

ISO 21009-1:2008-09 (E)

Cryogenic vessels - Static vacuum-insulated vessels - Part 1: Design, fabrication, inspection and tests

Contents		Page
Foreword		v
1	Scope	1
2	Normative references	1
3	Terms and definitions	2
4	Symbols	5
5	General requirements	7
6	Mechanical loads	7
6.1	General	7
6.2	Load during the pressure test	7
7	Chemical effects	8
8	Thermal conditions	8
9	Material	8
9.1	Selection of materials	8
9.2	Inspection certificate	9
9.3	Materials for outer jackets and service equipment	9
10	Design	9
10.1	Design options	9
10.2	Common design requirements	9
10.3	Design by calculation	16
11	Fabrication	43
11.1	General	43
11.2	Cutting	43
11.3	Cold forming	47
11.4	Hot forming	49
11.5	Manufacturing tolerances	50
11.6	Welding	53
11.7	Non-welded permanent joints	54
12	Inspection and testing	54
12.1	Quality plan	54
12.2	Production control test plates	56
12.3	Non-destructive testing	57
12.4	Rectification	60
12.5	Pressure testing	60
13	Marking and labelling	61
14	Final assessment	62
15	Periodic inspection	62
Annex A (normative) Elastic stress analysis		63
Annex B (normative) Additional requirements for 9 % Ni steel		72

Annex C (normative) Pressure strengthening of vessels from austenitic stainless steels	74
Annex D (informative) Pressure limiting systems	85
Annex E (normative) Further use of the material cold properties to resist pressure loads	86
Annex F (informative) Specific weld details	90
Annex G (normative) Additional requirements for flammable fluids	94
Annex H (informative) Relief devices	95
Annex I (normative) Outer jacket relief devices	96
Annex J (informative) Increased material property for austenitic stainless steel	97
Annex K (normative) Base materials	98
Annex L (normative) Cylindrical shells subject to external pressure (pressure on the convex surface) -- Calculation	107
Annex M (normative) Design of openings in cylinders, spheres and cones -- Calculation	112
Annex N (normative) Design of ends for internal pressure	122
Bibliography	124