

This is a preview of "ISO 21013-3:2016". [Click here to purchase the full version from the ANSI store.](#)

Second edition  
2016-05-01

---

---

# Cryogenic vessels — Pressure-relief accessories for cryogenic service —

## Part 3: Sizing and capacity determination

*Réipients cryogéniques — Dispositifs de sécurité pour le service cryogénique —*

*Partie 3: Détermination de la taille et du volume*



Reference number  
ISO 21013-3:2016(E)

© ISO 2016

This is a preview of "ISO 21013-3:2016". Click [here](#) to purchase the full version from the ANSI store.



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2016, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
Ch. de Blandonnet 8 • CP 401  
CH-1214 Vernier, Geneva, Switzerland  
Tel. +41 22 749 01 11  
Fax +41 22 749 09 47  
copyright@iso.org  
www.iso.org

This is a preview of "ISO 21013-3:2016". Click here to purchase the full version from the ANSI store.

## Contents

	Page
<b>Foreword</b> .....	<b>v</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Symbols</b> .....	<b>2</b>
<b>4 Calculation of the total quantity of heat transferred per unit time from the hot wall (outer jacket) to the cold wall (inner vessel)</b> .....	<b>6</b>
4.1 General.....	6
4.2 Under conditions other than fire.....	6
4.2.1 Vacuum-insulated vessels under normal vacuum.....	6
4.2.2 Pressure build-up device.....	7
4.2.3 Vacuum-insulated vessels in the case of loss of vacuum and non-vacuum insulated vessels.....	7
4.2.4 Supports and piping.....	9
4.3 Under fire conditions.....	9
4.3.1 Insulation system remains fully or partially in place during fire conditions.....	9
4.3.2 Insulation system does not remain in place during fire conditions.....	10
4.4 Air or Nitrogen condensation.....	10
4.4.1 General.....	10
4.4.2 Loss of vacuum with air and nitrogen.....	10
4.4.3 Fire with loss of vacuum with air or nitrogen.....	11
4.5 Heat transfer per unit time (watts).....	12
4.5.1 General.....	12
4.5.2 Normal operation.....	12
4.5.3 Pressure build up regulator fully open.....	12
4.5.4 Loss of vacuum condition.....	12
4.5.5 Fire condition with loss of vacuum, vacuum jacket, and insulation fully or partially in place.....	13
4.5.6 Fire condition with loss of vacuum, insulation not in place.....	13
4.5.7 Total heat transfer rate.....	13
<b>5 Calculation of the mass flow to be relieved by pressure relief devices</b> .....	<b>13</b>
5.1 Relieving pressure, $P$ , less than the critical pressure.....	13
5.2 Relieving pressure, $P$ , equal to or greater than the critical pressure.....	14
5.3 Example.....	14
<b>6 Piping for pressure relief devices</b> .....	<b>15</b>
6.1 Pressure drop.....	15
6.1.1 General.....	15
6.1.2 Relief valves.....	15
6.1.3 Bursting discs.....	15
6.2 Back pressure consideration.....	16
6.3 Heat transfer.....	16
<b>7 Sizing of pressure relief devices</b> .....	<b>17</b>
7.1 General.....	17
7.2 Sizing of pressure relief valves.....	17
7.2.1 Discharge capacity.....	17
7.2.2 Determination of critical vs. subcritical flow for gases.....	18
7.2.3 Critical flow.....	18
7.2.4 Subcritical flow.....	19
7.2.5 Recommended analysis method.....	20
7.2.6 Example.....	22
7.3 Sizing of bursting discs.....	26
7.3.1 Discharge capacity.....	26

This is a preview of "ISO 21013-3:2016". [Click here to purchase the full version from the ANSI store.](#)

7.3.2	Determination of critical vs. subcritical flow for gases .....	27
7.3.3	Critical flow .....	27
7.3.4	Subcritical flow.....	27
7.3.5	Recommended analysis method.....	28
7.3.6	Example .....	31
<b>Annex A (informative) Cryostats.....</b>		<b>34</b>
<b>Bibliography .....</b>		<b>35</b>

This is a preview of "ISO 21013-3:2016". [Click here to purchase the full version from the ANSI store.](#)

## 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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/TC 220, *Cryogenic vessels*.

This second edition cancels and replaces the first edition (ISO 21013-3:2006), which has been technically revised.

ISO 21013 consists of the following parts, under the general title *Cryogenic vessels — Pressure-relief accessories for cryogenic service*:

- *Part 1: Reclosable pressure-relief valves*
- *Part 2: Non-reclosable pressure-relief devices*
- *Part 3: Sizing and capacity determination*
- *Part 4: Pressure-relief accessories for cryogenic service*