



Weldments Steel

Technical terms of delivery

GN9000

1 – Range of application

This standard applies for all weldments from **steel** that can be produced according to the drawings of GROB-WERKE.

2 – Data on the drawing and order

However, any data provided on the drawing or order that deviates from this standard shall govern in all cases.

The requirements of GN9000 apply for all non-defined, graphic weld seam data.

All weld seam data additionally defined in the drawing must be indicated by weld seam symbols in accordance with DIN EN ISO 2553.

If these symbols in accordance with DIN EN ISO 2553 fail to specify a defined welding process (e.g. resistance spot welding or stud welding), the process according to the number code indicated on the drawing shall apply here.

The scope of delivery stated on the order concerned must be respected.

The technical terms of delivery shall be entered above the drawing title block and in the order, stating the code for the welding process according to Table 1, the reference figure for the basic delivery condition according to Table 2, the reference figure for the additional option delivery condition according to Table 3 and the code for component stress according to Table 4 as follows:

Example:

- *Welding process:* Shielded gas arc welding, any SG process
- *Basic delivery condition:* Welded, welding debris removed
- *Additional option delivery condition:* None
- *Component stress:* Normal

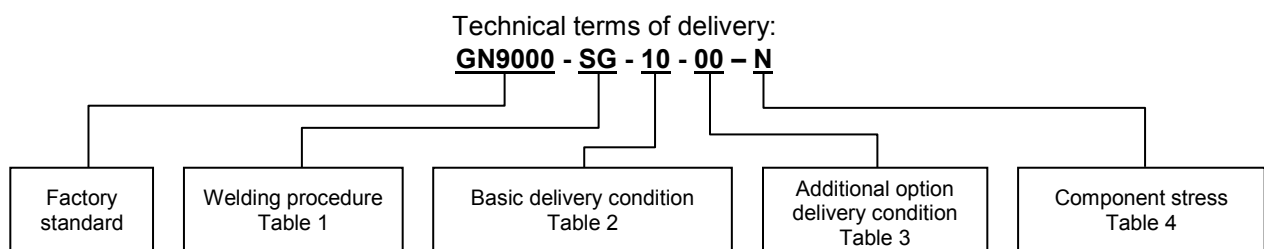


Table 1: Codes for the welding procedure

Code	Welding procedure
A	Acetylene welding
kE	Manual arc welding
SLS	Shielded gas arc welding; any SG process (GROB standard)
MAG	Shielded gas arc welding - metal - active gas
MIG	Shielded gas arc welding - metal - inert gas
TIG	Shielded gas arc welding - tungsten - inert gas
UP	Submerged arc welding
Z	As indicated on the drawing

Standardization

Table 2: Reference figure for the basic delivery condition

Reference data	Basic delivery condition
10	Welded, welding debris removed
13	Welded, welding debris removed, all sides primed as per Section 12
16	Welded, welding debris removed, all sides primed as per Section 12 and tested for tightness in the marked region (see drawing data)
18	Welded, welding debris removed, all sides primed and tested for tightness in the marked region (see drawing data)
20	Welded, welding debris removed, stress-relieved
23	Welded, welding debris removed, stress-relieved, all sides primed as per Section 12
26	Welded, welding debris removed, stress-relieved, all sides primed as per Section 12 and tested for tightness in the marked region (see drawing data)
28	Welded, welding debris removed, stress-relieved and tested for tightness in the marked region (see drawing data)
99	As stated on the drawing or order

Table 3: Reference figure for the additional option delivery condition

Reference data	Additional option delivery condition
00	None
01	Blasted
02	Vibrated
03	Blasted, vibrated
04	Temper colors removed
05	According to Steel Tub Directive (StaWaR)*
06

* Item 05 serves primarily to fulfil specific requirements in accordance with WHG [Federal Water Act].

Table 4: Code for component stress (see GN9001)

Code	Component stress
H	Up
N	Normal (GROB standard)

If no data for the technical terms of delivery are given on the drawing and/or the order, consultation with the customer is required.

3 – Order release on initial delivery

At GROB-WERKE, special raw weld part drawings are created. The welding supplier is responsible for preparing the documentation required for its production processes. Including:

- Flame-cutting drawing
- Workshop drawing
- Data on weld seam preparation (specified by GROB-WERKE, see Section 5)
- Welding sequence plans for minimizing shrinkage distortion and stress concentration

In principle, the welding supplier must provide **written** report on any required modifications to the design, number or position of the weld seams to the customer's Purchasing department at the time of order. Such modifications are permitted only following written approval by the customer. If the approval is not obtained by the welding supplier, the supplier shall be liable for the costs incurred by GROB-WERKE in the full amount.

4 – Materials

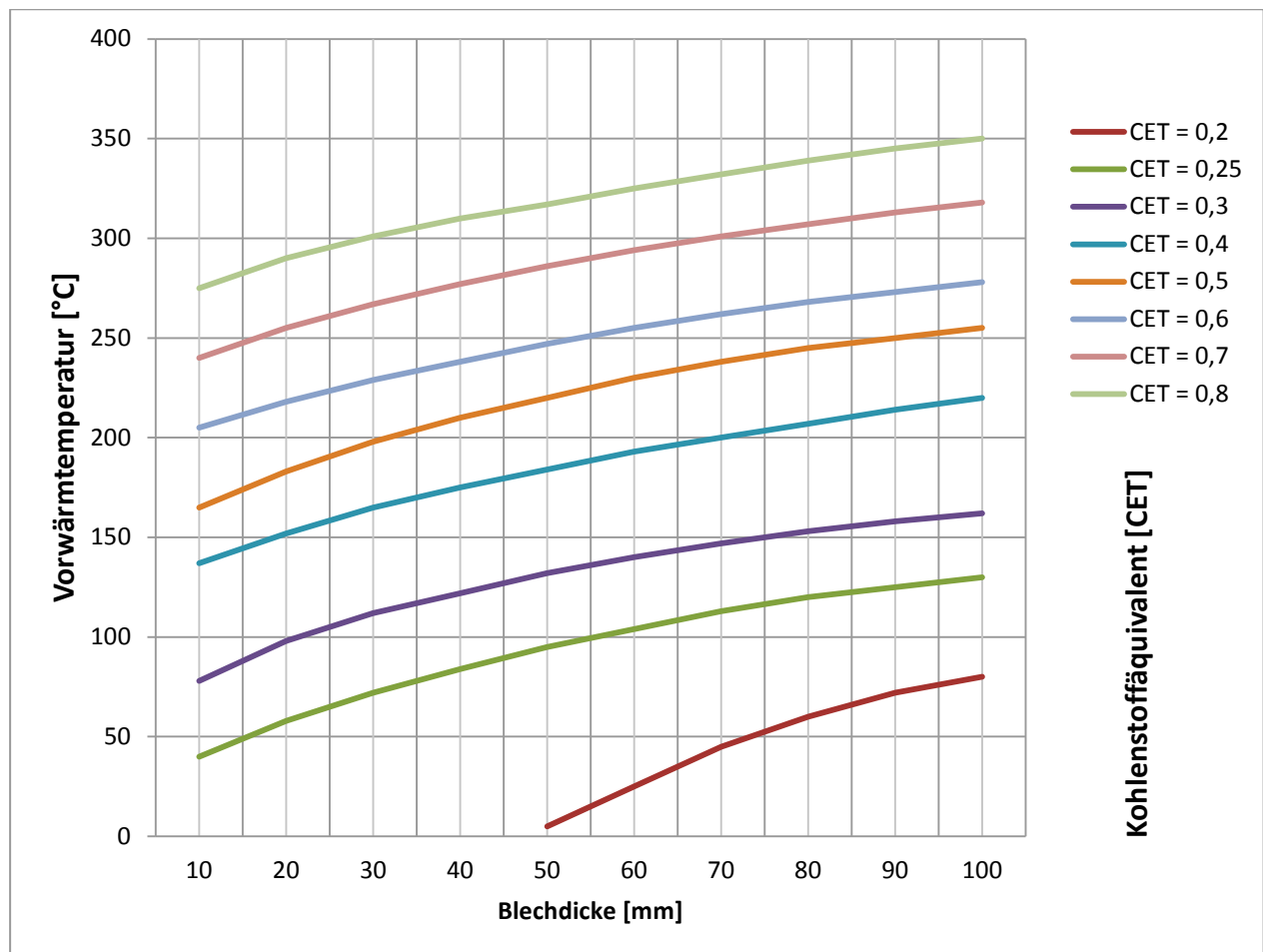
The material used must conform to the drawing data.

In the case of materials to DIN EN 10025-1 and DIN EN 10025-2 for non-alloy steels where $C > 0.25\%$, for alloy steels with a carbon equivalent ≥ 0.2 and also for welds at an ambient temperature below $10\text{ }^{\circ}\text{C}$, the base material must be preheated to room temperature (approx. 20°).

Pre-heating is also required for designs with large wall thicknesses or cross-section differences, or if a high residual stress is expected due to shrinkage prevention.

The pre-heat temperatures must be selected in dependence of the respective carbon equivalent of the base material and the material thicknesses. Data and values on the respective carbon equivalent are stated in the material products (e.g. 3.1B - Certificate in accordance with EN 10204).

The following pre-heat temperatures in accordance with the table must be respected:



5 – Weld seams

Unless otherwise indicated on the drawing, all seams must be welded continuously and on both sides wherever possible. (GROB standard)

In case of access from one side, continuous welding is required. (see Section 5.1–5.6)

Any required deviations shall be indicated on the drawing.

Welding the vertical-down welds is not permitted at a material thickness of $t > 3\text{ mm}$.

In accordance with the welding processes indicated on the drawing and the materials to be used, the supplier must use suitable welding filler materials approved according to the applicable standards.

Weld seams near to surfaces to be machined at a later time must be set sufficiently deep so that, after machining the seam thickness as a retaining or supporting seam, as well as a sealing seam, meet the requirements of 5.1–5.6 (see Section 6).

Unless otherwise specified on the drawing, evaluation group for the weld seam irregularities:

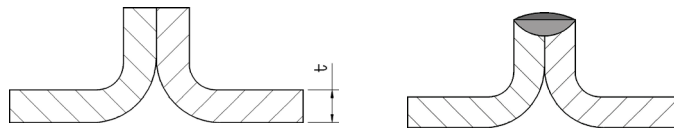
DIN EN ISO 5817 evaluation group C

Unless otherwise specified on the drawing, the following seam forms and the associated seam preparation shall be applied and executed:

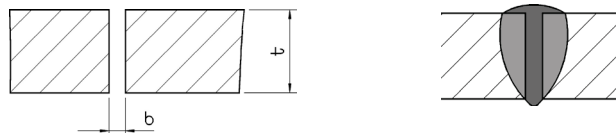
5.1 – I-butt joint

5.1.1 – Accessible from one side

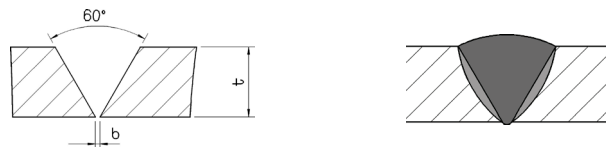
Thin metal sheet
 $t = 0-2 \text{ mm}$



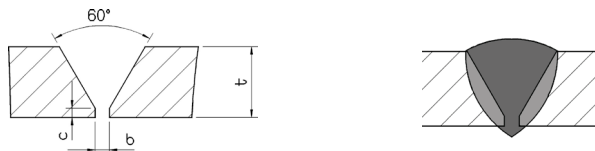
Thin metal sheet
 $t = 0-4 \text{ mm}$
 $b = \frac{t}{2}$



V-weld
 $t = 4-12 \text{ mm}$
 $b = 2 \text{ mm}$

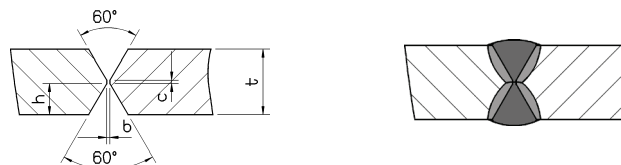


Y-butt weld
 $t = 14-40 \text{ mm}$
 $b = 2-4 \text{ mm}$
 $c = 2-4 \text{ mm}$

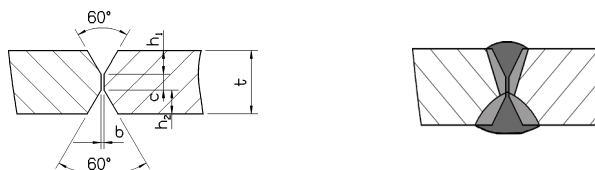


5.1.2 – I-Butt joint accessible from both sides

DV-seam
 $t = 10-15 \text{ mm}$
 $b = 2 \text{ mm}$
 $c = 2-4 \text{ mm}$



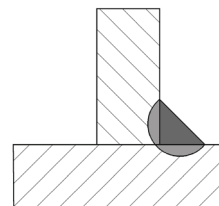
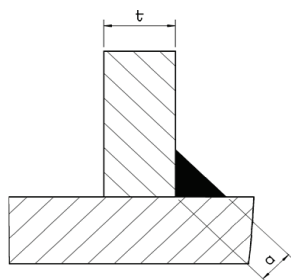
DY-seam
 $t = 15-40 \text{ mm}$
 $b = 2-4 \text{ mm}$
 $h_1 = h_2 = c = \frac{t}{3}$



5.2 – T-butt joint, fillet welds

5.2.1 – One-sided

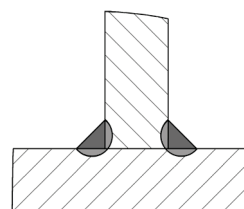
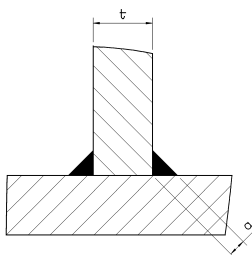
fillet weld
 $a = 0.5 \times t_{\min}$



5.2.2 – Two-sided

Double fillet weld

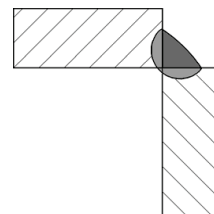
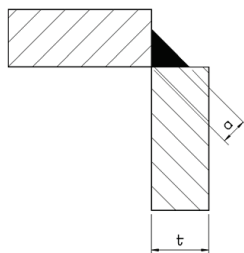
$t \leq 10 \text{ mm}$
 $a = 0.4 \times t_{\min}$
 $t > 10 \text{ mm}$
 $a = 0.3 \times t_{\min}$



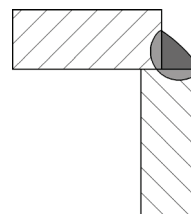
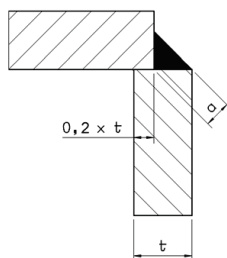
5.3 – Corner joint

5.3.1 – One-sided

$t \leq 10 \text{ mm}$
 $a = 0.5 \times t_{\min}$

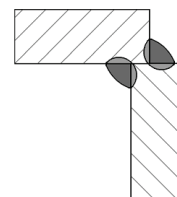
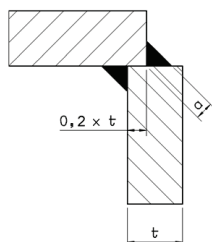


$t > 10 \text{ mm}$
 $a = 0.5 \times t_{\min}$



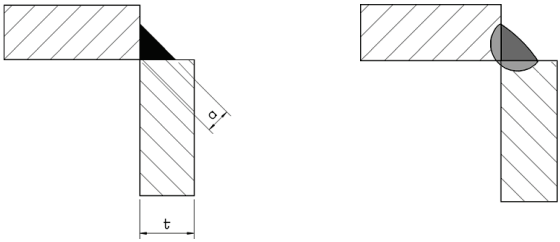
5.3.2 – Two-sided

$a = 0.3 \times t_{\min}$



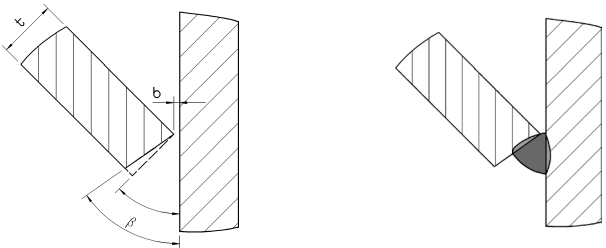
5.3.3 - Angle joint, bent part

$a = 0.5 \times t_{\min}$

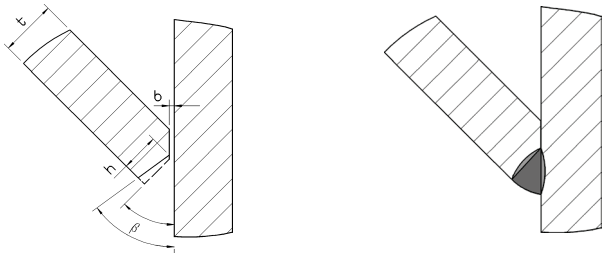


5.4 – Scarf joint

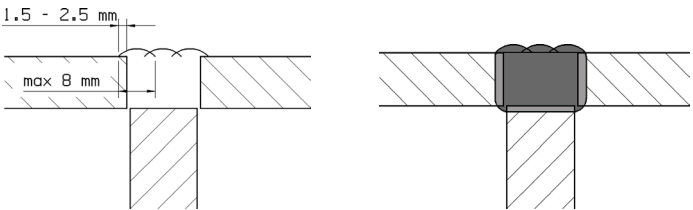
$t \leq 15 \text{ mm}$
 $a = 0.5 \times t_{\min}$
 $b = 0-2 \text{ mm}$
 $\beta = 60^\circ$



$t > 15 \text{ mm}$
 $b = 0-2 \text{ mm}$
 $\beta = 60^\circ$
 $h = \frac{2}{3}t$



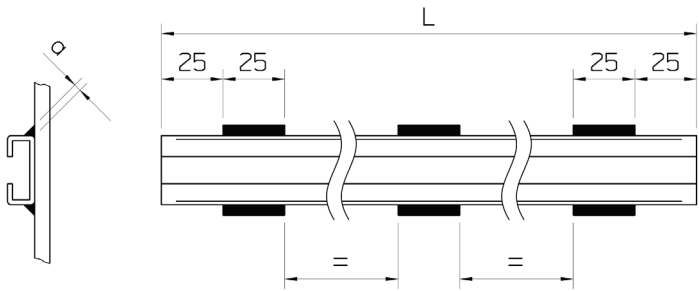
5.5 – Slot welds



5.6 – C-rails

$a = 3 \text{ mm}$

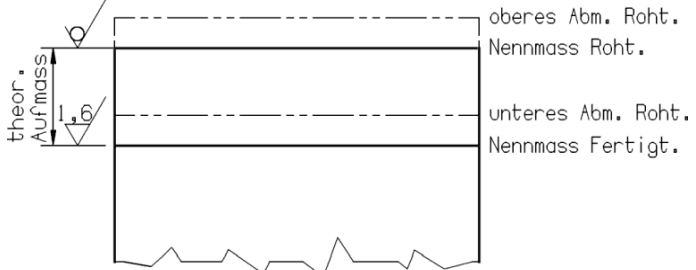
L [mm]	Weld seams per side
0 - 250	2
251 - 750	3
751 - 1000	4
1001- 1800	6



6 – Machining allowances

Unless any other data on any machining processes are stated on the drawing, machining allowances as shown in Table 5 must be provided at the locations to be machined (applies only for components without rough part drawing).

Table 5: Machining allowances

Length [mm]	Machining allowance (theor. allowance) [mm]	Tolerance [mm]	
>2000	10	+2.5 -5.5	
<=2000	8	+2 -5	
<=1000	5	+1.5 -3.5	
<=500	3	+1.5 -1.5	

Locations to be machined prior to welding must be indicated on the drawing.

7 – General tolerances

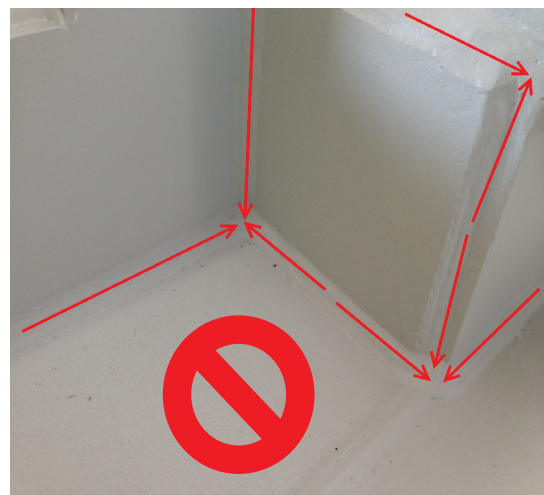
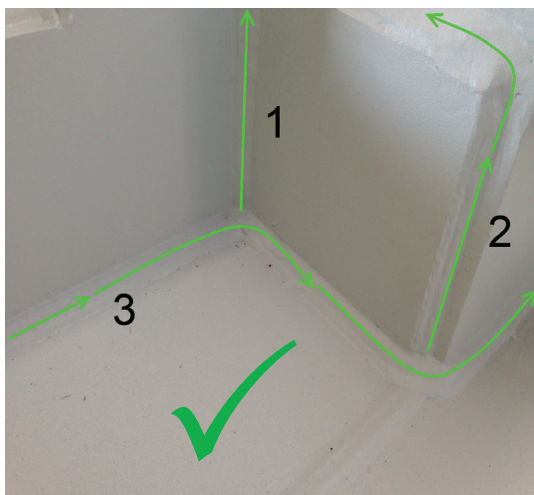
Unless otherwise stated on the drawing:

- ISO 2768-mK-E → for surfaces to be machined without tolerance data, also for pre-machining
- DIN EN ISO 13920-BF → for welding dimensions without tolerance data
- DIN EN ISO 9013-342 → for flame cuts
- DIN EN ISO 9013-341 → for laser cuts

8 – Stiffening gussets and corner joints, general

For seam cross-overs or when welding in and around the corners, it must be ensured that the end of the seam does not end in the corner, but is welded around the corner or around the gusset.

This prevents end cavities and cold welding spots in the corners, and thereby inhibits leakage in this region.



9 – Stress-relieving

If stress-relieving is specified, it is important to observe the following points:

Prior to stress-relieving, even if not stated on the drawing, all hermetically-sealed cavities must be opened. The dimensions and position must be clarified with the Design department. If this opening has to be closed against after annealing, this must be explicitly stated on the drawing.

Solid components (e.g. housing, columns, machine bed) must be heated to annealing temperature slowly and consistently - heat-up rate max. 60 K/h.

After annealing, furnace cooling is required to 120 °C above ambient temperature - cool-down rate max. 60 K/h; thereafter, cooling to approximately room temperature in a draft-free workshop.

With thin-walled components to approx. 3 mm, the heat-up and cool-down rate must not exceed max. 200 K/h. Cooling in the furnace must be to a temperature of less than or equal to 300 °C, thereafter cooling in the air in a draft-free workshop is permitted.

An annealing record in accordance with an acceptance test certificate 3.1 to DIN EN 10204 must be present on delivery of the goods.

To guarantee traceability, this annealing record must show all parts annealed in this batch with the GROB order number.

Weldments that were welded at room temperature, at least at 10 °C must, after welding, be annealed at a temperature of 550 to 580 °C with a hold time of 2 minutes per mm of wall thickness, for at least 30 minutes. The largest wall thickness of the component is decisive for determining the holding time.

10 – Leak test

If a tightness test is specified, all weld seams in the marked regions must be tested for tightness. The following methods for tightness testing are approved.

Pressure test: Pipelines must be leak-tested under pressure after welding. Unless otherwise specified, the test pressure is 6 bar. Sealants are permitted only with the customer's consent. .

Dye penetrant test PT: The dye penetrant method to DIN EN ISO 3452 is permitted as a test method. This method is preferred for tightness tests, particularly if chambers are unable to be sealed or the component has no discharge area.

Magnetic particle test MT: The magnetic particle method to DIN EN ISO 9934-1 is approved for the surface crack testing of ferromagnetic components.

Visual test VT: A visual test to DIN EN ISO 17637 is required in all cases.

Tightness test with water: Alternatively, the component can be filled with water to test for tightness. The dwell time of the fill is min. 10 hours.

The region to be tested is indicated on the drawing.

All test methods must be performed only with qualified personnel.

11 – Blasting

If blasting is specified, this is carried out after the leak test and annealing process.

The part shall be blasted with steel granulate to a standard purity according to DIN EN ISO 12944-4 of Sa 2 ½.

Sa 2 ½ – "Near White Blast Cleaning"

The surface is defined as free of any oil, grease, dirt, scale, rust, oxides, color and other foreign matter. Only slight traces or discoloration from rust or scale and slightly adherent residues of color or coating may remain. At least 95 % of each square inch is to be free of visible residues, and these are to be limited to slight discoloration, stains or small residues of the stated substances.

Finish-machined surfaces and hole patterns must be covered prior to blasting.

The first color layer or preserving agent shall be applied no more than 10 to 15 hours after blasting - assuming dry room storage.

12 - Paintwork, corrosion protection

If priming is specified, the surface to be primed must be free of oil, grease, dirt, scale, rust, paint and other impurities. Unless otherwise specified on the order or in the relevant engineering data, a product from a product group according to the GROB color regulation shall be used. Essentially, the color shade is specified in the order.

If no data on the product group are available, the Contractor must contact the customer.

Colors not approved in the standard will be removed and replaced for a charge.

The dry film layer thickness of the primer coat must be 60 to 80 µm.

Finish-machined surfaces and internal surfaces must not be coated with color, they must be protected against corrosion with a preserving agent. Holes in finished hole patterns must be protected with a grease plug.

13 – Initial sample acceptance

If an initial sample acceptance is specified, materials, production, welding procedures, heat treatment, inspection scope and certificates must satisfy the latest applicable regulations.

The welding operation must be in possession of a valid approval with the requisite certificates, which confirm the suitability for executing the tendered welding work.

The relevant instructions concerning the certificates, on the drawing and in the order shall be followed.

14 - Quality assurance

The welding operation must satisfy the requirements of GN9001. It may employ only certified welding personnel.

Unless otherwise specified on the drawing or in the order, the quality of the welding work must be assured in accordance with DIN EN ISO 5817-C.

The quality assurance on the part of the welding operation is assumed to be reliable. Particular attention should be paid to the weld seams that are no longer visible or accessible in the final condition (double walls). The welding operation is responsible for verifying adequate machining allowances, dimensional stability and tightness. For weldments where the welding work and mechanical machining is executed by different companies, an inspection report showing actual dimensions must be sent to the customer's incoming goods inspection department.

The welded parts must be measured in the x, y and z-axes and documented in the inspection report provided at the same time. The ideal central and control seams defined by the welding operation must be marked by prick punch bordered with color circles. These centers are considered the starting basis for laying out for machining.

Parts that were finish-machined prior to welding must be tested for damage and distortion on the finished component. Sealing surfaces and/or flanged surfaces must be flat so that the seal is guaranteed. Surfaces are to be reworked and threads re-cut as necessary.

The customer reserves the right to monitor production and/or the final acceptance. For the final acceptance, the welding operation must notify the customer and grant an adequate period of at least 7 days in order to attend the acceptance. The tests executed by the customer during this procedure do not release the welding operation from its warranty obligation in any way whatsoever.

If deviations from the target state are detected during mechanical machining and these are clearly caused by deficient welding work, the welding operation is responsible for rectifying such defects, without charge for GROB-WERKE, following consultation with the customer and the machining operation.

All requisite certificates and attestations are part of the order and must be handed to the customer on request. The documentation must be marked such that it can be clearly assigned to the part and to the order.

For finish-machined parts, the inspection report provided where applicable must be created for all tolerated dimensions (e.g. lengths, diameters etc.) and also for all locations provided with form and position tolerances. All measured value recordings must be provided to the customer on delivery of the goods for incoming goods inspection. The documentation must be marked such that it can be clearly assigned to the part and to the order.

15 - Documentation

All requisite certificates/documentary evidence and all tests to be supported with certificates, are defined in the order documents and handed to the customer on request.

Specifications in the order with reference to GN9001 are supplemented by specifications on drawing documents. All requisite documents are an essential part of the order and, if incomplete, constitute a fault which entitles the customer to measures under the rules of German law.

All documents requested by GROB-WERKE, such as plant certificates, acceptance test certificates, attestations and reports must be prepared in German or English.

The content must clearly relate to the required acceptances, tests and GROB factory standards. The documents must be clearly legible.

16 – Reference to cited standards

Standard designation	Issue date	Description
DIN EN 10025-1	2005-02	Hot-rolled products from construction steels - Part 1: General technical terms of delivery
DIN EN 10025-2	2005-04	Hot-rolled products from construction steels - Part 2: Technical technical terms of delivery for non-alloy construction steels
DIN EN 10204	2005-01	Metallic products – Test certificate types
DIN EN ISO 2553	2014-04	Welding and related processes, symbolic representation in drawings, welded joints
DIN EN ISO 3452-1	2014-09	Non-destructive testing - Penetration test - Part 1: General principles
DIN EN ISO 5817	2014-06	Fusion welded joints on steel, nickel, titanium and the alloys thereof (excluding beam welding) - Assessment groups of irregularities
DIN EN ISO 9013	2017-05	Thermal cutting - Division of thermal cuts - Geometric product specification and quality
DIN EN ISO 9934-1	2017-03	Non-destructive testing - Magnetic particle test - Part 1: General principles
DIN EN ISO 12944-4	2018-04	Coating materials - Corrosion protection of steel components by means of coating systems – Part 4: Types of surfaces and surface preparation
DIN EN ISO 13920	1996-11	Welding - General tolerances for weldments - Length and angular dimensions, form and position
DIN EN ISO 17637	2017-04	Non-destructive testing of welds - Visual inspection of fusion-welded joints
DIN ISO 2768-1	1991-06	General tolerances, tolerances for length and angular dimensions or individual tolerance entry
DIN ISO 2768-2	1991-04	General tolerances, tolerances for form and position without individual tolerance entry
GN9001	2015-02	GROB-factory standard Welded designs - Qualification of welding operations