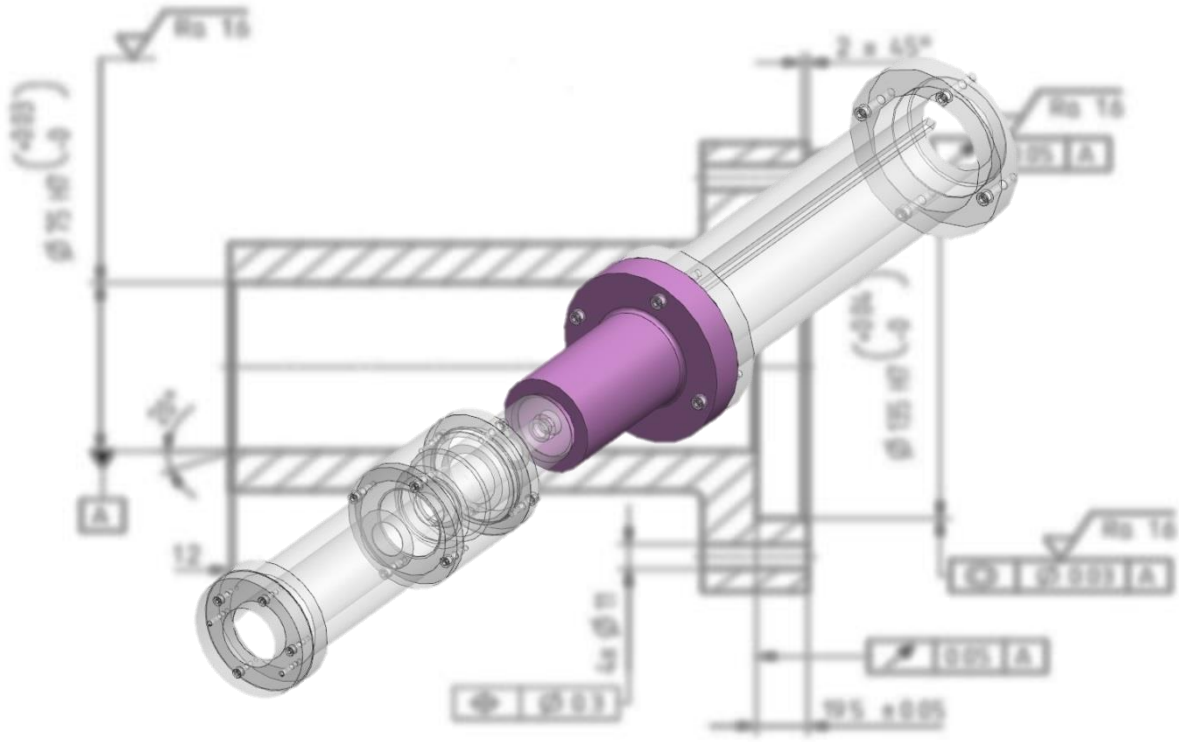
# Guideline for Vendors as Part of Order Placement

## Manufacturing of Individual Parts and Sub-assemblies

**Valid for all sites of thyssenkrupp Automation Engineering located in Germany**

Document: IMS001243 / Issue: 14.09.2022



**Change information:**

| Date | Author/ Organization Area | Site | Description |
|---|---|---|---|
| 14.09.2022 | André Steffen/PSM-QM | Bremen | 3.1 Restriction to “Bremen site only” added |
| | | | |

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# 1 General Information

## 1.1 Purpose of guideline

This guideline is intended to achieve the reduction of the number of inquiries and the avoidance of possible mistakes and the related costs and effort on both sides as part of the cooperation between the customer, thyssenkrupp Automation Engineering (hereafter CU) and the vendor (hereafter VE).

## 1.2 Contact

If there are any technical questions please use the contacts below:

- Bremen: + 49 (0) 421 6888-44312,
  manufacturer.systemengineering@thyssenkrupp.com
- Hohenstein-Ernstthal / Chemnitz: +49 (0) 3723 62-13442 or +49 (0) 3723 62-13292
  AE.B-Eng.manufacturer@thyssenkrupp.com

If dimensional deviations occurred during manufacturing, they have to be marked in the drawing. The scanned documents are to be sent for approval to the regarding email above. Test reports are not accepted

## 1.3 Refresh period of this guideline

The CU reserves the right to update this guideline at irregular intervals and without prior notice.

The VE shall ensure that it has the latest version of this guideline for the respective order and that it has taken note of this guideline.

The respective latest version of this guideline is available for downloading at the following link on the thyssenkrupp Automation Engineering homepage for this purpose.

https://www.thyssenkrupp-automation-engineering.com/en/purchasing/purchasing-download-centre/

## 1.4 Feedback on this guideline

We make an effort to constantly improve ourselves and our tools. Please help us with this task and contact us at any time if you have ideas, suggestions, or requests, or if contents are unclear to you.

## 1.5 Condition of the Products

The order to be delivered must be free from CFCs (CHCs) and substances that inhibit paint adhesion, such as silicone. Furthermore the REACH regulation applies.

## 1.6 Securing of Deadlines and Progress Checks

The CU sends an order confirmation form together with the purchase order, which shall be completely filled out by the VE and returned within three working days.

### 1.7 Securing of Deadlines

The VE is responsible for securing deadlines. It must immediately notify the CU of any malfunctions which occur that endanger the delivery date. Possibility arising extra costs, caused by the CU, have to be claimed by the VE within 1 week after it became known. In addition, it shall be obligated to initiate comprehensive measures which serve to secure the agreed upon delivery date.

### 1.8 Progress Checks

The VE shall grant the CU the right to carry out progress checks, including on the VE's premises, at any time. These checks can also be carried out as required without prior notice.

## 2 Manufacturing Assemblies

In addition to the necessary drawings, the parts lists of the assemblies serve as purchasing-relevant documents.

Only those materials named in the parts list may be used to manufacture the assemblies. If these specifications are to be deviated from, then this can only take place by consulting with the CU and obtaining its express agreement.

## 3 Changes to Manufacturing Documents

Manufacturing documents are drawings, sketches and parts lists.

### 3.1 Use of manufacturing drawings (Bremen site only)

The VE receives a new set of drawings with every purchase order. Manufacturing may only be carried out in accordance with these drawings.

If the VE fails to receive a new set of drawings with the purchase order, then it shall request this immediately from the orderer (in accordance with the purchase order).

It is not permissible to manufacture parts according to the offer drawings or drawings from previous orders.

### 3.2 Drawing changes or additions by the VE

Necessary changes during the manufacturing process can have the following causes:

- A faulty or unclear drawing
- Errors during the manufacturing process, although the part can continue to be used

In case of changes which have been made by the VE in agreement with the CU (Purchasing or Design), the following must be noted in handwriting and permanently on the drawing:

1. Deviation from the drawing or any drawing changes
2. Name of the person with whom the agreement has been reached at the CU
3. Name of the VE and/or authorized representative

4. Date and signature

# 4 Packing and Preservation

## 4.1 General Information

The goods to be delivered by the VE must be "goods relevant for preference". In addition to the goods, the scope of delivery also includes indication of the relevant customs tariffs numbers and countries of origin as well as a supplier's declaration.

The VE shall state this information on the order confirmation and delivery slip.

## 4.2 Handling

It must be ensured that the quality is not reduced when handling the products.

To prevent damage to the product, all selected means of transport, such as pallets, containers, and floor conveyors must be suitable for the purpose and in proper condition. It must be possible to handle the means of transport with a common transport device (forklift truck etc.). If special transport devices (e.g. special crane) are required for handling, then this must be coordinated beforehand.

## 4.3 Packing and transport

The packing is used to protect the products during shipping and storage.

To prevent damage to the products, preservation and, if necessary, additional packing options shall be used.

This applies to mechanical, chemical, and physical loads.

Own and legal specifications and customer-specific guidelines require the following basic principles to be observed during packing and shipping activities:

- The packing size and the packing effort shall be limited to the protection of the product.
- Filling materials shall be reduced to a minimum.
- Use reusable or recyclable packing materials if possible.
- Only use oil and wax paper with the approval of the customer.
- Only use preservatives in accordance with IPPC and EC directives.

The VE shall bear the responsibility for the use of the selected packing materials.

Information on handling the packing materials must be applied so as to be visible from the outside (e.g. protect against moisture, attachment points for crane and forklift transport, various customer-specific and legal markings).

# 5 Paint

## 5.1 Color tone

The VE shall be provided with the information on which color tone is to be used to paint the respective elements with the project-specific information following placement of the order or the purchase order.

## 5.2 Painting

### 5.2.1 Specifications for painting

The specifications for painting apply to individual parts, assemblies and entire machines.

1. All surfaces to be painted shall be primed and painted.

   Exception: machined areas (see #4)

2. The color tone (RAL Number) can be found on the drawing and/or the purchase order. Information on the purchase order override the once on the drawing.
3. The primer must always be carried out in "light ivory" (comparable to RAL 1015).
4. Machined areas are to be painted with SIGACRYL topcoat “esta” RAL 9006 White aluminum silk gloss. No primer to be applied.
   The painting on machined areas must not exceed 0,05mm.

   SIGARCRYL is available from J.Sigel&Sohn GmbH, Ochsenbrunnerstraße 4, 74078Heilbronn, Germany; www.sigel-lacke.de
5. Surfaces which are marked on the drawings with the note "Paint-free surface" must remain paint free.
6. The degree of gloss of the paint is 60% glossy if not otherwise specified.
7. The surface must be smooth.
8. Threads and thread fits as well as mirrored surfaces for bolt heads must be color-free. For all treatment processes (e.g. surface protection, heat treatment method) it is be ensured hat the dimensions and tolerances indicated on the drawings are to be adhered to in the delivery condition of he workpieces.
9. In order to avoid deviations in the color shades, we strongly recommend to obtain paints and varnishes from Mankiewicz Gebr.&Co.; www.mankiewicz.de.

   Exception: Machined areas (see #4)

10. If the note "Non-slip coating" is indicated on the drawing, ALEXIT top coat 406-25 must be used. (Available from company Mankiewicz Gebr.&Co.)
11. The manufacturer's specifications must be observed when applying the paints.
12. Paints must always be sprayed on. If not otherwise possible, the paint may also be applied with a roller.
13. Repairs must always be carried out with a roller. If not otherwise possible, the paint may also be applied with a brush.

14. Masking materials must be removed following painting work or prior to delivery.

**Color tone cards / color charts** ( Bremen site only)

15. Vendors receive standard RAL color cards for checking the RAL color tones ordered.
16. If a color tone is ordered by the CU which is not an RAL color tone, then the VE will receive a color chart painted correspondingly with the purchase order.
17. The VE will contact the CU if it receives an purchase order in which a non-RAL color tone is orderd, however no painted color chart has been received with the order.

# 6 Marking

## 6.1 Marking in general

The VE is required to mark all manufacturing parts and assemblies.

## 6.2 Valid marking methods

| Material | Stroke Numbers | Acid Stamp | Electrical En-craving Pen | Sticker | Tag | Bag with sticker | Laser signing |
|---|---|---|---|---|---|---|---|
| Polyurethanes | | | | X | X | X | |
| PA6 | | | | X | X | X | X |
| Steel unhardened | X | X | X | | | | X |
| Steel hardened | | X | X | X | X | | X |
| Aluminium | X | X | X | | | | X |

**Note: On fits, use Acid Stamps or Laser Signing only!**

### 6.2.1 Where is the Marking Applied?

The marking shall be applied directly on the manufacturing part at the point marked in the drawing with ""XXX"".

Assemblies shall be marked with a captive metal tag.

If the marking cannot be or is not to be applied directly to the manufacturing part due to its condition (part is too small, mass-production parts = individual part marking not practical), then they shall be delivered in suitable containers (plastic bag, carton, Euro-pallet).

The marking shall then be carried out with an adhesive label or a tag.

It must be captively mounted so that it is intact from the point in time of mounting up to the location of use.

Parts for which the marking has been lost due to reworking or other influences must be remarked.

Generally the VE is obligated to identify all single manufactured parts and sub-assemblies.

### 6.2.2 Scope of marking

#### 6.2.2.1 Manufactured part with K-Number

Each individual part shall be marked with an ID number, the version number and the VE's supplier number (and/or the VE's company logo).

**Note:**

- The supplier number can be found under "Supplier" on each purchase order.
- Marking with the VE's company logo is only permissible if use of the logo has been expressly confirmed by the CU.

**The ID number always corresponds to the CU's drawing number plus the version number.**

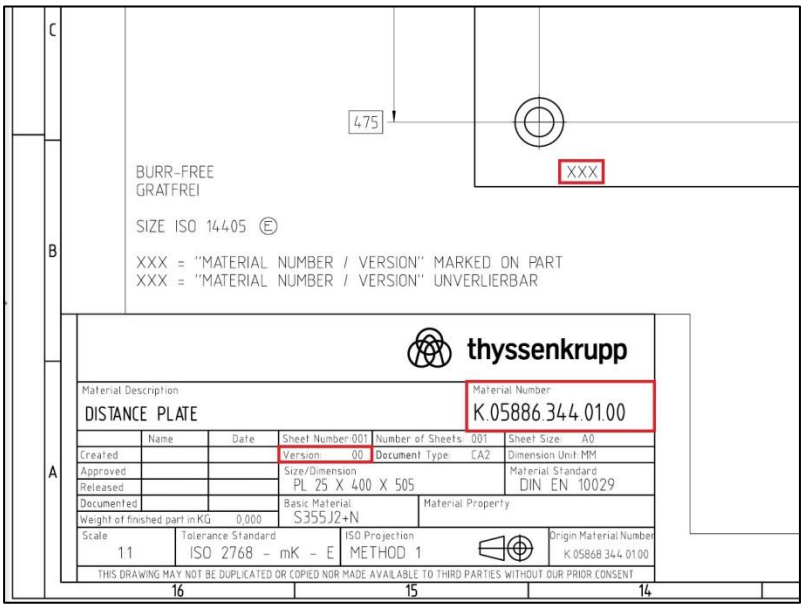
The ID number is positioned in the respective drawing's field „Material Number".

The version number is positioned in the respective drawing's field Version.

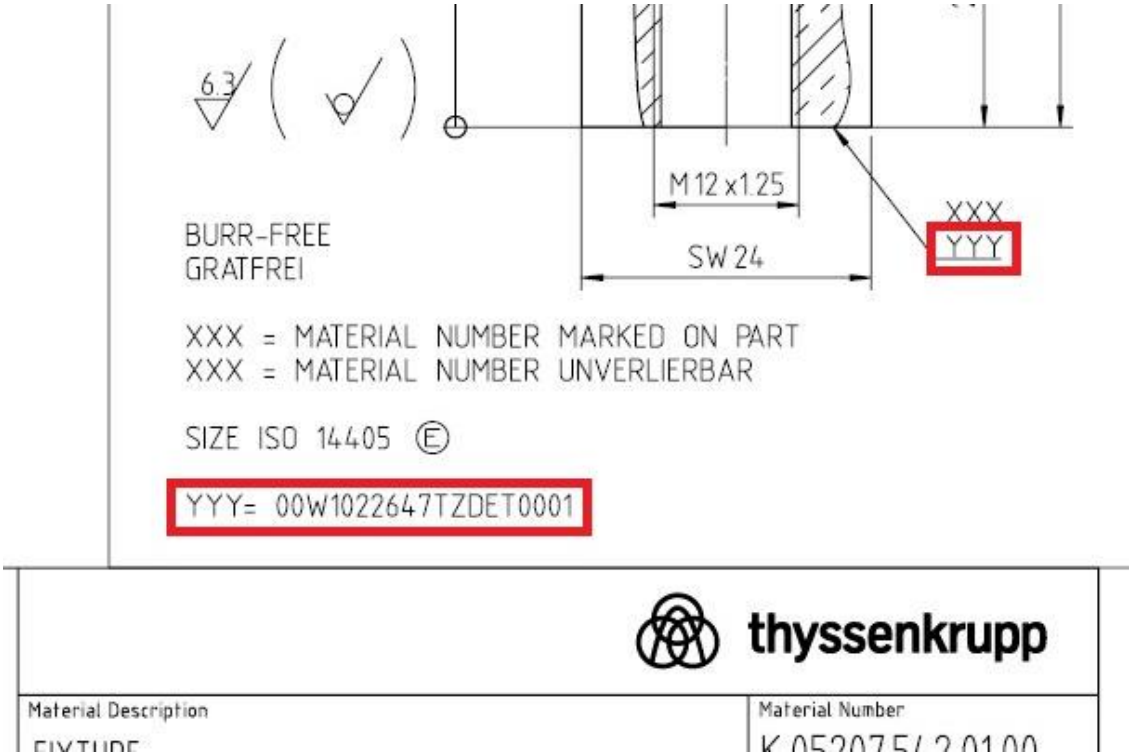
The drawing and version number are to be written down separated by a slash:

**K.05886.344.01/00**

You can take the marking place from the drawing XXX.




Sometimes it is required to place a further number as shown in the following example:




In this case only the number after „YYY=“ has to be placed on the manufacturing part, as shown in this example:

00W1022647TZDET0001

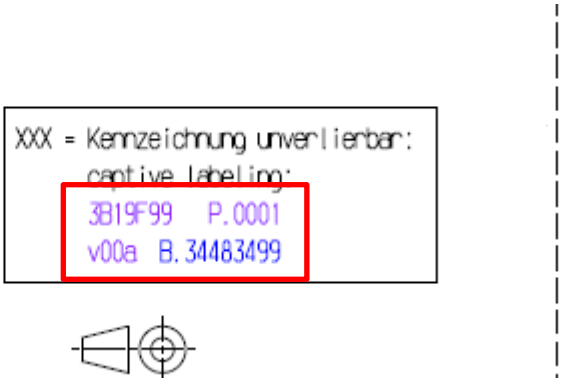
**Position of supplier number/company logo**

The VE shall always mark its supplier number (and/or company logo) in the center above or below the ID number.

### 6.2.2.2 Manufactured part with B-Number

Each individual part shall be marked with the ID number (B-Nr.). Additionally all customer information are part of the marking.

Customer information are shown on the drawing



### 6.2.3 Marking of assemblies

**Permanent marking**

Where the VE compiles a complete assembly, an adhesive label with the following attributes must be affixed to the assembly:

- The label is permanent
- Dimensions: 2 x 4 cm
- Silver background, black lettering

The adhesive label shows the supplier number (or company logo of the VE).

**Marking for logistical purposes**

All assemblies shall be marked with a captive metal tag. The tag indicates the CU's assembly number.

## 6.3 Production of manufactured parts

### 6.3.1 Relevant manufacturing drawings

Manufacturing parts are to be produced on the basis of 2D-drawings.

3D-models represent only an additional information without any commitment!

### 6.3.2 Tolerancing

The DIN 7167 has been withdrawn and been replaced with DIN EN ISO 14405-1.

If drawings are stated with „ Tolerance DIN Standard 7167 “ or „Tolerierung DIN 7167“ the corresponding replacement „Size ISO 14405 Ⓔ “ is valid.

### 6.3.3 Pre-Drills

If the information „pre-drill“ is stated in the manufacturing drawing, the pre-drill has to be bored 0,2 mm diameter smaller than stated in the drawing.

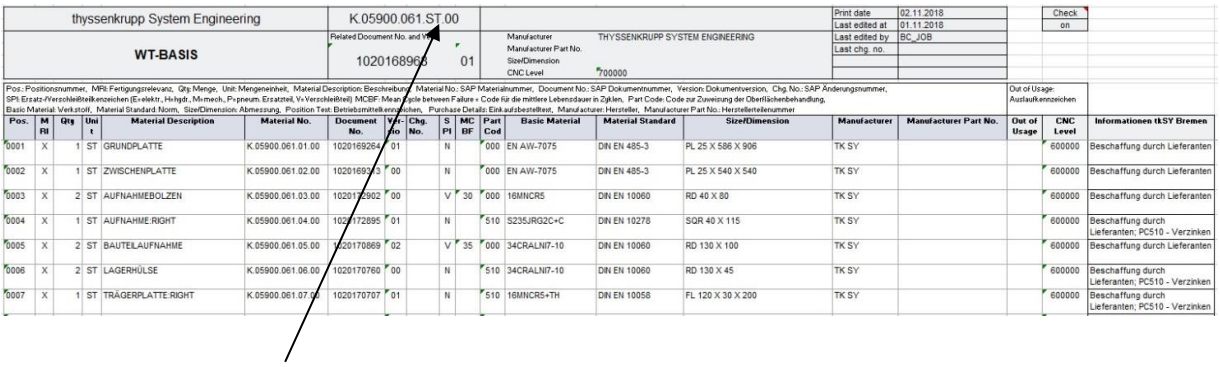
### 6.3.4 Polished parts

Polishing is the finishing process of the corresponding part.

### 6.3.5 Description of a parts list

The most important characteristics from the parts list for realizing assembly mounting and material purchasing are described in the following.

Illustration of the attribute of an assembly parts list in the mechanical engineering sector (sample)



| thyssenkrupp System Engineering | K.05900.061.ST.00 | | Print date | 02.11.2018 | | Check |
|---|---|---|---|---|---|---|
| | | | Last edited at | 01.11.2018 | | on |
| WT-BASIS | Related Document No. and Vers. | Manufacturer THYSSENKRUPP SYSTEM ENGINEERING | Last edited by | BC_JOB | | |
| | 1020168968 01 | Manufacturer Part No. | Last chg. no. | | | |
| | | Size/Dimension | | | | |
| | | CNC Level 700000 | | | | |

Pos.: Positionsnummer, MRI:Fertigungsrelevanz, Qty:Menge, Unit:Mengeneinheit, Material Description: Beschreibung, Material No.: SAP-Materialnummer, Document No.: SAP Dokumentnummer, Version: Dokumentversion, Chg. No.: SAP Änderungsnummer, SPI: Ersatz-/Verschleißteilkennzeichen (E=elektr., H=hydr., M=mech., P=pneum. Ersatzteil, V=Verschleißteil) MCBF: Mean Cycle between Failure = Code für die mittlere Lebensdauer in Zyklen, Part Code: Code zur Zuweisung der Oberflächenbehandlung, Basic Material: Werkstoff, Material Standard: Norm, Size/Dimension: Abmessung, Position Text: Betriebsmittelkennzeichen, Purchase Details: Eink.aufs bestellteil, Manufacturer: Hersteller, Manufacturer Part No.: Herstellerteilenummer — Out of Usage: Auslaufkennzeichen

| Pos. | MRI | Qty | Unit | Material Description | Material No. | Document No. | Vers. No | Chg. No. | SPI | MCBF | Part Cod | Basic Material | Material Standard | Size/Dimension | Manufacturer | Manufacturer Part No. | Out of Usage | CNC Level | Informationen tkSY Bremen |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0001 | X | 1 | ST | GRUNDPLATTE | K.05900.061.01.00 | 1020169264 | 01 | | N | | 000 | EN AW-7075 | DIN EN 485-3 | PL 25 X 586 X 906 | TK SY | | | 600000 | Beschaffung durch Lieferanten |
| 0002 | X | 1 | ST | ZWISCHENPLATTE | K.05900.061.02.00 | 1020169313 | 00 | | N | | 000 | EN AW-7075 | DIN EN 485-3 | PL 25 X 540 X 540 | TK SY | | | 600000 | Beschaffung durch Lieferanten |
| 0003 | X | 2 | ST | AUFNAHMEBOLZEN | K.05900.061.03.00 | 1020172902 | 00 | | V | 30 | 000 | 16MNCR5 | DIN EN 10060 | RD 40 X 80 | TK SY | | | 600000 | Beschaffung durch Lieferanten |
| 0004 | X | 1 | ST | AUFNAHME.RIGHT | K.05900.061.04.00 | 1020172895 | 01 | | N | | 510 | S235JRG2C+C | DIN EN 10278 | SQR 40 X 115 | TK SY | | | 600000 | Beschaffung durch Lieferanten; PC510 - Verzinken |
| 0005 | X | 2 | ST | BAUTEILAUFNAHME | K.05900.061.05.00 | 1020170869 | 02 | | V | 35 | 000 | 34CRALNI7-10 | DIN EN 10060 | RD 130 X 100 | TK SY | | | 600000 | Beschaffung durch Lieferanten |
| 0006 | X | 2 | ST | LAGERHÜLSE | K.05900.061.06.00 | 1020170760 | 00 | | N | | 510 | 34CRALNI7-10 | DIN EN 10060 | RD 130 X 45 | TK SY | | | 600000 | Beschaffung durch Lieferanten; PC510 - Verzinken |
| 0007 | X | 1 | ST | TRÄGERPLATTE.RIGHT | K.05900.061.07.00 | 1020170707 | 01 | | N | | 510 | 16MNCR5+TH | DIN EN 10058 | FL 120 X 30 X 200 | TK SY | | | 600000 | Beschaffung durch Lieferanten; PC510 - Verzinken |

**K.0xxxx.xxx.ST.00** (assembly number)

**Last edited at/Last edited by** (reference to author/editor/date)

**Pos.** = Position number

**MRI** = Manufacturing relevance
**X** = Amount effectively
**Empty Field** = Not amount effectively
**Qty** = Quantity

**Unit** = Base Unit

**EA** = Each
**PAA** = Pair
**LOT** = Lot
**L** = Liter
**KG** = Kilogram
**M** = Meter
**M2** = Square Meter

**Vers** = Version (version of part in parts master)

**Material Description** = Material Description

**Material No.** = Material Number (ID number of thyssenkrupp Automation Engineering)

**Information tkSY Bremen**

= ordering extent of tkAE, marking of materials, materials which are provided the VE by the CU

**SPI** = Spare Part Indicator (spare and wearing parts identifier)

**E** = Electrical spare part

**H** = Hydraulic spare part

**M** = Mechanical spare part

**P** = Pneumatic spare part

**V** = Wearing part (mechanical part that comes into contact with the customer component)

**N** = No spare or wearing part

**Part Code** = Part Code (for color assignment)
Assigns the corresponding color tone in conjunction with the order-related specifications.

**Manuf. Part No.** = Manufacturer Part Number

**Basic Material** = Raw material

**Material Standard** = Material Standard (standard for raw material or standardized part)

**Size/Dimension** = Dimensions for raw material or purchased part

**Manufacturer**

**tkSY** = thyssenkrupp Automation Engineering

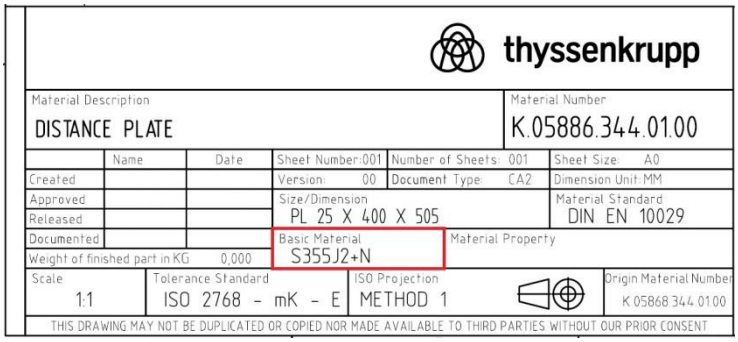
**TKT-KR** = THYSSENKRUPP KRAUSE GROUP (for older documents still valid)

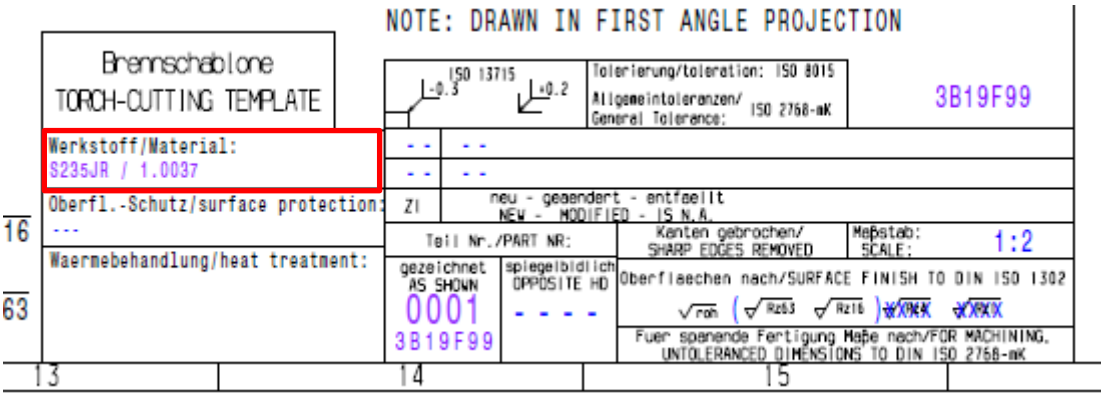
**N/A** = Standard Part

## 6.4 Application of optional material

### 6.4.1 General information

At thyssenkrupp Automation Engineering material information is basically positioned in the drawing head (field „Basic Material“ respectively “Werkstoff/Material”).



The material specified there is to be used by the employee. The application of comparable or optional material of superior grade according to the criteria described in the following is acceptable but is to be approved by the employer before. In this case the contact persons in chapter 1.2 are to be contacted.

For this the appropriate values of the optional material for the confirmation of the equality and higher valence are to be transmitted to the employer (material sheet per Email). Afterwards the employer checks the optional material's acceptance for case of application and possibly releases the optional material only for this drawing number and only for this order. In no case this optional material released can be used as basic option to the standard material.

Optional material not fulfilling the criteria described in the following is not released by the employer. In this case an employee's inquiry can be resigned.

## 6.5 Mounting of Assemblies

The execution of mounting shall be checked and documented.

The following basic points must be observed during mounting:

### 6.5.1 General Information

- The assembly must be aligned and pinned.
- Reference dimensions in drawings must be observed.
- Screw connections must be tightened to the specified torque and marked in color.
- Blind tap holes:
  - Tightening torques for bolts in blind tap holes must be attained by head contact and not based on reaching the end of the thread in the hole
  - Blind tap holes must be deburred prior to bolt fitting
- Through tap holes: Unless otherwise specified on the assembly drawing, bolts must not protrude over the end of a through tap hole
- Minimum screw-in depth t min => 1 x d
- Screw-on surfaces must be kept metallically pure (exception: bronzed or other galvanic corrosion protection measures, aluminum, V2A, etc.).
- Sliding and running surfaces must be metallically pure.
- Cylinder couplings must be secured against twisting.
- Take transport options for packed manufactured parts and assemblies into account (possibly additional threaded hole for eye bolt, bore or holes for rope stop); with larger assemblies, provide pipes for forklift transport and prepare a stop plan.
- The stop plan shall be included with the delivery papers.
- Moving assemblies must have carried out a test run.
- All components must be deburred.

- If the assembly must be tested with try-out parts, these shall be provided by thyssenkrupp Automation Engineering.
- Assemblies must be weighed. The result shall be documented and included with the delivery papers.
- Tooth backlash shall be adjusted and toothed racks shall be pinned.
- Corrosion protection shall be applied to the screw-on surfaces.
- Stability of small base frames shall also be ensured without fastening to the floor.
- Clamping sets and friction clutches shall be mounted in accordance with the manufacturer's specifications.
- When mounting a screw spindle, the correct position of the chamfer on the screw-on surface must be ensured.
- Manufacturer's documents of purchased parts shall be included with the delivery.

## 6.6 Weldments

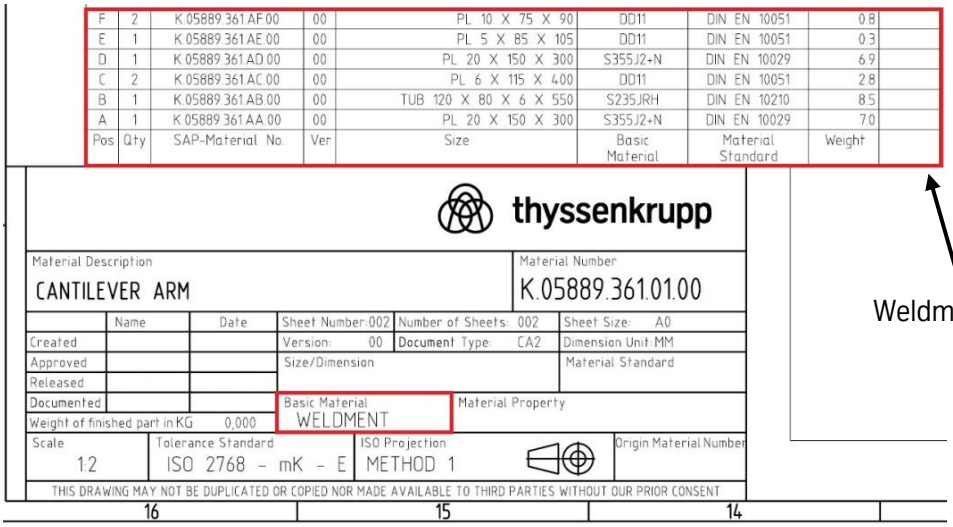
### 6.6.1 General Information (Bremen site only)

No specifications relating to welding seams are indicated on drawings issued by thyssenkrupp Automation Engineering Bremen, apart from a few exceptions.

This guideline includes virtually all the information necessary for welding. Welding specifications are only included on drawings when special requirements apply with regard to strength and accuracy, or when welding is not allowed at certain locations. Specifications on drawings replace or supplement the rules laid down in this guideline. If no specifications are indicated on drawings, this guideline shall apply exclusively.

### 6.6.2 Welding Parts (Bremen site only)

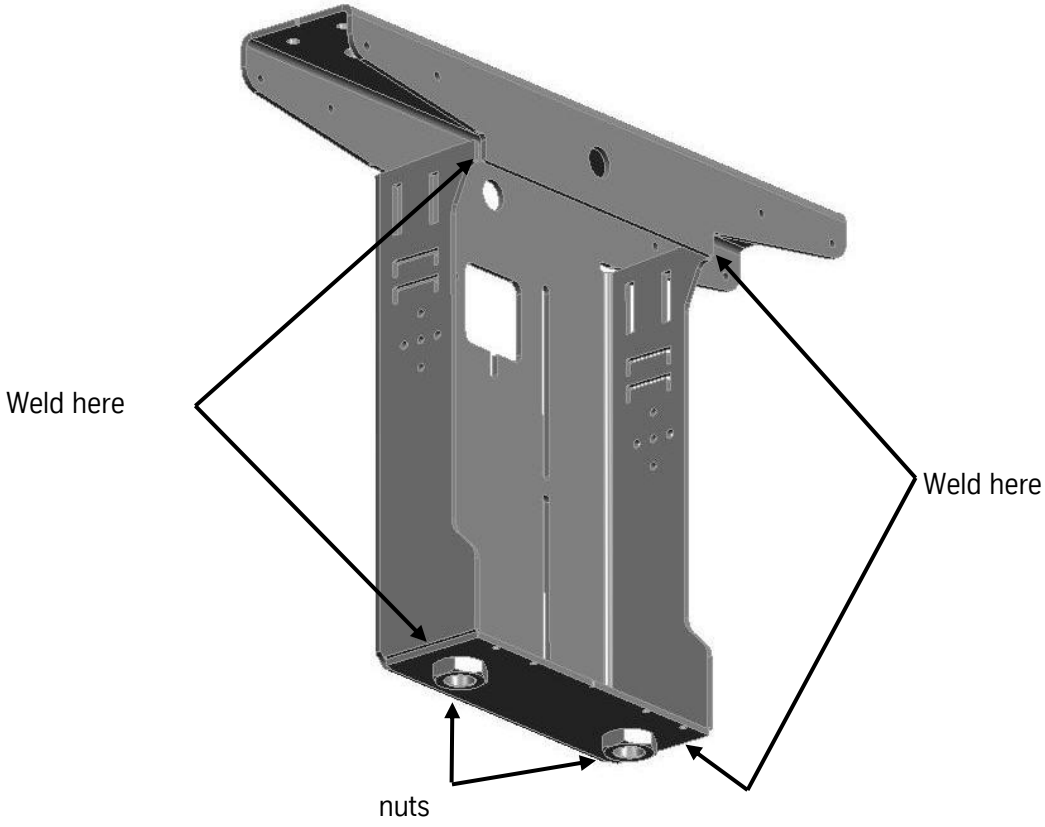
All parts containing the entry **"Weldment"** in the "Basic Material" field of the drawing header and accompanied by a weldments parts list above the drawing header shall be welded.



If both these criteria are met, the part shown shall be classed in its entirety as a welding part. This means that not only the weldments in the weldment parts list must be welded together, but also bent sheet metal parts themselves, provided the shape allows and their intrinsic stability can be enhanced as a result.

**For example:**

Not only must the nuts be welded onto the bent sheet metal parts, but also the bent sheet metal part itself.

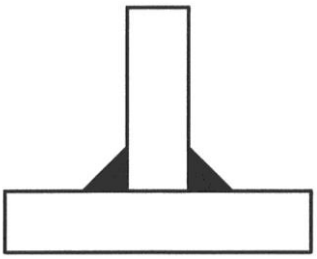



### 6.6.3 Welding Seam Types

One of a total of three possible welding seam types is applied depending on the arrangement of the sheets being welded together:

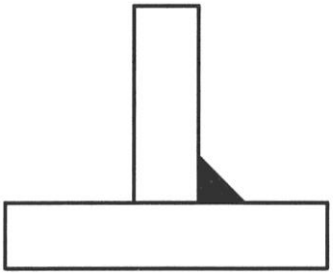
#### 6.6.3.1 Double fillet weld

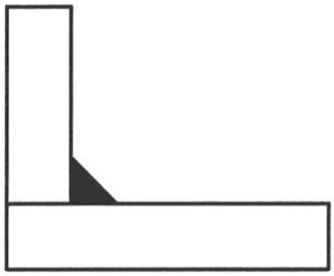
Two sheets are welded together vertically by a double fillet weld. The double fillet weld should be used in preference to the single fillet weld.



### 6.6.3.2 Fillet weld

Fillet welds are permissible in exceptional cases, such as where one side of the sheet being welded is not accessible, or where the sheets are contacting flush on one side.





### Butt weld

The following forms of butt weld should be implemented dependent on the sheet thickness:

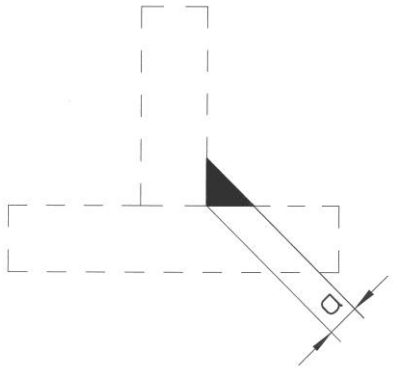
| Sheet thickness t [mm] | Welding seam type | Symbol | Structure of the weld surface |
|---|---|---|---|
| 0-4 | I-weld |  | The seams are executed flat, and reworked flat as appropriate, so that they abut flush with the sheet surfaces |
| 5-12 | V<br>or<br>HV weld |  | No specification |
| >12 | D-V<br>or<br>D-HV weld |  | No specification |

### 6.6.4 Welding seam thicknesses

The thickness of the welding seams "a" is indicated in the following table dependent on the sheet thickness "t":

| Sheet thickne | Single fillet w | Double fillet weld "a" |
|---|---|---|
| up to 3 | 2 | 2 |
| 4 | 3 | |
| 5 | | 3 |
| 6 | 4 | |
| 8 | | |
| 10 | 5 | 4 |
| 12 | | |
| 14 | | |
| 15 | 6 | 5 |
| 16 | | |
| 18 | | |
| 20 | | |
| 22 | 8 | 6 |
| 25 | | |
| 30 | | |
| 35 | 12 | |
| 40 | | |

All figures in mm



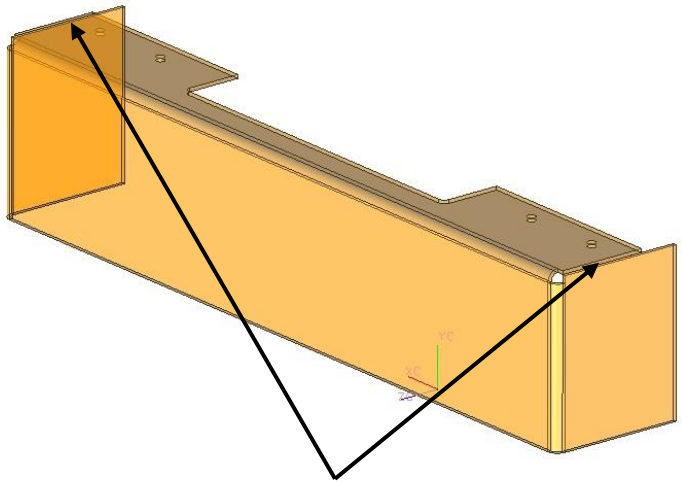

Dimension "a" = seam thickness

The welding seam thicknesses, for abutting seams, are derived from the sheet thickness: The sheets are welded to their full thickness (see symbolic view of seams, table on page 18).

### 6.6.5 Welding seam – additional information

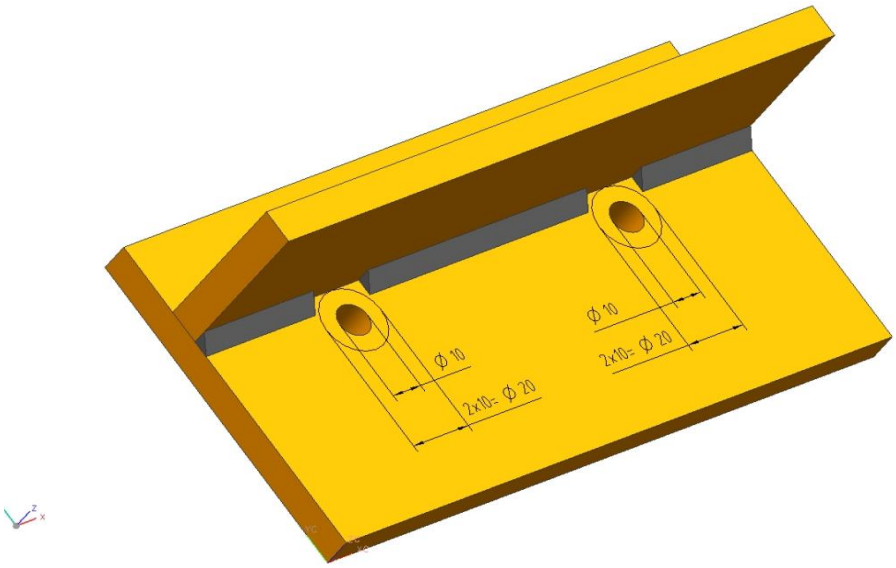
Drawings of covers do not necessarily include a weldment table and the entry **"Weldment"** in the "Basic Material" field. They nevertheless should be welded, provided the shape allows and their intrinsic stability can be enhanced as a result.

**For example:**



Weld here

**Areas around holes** must be kept free of single and double fillet welds within an area of twice the diameter of the hole (snug face for bolt heads, nuts and washers).




### 6.6.6 Tolerances for weldments

#### 6.6.6.1 Lengths

Lengths for welded constructions, with and without subsequent machining, are subject to the general tolerances as per DIN EN ISO 13920 tolerance class B.

| Tolerance class | Range of nominal sizes, $l$, in mm | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 to 30 | Over 30 up to 120 | Over 120 up to 400 | Over 400 up to 1000 | Over 1000 up to 2000 | Over 2000 up to 4000 | Over 4000 up to 8000 | Over 8000 up to 12000 | Over 12000 up to 16000 | Over 16000 up to 20000 | Over 20000 |
| | Tolerances, $t$, in mm | | | | | | | | | | |
| A | ±1 | ±1 | ±1 | ±2 | ± 3 | ± 4 | ± 5 | ± 6 | ± 7 | ± 8 | ± 9 |
| B | | ±2 | ±2 | ±3 | ± 4 | ± 6 | ± 8 | ±10 | ±12 | ±14 | ±16 |
| C | | ±3 | ±4 | ±6 | ± 8 | ±11 | ±14 | ±18 | ±21 | ±24 | ±27 |
| D | | ±4 | ±7 | ±9 | ±12 | ±16 | ±21 | ±27 | ±32 | ±36 | ±40 |

### 6.6.6.2 Angles

Angles for welded constructions, without subsequent machining, are subject to the general tolerances as per DIN EN ISO 13920 tolerance class B.

| Tolerance class | Range of nominal sizes, $l$, in mm (length or shorter leg) | | |
|---|---|---|---|
| | Up to 400 | Over 400 up to 1000 | Over 1000 |
| | Tolerances, $\Delta\alpha$, (in degrees and minutes) | | |
| A | ±20 | ±15 | ±10 |
| B | ±45 | ±30 | ±20 |
| C | ±1° | ±45 | ±30 |
| D | ±1°30 | ±1°15 | ±1° |
| | Calculated and rounded tolerances, $t$, in mm/m[1]) | | |
| A | ± 6 | ± 4,5 | ± 3 |
| B | ±13 | ± 9 | ± 6 |
| C | ±18 | ±13 | ± 9 |
| D | ±26 | ±22 | ±18 |

[1]) The value indicated in mm/m corresponds to the tangent value of the general tolerance. It is to be multiplied by the length, in m, of the shorter leg.

### 6.6.6.3 Straightness, flatness and parallelism tolerances

Straightness, flatness and parallelism tolerances for weldments without subsequent machining, such as covers, are subject to the general tolerances as per DIN EN ISO 13920 tolerance class E.

| Tolerance class | Range of nominal sizes, $l$, in mm (relates to longer side of the surface) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Over 30 up to 120 | Over 120 up to 400 | Over 400 up to 1000 | Over 1000 up to 2000 | Over 2000 up to 4000 | Over 4000 up to 8000 | Over 8000 up to 12000 | Over 12000 up to 16000 | Over 16000 up to 20000 | Over 20000 |
| | Tolerances, $t$, in mm | | | | | | | | | |
| E | 0,5 | 1 | 1,5 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| F | 1 | 1,5 | 3 | 4,5 | 6 | 8 | 10 | 12 | 14 | 16 |
| G | 1,5 | 3 | 5,5 | 9 | 11 | 16 | 20 | 22 | 25 | 25 |
| H | 2,5 | 5 | 9 | 14 | 18 | 26 | 32 | 36 | 40 | 40 |

### 6.6.7 Tolerances for weldments with subsequent machining

#### 6.6.7.1 Angles

Separate angle tolerance requirements apply for welded constructions with subsequent machining.

thyssenkrupp Automation Engineering details large weldments on multiple drawing sheets. This means, for example, the individual welded parts may be shown on sheet 3, the welding instructions on sheet 2, and the machining specifications on sheet 1.

To comply with the tolerances, it may be necessary not only to follow the welding instructions but also to adhere to the machining specifications on the relevant sheets of the drawing.

#### 6.6.7.2 Straightness, flatness and parallelism tolerances

The straight, flatness and parallelism requirements for welded constructions with subsequent machining are the same as those set out in the chapter on "Angles for weldments with subsequent machining".

To comply with the tolerances, it may be necessary not only to follow the welding instructions but also to adhere to the machining specifications on the relevant sheets of the drawing.

### 6.6.8 Welding Seam Quality

The welding seam quality must conform to:

- DIN EN ISO 5817 Group D for steel
- DIN EN ISO 10042 Group D for aluminum

### 6.6.9 Vent holes

Vent holes can be bored in one’s sole discretion, but not within field vision, not within operating sphere and not within process areas.

**Preferably vent holes are to be bored from below.**

### 6.6.10 Leak Test

If the drawing specifies that a welded construction is to be leak-tight, this must be verified.

The VE must make a documentation of the leak test and must send this documentation to the CU.

## 6.7 Delivery of Manufacturing Parts and Assemblies

Manufacturing parts and assemblies shall always be delivered with delivery papers (delivery slip, manufacturing drawings, logs, etc.) with specification of the CU's respective purchase order number.

Does the drawing show that a test certificate is required, the VE has to send the test certificate to the CU without a further request on the delivery of the goods.

### 6.7.1 Delivered state of manufactured parts

Manufactured parts shall always be delivered in the tested state (final inspection prior to shipping) by the VE.
If necessary, the inclusion of an inspection report with the order by the CU shall be ordered.

### 6.7.2 Delivered state of assemblies

Assemblies shall always be delivered in the tested state.

### 6.7.3 Notification of Delivery

For large orders/parts, coordination/notification takes place before the delivery is made.