

ICS 25.020

Supersedes
SN 200-6:2016-05**Table of contents**

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Introduction

The manufacturing requirements specified in this part of SN 200 are used to achieve the relevant SMS product quality. Consequently, these requirements must always be satisfied unless otherwise stipulated in drawings, purchase order documents, and/or other manufacturing documents. This standard is indicated as a binding document in drawings (title blocks), contracts and/or purchase order documents. If the requirements cannot be fulfilled, SMS group must be consulted.

1 Scope

This company standard specifies for SMS group the requirements for pre-assembling products in manufacturing shops, dismantling them for shipment, and finally assembling and installing them.

2 Normative references

The following documents, which are quoted here either in whole or in part, are required for the application of the present document. Dated references refer only to the dated edition indicated. Undated references refer to the most recent edition of the respective document including all revisions.

DIN 51524-2:2017-06	Pressure fluids – Hydraulic oils – Part 2: HLP hydraulic oils; minimum requirements
DIN EN 1090-2:2018-09	Execution of steel structures and aluminum structures – Part 2: Technical requirements for steel structures
DIN EN 1092-1:2018-12	Flanges and their joints – Circular flanges for pipes, valves, fittings and accessories, PN designated – Part 1: Steel flanges
DIN EN ISO 4413:2011-04	Hydraulic fluid power – General rules and safety requirements for hydraulic systems and their components
DIN EN 10305-1	Steel tubes for precision applications – Technical delivery conditions – Part 1: Seamless cold-drawn tubes
DIN EN 10305-2	Steel tubes for precision applications – Technical delivery conditions – Part 2: Welded cold drawn tubes
DIN EN 10305-3	Steel tubes for precision applications – Technical delivery conditions – Part 3: Welded cold sized tubes
DIN EN 10305-4	Steel tubes for precision applications – Technical delivery conditions – Part 4: Seamless cold-drawn tubes for hydraulic and pneumatic power systems
DIN EN 10305-5	Steel tubes for precision applications – Technical delivery conditions – Part 5: Welded cold sized square and rectangular tubes
DIN EN 10305-6	Steel tubes for precision applications – Technical delivery conditions – Part 6: Welded cold drawn tubes for hydraulic and pneumatic power systems
DIN EN 13480-4:2017-12	Metallic industrial piping – Part 4: Fabrication and installation
DIN EN ISO 12944-4:2018-04	Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Types of surface and surface preparation
DIN EN ISO 13920:1996-11	Welding – General tolerances for welded constructions – Dimensions for lengths and angles; shape, and position
DIN EN ISO 13715:2020-01	Technical product documentation – Edges of undefined shape – Indication and dimensioning
ISO 4406:2017-08	Hydraulic fluid power – Fluids – Method for coding the level of contamination by solid particles
SN 180-1:2019-11	Equipment, lubricating grease
SN 200-1	Manufacturing instructions; Requirements and principles
SN 200-7	Manufacturing instructions; Corrosion protection
SN 200-8	Manufacturing instructions; Inspection
SN 403	Pretensioning and operating forces for bolted joints
SN 507:2012-09	Gluing
SN 624-3	Flanges for pipelines and hoses; Complete flanges, reducing and blind flanges
SN 696	Piping support

3 Terms and definitions

The following terms and definitions are valid for the application of this company standard.

3.1

Assembly/installation

Assembly is the permanent joining or other means of fitting together two or more workpieces of a defined geometrical shape; it includes all handling and auxiliary procedures as well as measuring and checking/inspecting.

3.2

Dismantling

Taking pre-assembled, partly assembled or fully assembled units apart into their component parts and/or assemblies.

3.3

Disassembling [DIN 8591:2003-09]

Cutting/separating previously joined workpieces of a geometrically defined shape or of workpieces of a geometrically defined shape and filled-in amorphous material without causing damage to the workpieces.

NOTE

Disassembling is the reverse of the joining process specified in DIN 8593-0. The restriction that applies here is that joined parts cannot always be separated by disassembling them, because some joining methods only allow joined parts to be cut or separated by destroying or damaging the parts themselves (refer to DIN 8593-0). Irrespective of this, the number of methods of disassembly is lower than that for joining methods, because disassembling methods in many cases are not distinguished to the same degree as joining methods.

4 Safety instructions

The safety instructions and specifications concerning hazardous materials and environmental protection given in [SN 200-1](#) shall always be followed.

When using load lifting equipment (e.g. cross-beams, clamps, etc.) and/or attachment devices (e.g. plastic slings, endless ropes, lifting straps, etc.), the safety instructions, scope of application and/or field of utilization of the respective standard or manufacturer must always be observed.

5 Assembly/installation

5.1 Preparation

All parts shall be deburred (free of burrs according to [DIN EN ISO 13715:2020-01](#)) and cleaned. All surfaces shall be properly dressed before assembling. Holes used for conveying fluids shall be illuminated, residues removed, and cleaned (e.g. using compressed air) to check the correct passage of gas. The parts shall be assembled on a base surface that corresponds to the future supporting surface and complies with the accuracy required for the inspections to be made. The static and dynamic loads shall be taken into account. Components may only be assembled after the individual parts have been inspected.

For pipelines and vessels without a manhole (no inspection opening), cleanliness level *Be* as specified in [DIN EN ISO 12944-4:2018-04](#) is required on the inner surfaces. Pickling is followed by flushing. Pickling and flushing residues are removed by blowing them out with compressed air. The component must then be dried and passivated.

For central and oil film bearings, water and compressed air systems, cleanliness level *Sa* 2½ and for hydraulic tanks, cleanliness level *Sa* 3 according to [DIN EN ISO 12944-4:2018-04](#) is required.

Note:

Pickling and passivating shall not be carried out on:

- Pipes made with precision steel tubes according to [DIN EN 10305-1 to 6](#) that have been neither welded nor heat-treated (e.g. pipes in conjunction with cutting ring couplings or similar methods, e.g. WALFORM; see [SN 888](#)).
- Pipes that have undergone welding or heat treatment with specific protection against atmospheric oxygen (e.g. by means of forming gases) and do not exhibit any oxidation or scale buildup.

5.2 Mechanical units

5.2.1 Basic specifications

For assembly work (e.g. of wear plates, couplings, bushings etc.), the bonding, lubricating and sealing instructions from the manufacturers must be followed. On assembled parts and machined surfaces, the maximum surface contact area should be aimed for. The specified fitting clearances and contact patterns shall be considered, applied, and documented. The geometrical tolerances for assembling machine components must be complied with in accordance with section 7.2.

5.2.2 Screws/bolts

As a rule, screwed/bolted joints must be tightened using the standard tightening procedures for assembly work according to [SN 403](#) and secured e.g. with Loctite 243 or Delo 5249 according to [SN 507:2012-09](#).

If torque or pretensioning values are explicitly specified on the drawing, the screws/bolts are not secured with glue.

Tightening torques indicated in the manufacturing documents must also be applied for part assembly for finish machining.

5.2.3 Shrink fitting

For the shrink fitting or removal by shrinking of bearings, couplings and other parts, the manufacturers' installation instructions and the maximum permissible heating and undercooling temperatures must be observed. This applies in particular to quenched and tempered as well as to hardened components.

5.2.4 Lubrication

Grease bearing points and grease lines shall be delivered with initial fill. All components requiring lubrication shall be properly provided with sufficient quantities of one of the lubricants recommended in [SN 180-1:2019-11](#) following consultation with SMS group.

5.2.5 Hydraulics

If a hydraulic unit is used to effect movements, the required purity of the hydraulic fluid must be ensured; the minimum degree of purity is 16/14/11 acc. to [ISO 4406:2017-08](#). A hydraulic fluid with a different degree of purity may only be used following consultation with SMS group.

As a minimum requirement, the hydraulic fluid shall fulfill the properties of an HLPD according to [DIN 51524-2:2017-06](#) (e.g. Renolin MRX 46).

5.2.6 Corrosion protection

Areas that are no longer accessible after assembly must be provided beforehand with permanent corrosion protection in accordance with the specification in the manufacturing documents.

Unless specified in the manufacturing documents, permanent corrosion protection shall be provided according to [SN 200-7](#).

Unless otherwise specified in the manufacturing documents, all exposed worked contact and functional surfaces, except those intended for shrink joints, shall be provided with temporary corrosion protection according to [SN 200-7](#) prior to assembly.

5.3 Fluid-carrying units

5.3.1 Basic specifications

The locations of the pipelines, line components and line supports (SN 696) are shown on drawings. Deviations are allowed only if agreed with the design department. For pipework that is not fully dimensioned and has to be fitted during assembly, the following shall be taken into account:

- Functionally correct installation of the pipework according to the general arrangement drawing, pipework or P&I (piping and instrumentation) diagram
- Functionally correct installation of valves/fittings, taking accessibility into account
- Appropriate pipework arrangement and routing for easy assembling and disassembling
- Stress-free installation of pipelines according to DIN EN 13480-4:2017-12
- The space required for hydraulic pretensioning units (e.g. for anchor bolts, gear bearing bolts)

The general tolerances for the installation of pipelines are specified in section 7.3. Prior to their final installation, clean pipes and fluid-carrying components to remove all impurities (dirt, chips, welding spatter, paint, etc.) adhering to the inside surface.

5.3.2 Couplings and flanges

When installing pipe couplings, the cleanliness and lubrication of the thread must be ensured, and the suppliers' installation instructions must be followed. If stainless steel pipe couplings are used, the thread and the surface of the union nut in contact with the welding cone shall be provided with a sufficient quantity of lubricant (e.g. "Fett-Micro-Gleit GP 350" made by Micro Gleit, or any other lubricant approved by SMS group), to prevent the couplings from seizing. If flanges made of two different materials are used, the parts remaining on the pipe (flanges and welding collar) must always be made of an equivalent pipe material for pickling-related reasons. For all piping components that can be removed before pickling (split SAE flanges/split flanges etc.), the use of surface-treated (galvanized, chromalized or nickel-plated) steel is allowed. The bolt holes of pipelines and fittings shall be arranged according to 0 so that they are symmetrical to the two main axes and that no bores are made in them; see DIN EN 1092-1:2018-12. Every flange shall be provided with a number of bolt holes that can be divided by four. The screwed/bolted joints of the flanges must be made in accordance with the specifications in the manufacturing documents, the manufacturer's specifications, and/or relevant standards.

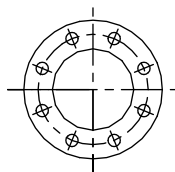


Fig. 1 – Flange

5.3.3 Sealing of couplings and threaded fittings

When male stud couplings with front-side elastic seal are used, no sealing agents shall be applied in addition.

No copper seals may be used to seal male stud couplings.

In exceptional cases, couplings and threaded fittings without front-side elastic seals shall be sealed in the low-pressure range ≤ 1.6 MPa with Omnifit 50H (made by Henkel), in the high-pressure range > 1.6 MPa with AVX No. 586 (made by Loctite) or equivalent sealing compounds.

Couplings sealed with AVX can be disconnected only by the introduction of heat (flame); for this reason AVX shall not be used for pipelines that convey flammable fluids. Couplings in grease pipelines shall not be provided with additional sealing.

5.3.4 Connecting holes

To avoid contamination of the control elements, all connecting holes (of valves, measuring instruments, cylinder ports, valve block connections etc.) shall be kept closed with appropriate means like disks, caps, adhesive tape etc. until final assembly. Connecting holes opened for reasons of installation or inspection shall be closed again immediately after installation/inspection.

5.3.5 Arrangement of fastening elements

Pipework shall be installed in such a way that the distance between two fasteners does not exceed the values in Table 1. Fastenings shall always be used immediately near detachable connections and pipe bends.

When pipe clamps are welded on, they shall be provided with a fillet weld of $a = 0.3 \times$ smallest plate thickness. Grease pipelines of outside diameters up to and including 10 mm shall be fastened to the machine without clearance using appropriate pipe clamps.

Table 1 – Distances

Pipe outside \varnothing	Max. distance in m
≤ 10	0.6
$> 10 \leq 38$	1.5
$> 38 \leq 88.9$	2.5
> 88.9	3.0

6 Dismantling

6.1 Basic specifications

The transportability of the units is decisively influenced by the degree of disassembly. It shall be borne in mind that disassembly must finally lead to obtaining transportable units.

6.2 Mechanical units

Such equipment should only be disassembled to the required extent. Screws/bolts and shims shall be left on the components provided that this does not cause problems for shipment.

Prior to disassembling, parts likely to be mixed up (e.g. pipe supports, split covers, split housings etc.) shall be provided with permanent and well visible marking using steel stamping letters or figures.

6.3 Fluid-carrying units

Such equipment should only be disassembled to the required extent. For pipework operated with oxygen, it shall be ensured that it is totally free of oil and grease.

In accordance with [DIN EN ISO 4413:2011-04](#), the lines and associated line connections of hydraulic systems that must be disassembled for transport and that may pose a hazard if not properly reconnected must be clearly marked. The marking must comply with the specifications in all relevant drawings.

The pipelines and fluid-carrying components must then be closed in such a way that they cannot be re-contaminated and that no fluid (e.g. hydraulic oil used during the trial run) can escape.

For this purpose, e.g. for SAE flanges, a gasket plus cover can be provided; for C-flanges, a plastic flange cover can be provided.

Plastic caps may be used on ends without flanges and pipe couplings. Pipelines with couplings on the end shall be sealed with plastic screw-in caps or screw plugs and plug cones (if there is oil in the line).

Steel tubes for precision applications shall be closed with closing elements with 24° inside cone or with sealing plugs.

7 Inspection of assembled units

7.1 Basic specifications

The scope of inspection for assembled units shall be agreed with the SMS group department of quality inspection, see [SN 200-8](#).

The manufacturer shall draw up records of all checks/inspections carried out.

As far as applicable and feasible, the minimum requirement is the examination of:

- the tolerances on shape and position for assembled units;
- the general tolerances for pipelines;
- the supporting and seating surfaces, connecting and takeover points;
- clearances and contact patterns to be adjusted;
- surface contact percentages (with 0.05 mm feeler gauge);
- movements and traveling distances (with auxiliary drives if necessary);
- cylinder strokes (using suitable hydraulic power units);
- corrosion protection, see [SN 200-7](#).

7.2 Shape and position tolerances for assembled units

The tolerances in Table 2 are related to the indicated reference length or relevant overall length of the components.

Tolerance class medium (m) is the SMS group standard tolerance class. The SMS group-specific indication of the level condition is shown in Table 3, for the vertical refer to Table 4. The tolerances for assembled components that are subject to the Construction Products Regulation [305/2011 EUV](#) are given in [DIN EN 1090-2:2018-09](#) / Annex B.

Table 2 – Shape and position tolerances

Property	Tolerance class			
	Very fine (sf)	Fine (f)	Medium	Coarse (g)
Axial alignment	0.03	0.1	0.2	0.5
Angularity				
Parallelism				
Perpendicularity	0.05			
Straightness				
Flatness				
Level condition				
Vertical				

Table 3 – Level condition

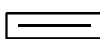
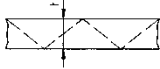
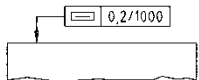

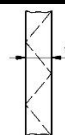

Symbol	Tolerance zone definition	Drawing indication	Explanation
			The tolerated horizontal line shall lie between two horizontal lines which are $t = 0.2$ mm apart. When no reference length is indicated, reference is always made to the relevant overall length.

Table 4 – Vertical line

Symbol	Tolerance zone definition	Drawing indication	Explanation
			The tolerated vertical line shall lie between two vertical lines that are $t = 0.2$ mm apart. When no reference length is indicated, reference is always made to the relevant overall length.

7.3 General tolerances for pipelines

With pipework that is not fully dimensioned and installed openly, the focus is placed on guaranteeing its full functionality. All untoleranced dimensions are subject to accuracy classes C and F according to Table 5 through Table 7; extract from [DIN EN ISO 13920:1996-11](#). For fully dimensioned pipelines (e.g. pipe detail drawings, isometric drawings), accuracy classes B and F according to Table 5 through Table 7 apply to all untoleranced dimensions; extract from DIN EN ISO 13920:1996-11.

Table 5 – Tolerances on linear dimensions (external, internal and stepped dimensions)

Tolerance class	Nominal dimension range										
	2 to 30	> 30 to 120	> 120 to 400	> 400 to 1,000	> 1000 to 2000	> 2000 to 4000	> 4000 to 8000	> 8000 to 12000	> 12000 to 16000	> 16000 to 20000	> 20000
B	± 1	± 2	± 2	± 3	± 4	± 6	± 8	± 10	± 12	± 14	± 16
C	± 1	± 3	± 4	± 6	± 8	± 11	± 14	± 18	± 21	± 24	± 27

Table 6 – Angular dimensional tolerances

Tolerance class	Nominal dimension range (length of the shorter leg, see SN 200-4, section 8.3)					
	Up to 400	> 400 to 1000	> 1000	Up to 400	> 400 to 1000	> 1000
	Permissible deviations in degrees and minutes			Permissible deviations in tangent values		
B	$\pm 45'$	$\pm 30'$	$\pm 20'$	0.013	0.009	0.006
C	$\pm 1^\circ$	$\pm 45'$	$\pm 30'$	0.018	0.013	0.009

Table 7 – Straightness, flatness and parallelism tolerances

Tolerance class	Nominal dimension range (longer lateral length of the surface)									
	> 30 to 120	> 120 to 400	> 400 to 1,000	> 1000 to 2000	> 2000 to 4000	> 4000 to 8000	> 8000 to 12000	> 12000 to 16000	> 16000 to 20000	> 20000
F	1	1.5	3	4.5	6	8	10	12	14	16

Bibliography

305/2011 EUV	Regulation laying down harmonized conditions for the marketing of construction products and repealing Council Directive 89/106/EEC
DIN 8591:2003-09	Manufacturing processes disassembling – Classification, subdivision, definitions
DIN 8593-0	Manufacturing processes joining – Part 0: General; Classification, subdivision, terms and definitions

Revisions

Amendments made in comparison with [SN 200-6:2016-05](#):

Editorial revisions	New introduction added Updated normative references;
Section 4	Safety instructions for load lifting equipment extended;
Section 5.1	Cleanliness of pipelines added;
Section 5.2.2	Section completely revised;
Section 5.2.4	Consultation with SMS group added;
Section 5.2.5	Degree of purity revised from 15/14/11 to 16/14/11; "A hydraulic fluid with a different degree of purity may only be used following consultation with SMS group." added;
Section 5.3.2	Note on screwed/bolted joints on flanges added;
Section 6.3	Marking of lines and associated line connections of hydraulic systems added; The sealing/closing of pipes has been defined more clearly;
Section 7.2	Symbol for the vertical line added

Previous editions

SN 200:1971-09, 1975-11, 1978-01, 1981-01, 1985-01, 1992-03, 1996-03, 1999-09, 2003-09, 2007-02, 2010-09
SN 200-6:2016-05