



## **Specifications for suppliers in the field of machine engineering and toolmaking**

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# Table of Contents

<b>1. General requirements for deliveries from ILLIG</b>	<b>5</b>
1.1. Scope - validity	5
1.2. Applicable documents for components to be supplied, which ILLIG can add to an order as part of the contract	5
1.3. Copyright notice according to DIN ISO 16016: 2016-04	5
1.4. Receipt of supplied goods	5
1.5. Quality	5
1.6. Notice of defects (NOD) to the supplier	6
1.7. Cleaning workpieces	6
1.8. Packaging	6
<b>2. Requirements for all components</b>	<b>7</b>
2.1. Attaching the part labeling	7
2.1.1. Part labeling for W-Parts	7
2.1.2. Type of part labeling	7
2.2. Workpiece dimensions for coated parts	8
2.3. Hardened workpieces	8
2.3.1. Workpiece dimensions	8
2.3.2. Hardness data	8
2.4. Threaded surfaces	8
2.5. Tolerance classes for threadings	8
2.6. Production-related work	9
2.7. Workpiece edges	9
2.8. Tolerances and depictions	9
2.9. Visible flaws and visible sides	9
2.10. Lubrication grooves in bolts	10
2.11. Balanced parts	10
2.12. Tolerances for counterbores for screws	10
2.13. Use of Ensaf threaded inserts	10
2.13.1. Drilling and thread preparation for the installation of Ensaf threaded inserts	10
2.13.2. Thread locking Ensaf threaded inserts	11
<b>3. Specifications for sheet-metal parts</b>	<b>12</b>
3.1. Tolerances for sheet-metal thickness	12
3.2. Flatness of sheet-metal parts	12
3.3. Flat sheet-metal parts lased or punched	12
3.3.1. Tolerances for length dimensions (cutting edge)	13
3.3.2. Tolerances for angular dimensions (cutting edge)	13
3.3.3. roughness depth (cutting edge)	13
3.4. Bent sheet-metal parts	13
3.4.1. Tolerances for length dimensions	13
3.4.2. Tolerances for angular dimensions	13
3.4.3. Bending radii	13
3.5. Conditions for welded part assemblies	13
3.6. Welded parts with hygiene requirements	14
3.7. Joints	14
3.8. Requirements for welded assemblies with closed profiles	14
<b>4. Requirements for cut parts</b>	<b>15</b>
4.1. length tolerance of raw material for milled and turned parts	15

4.2.	Miter cuts on standard profiles .....	15
<b>5.</b>	<b>Requirements for cutting methods .....</b>	<b>16</b>
5.1.	Water jet cutting process: Requirements for components .....	16
5.2.	Flame cutting: Requirements for components .....	16
5.2.1.	Tolerances for length dimensions .....	16
5.2.2.	Tolerances for angular dimensions (trimmed edges) .....	16
5.2.3.	Surface roughness (trimmed edges) .....	16
5.2.4.	Stress-free annealing .....	16
5.2.5.	Flatness .....	16
5.2.6.	Deburring the flame-cut edges .....	16
5.2.7.	Applying material numbers on flame-cut parts: .....	16
5.2.8.	Tolerances for angular dimensions (trimmed edges) .....	17
5.2.9.	Surface roughness (trimmed edges) .....	17
<b>6.</b>	<b>Requirements for the assembly of assemblies .....</b>	<b>18</b>
6.1.	Use of DU bushings for joint assemblies .....	18
6.2.	Threadlocking agents .....	18
6.3.	Agents for sealing .....	18
6.4.	Agents for joining and bonding components .....	18
6.5.	Screw locking for assemblies .....	19
6.6.	Lubricants .....	19
<b>7.</b>	<b>Panes made of transparent plastics: Requirements for components and assemblies .....</b>	<b>20</b>
<b>8.</b>	<b>ILLIG materials: Requirements for components .....</b>	<b>20</b>
8.1.	Material for precision shafts .....	20
8.1.1.	<b>ILLIG-1</b> (hardened piston rods) .....	20
8.1.2.	<b>ILLIG-2</b> (standard precision steel shafts) .....	20
8.1.3.	<b>ILLIG-3</b> (chrome plated precision steel shafts) .....	20
8.1.4.	<b>ILLIG-4</b> (precision stainless-steel shafts) .....	20
8.1.5.	<b>ILLIG-5</b> (precision stainless-steel shafts) .....	20
8.1.6.	<b>ILLIG-6</b> (precision steel hollow pipes) .....	20
8.1.7.	<b>ILLIG-7</b> (chrome-plated precision steel shafts) .....	20
8.1.8.	Standard dimension tolerances for <b>ILLIG-1 – ILLIG-7</b> : .....	21
8.1.9.	Hardening depth for induction hardening ( <b>ILLIG-1 – ILLIG-6</b> ) .....	21
8.2.	Other <b>ILLIG</b> materials .....	22
8.2.1.	<b>ILLIG-8</b> (round material C45E) .....	22
8.2.2.	<b>ILLIG-9</b> (round material S355J0) .....	22
8.2.3.	<b>ILLIG -10</b> (milled cast aluminum plate; workpiece 3.3547) .....	22
8.2.4.	<b>ILLIG-11</b> (manufactured based on PE-UHMW TG 1.2) .....	23
8.2.5.	<b>ILLIG-12</b> (manufactured based on PE-UHMW TG 1.2) .....	23
8.2.6.	<b>ILLIG-14</b> (manufactured based on PE-UHMW TG 1.2) .....	23
8.2.7.	<b>ILLIG-20</b> (sheet of Feran®) .....	24
8.2.8.	<b>ILLIG-40</b> Vulkollan D15 .....	25
8.2.9.	<b>ILLIG-41</b> Phenolic Paper PF-CP 201 (previously 2061) .....	25
8.3.	Special materials .....	26
8.3.1.	<b>ILLIG-99</b> (special materials) .....	26
<b>9.</b>	<b>Requirements for components with coatings .....</b>	<b>27</b>
9.1.	Surfaces that are not to be coated .....	27
9.2.	Coating types: phosphating, galvanizing, electroless nickel plating .....	27
9.3.	Surfaces that are not to be painted .....	27

9.4. Hard coating (hard coat anodizing).....	27
9.5. Coating types .....	28
<b>10. Requirements for components with food contact .....</b>	<b>31</b>
10.1. Labeling of components with food contact.....	31
10.2. Requirements for components with food contact.....	31
10.3. Declaration of conformity for components with food contact .....	31
<b>11. Appendix .....</b>	<b>32</b>
11.1. Other coating types and abbreviations used .....	32

# 1. General requirements for deliveries from ILLIG

## 1.1. Scope - validity

- The general "Specifications for Suppliers" apply to all deliveries and services provided by the suppliers.
- These specifications for suppliers define the general rules for suppliers of ILLIG packaging solutions GmbH.
- Any details specified in drawings, manufacturing or work instructions take precedence over these general specifications for suppliers.
- Components from the fields of mechanical engineering and components of tool manufacture are partially treated differently at ILLIG. Drawings from the field of mechanical engineering always begin with M and are referred to as M parts. Drawings from the field of tool manufacturing always begin with a W and are referred to as W parts.

## 1.2. Applicable documents for components to be supplied, which ILLIG can add to an order as part of the contract

- Quality assurance agreement
- Drawings
- Manufacturing instructions
- Work instructions
- Inspection instructions
- Packaging instructions
- ILLIG general terms and conditions of procurement
- Letter of Intent
- Partner and supplier framework agreements
- Research and development agreements
- Non-disclosure agreements

## 1.3. Copyright notice according to DIN ISO 16016: 2016-04

Please observe the copyright notice according to DIN ISO 16016:2007-12:

"This document may not be reproduced or transmitted, used or its contents communicated without the express consent. Violations are subject to compensation for damages. All rights with regard to patent claims, registered designs and utility models are reserved."

## 1.4. Receipt of supplied goods

Any goods supplied by ILLIG packaging solutions GmbH (e.g. components required to manufacture ordered product) must be inspected by the supplier for obvious flaws (e.g. rust, transport damage). If the deficiency is discovered at a later date, the supplier must immediately report it, otherwise the delivered goods irrespective of the discovered deficiency will be considered accepted.

## 1.5. Quality

- Inspection by the supplier is an integral part of the quality assurance system of ILLIG packaging solutions GmbH. The supplier is responsible for compliance with the defined dimensions, criteria and specifications.
- The supplier must ensure that only parts are delivered to ILLIG packaging solutions GmbH that meet the required specifications. The scope of the applied quality assurance measures, including inspection of goods received and dispatched as well as the inspection of ongoing production processes must be appropriate with respect to the applied production processes, product requirements and inspection instructions. Measuring and test equipment must be used appropriately and be subjected to inspection.
- If specifications or requirements with respect to the product are not certain, the supplier is obligated to resolve the uncertainty with ILLIG packaging solutions GmbH.
- The supplier must immediately notify ILLIG packaging solutions GmbH, if the supplier suspects that different parts may have been delivered than what were specified.

### 1.6. Notice of defects (NOD) to the supplier

- For all parts that are delivered to ILLIG packaging solutions GmbH that are determined to be flawed, a Notice of defects (NOD) will be submitted.
- The supplier can submit a formal objection to ILLIG packaging solutions GmbH within 5 workdays of receiving the NOD. If the supplier does not submit a formal objection, the NOD as submitted by ILLIG packaging solutions GmbH will be considered valid and the supplier will be obligated to perform the remedy as specified in the NOD.
- If a qualified statement has been requested in the NOD, the supplier has 5 workdays to submit his response to ILLIG packaging solutions GmbH.
- A schedule to determine when the deficiency will be fully remedied must be submitted within 5 workdays.
- Within the specified period, the following must also be agreed with the purchase from ILLIG: the collection or return of the rejected material for post-processing or for replacement delivery or scrapping and / or credit, as well as the associated costs.

### 1.7. Cleaning workpieces

- Workpieces must be carefully cleaned and freed of all debris before being delivered to ILLIG packaging solutions GmbH.
- Transport containers and outer packaging (boxes, boxes and pallets); Adhesive tapes and adhesive labels on the material must be easy to remove without residue and without additional aids.

### 1.8. Packaging

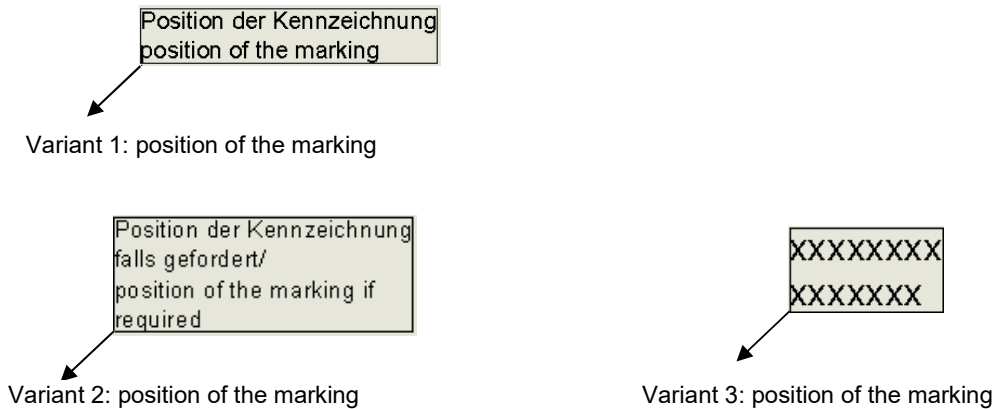
- The aspects logistics, quality assurance, environmental safety and efficiency must be taken into consideration when packaging the parts. Damage in transit should be avoided by proper packaging. ILLIG requires you to propose appropriate packaging and to submit your recommendation to ILLIG packaging solutions GmbH for approval.
- The parts must be preserved so that no corrosion or surface rust occurs when stored for several days or when subjected to the elements. Absorbing materials are not be used for wrapping the parts (e.g. corrugated fiberboard, newspaper, etc.). Instead, use wax paper or protective sleeves.
- Packaging supplied by ILLIG that were tailor-made specifically for the components must be returned to ILLIG together with the processed parts.
- If the use of wooden transport materials is required, they must be heat treated according to the IPPC standard (ISPM 15). The IPPC marking must be applied to the wooden transport materials where it is readily visible.

## 2. Requirements for all components

### 2.1. Attaching the part labeling

All components according to the drawing must be marked with the material number and order number.

If the parts are to be marked at a specific location, this location is marked in the drawing as follows.



Variant 1 shows the current representation on the drawing. Variant 2 or 3 was also used in some cases.

Embodiment in two lines:

- Upper line: material number
  - Lower line: order number
- Sans-serif fonts, font height 5 mm
  - If the selected font is too large for the part, you can adjust it to scale.

#### 2.1.1. Part labeling for W-Parts

- If a serial number is specified on a machined surface of the production part on the drawing, the serial number must also be inserted at this position when the production part is manufactured.

#### 2.1.2. Type of part labeling

- For sheet metal parts in stainless steel quality, the part marking must always be applied as a laser marking.
- For sheet metal parts that are coated, the part marking must always be applied as a self-adhesive label.
- For plastic panes, the part marking must always be applied as a self-adhesive label.
- For cast parts, the model number must always be cast in.
- For flame-cut parts, the material number must be added using a white permanent marker.
- Small parts in large quantities can be marked with a label or tag on the packaging.
- Permanent marking is required for safety-relevant components.

These parts are marked on the drawing as follows:

Dauerhafte Kennzeichnung Material-Nr. + Bestell-Nr./ permanent marking Id.-No. + Order No.
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The permanent marking can be made by engraving, lasering, (insertion depth 0.1 - 0.2 mm) anodizing, printing or similar.

- In the case of assemblies that cannot be dismantled (welded assemblies, etc.), only the ordered assembly must be marked. Sub-assemblies or individual parts do not have to be marked.

If, for technical reasons, it is not possible to mark the parts as described above, a self-adhesive label or a permanent marker can also be used after consultation with Illig.

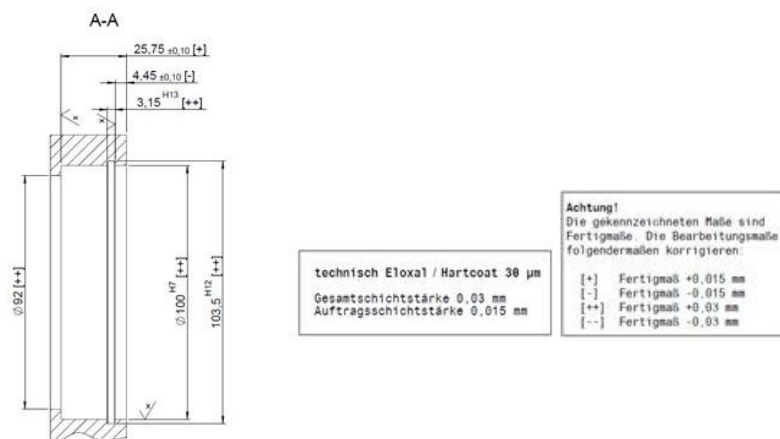
## 2.2. Workpiece dimensions for coated parts

- Dimensions for coated parts are final dimensions.
- The required pre-processing dimensions are indicated at relevant points on the components using symbols (“[+]” and “[-]”). The corresponding layer thicknesses are added or subtracted.

Note: Alternatively, the pre-machining dimensions are shown in brackets at these points, e.g. [Ø29.9h6].

- If the coating thickness shows fluctuations in accordance with the process, which exceed the specified tolerance or the clearance tolerance, the further procedure must be coordinated with Illig.
- The general table for fit tolerances will continue to be used on the drawings.
- Phosphate coating and galvanization are not subject to this rule.

Example:



## 2.3. Hardened workpieces

### 2.3.1. Workpiece dimensions

- Dimensions for hardened parts are final dimensions.
- Deviating dimensions required for the finishing of hardened workpieces may not be indicated on the drawing.
- If finishing is required, it must be ensured that the specified effective hardening depth is still accurate once finishing is complete.

### 2.3.2. Hardness data

The hardness data are given in a table on the drawing. For drawings created before 06/2023, the hardness method is sometimes indicated as an abbreviation in the "Surface" field. See appendix for the meaning of the abbreviations.

## 2.4. Threaded surfaces

Threads must always be manufactured with a roughness of Rz 63 in accordance with ISO 1302 unless there is any other information on the drawing.

## 2.5. Tolerance classes for threadings

- If there is no information on the tolerance classes for threads on the drawing, the following apply:
- Metric Internal thread: 6H
- Metric External thread: 6g



- Trapezoidal thread inside. 7H
- Trapezoidal threads outside: 7e
- If information on the tolerance classes for threads is given on the drawing, these apply.

## 2.6. Production-related work

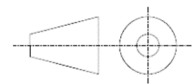
Production-related work is indicated by the abbreviation (FB). The abbreviation (FB) appears after the dimension of the production-related work. If this work is not required in the manufacturing process, it can be ignored.

## 2.7. Workpiece edges

- DIN ISO 13715: 2017-03 applies to all undimensioned workpiece edges: Outer edges – 0.1 to 0.3 mm and inner edges + 0.8 mm.
- Interconnecting holes, e.g. cross holes, can have a maximum burr tolerance of +0.1 mm.
- If a burr-free cross hole is required, but not indicated on the drawing, no chamfer dimension is given. However, a minimum of 0.2 mm is required for unspecified chamfer dimensions.
- Workpieces designed to have sharp edges must be labeled according to DIN ISO 13715:2000-12 with a tolerance of 0 – 0.05 mm for allowable deburring of outer edges or passing of inner edges.
- Cutting edges: Cutting edges are designated as such and are provided with a transition of 0-0.005mm.
- Inner and outer threads must be beveled at least until the minor diameter unless otherwise indicated on the drawing.

## 2.8. Tolerances and depictions

- The tolerances specified in the ILLIG drawings comply with DIN EN ISO 14405 E and follow the envelope principle.
- When no tolerances are specified for length or angle dimensions, or for chamfered edges, they are subject to the general tolerance m (medium) according to DIN ISO 2768-1: 1991-06.
- When no tolerances are specified for shapes or layers, they are subject to the general tolerance K according to DIN ISO 2768-2:1991-04.
- In all drawings, ILLIG always uses the first-angle projection, even if it is not specified.

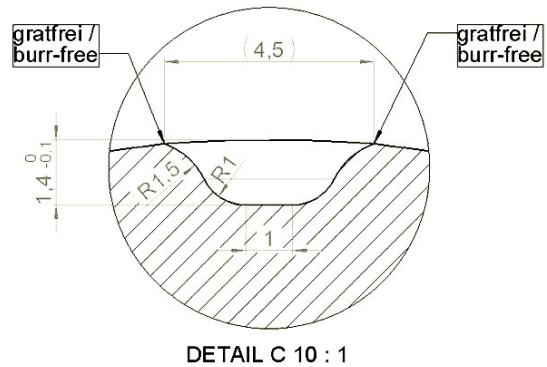


## 2.9. Visible flaws and visible sides

- If a surface has been indicated as a visible side, it must be free of any visible flaws.
- A visible flaw is defined as any visually perceptible irregularity on a side that has been indicated as the visible side that is perceived as a flaw by an unbiased observer.
- The distinction to expected irregularities depends on the specified surface roughness as well as the viewing distance and angle of the observer. Based on technical guidelines from the painting trade, the viewing distance is defined as 1 m at a right angle and under diffused light. If ILLIG quality assurance detects a visible flaw during the inspection of incoming goods, this shall represent grounds for complaint and may result in the submission of a warranty claim or demand for rectification of the defect.
- The distinction to accepted deviations is determined by comparing with other existing parts of the same surface finish specifications.
- Examples of visible flaws include scratches, color deviations, nicks, imperfections, dents, flattening at corners and edges, elevations, bumps, discolorations, non-compliance with specified surface roughness, irregularities in the grinding or brushing pattern, poor surface finishing of welded parts, etc., insofar as they are avoidable on the raw materials and coating processes specified.

## 2.10. Lubrication grooves in bolts

Applies to M-parts: Lubrication grooves in bolts must not be sharp-edged, otherwise the homogeneous distribution of the lubricant on the bolt cannot be ensured. A sharp edge on a lubrication groove acts like a scraper that holds back the lubricant. Therefore, the lubrication grooves must be designed as shown below, in which the groove merges burr-free into the bolt surface in a gradual transition radius.



## 2.11. Balanced parts

Parts that are balanced are, for example, knives or rotors.

- Balancing quality according to ISO 1940: Quality Q 6.3; dynamically balanced at max. 960 rpm
- Place balancing bore holes on contact surfaces only
- Place balancing holes only on contact surfaces

## 2.12. Tolerances for counterbores for screws

The tolerances must be implemented in accordance with DIN EN ISO 4762: H13.

## 2.13. Use of Ensaf threaded inserts

### 2.13.1. Drilling and thread preparation for the installation of Ensaf threaded inserts

- For components that are supplied with fully assembled Ensaf threaded inserts, the holes in the components can be prepared in different ways.

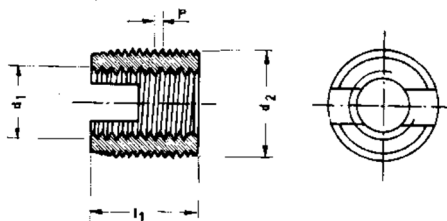
In aluminium with a yield strength  $R_m$  greater than 350 N/mm<sup>2</sup>, a pre-cut thread in the component is essential for installing the Ensaf threaded insert. In softer aluminium, this is not necessary if the Ensaf threaded inserts are joined on the processing machine.

This results in the following possibilities:

- o Thread completely pre-cut ( $R_m > 350 \text{ N/mm}^2$ )
- o Thread only partially pre-cut ( $R_m < 350 \text{ N/mm}^2$ , when joining the Ensaf at the manual workstation)
- o Thread not pre-cut ( $R_m < 350 \text{ N/mm}^2$ , when joining the Ensaf on the processing machine)
- For parts that are supplied without Ensaf threaded inserts, the holes for installation must be drilled with completely pre-cut threads. The thread depth must correspond to the length of the Ensaf threaded insert.

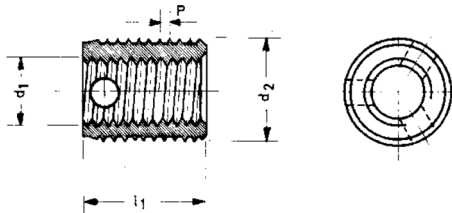
- The specifications for the holes and threads can be found in the following tables:

- IN 22 b – Ensat 302



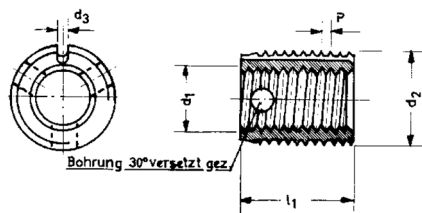
d1	d2	P	l1	hole- ø	Drill hole depth min.	material- no.
M 3	5,0	0,50	6	4,6	8	8027898
M 4	6,5	0,75	8	5,9	10	8048544
M 5	8,0	1,00	10	7,2	13	8048553
M 6	10,0	1,50	14	8,8	17	8048562
M 8	12,0	1,50	15	10,8	18	8048571
M 10	14,0	1,50	18	12,8	22	8048580
M 12	16,0	1,50	22	14,8	26	8048599
M 16	20,0	1,50	22	18,8	27	8175175

- IN 38 K – Ensat 307 = l1 short



d1	d2	P	l1	hole- ø	Drill hole depth min	material- no.
M 4	6,5	0,80	8	6,1	10	8046439
M 5	8,0	1,00	7	7,5	9	8048606
M 6	10,0	1,25	8	9,3	10	8048615
M 8	12,0	1,50	9	11,2	11	8048624
M 10	14,0	1,50	10	13,2	13	8048633
M 12	16,0	1,75	12	15	15	8048642

- IN 38 SN – Ensat 318 = l1 long
- Ensat\_3180\*



d1	d2	P	l1	hole- ø	Drill hole depth min.	material- no.
M 5	8	1,00	10	7,5	13	8048651
M 6	10	1,25	12	9,2	15	8048660
M 8	12	1,50	14	11,2	17	8048679
M 10	14	1,50	18	13,2	22	8048688
M 12	16	1,75	22	15	26	8048697
M 12	16	1,5	22	15	26	9220944 *special without safety groove

### 2.13.2. Thread locking Ensat threaded inserts

- All Ensat threaded inserts must be locked in place using high-strength adhesive. To do this, use 'glue 6' screw locking compound as described in section 6.2.

### 3. Specifications for sheet-metal parts

- This standard is used to simplify the drawings. It defines general tolerances for sheet-metal parts.
- The general tolerances apply to all dimensions without specified tolerances in a drawing, as well as to all non-dimensioned geometries.
- If smaller tolerances are required, or larger tolerances are permissible and more economical, they must be defined in the drawing.
- Any dimensions for sheet-metal parts that are not included can be taken from the corresponding 3D model or NC program (GEO). The drawing is binding for production.

#### 3.1. Tolerances for sheet-metal thickness:

Sheet-metal thickness [mm]	Lower limit [mm]	Upper limit [mm]
$t < 3$	- 0,22	+ 0,22
$3 \leq t < 5$	- 0,26	+ 0,26
$5 \leq t < 8$	- 0,30	+ 0,30
$8 \leq t < 15$	- 0,38	+ 0,38
$15 \leq t < 25$	- 0,3	+ 1,3
$25 \leq t < 40$	- 0,3	+ 1,7
$40 \leq t < 80$	- 0,3	+ 2,3
$80 \leq t < 150$	- 0,3	+ 2,9
$150 \leq t < 250$	- 0,3	+ 3,3

Values are based on: DIN EN 10051 table 3  
 $w \leq 1500$  mm nominal width for a sheet-metal thickness up to 15 mm, DIN EN 10029 class B for a sheet-metal thickness  $> 15$  mm

#### 3.2. Flatness of sheet-metal parts

Flatness of sheet metal with a thickness of up to and including 15 mm: 3 mm/m

Flatness of sheet metal with a thickness  $> 15$  mm: 2 mm/m

#### 3.3. Flat sheet-metal parts lased or punched

- Laser parts are indicated on drawings by the following CAD symbol, whenever the component cannot be flame cut due to design constraints (e. accuracy of geometry): This is generally required for parts with a material thickness  $> 15$  mm.

**Laserteil / laser-cut part**  
DIN EN ISO 9013 - 231

Figure 2: Laser part symbol

- For sheet-metal parts with a material thickness  $\leq 15$  mm, we assume that the parts are lased or punched. Therefore, such parts are not indicated by the symbol below.
- To determine the appropriate values the standard DIN EN ISO 9013 is to be used.
  - 2 = squareness and inclination tolerance of  $0.15 \text{ mm} + (0.007 \times \text{cutting thickness (in mm)})$
  - 3 = the average roughness depth  $Rz5$  in of  $70 \text{ } \mu\text{m} + (1.2 \times \text{cutting thickness (in mm)}) \text{ } \mu\text{m}$
  - 1 = tolerance class 1

### 3.3.1. Tolerances for length dimensions (cutting edge)

Values in accordance with DIN EN ISO 9013 tolerance class 1.

dimensions in [mm]

Workpiece thickness t	Nominal size							
	0 < t < 3	3 ≤ t < 10	10 ≤ t < 35	35 ≤ t < 125	125 ≤ t < 315	315 ≤ t < 1000	1000 ≤ t < 2000	2000 ≤ t < 4000
Limit dimensions								
0 < t ≤ 1	± 0,04	± 0,1	± 0,1	± 0,2	± 0,2	± 0,3	± 0,3	± 0,3
1 < t ≤ 3,15	± 0,1	± 0,2	± 0,2	± 0,3	± 0,3	± 0,4	± 0,4	± 0,4
3,15 < t ≤ 6,3	± 0,3	± 0,3	± 0,4	± 0,4	± 0,5	± 0,5	± 0,5	± 0,6
6,3 < t ≤ 10	-	± 0,5	± 0,6	± 0,6	± 0,7	± 0,7	± 0,7	± 0,8
10 < t ≤ 50	-	± 0,6	± 0,7	± 0,7	± 0,8	± 1	± 1,6	± 2,5
50 < t ≤ 100	-	-	± 1,3	± 1,3	± 1,4	± 1,7	± 2,2	± 3,1
100 < t ≤ 150	-	-	± 1,9	± 2	± 2,1	± 2,3	± 2,9	± 3,8
150 < t ≤ 200	-	-	± 2,6	± 2,7	± 2,7	± 3	± 3,6	± 4,5
200 < t ≤ 250	-	-	-	-	-	± 3,7	± 4,2	± 5,2
250 < t ≤ 300	-	-	-	-	-	± 4,4	± 4,9	± 5,9

Figure 3: Limit dimensions for nominal dimensions of tolerance class 1

### 3.3.2. Tolerances for angular dimensions (cutting edge)

Perpendicularity tolerance [mm]: 0,15

### 3.3.3. roughness depth (cutting edge)

Average roughness depth Rz [μm]: 70

## 3.4. Bent sheet-metal parts

### 3.4.1. Tolerances for length dimensions

Length ranges l [mm]	l ≤ 120	120 < l ≤ 400	400 < l ≤ 1000	1000 < l ≤ 2000	2000 < l ≤ 4000
Tolerances [mm]	± 0.3	± 0.5	± 0.8	± 1.5	± 2.0

### 3.4.2. Tolerances for angular dimensions

Length of shorter panel	≤ 400 mm	> 400 mm
≤ 6 mm sheet thickness	± 0°30	± 1°
> 6 mm sheet thickness	± 1°	± 2°

### 3.4.3. Bending radii

Non-dimensioned bending radii are to be taken from the 3D model. These bending radii must be produced with a permissible tolerance of ±1.5 mm.

## 3.5. Conditions for welded part assemblies

- Suppliers of welded part assemblies must be certified according to DIN EN ISO 3834 and employ DIN EN ISO 9606-certified welders as well as DIN EN ISO 14731-certified welding supervisors.
- Suppliers who are not DIN EN ISO 3834 certified can undergo a supplier audit by ILLIG packaging solutions GmbH to become certified and thus attain approved supplier status.
- Welded part assemblies or welds that require the quality level C or B in accordance with DIN EN ISO 5817 or DIN EN ISO 10042 may be performed exclusively by DIN EN ISO 9606-certified welders.
- Suppliers must produce their valid certifications from an approved authority as proof of their qualifications. The certifications are an integral part of the order contract for the first delivery.
- Suppliers must produce their valid certifications from an approved authority as proof of their qualifications. The certifications are an integral part of the order contract for the first delivery.
- DIN EN 1011-1 - 4: "Welding – Recommendations for welding metallic materials" must be adhered to.
- Blemishes on welds or sheet metal may not be touched up or corrected with putty. Other methods of eliminating blemishes or flaws must first be cleared by ILLIG before any such work can be started.

### 3.6. Welded parts with hygiene requirements

- Welded parts that have hygiene requirements must comply with specifications of DIN EN ISO 14159:2208-07.
- Drawings that contain welded parts with hygiene requirements are indicated by the signal word HYGIENE (CAD symbol).
- Surfaces must be free of defects such as holes, creases, tears or cracks (compare: DIN EN ISO 14159:2208-07; point 5.2.2.1 sentence 1). Parts that do not require a continuous weld may be welded using an intermittent weld. These are indicated on the drawing.
- The gaps between the welds are to be sealed with a thin weld, in order to satisfy hygiene requirements. This sealing weld does not have any requirements in accordance with DIN EN ISO 5817.
- This should serve to minimize deformation of the parts.

### 3.7. Joints

- Permanent joints between metals must be welded in a continuous seam. (DIN EN ISO 14159:2208-07; point 5.2.2.7 paragraph 1, sentence 1)
- Welded joints [...] must be done so that a flat surface is created that is free from defects such as holes, creases, inclusions, tears and cracks. (DIN EN ISO 14159:2208-07; point 5.2.2.7 paragraph 5)
- Welding seams are illustrated according to DIN EN ISO 2553:2014-04.

### 3.8. Requirements for welded assemblies with closed profiles

Drain holes must be made for welded assemblies with closed profiles.

- The drain holes are illustrated without dimensions.
- It is up to the manufacturer to decide how to machine the drain holes: They can be milled, grinded, cut, laser cut, or plasma cut.
- Sharp edges are not allowed.
- The drain holes may not be closed during the welding process.
- Drawings that contain drain holes are indicated by the signal word: "AB-LAUFBOHRUNGEN / DRAINING HOLES"
- The drain holes must be drilled as shown in figure 5.
- If no drain holes are depicted, ILLIG must be consulted first before adding any.

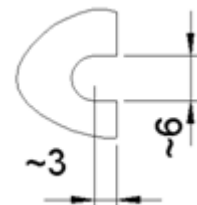


Figure 4: Drain hole sketch

## 4. Requirements for cut parts

### 4.1. length tolerance of raw material for milled and turned parts

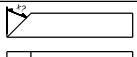
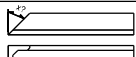
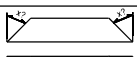
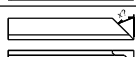
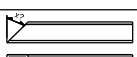
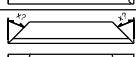
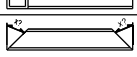
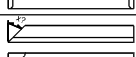

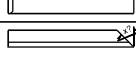
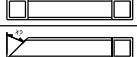
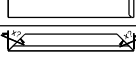
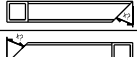
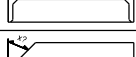

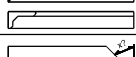
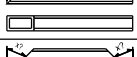
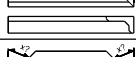
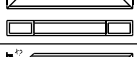
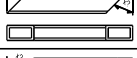
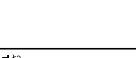

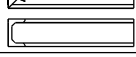

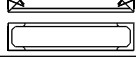
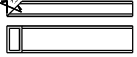
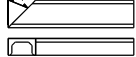

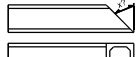
Length tolerance 0 / + 3 mm

### 4.2. Miter cuts on standard profiles

Short descriptions for profile ends:

To avoid separate drawings of profile ends, the table below has been created for profile ends with miter angles.

-	Profiles cut at a right angle are not given a separate description of their profile end.
-	The specifications are organized as follows: e.g. QR-1 x 45° - Profile type – Cut number – Angle specification
-	Profiles that cannot be depicted using the (standardized) shapes are shown and dimensioned on a separate drawing.

Profile types:	Bezeichnung für Gehrungsschnitte bei unterschiedlichen Profilen				Stand 12/99			
FL = rolled flat steel QR = square hollow profile RR = rectangular hollow profile WG = equal-sided angular profile WU = unequal-sided angular profile U = U-profile	FL-1				WG-1			
	FL-2				WG-2			
	QR-1				WG-3			
	QR-2				WU-1			
	QR-3				WU-2			
	QR-4				WU-3			
	QR-5				WU-4			
	RR-1				WU-5			
	RR-2				WU-6			
	RR-3							
	RR-4				U-1			
	RR-5				U-2			
	RR-6				U-3			
	RR-7				U-4			
	RR-8				U-5			

## 5. Requirements for cutting methods

### 5.1. Water jet cutting process: Requirements for components

The same specifications for parts manufactured by laser cutting apply here also.

### 5.2. Flame cutting: Requirements for components

- Flame-cut parts are indicated on drawings by the following CAD symbol (see: Figure 6)



Figure 5: Burning part symbol

- To determine the appropriate values the standard DIN EN ISO 9013 is to be used.  
 3 = squareness and inclination tolerance of  $0.4 + 0.01 \times \text{cutting thickness (in mm)}$   
 4 = the average roughness depth  $R_{z5}$  in  $\mu\text{m}$  of  $110 + 1.8 \times \text{cutting thickness (in mm)}$   
 2 = tolerance class 2

#### 5.2.1. Tolerances for length dimensions

Values in accordance with DIN EN ISO 9013 tolerance class 2.

dimensions in [mm]

Workpiece thickness t	Nominal size							
	$0 < t < 3$	$3 \leq t < 10$	$10 \leq t < 35$	$35 \leq t < 125$	$125 \leq t < 315$	$315 \leq t < 1000$	$1000 \leq t < 2000$	$2000 \leq t < 4000$
	Limit dimensions							
$0 < t \leq 1$	$\pm 0,1$	$\pm 0,3$	$\pm 0,4$	$\pm 0,5$	$\pm 0,7$	$\pm 0,8$	$\pm 0,9$	$\pm 0,9$
$1 < t \leq 3,15$	$\pm 0,2$	$\pm 0,4$	$\pm 0,5$	$\pm 0,7$	$\pm 0,8$	$\pm 0,9$	$\pm 1$	$\pm 1,1$
$3,15 < t \leq 6,3$	$\pm 0,5$	$\pm 0,7$	$\pm 0,8$	$\pm 0,9$	$\pm 1,1$	$\pm 1,2$	$\pm 1,3$	$\pm 1,3$
$6,3 < t \leq 10$	-	$\pm 1$	$\pm 1,1$	$\pm 1,3$	$\pm 1,4$	$\pm 1,5$	$\pm 1,6$	$\pm 1,7$
$10 < t \leq 50$	-	$\pm 1,8$	$\pm 1,8$	$\pm 1,8$	$\pm 1,9$	$\pm 2,3$	$\pm 3$	$\pm 4,2$
$50 < t \leq 100$	-	-	$\pm 2,5$	$\pm 2,5$	$\pm 2,6$	$\pm 3$	$\pm 3,7$	$\pm 4,9$
$100 < t \leq 150$	-	-	$\pm 3,2$	$\pm 3,3$	$\pm 3,4$	$\pm 3,7$	$\pm 4,4$	$\pm 5,7$
$150 < t \leq 200$	-	-	$\pm 4$	$\pm 4$	$\pm 4,1$	$\pm 4,5$	$\pm 5,2$	$\pm 6,4$
$200 < t \leq 250$	-	-	-	-	-	$\pm 5,2$	$\pm 5,9$	$\pm 7,2$
$250 < t \leq 300$	-	-	-	-	-	$\pm 6$	$\pm 6,7$	$\pm 7,9$

Figure 6: Limit dimensions for nominal dimensions of tolerance class 2

#### 5.2.2. Tolerances for angular dimensions (trimmed edges)

Perpendicularity tolerance [mm]:  $0.4 + 0.01 \cdot a$  (a = sheet-metal thickness)

#### 5.2.3. Surface roughness (trimmed edges)

Average surface roughness  $R_z$  [ $\mu\text{m}$ ]:  $70 + 1.2 \cdot a$  (a = sheet-metal thickness)

#### 5.2.4. Stress-free annealing

- 16MnCr5, 42CrMo4, C45
- Not stress-free annealing: 1.4301, 1.4571, 1.8928 (S690QL)
- Depends on part design, shape and post-processing: S355
- Note: Specifications for stress-free annealing are always indicated in the respective purchase order description.

#### 5.2.5. Flatness

2 mm / m

#### 5.2.6. Deburring the flame-cut edges

in accordance with DIN ISO 13715 from -0.1 to -0.8

#### 5.2.7. Applying material numbers on flame-cut parts:

see 2.1



#### 5.2.8. Tolerances for angular dimensions (trimmed edges)

Perpendicularity tolerance [mm]: 0.15

#### 5.2.9. Surface roughness (trimmed edges)

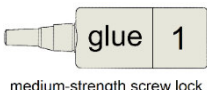
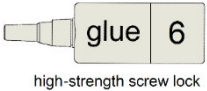
Average surface roughness  $R_z$  [ $\mu\text{m}$ ]: 70

## 6. Requirements for the assembly of assemblies

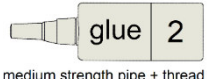
### 6.1. Use of DU bushings for joint assemblies

In assemblies with DU bushings that must be coated after the DU bushings have been installed, only DU bushings manufactured by GGB may be used. Type designation: 'DU ® Metal-Polymer Anti-Friction Plain Bearings'.

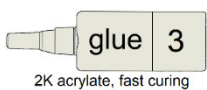


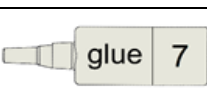
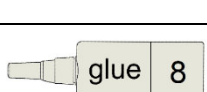

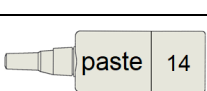
### 6.2. Threadlocking agents

 <p>medium-strength screw lock</p>	Weiconlock AN 302-43 or Loctite 243 (medium viscosity, medium strength)
 <p>high-strength screw lock</p>	Weiconlock AN 302-70 or Loctite 270 (medium viscosity, difficult to disassemble)

### 6.3. Agents for sealing

 <p>medium strength pipe + thread seal</p>	Weiconlock AN 305-77 or Loctite 577 Pipe and thread sealant (high viscosity, medium strength)
---	---

### 6.4. Agents for joining and bonding components

 <p>2K acrylate, fast curing</p>	Two-part acrylic adhesive with a cure time of 4–6 minutes for high-performance bonding of metals and plastics Type: Scotch-Weld DP 8405 NS
 <p>2K epoxy - steel-filled</p>	Epoxy resin minute adhesive, pasty, steel-filled, gap-filling, 5-minute cure time, bridges larger cracks Type: Weicon Easy-Mix Metal
 <p>contact glue</p>	Liquid contact adhesive, temperature-resistant from -40 to +110°C. Suitable for bonding HPL panels, leather, cork, felt, rigid PVC, flexible foam panels, artificial leather and metals. (low strength connection) Type: Pattex high-strength adhesive or Teroson SB 2490
 <p>retaining compound - high strength</p>	Weiconlock AN 306-01 or Loctite 601 Bonding bearings and shafts (low viscosity, difficult to disassemble)
 <p>2K epoxy, slow curing</p>	Two-part epoxy adhesive, heat resistant up to 80°C, fills gaps, waterproof, paintable, resistant to many chemicals (long processing time) Type: UHU Plus endfest
 <p>thermal</p>	Heat conducting paste / copper paste; temperature resistant up to 1100°C Type: Weicon Kupferpaste Manufacturer: Weicon GmbH & Co. KG
 <p>for screw connections</p>	Assembly paste with NSF-H1 certificate Assembly and disassembly aid for screw connections Type: Rivolta F.L.A. Manufacturer: Bremer & Leguil GmbH

## 6.5. Screw locking for assemblies

The Illig internal guideline 03 15 22 applies to the unit fitted with screws. The following sections are particularly relevant.

### Part 1:

All screw connections must be secured.

### Part 4:

Screws have to be chemically secured if one of the conditions below is met:

- If the screw connection must not be tightened to the specified torque.
- If the attached parts have to be movable.
- If a part of the screw connection is elastic (e.g. plastic)
- If the screw connection cannot be equipped with hexagon elements.
- If a contact surface of the screw head or nut is hardened.
- If the screw is a countersunk screw.

### Part 6:

- Spray oily or dirty components of the screw connection with Cleaner S and blow out.
- Put adhesive ("normally" detachable type) on the screw and join the screw connection and tighten with the specified torque.
- Complete hardening is achieved after 48 hours.

### Part 11:

- ... If screw connections are chemically secured, this requirement is not explicitly documented. This means that screw connections without further labeling are chemically secured.

## 6.6. Lubricants

 grease	Lubricant – Grease: ILLIG Standard Lithium, semi-synthetic Type: UNIL Lycos RK2 Manufacturer: Unil Lubricants
 grease	Lubricant – Grease: ILLIG Standard with NSF-H1 certificate, synthetic Type: Purity FG2 Synthetic Heavy 220 Manufacturer: Petro-Canada Lubricants Inc.
 spray oil	Schmierstoff – Öl: ILLIG Standard with NSF-H1 certificate Type: Interflon Food Lube Manufacturer: Interflon Deutschland GmbH

## 7. Panes made of transparent plastics: Requirements for components and assemblies

- Panes made of transparent plastic are to be covered on both sides with a protection foil to avoid being scratched or damaged.
- External corners are to be manufactured with R5.
- If panes are to be painted, coated or labeled, this side should be marked with the letter A.

## 8. ILLIG materials: Requirements for components

### 8.1. Material for precision shafts

#### 8.1.1. ILLIG-1 (hardened piston rods)

Material	42CrMo4QT (1.7225)
Finish	Induction hardened HRC 56–64, polished, hard chrome plated with specified layer thickness $20 \pm 5 \mu\text{m}$ , polished $Ra \leq 0.30 \mu\text{m}$
Tolerance	f7

#### 8.1.2. ILLIG-2 (standard precision steel shafts)

Material	Cf53 (1.1213)
Finish	Induction hardened HRC 59–66, ground, polished $Ra \leq 0.30 \mu\text{m}$
Tolerance	h6

#### 8.1.3. ILLIG-3 (chrome plated precision steel shafts)

Material	Cf53 (1.1213)
Finish	Induction hardened HRC 59–66, ground, hard chrome plated with a specified layer thickness $10 \pm 5 \mu\text{m}$ , polished $Ra \leq 0.30 \mu\text{m}$
Tolerance	h6

#### 8.1.4. ILLIG-4 (precision stainless-steel shafts)

Material	X46Cr13 (1.4034)
Finish	Induction hardened HRC 52–58, ground, polished $Ra \leq 0.30 \mu\text{m}$
Tolerance	h6

#### 8.1.5. ILLIG-5 (precision stainless-steel shafts)

Material	X90CrMoV18 (1.4112)
Finish	Induction hardened HRC 52–59, ground, polished $Ra \leq 0.30 \mu\text{m}$
Tolerance	h6

#### 8.1.6. ILLIG-6 (precision steel hollow pipes)

Material	C60 (1.0601)
Finish	Induction hardened HRC 597–66
Tolerance	arc ground $Ra \leq 0.8 \mu\text{m}$ , tolerance IT 9 peripheral ground $Ra \leq 0.4 \mu\text{m}$ , tolerance IT 7

#### 8.1.7. ILLIG-7 (chrome-plated precision steel shafts)

Material	20MnV6 (1.5217)
Finish	Thermoformed, trimmed, ground, hard chrome plated with a specified layer thickness $25 \pm 5 \mu\text{m}$ , polished $Ra \leq 0.30 \mu\text{m}$
Tolerance	f7

#### 8.1.8. Standard dimension tolerances for ILLIG-1 – ILLIG-7:

Ø mm	Illig_1 1.7225	Illig_2 1.1213	Illig_3 1.1213	Illig_4 1.4034	Illig_5 1.4112	Illig_6 1.0601	Illig_7 1.5217
3					h6		
4				h6	h6		
5		h6			h6		
6		h6	h6	h6	h6		
8		h6	h6	h6	h6		
10		h6	h6	h6	h6		
12	f7	h6	h6	h6	h6	h6	f7
14	f7	h6	h6				f7
15		h6					
16	f7	h6	h6	h6	h6	h6	f7
18	f7	h6					f7
20	f7	h6	h6	h6	h6	h6	f7
22	f7	h6					f7
25	f7	h6	h6	h6	h6	h6	f7
28	f7	f7					f7
30	f7	h6	h6	h6	h6	h6	f7
32	f7	h6	h6				f7
35	f7	h6	h6				f7
36	f7	h6	h6				f7
40	f7	h6	h6	h6	h6	h6	f7
45	f7	h6					f7
50	f7	h6					f7
55							
56	f7						f7
60	f7	h6	h6	h6	h6	h6	f7
63	f7						f7
65							
70	f7	h6	h6				f7
75	f7						f7
80	f7	h6	h6	h6	h6	h6	f7
85							
90	f7						f7
100	f7	h6					f7
110	f7						f7

#### 8.1.9. Hardening depth for induction hardening (ILLIG-1 – ILLIG-6)

Finish	Dimensions mm	Surface hardening depth (SHD) mm
Piston rod material Induction hardened	0 – 25.4 28 – 90 90	0.75 – 1.25 1.25 – 2.25 1.8 – 3.0
Precision steel shafts with normal finish	5 – 8	0.5 – 1.0
Precision steel shafts with hard chrome plating to specified layer thick- ness	10 – 16 18 – 28 30 – 56 60 – 70 ≥ 80	1.0 – 1.5 1.5 – 2.0 2.0 – 3.0 2.5 – 3.5 3.5 – 4.5
Precision steel shafts		
Precision steel shafts that are corrosion re- sistant	0 – 25 25 – 50	1.5 – 2.5 2.5 – 3.5

## 8.2. Other **ILLIG** materials

### 8.2.1. **ILLIG-8** (round material C45E)

#### 8.2.1.1. D<80 mm

Material	C45E+C/+SH (1.1191+C/+SH)
Finish	bright
Tolerance	DIN EN 10278

#### 8.2.1.1. D≥80 mm

Material	C45E+SH (1.1191+SH)
Finish	hot rolled, VITAC 3000
Tolerance	DIN EN 10060

### 8.2.2. **ILLIG-9** (round material S355J0)

#### 8.2.2.1. D<80 mm

Material	S355J0+SH (1.0553+SH)
Finish	bright, peeled
Tolerance	DIN EN 10278

#### 8.2.2.2. D≥80 mm

Material	S355J0+SH (1.0553+SH)
Finish	hot rolled, VITAC 3000
Tolerance	DIN EN 10060

### 8.2.3. **ILLIG -10** (milled cast aluminum plate; workpiece 3.3547)

- High dimensional stability achieved by a special heat treatment
- Excellent machinability
- Excellent weldability
- Excellent corrosion-resistant properties
- Even, fine granular structure
- Good anodization properties
- Optimal for hard anodization

#### 8.2.3.1. Tolerances

- Thickness: ± 0.1 mm
- Flatness, material thickness < 12.7 mm: max. 0.40 mm
- Flatness, material thickness > 12.7 mm: max. 0.13 mm
- Surface roughness: Ra = ~ 0.60 µm

#### 8.2.3.2. Mechanical properties

- Tensile strength Rm 250 MPa
- Yield strength Rp 0.2 110 MPa
- Elastic modulus 70 GPa
- Extension A5 min. 10%
- Brinell hardness HBS 2.5 / 62.5 68

#### 8.2.3.3. Physical properties

- Thermal expansion coefficient 23.3 µm/(m K)
- Thermal conductivity 110-130 W/(m K)
- Electrical conductivity 16.2 MS/m
- Specific heat (25 - 100°C) 900.0 J/(kg K)
- Permeability 2.66 g/cm<sup>3</sup>

#### 8.2.4. **ILLIG-11** (manufactured based on PE-UHMW TG 1.2)

##### 8.2.4.1. General

Abbreviation	ISO 1043-1	PE-UHMW
Sheet group	ISO 15527	1.2
Plastic color	Green	
Molecular weight	g/mol	5 x 10 <sup>6</sup>
Permeability	ISO 1183	kg/dm <sup>3</sup> ≤ 0.93

##### 8.2.4.2. Mechanical properties

Yield stress/stress at break	ISO 527	MPa	20.4
Ductile yield (elongation at break)	ISO 527	%	380
Notch impact resistance – Charpy	ISO 179	kJ/m <sup>2</sup>	≥ 170
Shore hardness D	DIN 53505	°	66
Ball indentation hardness	MPa	38	
Wear resistance (Sand-Slurry test)		%	100
Coefficient of friction		0.1 – 0.2	

##### 8.2.4.3. Thermal properties

Thermal conductivity at 23 °C	ISO 52612	W/(K ° m)	0.4
Coefficient of linear thermal expansion α:	ISO 11359		
- Mean value between 23 and 60 °C		m/(m ° K)	20 ° 10 <sup>-5</sup>
Maximum heat resistance in the air:			
- Temporary 2)		°C	90
- Continuous: during 5 000 h 3)		°C	80
Low temperature resistance 4)		°C	-200
Flammability according to UL 94		HB	

##### 8.2.4.4. Electrical properties

Dielectric strength	IEC 60243	kV/mm	≤ 45
Electrical resistivity	IEC 60093	Ω ° cm	> 10 <sup>14</sup>
Surface resistivity	IEC 60093	Ω	> 10 <sup>13</sup>

##### 8.2.4.5. Conformity with food standards

FDA	Yes
EU 1935/2004 (only for [FS] variants)	Yes

#### 8.2.5. **ILLIG-12** (manufactured based on PE-UHMW TG 1.2)

Abbreviation	ISO 1043-1	PE-UHMW
Sheet group	ISO 15527	1.2
Plastic color	Natural	
Molecular weight	g/mol	5 x 10 <sup>6</sup>
Permeability	ISO 1183	kg/dm <sup>3</sup> ≤ 0.93

Further properties similar to ILLIG 11

#### 8.2.6. **ILLIG-14** (manufactured based on PE-UHMW TG 1.2)

Abbreviation	ISO 1043-1	PE-UHMW
Sheet group	ISO 15527	1.2
Plastic color	Black	
Molecular weight	g/mol	5 x 10 <sup>6</sup>
Permeability ISO 1183	kg/dm <sup>3</sup>	≤ 0,94

#### 8.2.6.1. Mechanical properties

Yield stress/stress at break	ISO 527	MPa	20,4
Ductile yield (elongation at break)	ISO 527	%	>300
Notch impact resistance – Charpy	ISO 179	kJ/m <sup>2</sup>	≥ 170
Shore hardness D	DIN 53505	°	61-65
Ball indentation hardness	MPa	>30	
Wear resistance (Sand-Slurry test)		%	100
Coefficient of friction		~ 0,2	

#### 8.2.6.2. Thermal properties

Thermal conductivity at 23 °C	ISO 52612	W/(K ° m)	0,4
Coefficient of linear thermal expansion α:			
- Mean value between 23 and 60 °C			20 x 10 <sup>5</sup>
Maximum heat resistance in the air:			
- Temporary 2)		°C	90
- Continuous: during 5 000 h 3)		°C	80
Low temperature resistance 4)		°C	-200
Flammability according to UL 94		HB	

#### 8.2.6.3. Electrical properties

Dielectric strength	IEC 60243	kV/mm	
Electrical resistivity	IEC 60093	Ω ° cm	> 10 <sup>6</sup>
Surface resistivity	IEC 60093	Ω	> 10 <sup>9</sup>

#### 8.2.6.4. Conformity with food standards

FDA	Yes
EU 1935/2004 (only for [FS] variants)	Yes

#### 8.2.7. ILLIG-20 (sheet of Feran®)

Strip steel, clad on one or both sides with aluminum (FERAN®)  
 bright rolled, (decorative) surface  
 overlay approx. 5%/side  
 thickness: 1,5 +/-0,035 mm  
 Note: Raw material must be well greased

Position	Material	Designation	Material No.	Standard
Core	Unalloyed steel	similar to DD11 *	1.0332	DIN EN 10111
Outer layer	Aluminium	similar to Al99,0	3.0205	DIN EN 573-3

\* Reference according to DD11 with regard to non-ageing material behavior

Adhesion: Overlay material cannot be mechanically removed from steel core.

Older designations of the material at Illig: "K32" or "1.0330+C290\_DC01+C290".

#### REPLACEMENT material for FERAN (K32 or 1.0330+C290\_DC01+C290)

Components manufactured with the material FERAN (K32 or 1.0330+C290\_DC01+C290) can be manufactured with the material 1.4509, contrary to the drawing specification. The sheet thickness remains 1.5 mm.



## 8.2.8. ILLIG-40 Vulkollan D15

Coating materials	Vulkollan D15 shore A 90, polyurethane (Bayer AG) Polyurethane caoutchouc AU (brand name: Vulkollan)
Hardness	90 shore A +/-5 according to DIN 53505
Tensile strength	47 MPa according to DIN 53504
Elongation at break	680% according to DIN 53504
Strain at 100% tensile force	6.6 MPa according to DIN 53504
Strain at 300% tensile force	10.2 MPa according to DIN 53504
Impact elasticity	60% according to DIN 53512
Tear strength	42 N/mm according to DIN 53515
Abrasion	32mm <sup>3</sup> according to DIN 53516
Compression set 70h / 22°C	11% according to DIN 53517
Compression set 24h / 70°C	20% according to DIN 53517
Permeability	1.26 g/cm <sup>3</sup>
Temperature resistance	-25 / +80 °C

## 8.2.9. ILLIG-41 Phenolic Paper PF-CP 201 (previously 2061)

Eigenschaft	Prüfverfahren nach IEC 60893- 2, Abschnitt	Einheit	max. oder min.	
Biegespannung beim Bruch senkrecht zur Schichtung	5.1	MPa	min	135
Elektrizitätsmodul aus dem Biegeversuch	5.2	MPa	min	7000
Druckfestigkeit senkrecht zur Schichtrichtung	5.3	MPa	min	300
Schlagzähigkeit (Charpy) parallel zur Schichtrichtung	5.5.2	KJ/m <sup>2</sup>	min	
Schlagzähigkeit (Izod) parallel zur Schichtrichtung	5.5.3	KJ/m <sup>2</sup>	min	
Scherfestigkeit parallel zur Schichtung	5.6	MPa	min	10
Zugfestigkeit	5.7	MPa	min	80
Durchschlagfestigkeit bei 90°C in Öl senkrecht zur Schichtung	6.1.2	kV/mm	min	nur für Rohre
Durchschlagspannung bei 90°C in Öl parallel zur Schichtung	6.1.2	kV	min	20
Permittivität bei 48 Hz bis 62 Hz	6.2		max	5,5
Permittivität bei 1 MHz	6.2		max	
Verlustfaktor bei 48 Hz bis 62 Hz	6.2		max	
Verlustfaktor bei 1 MHz	6.2		max	
Isolationswiderstand nach Eintauchen in Wasser	6.3	MΩ	min	5*10 <sup>3</sup>
Prüfzahl der Kriechwegbildung	6.4			
Vergleichszahl der Kriechwegbildung	6.4		min	100
Widerstand gegen Kriechwegbildung	6.5	Klasse	min	
Thermisches Langzeitverhalten	7.1	T.I.		120
Enflammbarkeit	7.2	Kategorie		
Dichte	8.1	g/cm <sup>3</sup>	Bereich	1,3 bis 1,4
Wasseraufnahme	8.2	mg	max	209

### 8.3. Special materials

#### 8.3.1. **ILLIG-99** (special materials)

The material designation ILLIG-99 is a variable under which materials are grouped, that are not used by Illig as a standard.

With this specification, the material designation is directly on the drawing and additionally in the purchase order text.

## 9. Requirements for components with coatings

### 9.1. Surfaces that are not to be coated

Applies to M-Parts: Surfaces such as interference fit holes, threads and surfaces with a specified tolerance may not be treated with depositing coating. Such surfaces must be covered before coating the rest of the workpiece. Exceptions, for which the above-mentioned surfaces are to be coated, are indicated as "coated".

Applies to W-Parts: Surfaces, that must not be treated with conversion coatings are marked in the drawing. These areas must be covered before coating.

### 9.2. Coating types: phosphating, galvanizing, electroless nickel plating

All surfaces are coated during phosphating, galvanizing and electroless nickel plating.

### 9.3. Surfaces that are not to be painted

Threaded surfaces and surfaces with tolerances may not be painted. These surfaces must be covered before painting. Other surfaces that may not be painted are indicated on the drawing as "paint free".

### 9.4. Hard coating (hard coat anodizing)

according to ISO 10074:2021 ( E )

- Vickers microhardness according to ISO 10074, table 5
- The pre-machining dimensions of a workpiece that has to be hard coated (anodized) assume a single-layered coating and are calculated so that half the thickness of the hard-coated layer is applied to the workpiece surface and the other half to the conversion of aluminum into its oxide without increasing the thickness of the material. (e.g. for a planned layer thickness of 0.050 mm, only half of the layer dimension, i.e. 0.025 mm, is accounted for in the pre-machining dimension.)
- A hard coating that deviates from the abovementioned ratio 1:1 for layer thicknesses is not permitted.
- The same conditions apply to coatings that serve multiple purposes and include anodizing.
- HC-PLUS 2 is a surface impregnation of a hard-coated layer with PTFE (Polytetrafluoroethylene). It improves the sliding and corrosion behavior of the treated workpiece. In addition, the PTFE particles embedded in the HC coating enable optimum dry lubrication properties without additional coating buildup. In the case of abrasive wear, the sliding properties of the coating are retained. The antiadhesive properties of HC-PLUS also makes it easier to clean the surface of the final product.

## 9.5. Coating types

The coating types are indicated in the drawing header in the "Surface" field by a letter abbreviation. The currently used abbreviations and their meanings are listed below.

Other abbreviations used in drawings from the past (mainly before 06/2023) can be found in the appendix.

Abbreviation	Description	Specification
_AD	hard coated (hard coat anodization)_30	Hard anodized aluminum; oxidized layer thickness: 0.030 mm
_AP	hard coated_30, HC Plus 2 (with PTFE)	Hard anodized aluminum; oxidized layer thickness: 0.030 mm A PTFE-coating is applied to the hard coated layer which improves the coefficient of friction, as well as the corrosion and dry lubricant properties of the treated surface.
_CC	CrCN (Chromcarbonitrid)	Wear protection steel, good sliding properties, coating thickness $3 \mu\text{m} \pm 1 \mu\text{m}$
_CF	hard chrome-plated_50	Hard chrome-plated with a layer thickness of 0.050 mm
_CZ	hard chrome-plated_20	Hard chrome-plated with a layer thickness of $0.020 \text{ mm} \pm 0.005 \text{ mm}$
_EF	natural anodized	Anodized
_ES	black anodized	Anodized, dyed and sealed
_GM	rubberized	rubberize
_HS	Hard Slide Sinter (HSS)	Special coating for heating rolls (VHW)
_LA	painted A (light gray RAL 7035)	Light gray RAL 7035; coarse textured paint; powder coated or wet painted <ul style="list-style-type: none"> <li>powder coated with a layer thickness of <math>70 - 120 \mu\text{m}</math> Manufacturer: PPG Industrial Coatings Type powder coating: Envirocron PCF – Epoxy Polyester Series P8 Designation powder coating: P811G674T-YD EP-PE Gray T TXT CA-7035 textured paint</li> <li>Wet painted with a layer thickness of <math>70 - 120 \mu\text{m}</math> Manufacturer: PPG Industrial Coatings Type wet paint: Selemix Direct Binder GL 80% Leadfree Variable Pack Size Designation wet paint: 7.539-MX01/EX-ILLIG Calibration with ILLIG sample boards required Primer treatment and thinning if necessary according to paint manufacturer specifications</li> </ul>
_LB	painted B (RAL 5013 cobalt blue)	Cobalt blue RAL 5013; coarse textured paint; powder coated or wet painted; layer thickness of $70 - 120 \mu\text{m}$ <ul style="list-style-type: none"> <li>Manufacturer: powder coating: Colore Srl. Type: Colore Serie P.11 PE Designation: P.11-05013-GL2Z PE Blu COBALTO RAL 5013 textured paint</li> <li>Manufacturer wet paint: PPG Industrial Coatings Type: Selemix Direct Binder GL 80% Leadfree Variable Pack Size Designation: 7.538-MX01/EX-ILLIG Calibration with ILLIG sample boards required Primer treatment and thinning if necessary according to paint manufacturer specifications</li> </ul>

Abbrevia- tion	Description	Specification
_LC	painted C (white aluminum – silk-matt)	Wet painted with a layer thickness of 30 – 50 µm; Temperature resistance up to 400°C Manufacturer: Mankiewicz Gebr. & Co. (GmbH & Co. KG) Type: CELEROL Decklack 969-76 Thinner: CELEROL Verdünner 903-76
_LD	painted D (silver – FS B 7956)	Wet painted with a layer thickness of 30 – 50 µm
_LI	painted I (RAL 1021 rape yellow)	Wet painted with a layer thickness of 30 – 50 µm
_LM	painted A (light gray RAL 7035)	<p>Light gray RAL 7035; coarse textured paint; powder coated or wet painted</p> <ul style="list-style-type: none"> <li>• powder coated with a layer thickness of 70 – 120 µm Manufacturer: PPG Industrial Coatings Type powder coating: Envirocron PCF – Epoxy Polyester Series P8 Designation powder coating: P811G674T-YD EP-PE Gray T TXT CA-7035 textured paint</li> <li>• Wet painted: prime coat with a layer thickness of 50 – 80 µm; cover coat with a layer thickness of 60 – 80 µm Manufacturer: PPG Industrial Coatings Type wet paint: Selemix Direct Binder GL 80% Leadfree Variable Pack Size Designation wet paint: 7.539-MX01/EX-ILLIG Calibration with ILLIG sample boards required Primer treatment and thinning if necessary according to paint manufacturer specifications</li> </ul>
_NF	Niflor (nickel sulfate layer with PTFE)	Niflor® 11 PF is the latest generation of high-performance non-PFOS autocatalytic NiP-PTFE composite coating with excellent dry lubricating properties and a low friction coefficient. The coatings are uniform, corrosion resistant, extremely durable and provide excellent lubricating properties over their entire lifetime. Totally free of PFOS, Pb and Cd, it meets all requirements of the ELV and RoHS directives.
_NH	electroless nickel plating / DNC_5	Electroless nickel plating layer thickness: 5 µm
_NL	electroless nickel plating / DNC_30	Electroless nickel plating layer thickness: 30 µm
_NT	nitrocarburated	for non-stainless steels. Thermochemical treatment that diffuses nitrogen and carbon into the outer layers of a workpiece. This results in a nitrided case consisting of a compound layer and a diffusion layer.
_PD	phosphated_zinc_thin layer	Zinc phosphate coating; 3 – 6 µm
_PH	phosphated_manganese	Manganese phosphate coating; 3 - 15 µm
_PN	plasma nitrided	For stainless steels only. Nitriding is a heat treating process that diffuses nitrogen into the surface of a metal to create a case hardened surface. The result is a coating that withstands temperatures of 500 °C. When nitrogen is added to a plasma gas the process is called plasma nitriding.
_SO	Special coating	Specification is given on the drawing
_TK	PTFE-coated TFE-LOK (sealing heater)	Brand name from Peter Schreiber GmbH, electroless nickel with PTFE see NF

<b>Abbrevia- tion</b>	<b>Description</b>	<b>Specification</b>
_TL	PTFE-coated	coated with PTFE, Specification is given on the drawing
_VH	hardslide S	Brand name of the company MCG, Brühl: wear resistant, low-friction, non-stick, self-dry-lubricating, temperature proof, layer thickness: 0.020–0.030 mm
_VT	HS (CCR 52 T)	Brand name from the company MCG, Brühl: anti-corrosive, low-friction, abrasion proof on aluminum parts, electroconductive, layer thickness: 0.035–0.055 mm
_ZG	galvanized	galvanization and blue passivation 15 µm

## 10. Requirements for components with food contact

### 10.1. Labeling of components with food contact

Components intended to come into contact with foodstuffs are marked in the drawings as follows:



Material mit Lebensmittelkontakt  
Food Contact Material  
Lieferantenspezifikation beachten  
Observe specifications for suppliers

### 10.2. Requirements for components with food contact

For materials and articles intended to come into contact with foodstuffs the following regulations must be observed in their currently valid versions:

- REGULATION (EC) No. 1935/2004 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 October 2004 on materials and articles intended to come into contact with food and repealing Directives 80/590/EEC and 89/109/EEC
- COMMISSION REGULATION (EU) No. 10/2011 of 14 January 2011 on plastic materials and articles intended to come into contact with food
- COMMISSION REGULATION (EC) No. 2023/2006 of 22 December 2006 on good manufacturing practice for materials and articles intended to come into contact with food
- German Commodities Ordinance - Bedarfsgegenständeverordnung (BedGgstV)

### 10.3. Declaration of conformity for components with food contact

The scope of delivery includes a declaration of conformity that the product complies with the legal requirements of the German Commodities Ordinance (BedGgstV) and REGULATION (EC) No. 1935/2004, as amended. All materials and raw materials used comply with COMMISSION REGULATION (EU) No. 10/2011.

The total migration as well as the specific migration are below the legal limits when used according to specification.

The Compliance Testing was carried out according to Regulation (EU) No. 10/2011 (Annex V)

## 11. Appendix

### 11.1. Other coating types and abbreviations used

Abbreviations used in the past (especially in drawings before 06/2023):

Abbrevia- tion	Description	Specification
_AF	hard coated (hard coat anodization) _50	Hard anodized aluminum; oxidized layer thickness: 0.050 mm
_AG	Gliss-Coat-HvR 200-W-60-P	replaced by _TL
_AH	hard coated (hard coat anodization)	replaced by _AD
_AS	hard coated (hard coat anodization) _60	Hard anodized aluminum; oxidized layer thickness: 0,060 mm
_AV	hard coated (hard coat anodization) _40	Hard anodized aluminum; oxidized layer thickness: 0,040 mm
_AZ	hard coated _50, HC Plus 2 (with PTFE)	Hard anodized aluminum; oxidized layer thickness: 0.050 mm A PTFE-coating is applied to the hard coated layer which improves the coefficient of friction, as well as the corrosion and dry lubricant properties of the treated surface.
_BR	gunmetal-finished	Bluing is a passivation process that forms a light protective layer on metal alloys, usually containing iron, against corrosion. The workpiece is dipped in acid, an alkali salt solution, or some other salt solution to form black mixed oxide layers of FeO and Fe <sub>2</sub> O <sub>3</sub> . Bluing is not a real coating, as there is no layer application.
_CG	glossy chrome-plated (electroplating)	Galvanic chrome-plated layer of 0.2 to 0.5 µm.
_CH	hard chrome-plated (electroplating)	replaced by _CG
_CV	hard chrome-plated _05	Hard chrome-plated with a layer thickness of 0.005 mm
_CD	hard chrome-plated _10	Hard chrome-plated with a layer thickness of 0.010 mm
_EB	blue anodized	Anodized, dyed and sealed
_ED	dark bronze anodized	Anodized, dyed and sealed
_EG	gold anodized	Anodized, dyed and sealed
_EH	hard anodized	Anodized
_EM	medium bronze anodized	Anodized, dyed and sealed
_ER	red anodized	Anodized, dyed and sealed
_G1	rubberized 1	Rubber coating approved under statutory food regulations in temperature range: ambient temperature; hardness 50° Shore A ±5°; elasticity 44%; density 1.2 ±0.05 g/cm <sup>3</sup> ; abrasion 190 ±20 mm <sup>3</sup> ; compression set 5.6%
_G2	rubberized 2	Rubber coating in temperature range: ambient temperature; hardness 80° Shore A ±5°; elasticity 31%; density 1.2 ±0.05 g/cm <sup>3</sup> ; compression set 5%
_G3	rubberized 3	Rubber coating approved under statutory food regulations; temperature range: suitable for continuous temperatures of up to 200°C (silicone rubber); hardness 70° Shore A ±5°, elasticity 58%; density 1.5 ±0.05 g/cm <sup>3</sup> ; compression set 6%
_GB	pickled	treat with acid to remove tinder



Abbrevia- tion	Description	Specification
_GE	glass bead blasted_ano- dized	glass bead blasted and natural anodized
_GG	glass bead blasting_150– 250 µm	Glass bead blasting with a glass bead size ranging from 150 to 250 µm. Glass bead blasting is a non-abrasive process used to treat metal surfaces. The glass beads remove stains or wear marks, and smoothen, seal and polish the surface.
_GN	gas nitrided	replaced by _PN or _NT
_HA	hardened throughout	
_HE	hardened insert	case hardening
_HF	flame hardened	flame hardening
_HI	induction hardened	Induction hardening, SHD (according to ISO 15787:2016-09) for cylindrical parts such as shafts with a diameter up to 100 mm: 1–2 mm, and for parts with a diameter greater than 100 mm: 2–3 mm For toothed parts: The specified hardness ensures a sufficient case hardening depth, which is deliberately not specified.
_HV	vacuum hardened	vacuum hardening
_IA	impregnate seal alumi- num	resin sealing of die cast parts to eliminate porosity
_KO	kolsterised (see drawing for specifications )	Hardening process (diffusion of carbon at low temper- atures)
_LE	painted E (RAL 1013 oys- ter white – FS)	Wet painted with a layer thickness of 30 – 50 µm
_LF	painted F (RAL 7032 peb- ble gray)	Wet painted with a layer thickness of 30 – 50 µm
_LG	painted G (RAL 3000 flame red)	Wet painted with a layer thickness of 30 – 50 µm
_LH	painted H (RAL 9005 jet black)	Wet painted with a layer thickness of 30 – 50 µm
_LJ	painted J (black/yellow safety)	Wet painted with a layer thickness of 30 – 50 µm
_LK	painted K (special re- quest)	Wet painted with a layer thickness of 30 – 50 µm
_LL	painted L (special re- quest)	Wet painted with a layer thickness of 30 – 50 µm
_LN	painted N (RAL 7035 light gray)	Wet painted with a layer thickness of 30 – 50 µm
_LP	painted P (RAL 7035 light gray)	powder coated with a layer thickness of 70 – 120 µm Defined manufacturer: PPG Industrial Coatings Type: Envirocron PCF – Epoxy Polyester Series P8 Designation: P811G674T-YD EP-PE Gray T TXT CA- 7035 textured paint Calibration with ILLIG sample boards required Primer treatment according to paint manufacturer specifications

Abbrevia- tion	Description	Specification
_LR	painted R (RAL 5013 co- balt blue)	powder coated with a layer thickness of 70 – 120 µm Manufacturer powder coating: Colore Srl. Type: Colore Serie P.11 PE Designation: P.11-05013-GL2Z PE Blu COBALTO RAL 5013 textured paint Calibration with ILLIG sample boards required Primer treatment according to paint manufacturer specifications
_TF	nickel-plated-electroless / DNC Type 571	replaced by _NL
_ND	nickel-plated-electroless	replaced by _NL
_NG	nickel-plated (semimatte)	Galvanic nickel plating (also known as nickel electro- plating) is a coating of pure nickel deposited with the help of an electric current. Usually nickel is deposited in a multi-layered system e.g. Fe/Cu/Ni or Fe/Cu/Ni/Cr. Protection against corrosion for iron or steel requires a coating thickness of at least 25 to 50 µm of nickel; or an alternative to improve corrosion protection is to apply multiple layers of nickel coating. Galvanic nickel coating are often applied as an optical corrosion protection layer or as a base for soldering. To create a high-luster finish additives are mixed into the nickel bath. Since sulfur additives electrolyze in time, layers tend to slowly turn yellow. To prevent this, Cr layers are often added on top of the nickel coating. The time it takes to add a nickel coating is regulated by the electric current. It is possible to make large nickel deposits in a very short time.
_NI	nickel-plated-electroless / DNC_06	replaced by _NH
_NJ	nickel-plated-electroless / DNC_15	nickel-plated-electroless, thickness 15 µm
_NK	nickel-plated-electroless / DNC_20	nickel-plated-electroless, thickness 20 µm
_NM	nickel-plated-electroless / DNC_40	nickel-plated-electroless, thickness 40 µm
_NO	nickel-plated-electroless / DNC_50	nickel-plated-electroless, thickness 50 µm
_NP	nickel-plated-electroless / DNC_60	nickel-plated-electroless, thickness 60 µm
_NV	niflor_05 (PTFE-haltige Nickel-Phosphor-Schicht)	replaced by _NF
_NZ	glossy nickel-plated	glossy nickel plating
_PG	phosphate coated lubricity (with manganese)	Manganese phosphating in compliance with DIN EN ISO 9717
_PO	polished	mechanical polishing / electrolytic polishing
_SC	slidecoat 1	Brand name of the company MCG, Brühl: Slidecoat = low-friction, sliding surface, highly self-lubricating, can be processed mechanically, anti-corrosive, non-stick
_SD	slidecoat 1_600-800	layer thickness: 0.600–0.800 mm
_SE	slidecoat 1_800-1000	layer thickness: 0.800–1.000 mm
_SG	blasted (cast parts)	Abrasive blasting with solid abrasive material
_TD	teflonized PTFE	replaced by _TL

<b>Abbrevia- tion</b>	<b>Description</b>	<b>Specification</b>
_TF	Tenifer treated	replaced by _PN or _NT
_TG	PTFE-coated green	coated with green-colored PTFE
_TS	PTFE-coated W-1 EL	PTFE system W-1 EL (black) 0.015–0.020 mm (EL = electrical conductivity) Temp. resistant up to 280°C
_VC	compocoat	Brand name of the company MCG, Brühl: non-stick at increased temperature application, low-friction, corrosion resistant, layer thickness: 0.035–0.055 mm
_VU	vulcanized	vulcanized
_ZF	hot-dip galvanized	hot-dip galvanization
_ZS	galvanized sprayed	zinc spraying

