

ST 50 MM0003 Technical Specification for Pressure Equipment

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1 General

This specification shall apply to vessel type pressure equipment (design pressure > 0,5 bar), excluding piping, piping components and pressure accessories.

All the pressure vessel shall comply with European and local laws and local government regulations. Requirements of the following shall be followed:

- Pressure Equipment Directive 2014/68/EU (PED)
- Simple Pressure Vessel Directive 2014/29/EU (SPVD) as applicable
- Requirements specified within the Enquiry documents and this specification
- Product standard

When the requirements of the product standard, laws, regulations, enquiry documents and this specification contradict, the most stringent requirement shall be followed.

Fulfilment of the above instructions does not free the Supplier from carrying out his responsibilities and guarantees as specified in the contract and its appendices.

This specification does not address civil engineering and structural engineering.

2 Reference Standards

ST 04 MG0001	General Mill Standard
ST 04 MG0002	Units to be used
ST 16 MM0004	Technical Specification for Surface Treatment and Painting-Metallic Surfaces
ST 14 MM0005	Technical Specification for Thermal Insulation
250/2021 Sb.	“Zákon o bezpečnosti práce v souvislosti s provozem vyhrazených technických zařízení a o změně souvisejících zákonů”
NV 219/2016 Sb.	“Nařízení vlády o posuzování shody tlakových zařízení při jejich dodávání na trh”
NV 191/2022 Sb.	“Nařízení vlády o vyhrazených technických plynových zařízeních a požadavcích na zajištění jejich bezpečnosti”
NV 192/2022 Sb.	“Nařízení vlády o vyhrazených technických tlakových zařízeních a požadavcích na zajištění jejich bezpečnosti”
246/2001 Sb.	“Vyhláška Ministerstva vnitra o stanovení podmínek požární bezpečnosti a výkonu státního požárního dozoru (vyhláška o požární prevenci)”
2014/68/EU	Pressure Equipment Directive
2014/29/EU	Simple Pressure Vessel Directive
EN 1092-1	Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Part 1: Steel flanges.
EN 10204	Metallic products. Types of inspection documents.
EN 13445	Unfired pressure vessels.

ČSN 69 0012	Operation of stationary pressure vessels
ČSN 38 6405	Gas equipment. Principles for operation
EN ISO 4014	Hexagon head bolts. Product grades A and B.
EN ISO 9606	Qualification testing of welders - Fusion welding.
EN ISO 9712	Non-destructive testing. Qualification and certification of NDT personnel.
EN ISO 14732	Welding personnel. Qualification testing of welding operators and weld setters for mechanized and automatic welding of metallic materials.
EN ISO 15609	Specification and qualification of welding procedures for metallic materials. Welding procedure specification.
EN ISO 15614	Specification and qualification of welding procedures for metallic materials. Welding procedure test.
ISO 9001	Quality management systems. Requirements.
ASTM E562	Standard Test Method for Determining Volume Fraction by Systematic Manual Point Count.
PSK 7800	Allowable nozzle loads of pressure vessels and tube heat exchangers.

3 Pressure equipment

The product standard shall be EN 13445, which all design, manufacturing, inspecting, and testing shall follow. Use of any other codes in pressure vessel design and manufacturing requires a written approval of the Purchaser.

3.1 Design

The specific mill & local environmental conditions shall be taken into account in the design.

The pressure equipment shall be classified according to PED Article 13, and the Supplier shall use a corresponding module for conformity assessment. The Supplier shall be responsible for arranging the approvals of the Notified Body (NoBo) and shall ensure that all required inspections and testing required by the design code, this specification, enquiry documents, or the Notified Body are carried out. The supplier shall be responsible of the related costs.

When the pressure equipment is classified into PED class I, II, III, or IV, the Manufacturer shall provide an EU Declaration of Conformity for the equipment and shall affix the CE marking on the equipment according to requirements of PED. For pressure equipment governed under sound engineering practice (SEP), the Manufacturer shall issue a Manufacturer's Declaration of Conformity, but the equipment shall not be CE marked.

The selection of Notified Body requires approval by the Purchaser. The Supplier is responsible for arranging design examinations from the Notified Body prior to start of manufacturing when separate examinations are required by the PED module or Enquiry documents.

All removable internals shall be such that they can be removed through the manhole.

The manhole design and location shall be discussed and approved by the Purchaser in order to find the safe access. The minimum size requirement is DN600, unless bigger required by local regulations.

Corrosion allowance shall be defined considering at least 30 years of continuous operation.

3.1.1 Flange connections

Flanges shall be according to EN 1092-1 and shall have a minimum pressure class of at least PN 10, even if the design pressure of the equipment is lower. Nominal pressure classes of the flanges shall be PN 10, PN 16, PN 25, PN 40, PN 63, PN 100, PN 160, PN 250, PN320 or PN400. Gaskets shall be according to project specifications. Hexagon screws and nuts shall be of the metric series, with standard ISO threads, and comply with the standards EN ISO 4014.

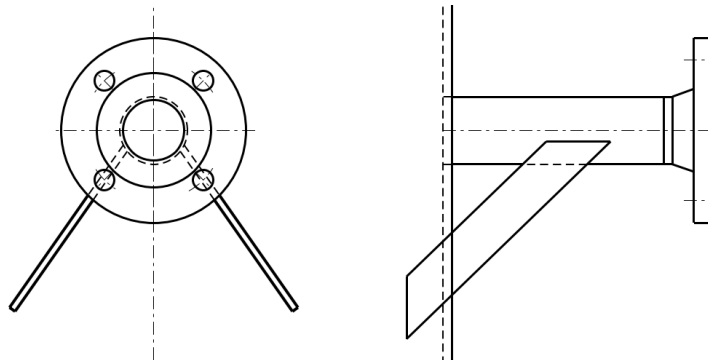
The strength class of the bolts should be in accordance with the design values of the vessel.

3.1.2 Nozzles and openings

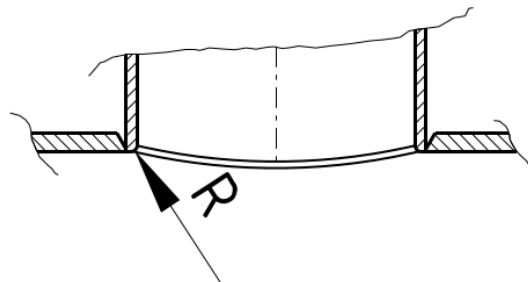
Nozzles shall be designed to carry external loads specified in the Table below, if not otherwise specified or agreed.

DN	PN16		PN25		PN40		PN63		PN100		PN160		PN250	
	F (kN)	M (kNm)	F (kN)	M (kNm)	F (kN)	M (kNm)	F (kN)	M (kNm)	F (kN)	M (kNm)	F (kN)	M (kNm)	F (kN)	M (kNm)
80	2,62	1,14	2,88	1,16	3,32	1,20	3,98	1,27	5,04	1,37	6,77	1,53	9,37	1,78
100	3,43	1,77	3,77	1,81	4,33	1,89	5,20	2,00	6,59	2,19	8,85	2,49	12,25	2,94
125	4,48	2,67	4,92	2,75	5,66	2,89	6,80	3,10	8,62	3,44	11,57	3,99	16,01	4,82
150	5,58	3,69	6,13	3,82	7,05	4,05	8,46	4,40	10,73	4,95	14,40	5,85	19,92	7,20
200	7,88	6,05	8,66	6,34	9,95	6,83	11,95	7,58	15,15	8,79	20,34	10,75	28,13	13,69
250	10,30	8,81	11,31	9,35	13,01	10,24	15,61	11,61	19,80	13,82	26,59	17,40	36,77	22,76
300	12,81	11,96	14,08	12,84	16,19	14,30	19,43	16,55	24,64	20,16	33,09	26,01	45,76	34,79
350	15,42	15,51	16,94	16,84	19,48	19,06	23,38	22,46	29,65	27,93	39,81	36,81	55,06	50,12
400	18,10	19,45	19,89	21,36	22,87	24,54	27,44	29,42	34,80	37,27	46,73	50,00	64,63	69,09
450	20,84	23,80	22,91	26,42	26,34	30,80	31,61	37,50	40,09	48,29	53,83	65,78	74,44	92,02
500	23,65	28,56	25,99	32,04	29,89	37,86	35,87	46,77	45,49	61,11	61,08	84,35	84,48	119,23
550	26,52	33,74	29,14	38,25	33,51	45,77	40,22	57,30	51,00	75,84	68,48	105,91	94,71	151,02
600	29,44	39,36	32,35	45,06	37,20	54,57	44,64	69,15	56,61	92,61	76,02	130,64	105,14	187,70
650	32,41	45,42	35,61	52,50	40,95	64,31	49,14	82,40	62,32	111,52	83,69	158,73	115,74	229,55
700	35,42	51,95	38,93	60,60	44,76	75,01	53,71	97,12	68,12	132,68	91,47	190,35	126,50	276,86
750	38,48	58,94	42,28	69,36	48,63	86,73	58,35	113,37	74,00	156,21	99,36	225,69	137,42	329,91
800	41,58	66,42	45,69	78,83	52,54	99,50	63,05	131,21	79,95	182,21	107,37	264,91	148,49	388,97
850	44,71	74,40	49,14	89,02	56,51	113,37	67,81	150,71	85,99	210,78	115,47	308,19	159,69	454,31
900	47,89	82,90	52,62	99,95	60,52	128,36	72,62	171,94	92,09	242,03	123,67	355,70	171,03	526,20
1000	54,34	101,47	59,72	124,13	68,67	161,90	82,41	219,81	104,50	312,97	140,33	464,04	194,08	690,65

Small nozzles (DN ≤ 50) shall be supported from two directions.



Inner edge of the nozzle or the shell opening edge shall be rounded with a radius of at least 3 mm.



The use of reinforcement plates when design temperature > 250°C shall be avoided.

Reinforcement plates shall be equipped with M6 threaded telltale holes in order to perform air leak test of welds.

Manhole covers shall be equipped with davits.

For nozzles with a reinforcing plate, the nozzle weld shall undergo non-destructive testing in the required scope prior to the placement of the reinforcing plate.

3.2 Materials

All materials shall be new and unused. Materials shall conform to the PED. Use of non-harmonized materials requires a separate approval of the Purchaser. The Manufacturer shall perform Particular Material Appraisals (PMA) for all non-harmonized materials used on pressure bearing parts or bolting materials. The impact toughness requirements of the PED shall be taken into account and included in the PMA.

Earthing lugs, lifting lugs, name plate brackets, foundation bolt templates for skirts, foundation bolts etc. shall be provided as part of the designs. Name plate brackets shall extend over insulation when the equipment is insulated.

All parts welded directly to the pressure bearing parts shall be of the same material as the pressure bearing part – including temporary components and attachments.

Name plate of the vessel shall be of type 1.4404 stainless steel.

3.2.1 Welding filler Materials

Welding filler materials shall be according to WPS / WPQR.

Filler materials – if necessary, in combination with welding consumables – must be suitable for the manufacture of pressure equipment and correspond with the requirements of the conditions of use. The weld metal shall be matched to the basic materials and the material characteristics required for this shall be determined in an additional welding specification.

3.3 Manufacturing

Manufacturing shall follow EN 13445-4.

Before welding, foreign materials such as paint, rust, oil, dirt etc. shall be removed from the groove and its immediate vicinity on both sides. All surfaces to be welded shall be properly cleaned before welding, and the materials shall be dry. All welding shall be performed indoors, unless otherwise agreed with the Purchaser. If any welding is agreed to be performed outdoors, weather proofing shall be applied as required by the weather and welding process.

Attachments of earths shall be such that welding current cannot harm any parts of the vessel. Welding galvanized or zinc painted parts directly on pressure bearing parts is not allowed, even if the coating has been removed.

Flame cutting of stainless materials is not allowed, and on plasma cut stainless steels, the heat affected area shall be removed mechanically before welding.

Stainless steels shall be protected from contamination (being in contact with carbon steels or other low alloyed steels). Tools, grinding discs etc. shall be compatible with stainless steels, and shall not have been used with carbon or low alloyed steels before. Stainless steels shall be protected, when work performed on carbon or low-alloyed steels causes a contamination risk by welding splatter or sparks. Blasting medium used previously for low alloyed materials shall not be reused for stainless materials.

A minimum distance of 50 mm or 2 times shell thickness (whichever is greater) shall be left between two welds, measured from the fusion line. Permanent attachment fillet welds to pressure shell shall be concaving and merging smoothly with the adjoining surfaces.

Shell circumferential or longitudinal welds shall not coincide with nozzles, supports, or the internal or external structures welded to the vessel.

The Supplier shall clarify the adequacy of supervision of their sub-suppliers and shall get acceptance of the Purchaser for it. The sub-suppliers shall be approved by the Purchaser.

3.3.1 Welding

All welders and welding operators shall be qualified according to EN ISO 9606 and EN ISO 14732, respectively.

The Manufacturer shall use welding procedure specifications (WPS) according to EN ISO 15609 on all welding. The WPS shall be qualified by a welding procedure qualification records (WPQR) according to EN ISO 15614, Level 2.

Quality level of welds shall be according to requirements of EN 13445-5 unless more stringent requirements have been specified within this specification or Enquiry documents. Minimum requirement of quality level is quality level C, no undercut allowed.

The quality requirements for welding defined in EN ISO 3834-2 or EN ISO 3834-3 as applicable shall be met.

Equipment related to welding shall be serviced, validated, inspected and measurement devices calibrated yearly. These actions shall be documented such that the action date and servicing instance can be identified for each piece of equipment. Validation date shall be marked on the equipment (e.g. with a sticker). The welders shall have the WPS related to the job with them when performing the welding.

Temperature and moisture shall be measured of the welding filler warehousing area twice a day. The results shall be recorded. A record shall be kept of the handed over welding fillers.

The Manufacturer shall have equipment required to supervise that the welding is performed according to the WPS. The Manufacturer shall make verifiable supervision for the welding. The supervision shall include ensuring, that the welding parameters and conditions (e.g. supervision of measuring of interpass temperatures) are according to the WPS. Supervision plans and reports shall be delivered to the Purchaser for each welder. The Supplier is also responsible for delivering these documents for their sub-suppliers. When the interpass temperature is limited, it shall be measured with a contact thermometer after each pass.

Welds of stainless materials shall be cleaned after welding by pickling, after which they shall be passivated. The welds shall be free of oxidation, discolouration, and slug after the cleaning.

First pass of all stainless materials shall be welded with root shielding gas. Use of backing paste is not allowed.

Interpass temperatures shall not exceed the following:

- Austenitic stainless steels: 150 °C
- Highly alloyed austenitic stainless steels: 120 °C
- Austenitic-ferritic stainless steels ("duplex"): 150 °C
- Highly alloyed austenitic-ferritic stainless steels ("super duplex"): 120 °C.

Minimum weld Preheat temperature is the one used during WPQR [Welding Procedure Qualification Record] qualification. Maximum weld Interpass Temperature is the one used during WPQR qualification. Minimum applicable weldments service temperature for pipes under impact load is the one tested during WPQR qualification.

On all WPQRs used in welding of austenitic-ferritic stainless steels (duplex steels), ferrite content shall have been measured by a metallographic method on weld metal and HAZ on all passes. Ferrite content of the WPQR shall be within a range of 35 % to 65 %. ASTM E562 or other reliable optical methods can be used in the determination.

Immediately after welding, each weld shall be marked with the individual identification mark of the welder. Marking shall be made with a solid marker. The Manufacturer shall keep an up-to-date welding log, where weld numbers, WPS & WPQR reference numbers, welder identification, and dates are presented. The welder identification codes and corresponding names shall be presented on separate list. The Manufacturer shall also keep up-to-date records of all inspections during the manufacturing.

Welds shall be numbered with running numbers in drawings. The Manufacturer shall produce a welding map, where weld numbers and corresponding WPS number of each weld

are presented. The Manufacturer shall provide the welding map, and related manufacturing documentation (WPS, WPQR and manufacturing drawings) for review of the Purchaser before start of manufacturing.

3.3.2 Heat treatment

Requirements of EN ISO 17663 shall be followed.

Temperature during all heat treatments, including post weld heat treatment (PWHT) and pre-heating, shall be monitored at all times by using suitable thermocouples. Placement and number of the thermocouples shall be agreed with the Purchaser and Notified Body before the heat treatment takes place. A heat treatment procedure shall be presented to and reviewed by the Purchaser before the heat treatment takes place. Heating and cooling rates shall be monitored at all times, and shall take requirements of the materials, wall thicknesses and geometry into account.

Time-temperature curves, placement sketch of the vessel relative to the thermocouples and heating elements, and calibration certificates of the used equipment shall be included within the final documentation. Time-temperature curves shall be delivered also in an electronic format, and analogue device graphs shall always be also scanned to a PDF-document. The time-temperature curves shall be traceable to the welds.

Flame heating of the materials shall not be used in any production stage.

3.3.3 Surface treatment

Surface Treatment shall be performed according to specification MM0004, Technical Specification for Surface Treatment and Painting-Metallic Surfaces.

4 Inspections

Inspections and testing shall be performed according to requirements of EN 13445-5 and the Notified Body, taking the additional welding quality requirements defined in section 3.3.1 into account.

The Manufacturer shall prepare an NDT plan, which shall be sent to the Purchaser for comments and review before start of manufacturing. The plan shall include inspection methods, scopes and acceptance criteria for each weld using the same weld numbers as in the welding log. Acceptance criteria are listed in the following Table:

Method	Visual Inspection (VT)	Penetrant Testing (PT)	Magnetic Particle Testing (MT)	Radiographic Testing (RT)	Ultrasonic Testing (UT)	Time of flight diffraction Technique (TOFD)	Phased array ultrasonic technique (PAUT)
Inspection procedure	EN 17637	EN ISO 3452-1	EN ISO 17638	-	-	-	-
Acceptance criteria	EN ISO 5817 Quality level B or C	EN ISO 23277 Acceptance level 2X.	EN ISO 23278 Acceptance level 2X.	EN ISO 10675-1 Acceptance level 1, Quality Level B per ISO 5817 & EN ISO	EN ISO 11666 Acceptance level 2 for Quality Level B & Acceptance level 3 for	EN ISO 15626 Acceptance level 1 for Quality Level B & Acceptance level 2 for	EN ISO 19285 Acceptance level 2 for Quality Level B & Acceptance level 3 for

				10675-1 Acceptance level 2 Quality Level C per ISO 5817	Quality Level C	Quality Level C	Quality Level C"
Radiographic techniques	-	-	-	EN ISO 17636-1 – Class B:	-	-	-
Testing technique and level	-	-	-	-	EN ISO 17640 at least B for Quality Level B & at least A for Quality Level C	EN ISO 10863 C for Quality Level B & at least B for Quality Level C	EN ISO 13588 B for Quality Level B & A for Quality Level C

All non-destructive testing (NDT) shall be performed after the heat treatments (if applicable).

The Supplier shall, on request, arrange free access for the Purchaser on the manufacturing, warehousing and erection sites, and shall present all quality, manufacturing and inspection/testing documentation to the inspector of the Purchaser. The Purchaser has the right to visit the sites to inspect progress or quality, witness the tests or to perform additional tests. The Supplier shall ensure these rights also apply towards their sub suppliers.

There shall be a certified welding engineer on site, in case pressure vessels are assembled by welding directly at the Purchaser site (plant, mill).

NDT reports and certificates shall be stamped by the performing inspection agency and shall include signatures of the inspectors.

The Supplier is responsible to advise the Purchaser of inspections and tests at least 3 weeks prior to the planned date for execution. Quality plan and inspection and testing plan (ITP) shall be delivered to the Purchaser for comments and review before beginning the manufacturing.

The above-mentioned measures do not free the Supplier from the responsibility concerning quality and timing of the work.

The Supplier's responsibility is to correct all faults in the inspections at his own expense. In case the inspection has required the dismantling of completed work and the fault has been found, the Supplier is responsible for all expenses due to these measures.

4.1 NDT personnel

NDT personnel shall be qualified according to EN ISO 9712, minimum level 2. The inspection agency shall have an audited quality system.

4.2 Pressure test

Hydrostatic pressure test shall be performed according to requirements of PED and EN 13445-5. Holding time of the pressure test shall be at least one hour. After the test, the equipment shall be thoroughly drained and dried. A pressure graph shall be recorded with a graphic plotter and attached to the quality control book.

Reinforcement plates with telltale holes shall be tested with 1,5 bar(g) clean air and soap water. A record shall be made from the test. Telltale holes shall be plugged after the test.

Gaskets of nozzles (incl. manway) opened after their installation shall not be reused.

4.3 Positive Material Identification

Positive material identification (PMI) shall be performed for metals having nominal alloying maximum of chrome, nickel or molybdenum greater than 1 wt.% in the material standard, or when the metallic material is not ferritic steel. PMI does not have to be performed for standard austenitic stainless steels SS304/304L and SS316/316L, if not otherwise specified in enquiry documents. PMI shall be performed on a portable X-ray fluorescence or laser based devices. Records shall be kept of the PMI tests. Testing scope shall be 5 % of the materials exceeding the composition limits.

4.4 Ferrite content measurements of austenitic-ferritic steels

Ferrite contents of welds shall be measured on duplex and super duplex steels by Ferritescope. Scope of testing shall be 10 % of welds. Acceptance criteria shall be equivalent to what has been defined for ferrite content in WPQRs in section 3.3.1.

5 Insulation

Insulation support rings and pins shall be part of the equipment delivery and shall be designed such that water cannot accumulate under the insulation. All welding required by the insulation shall be welded by the Manufacturer. The insulation contractor shall not perform any welding on the equipment.

The standard MM0005 Technical Specification for Thermal Insulation shall be followed.

6 Documentation

The documentation shall be provided as a physical set of quality control book with cardboard dividers. Additionally, the quality control book shall be delivered as an electronic file in .pdf format, which includes electronic bookmarks for each main section described before. The final documentation shall also contain the drawings in native formats. The index page and arrangement of the folders in the quality control book shall follow the document list below.

The Supplier is responsible to deliver the documentation required by the Governmental authorities, stamped by supplier and translated to local language.

The book delivered to the Purchaser shall include at least the following documents:

- Index
- EU Declaration of Conformity (PED classified equipment) / Manufacturer's Declaration of Conformity (SEP classified equipment)
- EU Certificate of Conformity
- EC Design examination report signed by Notified Body (PED classified equipment)
- Manufacturing drawings and part lists

- As Built drawings
- Design calculations including allowable loads on nozzles
- QA/QC plan
 - Inspection and testing plan (ITP)
- NDT
 - X-ray inspection chart and records (including original traceable radiographs)
 - Other NDT inspection charts and records
 - Qualification records of the NDT inspectors
- Welding book
 - Welding map & weld list
 - All WPSs and WPQRs
 - Qualification records of welders and welding operators
- Production test records
- Heat treatment records and certificates
- Pressure test report & procedure
- Telltale hole test report
- Material chart and material certificates
- Material certificates of welding fillers
- PMAs
- PMI reports
- Record of marking and nameplate details (rubbing, photography or other)
- Painting certificate
- Risk assessment and analysis (PED classified equipment)
- Non-Conformity Reports (NCR), approved by the Notified Body and Purchaser
- Installation, operation and maintenance instructions in local language
- Equipment list

6.1 Material certificate

Material certificates of all pressure bearing materials shall be according EN 10204 type 3.1, when the material manufacturer has an ISO 9001 quality system covering material manufacturing accredited within the European Community. In other cases, the material certificates shall be according to EN 10204 type 3.2.

Material certificates of welding fillers shall be according to EN 10204 type 3.1.

EN 10204 type 2.2 material certificates shall be provided for:

- Bolts, nuts and studs
- Non-pressure bearing materials
- Gaskets
- Supports

EN 10204 type 2.1 material certificates shall be provided for:

- Non-metallic gaskets
- Other non-metallic materials