 20421-1.

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Cryogenic vessels — Large transportable vacuum-insulated vessels —

Part 2: Operational requirements

1 Scope

This part of ISO 20421 specifies operational requirements for large transportable vacuum-insulated cryogenic vessels of more than 1 000 l volume.

The scope includes putting into service, filling, withdrawal, transport within the location, storage, maintenance, periodic inspection and emergency procedures.

For the transport of these vessels by public road, rail, waterway, sea and air, additional requirements may apply; these are defined in specific regulations.

This part of ISO 20421 applies to vessels for cryogenic fluids as specified in ISO 20421-1. The additional requirements for flammable fluids are detailed in Clause 16.

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2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 20421-1, *Cryogenic vessels — Large transportable vacuum-insulated vessels — Part 1: Design, fabrication, inspection and tests*¹⁾

ISO 23208, *Cryogenic vessels — Cleanliness for cryogenic service*

ISO 21010, *Cryogenic vessels — Gas/materials compatibility*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

putting into service

operation by which a new vessel being used for the first time or an existing vessel being returned to service is prepared for use

1) To be published.

3.2 filling
operation by which a transportable vessel undergoes a prefill check, filling with a cryogenic fluid and an after-fill check

3.3 withdrawal
operation by which the product is taken from a vessel connected to the supply system

3.4 outdoor location
location outside of any building or structure and not enclosed by more than two walls or one wall if a roof is also present

3.5 underground location
area or room whose ground or floor is on all sides significantly lower than the adjacent ground surfaces

3.6 vessels
large transportable cryogenic vessel as defined in ISO 20421-1

3.7 competent person
trained and qualified person for the purpose mentioned in this document

3.8 enterprise
any person or company that has a legal duty of care

3.9 filler
any enterprise which loads cryogenic fluids into a cryogenic vessel

3.10 owner
enterprise that legally owns the cryogenic vessel

3.11 operator
any enterprise for filling, storage, transport and withdrawal of cryogenic product

4 Preliminaries before putting into service

4.1 General

Before putting into service, verification shall take place to ensure that the vessel is suitable for the intended service and that the marking, labelling and handover documents are complete.

4.2 Marking and labelling

4.2.1 Marking

Marking shall be in accordance with ISO 20421-1.

4.2.2 Labelling

For labelling the following shall be affixed:

- a) a flow sheet denoting operation;
- b) an unshortened identification of the fluid which is transported in accordance with the transport and substance regulations and its net mass in accordance with the documentation;
- c) danger labels in accordance with transport regulations;
- d) risk and safety phrases associated with the gas content;
- e) name of the owner;
- f) name of the operator;
- g) actual holding time for gases being transported;
- h) maximum permissible gross mass;
- i) unladen (tare) mass.

4.3 Handover documents

In addition to the manufacturer's documentation, where necessary the cryogenic vessel shall be accompanied by vessel specific documents and instructions for all items supplied covering the

- operation;
- auxiliary equipment;
- inspection records.

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These documents shall be retained by the owner of the vessel.

The operator shall have appropriate instructions available. Such instructions may be attached to the vessel in a permanent manner, or carried by or available to the operator.

5 Personnel training

Only persons trained for the specific task shall be allowed to put into service, fill, handle, operate or maintain the vessel.

The training programme shall include

- normal procedures;
- product and hazard identification;
- safe operating limits;
- emergency procedures;
- physical and chemical properties of the vessel's content and their effects on the human body;
- personal protection;
- confined spaces entry, if applicable.

Training shall be repeated as necessary to ensure that personnel remain competent. A record should be maintained which details the training personnel have received.

6 General safety requirements

6.1 General

Before any operation the operator should ensure that all equipment is free from any obvious damage or defect which could affect its safe operation.

Marking and labelling shall not be removed or defaced.

Consideration should be given to the product properties and the use of appropriate personal protective equipment.

Parts under pressure shall be disconnected only if they have been previously depressurized.

Leaking valves or connections should be depressurized before rectification. When this is not possible, leaking valves under pressure shall be tightened using suitable tools and procedures.

Direct flame or direct intense heat shall never be used to raise the pressure or de-ice frozen components.

All surfaces which may come in contact with the product shall be clean for the intended service. For cleanliness requirements, see ISO 23208.

Outlets, seals and transfer hoses shall be checked to be clean, dry and free from contaminants and visible defects before connection.

Vessels and transfer hoses shall not be modified without proper authorization. It is recommended that the couplings be attached to the vessels and/or hoses in a manner that prevents unauthorized removal of the product couplings.

Operating valves should be opened and closed slowly.

6.2 Safety considerations

In all operations and training, the following safety considerations shall be taken into account.

- Small amounts of cryogenic fluids will produce large volumes of vaporized gas. Spillage of oxygen can result in an oxygen-enriched atmosphere, spillage of other cryogenic fluids can result in an oxygen-deficient atmosphere. Appropriate measures shall be taken for all these cases, e.g. ventilation.
- Because of the possibility of cold embrittlement, cryogenic fluids shall only be used in product systems with components which are suitable for low temperatures.
- Vaporizing cryogenic fluids produce gases that are heavier than air and can accumulate in lower areas (e.g. pits, trenches).
- Because of their extremely low temperatures, cryogenic fluids will produce cold burns when coming into contact with the skin. Cold burns can also be produced from contact with uninsulated equipment and piping.
- Oxygen enrichment due to liquefaction of ambient air can occur on the cold surfaces of uninsulated equipment which contains a fluid with a boiling point lower than that of oxygen.
- Consideration should be given to establishing proper safety distances during parking or product transfer.

7 Putting into service

This operation shall follow a written procedure and the results of the steps involved should be recorded (e.g. in a check list). Such lists should be retained by the operating company.

Vessels and accessories shall be visually checked for damage.

The following shall be verified.

- The vessel and accessories are appropriate for the intended service, comply with the flow-sheet and are appropriately marked and labelled; all labels shall be clearly displayed and appropriate for the product.
- A relief device with a set pressure not higher than the maximum allowable working pressure of the vessel is fitted. Pressure, size and installation shall comply with the documentation. Devices requiring approval shall be correctly stamped and matching certificates shall be available.
- All valves are operable.
- All required checks and tests have been carried out.

Ensure that the vessel and accessories are clean and compatible for the intended service; see ISO 23208 and ISO 21010.

The vessel should be purged with an appropriate gas until the gas emerging from the vessel is sufficiently dry and pure for the intended service.

The vessel shall be cooled down according to the manufacturer's recommendations. Steps shall be taken to avoid uncontrolled pressure rise due to rapid liquid vaporization. The cool-down gas chosen shall take into account the risk of solidification.

Measuring and controlling devices (level gauge, pressure gauge, etc.) shall be checked for correct operation and setting.

8 Location

The requirements listed in this clause are valid for storage and parking, as well as for other activities such as filling and withdrawal.

- Vessels shall be located in a suitable area such as in the open air or in a sufficiently ventilated enclosed area, away from sources of heat (welding source, open fire, etc.). Hot work shall be subject to appropriate safety measures. The area shall be kept appropriately clean and suitable access shall be provided.
- Adequate ventilation shall be provided. In locations at or above ground level, natural ventilation is generally sufficient, provided that the room is large enough or that the outdoor area is not closely surrounded by walls. In other circumstances, forced ventilation or other precautions shall be provided.
- Vessels should not be located underground. However, where this is unavoidable, relief device outlet(s) should be piped to a safe external venting point and the underground location shall have sufficient continuous ventilation to deal with product releases arising from normal operation.
- The floor of the designated trans-shipment area shall be level and strong enough to take the mass of the full transport unit. The vessel shall be located at a sufficient distance from the normal paths used by people or vehicles. Water accumulation in the vicinity of the vessel shall be avoided.
- For filling and withdrawing oxidizing liquids and cryogenic liquids colder than liquid nitrogen, the connections shall be located over a non-combustible surface, like concrete.
- Vessels and their components shall be protected against mechanical damage.