



Technical specification

Components of the control and monitoring system
for switches

DBS
918 121

Contents

	Page
FOREWORD.....	4
SCOPE	4
1 NORMATIVE REFERENCES.....	5
DIN 50979.....	5
WITH SUPPLEMENTARY CR(VI)-FREE TREATMENT	5
DIN 59220.....	5
DIN EN 3834.....	5
QUALITY REQUIREMENTS FOR FUSION WELDING OF METALLIC MATERIALS	5
DIN EN 10025-2.....	5
HOT ROLLED PRODUCTS OF STRUCTURAL STEELS - PART 2: TECHNICAL	
DELIVERY CONDITIONS FOR NON-ALLOY STRUCTURAL STEELS	5
DIN EN 10029.....	5
HOT-ROLLED STEEL PLATES 3 MM THICK OR ABOVE - TOLERANCES ON	
DIMENSIONS AND SHAPE.....	5
DIN EN 10058.....	5
HOT ROLLED FLAT STEEL BARS AND STEEL WIDE FLATS FOR GENERAL	
PURPOSES - DIMENSIONS AND TOLERANCES ON SHAPE AND DIMENSIONS	5
DIN EN 10060.....	5
HOT ROLLED ROUND STEEL BARS - DIMENSIONS AND TOLERANCES ON SHAPE	
AND DIMENSIONS.....	5
DIN EN 10088-3.....	5
STAINLESS STEELS - TECHNICAL DELIVERY CONDITIONS FOR SEMI-FINISHED	
PRODUCTS, BARS, RODS, WIRE, SECTIONS AND BRIGHT PRODUCTS OF	
CORROSION RESISTING STEELS FOR GENERAL PURPOSES	5
DIN EN 10130.....	5
COLD ROLLED LOW CARBON STEEL FLAT PRODUCTS FOR COLD FORMING -	
TECHNICAL DELIVERY CONDITIONS.....	5
DIN EN 10131.....	5
COLD ROLLED UNCOATED AND ZINC OR ZINC-NICKEL ELECTROLYTICALLY	
COATED LOW CARBON AND HIGH YIELD STRENGTH STEEL FLAT PRODUCTS FOR	
COLD FORMING - TOLERANCES ON DIMENSIONS AND SHAPE	5
DIN EN 10204.....	5
METALLIC PRODUCTS – TYPES OF INSPECTION DOCUMENTS.....	5
DIN EN 10210.....	5
FINISHED STRUCTURAL HOLLOW SECTIONS OF NON-ALLOY AND FINE GRAIN	
STEELS	5
DIN EN 10243-1/2.....	5
STEEL DIE FORGINGS - TOLERANCES ON DIMENSIONS.....	5
DIN EN 10254.....	5
STEEL CLOSED DIE FORGINGS - GENERAL TECHNICAL DELIVERY CONDITIONS.....	5
DIN EN 10278.....	6
DIMENSIONS AND TOLERANCES OF BRIGHT STEEL PRODUCTS	6
DIN EN ISO 13920.....	6

Continued on pages 2 to 7

Technical body: DB Netz AG I.NPF 111 (W)

Managing body: DB Netz AG I.NPF 1

WELDING - GENERAL TOLERANCES FOR WELDED CONSTRUCTIONS - DIMENSIONS FOR LENGTHS AND ANGLES; SHAPE AND POSITION	6
DIN EN ISO 1461	6
HOT DIP GALVANIZED COATINGS ON FABRICATED IRON AND STEEL ARTICLES	6
DIN ISO 2768-1	6
GENERAL TOLERANCES; TOLERANCES FOR LINEAR AND ANGULAR DIMENSIONS WITHOUT INDIVIDUAL TOLERANCE INDICATIONS	6
DIN ISO 2768-2	6
GENERAL TOLERANCES; GEOMETRICAL TOLERANCES FOR FEATURES WITHOUT INDIVIDUAL TOLERANCES INDICATIONS	6
DIN EN ISO 9606-1	6
QUALIFICATION TESTING OF WELDERS - FUSION WELDING - PART 1: STEELS.....	6
TL/TP-KOR-STAHLBAUTEN	6
TECHNICAL DELIVERY CONDITIONS FOR COATING MATERIALS FOR THE CORROSION PROTECTION OF STEEL CONSTRUCTIONS	6
RIL 120.0381V13	6
LIST OF CONTROL-COMMAND AND SIGNALING PRODUCTS SUBJECT TO QUALITY INSPECTION	6
2 ORDERING BASIS	6
3 QUALIFICATION AND QUALITY ASSURANCE	6
4 REQUIREMENTS FOR THE MATERIALS TO BE USED	6
4.1 Semi-finished steel products	6
4.2 Fastening components	7
4.3 Plastics	7
4.4 Forged parts	7
4.5 Requirements for welds	7
5 BENDING OF RODS	7
6 TOLERANCES	8
7 THREADS	8
8 CORROSION PROTECTION:	8
9 LABELING OF PARTS	9
10 DISPATCH	9
ANNEX 1 DATASHEET FOR PLASTICS – PAS-LGX	10
UP TO NOW, DB HAS ONLY PERMITTED PLASTIC BUSHES MADE OF PA-LGX FROM FAIGLE. ANNEX 2	
	DATA
SHEET FOR PLASTICS – PA	10
ANNEX 3 DATASHEET FOR PLASTICS – GRP	13
ANNEX 4 TOLERANCE DIMENSIONS ON CURVED BEARERS.....	14
ANNEX 5.....	14
5.1 TOLERANCES OF THE PARALLELISM OF THE FORK BORES	15
5.2 ALIGNMENT OF THE BORE WITH THE MOUNTING SLOT OF THE FORK HEAD	16

Edition	Date changed	Comments	Page
02	December 13, 2016	<ul style="list-style-type: none"> • Bending of rods: use of radial bending machines • Corrosion protection: RAL 1002 for primer • Annex 5.1: position tolerance reference changed from fork opening surface to fork bore • Annex 5.2: Dimension a1 added 	6 7
03	April 15, 2019	<ul style="list-style-type: none"> • Scope: Details added on control system components • Section 3: MPQ requirement deleted • Semi-finished products: Stainless steel studs added • Corrosion protection: <ul style="list-style-type: none"> ○ Bituminous coating deleted ○ Rilsan coating added 	3 5 5 7
04	September 6, 2019	<ul style="list-style-type: none"> • Semi-finished products: hot-rolled sheet metal for bearing parts and checker plate added • Threads + corrosion protection: Coupling rod designation specified in detail • Corrosion protection: coating for bell crank and W-signals specified in detail • Label: contents updated 	5 7 8 8

Foreword

This DB standard was prepared by DB Netz AG I.NPF 111(W) – Permanent Way Engineering in cooperation with the manufacturer plants and Quality Assurance (GS.EI 21). It represents the interests of Deutsche Bahn AG.

Scope

This DBS governs the requirements to be met by suppliers and manufacturers regarding the components of the switch control and monitoring system listed below in order to ensure a high-quality delivery. It applies to the following components:

- Tie bearer (steel flat bar, die-forged or bent)
- Bearer, support plates (flat steel, drilled, partially welded)
- Coupling plates (steel flat bar, drilled)
- Cover plates (steel flat bar, partially welded)
- Fastening components (not standardized)
- Covers
- Plastic parts (e.g. bushes, rollers, insulation parts)
- Forged parts for control system components (e.g. fork rods)
- Control rods
- Detector rods
- Throw rods
- Locking bars
- Coupling rods
- Tongue connecting rods
- Bell crank connecting rods
- Bell crank linkage rods
- Studs
- Bell cranks
- Rod guides
- Mechanical locks and detectors
- Securing bolts (e.g. deadlocks, HV 73, HVE)
- Derails
- Switch boxes
- Mechanical switch drives
- Switch and derail signals

1 Normative references

Through dated and undated references, the DB Standard contains specifications from other publications. These normative references are quoted at the relevant places in the text, and the publications are listed thereafter. In the case of dated references, subsequent amendments or revisions to these publications only belong to this standard if they have been incorporated by means of amendment or revision. In the case of undated references, the last edition of the referenced publication applies (including any amendments).

DIN 50979	Metallic coatings - Electroplated coatings of zinc and zinc alloys on iron or steel with supplementary Cr(VI)-free treatment
DIN 59220	Flat products of steel - Hot rolled patterned plate - Dimensions, mass, tolerances on dimensions, shape and mass
DIN EN 3834	Quality requirements for fusion welding of metallic materials
DIN EN 10025-2	Hot rolled products of structural steels - Part 2: Technical delivery con- ditions for non-alloy structural steels
DIN EN 10029	Hot-rolled steel plates 3 mm thick or above - Tolerances on dimen- sions and shape
DIN EN 10058	Hot rolled flat steel bars and steel wide flats for general purposes - Di- mensions and tolerances on shape and dimensions
DIN EN 10060	Hot rolled round steel bars - Dimensions and tolerances on shape and dimensions
DIN EN 10088-3	Stainless steels - Technical delivery conditions for semi-finished prod- ucts, bars, rods, wire, sections and bright products of corrosion resist- ing steels for general purposes
DIN EN 10130	Cold rolled low carbon steel flat products for cold forming - Technical delivery conditions
DIN EN 10131	Cold rolled uncoated and zinc or zinc-nickel electrolytically coated low carbon and high yield strength steel flat products for cold forming - Tol- erances on dimensions and shape
DIN EN 10204	Metallic products - Types of inspection documents
DIN EN 10210	Finished structural hollow sections of non-alloy and fine grain steels
DIN EN 10243-1/2	Steel die forgings - Tolerances on dimensions
DIN EN 10254	Steel closed die forgings - General technical delivery conditions

DIN EN 10278	Dimensions and tolerances of bright steel products
DIN EN ISO 13920	Welding - General tolerances for welded constructions - Dimensions for lengths and angles; shape and position
DIN EN ISO 1461	Hot dip galvanized coatings on fabricated iron and steel articles
DIN ISO 2768-1	General tolerances; tolerances for linear and angular dimensions without individual tolerance indications
DIN ISO 2768-2	General tolerances; geometrical tolerances for features without individual tolerances indications
DIN EN ISO 9606-1	Qualification testing of welders - Fusion welding - Part 1: Steels
TL/TP-KOR-Stahlbauten	Technical delivery conditions for coating materials for the corrosion protection of steel constructions
Ril 120.0381V13	List of control-command and signaling products subject to quality inspection

2 Ordering basis

The current drawings of DB Netz AG are definitive for the manufacture of the mechanical components for the switch control system. The drawings can be requested via the Planei, I.NPS 313. The drawing index of the DB standard drawings is updated quarterly and can be viewed at:

<https://mediendienste.extranet.deutschebahn.com>

→ Tech. notifications on track system → Permanent way engineering → List of standard drawings → List of LST drawings (control systems)

3 Qualification and quality assurance

The Ril 120.0381V13 “List of control-command and signaling products subject to quality inspection” applies to the delivery of bearing and connection parts. It governs the supplier qualifications.

4 Requirements for the materials to be used

4.1 Semi-finished steel products

Semi-finished products must be obtained with inspection certificates 3.1 as per EN 10204. The certificates must be presented to Quality Assurance (GS.El 21) or Engineering (I.NPF 121) on request. This applies to:

- Steel flat bar S235JR as per DIN EN 10025-2 and DIN EN 10058 as well as hot-rolled sheet metal as per DIN EN 10029 for all bearers

- Round steel S355J2+N as per DIN EN 10025-2 and DIN EN 10060 for all control rods, bell crank connecting rods, detector rods, throw rods, locking bars, coupling rods and tongue connecting rods
- Tube 42.4 x 4 S235JRH or S355J2H as per DIN EN 10210, zinc-plated as per DIN EN 10220 for all bell crank linkage rods
- Fine sheet DIN EN 10130/10131, checker sheet DIN 59220
- Forged steel S355J2 DIN EN 10025 for all bell cranks and fork heads
- Round steel S355J2 (+AR or +M) as per DIN 10060 or S355J2C as per DIN EN 10278 for all studs
- Round steel X5CrNi18-10 as per DIN EN 10088-3 for stainless steel studs on lubrication-free force transmission linkage

Deviating material requirements are specified on the drawings.

4.2 Fastening components

Semi-finished products must be obtained with inspection certificates 3.1 as per EN 10204. The certificates must be presented to Quality Assurance (GS.El 21) or Engineering (I.NPF 121) on request.

4.3 Plastics

The material properties must meet the following requirements:

- Plastic bushes made of PAS-LGX: PAS-LGX datasheet, Annex 1
- Plastic rollers made of PA: PA datasheet, Annex 2
- Insulated parts made of PA: PA datasheet, Annex 2
- Covers made of GRP: GRP datasheet, Annex 3

4.4 Forged parts

Fork heads, bell cranks and bearing blocks are forged parts. Tolerances apply as per DIN EN 10243-1/2, forging quality "F". Forged parts receive a label identifying the manufacturer and the forging year. Forged parts must be fully deburred and must not have notches.

4.5 Requirements for welds

Control rods, detector rods, throw rods, bell crank connecting rods and locking bars are manufactured of forged forks and round steel using flash welds. Welding may only be performed using machines with a continuous quality monitoring system (monitoring/recording of the welding parameters).

Flash welds must be deburred without notching. The components must be permanently labeled with a manufacturer sign on the fork head.

For other welded joints, the welding quality requirements as per DIN EN 3834 apply.

The welds must be executed by welders who have been certified as per DIN EN ISO 9606-1.

5 Bending of rods

Rods made of round material (Ø 26 mm, Ø 30 mm and Ø 36 mm) must be heated to 850 °C before bending. Bendings >90° must be normalized.

The preheating phase may be omitted if using an automatic radial bending machine. Freedom from cracking must be tested and documented with a 90° bend for each round-material delivery batch. The specimens must be kept for at least 6 months.

If no bending radius is indicated on the drawing, the bending radius must be at least 30 mm + material radius.

6 Tolerances

If no special tolerance dimensions are specified on the standard drawings, the general tolerance of DIN ISO 2768 -c for machined individual parts or DIN EN ISO 13920-CG for welded assemblies must be applied. The following form and position tolerances apply in addition:

- For screw-on surfaces of the bearers: Annex 4
- For the cutouts in the fork heads on all rods: Annex 5.1
- For the alignment of the bore of the fork heads with the mounting slot: Annex 5.2
 - ➔ Alternatively, a mounting test with a test engagement piece and A fitting stud is permissible.
 - The following requirements apply to the test piece:
 - Engagement height $h1$ = fork cutout h (nominal dimension) - 1 mm
 - Engagement depth $a1$ = nominal depth a - tolerance value (as per DIN EN 10243-1, forging quality “F”)
 - Test specimen width $b1$ = fork width b + 20 mm (overhang on both sides at least 10 mm)
 - The bore diameter of the test specimen corresponds to that of the fork head or the inside diameter of the mounted bush.
 - Relative to the nominal diameter with an $h9$ fit, the stud must be executed with an excess length of 10 mm.
- Alignment of the detector rod eyelet Annex 5.3
In the case of angulated detector rods, the described testing equipment is used to check that the position of the eyelet does not deviate from the alignment of the detector rod by more than $<1/150$ at the bore of the fork head. Relative to the nominal diameter with an $h9$ fit, the welded-on stud must be executed with an excess length of 10 mm.

7 Threads

Male thread of length-adjustable deflector rods and coupling rods Skst-L ((low 54.51.2007) must be produced using rollers.

8 Corrosion protection:

- All bearers and support or bearing plates must be provided with certified coating substances as per TL/TP-KOR-Stahlbauten. Alternatively, the corrosion protection coating can be replaced by hot galvanizing (DIN EN ISO 1461 min. 45 μm). Bearing parts for direct current railroads (S-Bahn in Berlin/Hamburg) additionally receive a Rislac coating, min. 300 μm .
- Protective cases and channels must be hot galvanized as per DIN EN ISO 1461. The min. layer thickness as per DIN EN ISO 1461 is 45 μm , average 55 μm .
- Detector rods and coupling rods SKst-L (low 54.51.2007) are galvanized (as per DIN 50979, minimum layer thickness 12 μm , thick layer passivation, sealed). Alternatively, cathodic dip coating and zinc-rich primers are permissible.

- Bell cranks and switch and derail signals receive a coating system consisting at least of a primer and top coat; a total layer thickness of $\geq 160\mu\text{m}$; epoxy resin, PUR or alkyd resin colors with zinc dust or iron mica. Alternatively, a cathodic dip coating can also be applied as a primer. The primer color must have a marked contrast to the base material and to the top coat.

Shade of the top coat:

- Bell crank RAL 601 mica green
- Switch and derail signals RAL 9005 jet black

9 Labeling of parts

The label contains:

- Component designation
- DB standard drawing
- DB material ID

The manufacturer can choose how to execute the label. The method by which the label is executed must ensure that the label will still be discernable after being stored for at least 3 years at the maintenance depot and after delivery to the installation location (e.g. weather-resistant adhesive labels).

10 Dispatch

The parts are generally delivered as an assembled module. All studs, threads and bearing points receive a basic lubrication when they are assembled at the manufacturing plant. The delivery must be performed in a suitable form that excludes the possibility of damage (e.g. threaded pieces) and bending.

Annex 1 Datasheet for plastics – PAS-LGX

Formmasse mit Bezeichnung nach ISO 9988 POM-K:

Polyoxymethylen mit ca. 13% Glasfaseranteil + PE-UHMW, olivgrün eingefärbt

Anforderungen und Prüfplan für das Formteil (Fertigteil):

Art der Prüfung	Spezifikation Prüfvorschrift	Anforderung	Qualifikations- prüfung - QP	Erstmuster- prüfung - EMP ¹⁾	Werkseigene Produktions- kontrolle - WPK
Farbe, Farbton	Zeichnung, Rückstellmuster	konform	X	X	X
Oberfläche	Zeichnung, Rückstellmuster	konform	X	X	X
Abmessungen	Zeichnung	Konform	X	X	X
Funktionsmaße	Zeichnung bzw. im QM-Plan festlegen	Konform	X	X	X
Gewicht	Zeichnung	konform	X	X	X
Lunker	Rückstellmuster	konform	X	X	X
Dichte	DIN EN ISO 1183-1	1,48 g/cm ³	X	X	X
Glasgehalt	DIN EN ISO 1172	13 ± 3 %	X	X	X
Thermogramm der DSC-Analyse	ISO 11357-3	165 – 175 °C	X	X	X
E-Modul aus Zugversuch	DIN EN ISO 527-1 u. 2	3600MPa	X	X	-
Kugeldruckhärte	DIN EN ISO 2039-1	160 MPa	X	X	-
Schlagzähigkeit	EN ISO 179-1/1eU bei 23°C/50% r.F.	35 kJ/m ²	X	X	-
Feuchtigkeitsgehalt	Prüfverfahren siehe Abschnitt 4.4	0,15 – 0,3 %	X	X	X
Kerbschlagzähigkeit	EN ISO 179-1/1eA bei 23°C/50% r.F.	5 kJ/ m ²	X	X	-
spezifischer Durchgangswiderstand	DIN IEC 60093	≥ 10 ¹⁴ Ωcm	X	-	-

¹⁾ Ist die EMP zugleich QP, gilt der QP-Prüfplan

Sonstiges:

Bei der WPK und bei zusätzlichen durch die DB AG durchgeführten Qualitätsprüfungen müssen die ermittelten Werte auf dem Niveau der Eigenschaftswerte aus den Qualifikationsprüfungen bzw. EMP liegen.

Up to now, DB has only permitted plastic bushes made of PA-LGX from Faigle.

Annex 2 Datasheet for plastics – PA

Molding material with designation as per ISO 1874: PA66+PA6-HI, MHR, 14-020N

Mechanical characteristics

		Standard	Unit	Status	
Tensile modulus of elasticity	1 mm/min	ISO 527	MPa	Dry cond.	2450 800
Tensile stress at yield	50 mm/min	ISO 527	MPa	Dry cond.	65 35
Elongation at yield	50 mm/min	ISO 527	%	Dry cond.	4 20
Failure stress	50 mm/min	ISO 527	MPa	Dry cond.	40
Elongation at break	50 mm/min	ISO 527	%	Dry cond.	25 > 50
Impact strength	Charpy, 23 °C	ISO 179/2- 1eU	kJ/mm ²	Dry cond.	No break- age No break- age
Impact strength	Charpy, -30 °C	ISO 179/2- 1eU	kJ/mm ²	Dry cond.	No break- age No break- age
Notch impact strength	Charpy, 23 °C	ISO 179/2- 1eU	kJ/mm ²	Dry cond.	12 47
Notch impact strength	Charpy, -30 °C	ISO 179/2- 1eU	kJ/mm ²	Dry cond.	11 8
Ball indentation hardness		ISO 2039-1	MPa	Dry cond.	125 45

Thermal properties

		Standard	Unit	Status	
Melting point	DSC	ISO 11357	°C	Dry	260
Dimensional stability HDT/A	1.80 MPa	ISO 75	°C	Dry	55
Dimensional stability HDT/B	0.45 MPa	ISO 75	°C	Dry	160
Therm. linear expansion, longitudinal	23-55 °C	ISO 11359	10 ⁻⁴ /K	Dry	1.2
Therm. linear expansion, transverse	23-55 °C	ISO 11359	10 ⁻⁴ /K	Dry	1.5
Max. service temperature	Continuous	ISO 2578	°C	Dry	80-100
Max. service temperature	Short-term	ISO 2578	°C	Dry	180

Electrical characteristics

		Standard	Unit	Status	
Dielectric strength		IEC 60243-1	kV/mm	Dry cond.	31 27
Comparative tracking index	CTI	IEC 60112	-	Cond.	600
Spec. volume resistivity		IEC 60093	$\Omega \cdot m$	Dry cond.	10^{12} 10^{10}
Spec. surface resistivity		IEC 60093	Ω	Cond.	10^{11}

General characteristics

		Standard	Unit	Status	
Density		ISO 1183	g/cm^3	Dry	1.13
Combustibility (UL94)	0.8 mm	ISO 1210	Level	-	HB
Water absorption	23 °C/saturated	ISO 62	%	-	8.5
Moisture absorption	23 °C/50% r.H.	ISO 62	%	-	2.5
Linear mold shrinkage	Longitudinal	ISO 294	%	Dry	1.25
Linear mold shrinkage	Longitudinal	ISO 294	%	Dry	1.25
Max. service temperature	Transverse	ISO 294	%	Dry	1.35

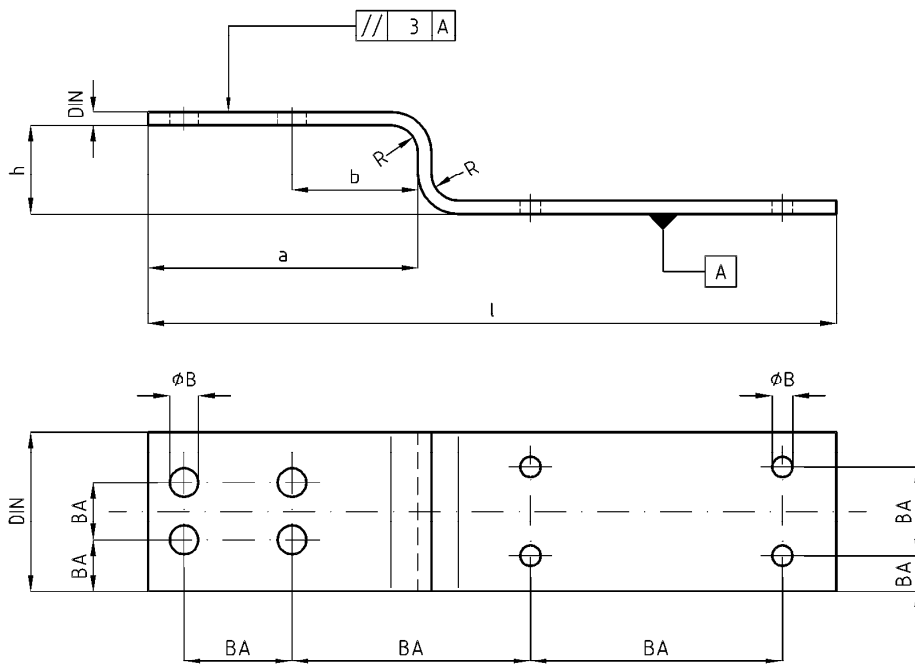
Annex 3 Datasheet for plastics – GRP

General characteristics

	Standard	Unit	
Bending strength	DIN 53452	N/mm ²	> 130
Impact strength	DIN 53453	kJ/mm ²	> 40
Notch impact strength	DIN 53453	kJ/mm ²	> 35
Dimensional stability in heat (as per Martens)	DIN 53462	°C	150
Resistance to glow heat	VDE 0304 T 3	BH 2 Flame jet	Level ≤10 mm
Water absorption	DIN 53472	mg	<80
Surface resistivity	VDE 0303 T 3	Ω	> 10 ¹⁴
Comparative tracking index	VDE 0303 T 1 + T10	Ω	CTI 500

Annex 4 Tolerance dimensions on curved bearers

Nominal dimension range	
Tolerance	
Bore distances	
Bore diameter	



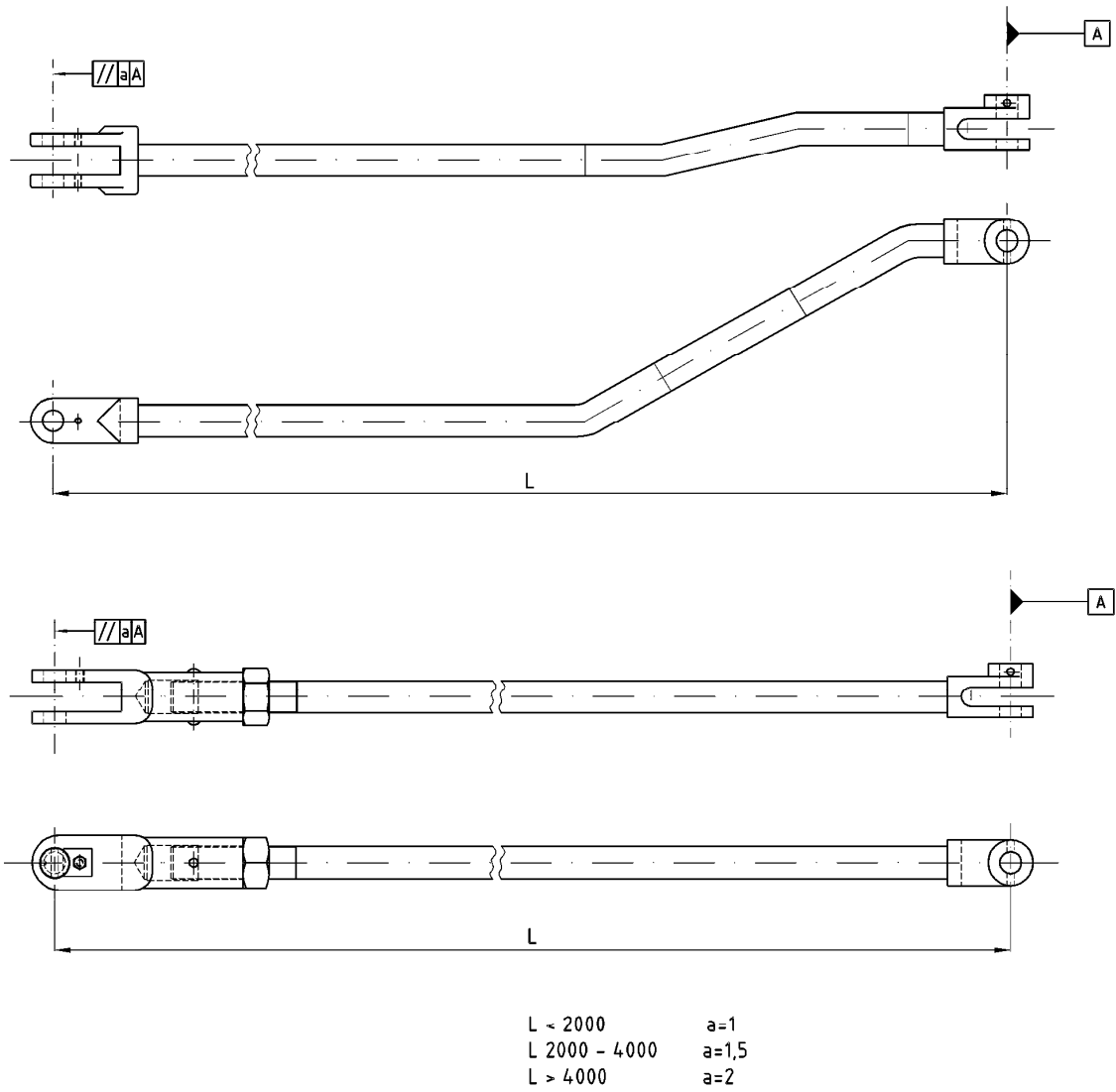
Nennmaßbereich		Toleranz	
		+	-
l	< 1000	15	5
	> 1000	20	10
h	< 200	8	5
	> 200	10	5
a		10	5
b		2	2

Bohrungsabstände		
Nennmaßbereich	Toleranz	
	+	-
< 100	0,8	0,8
100 - 200	1	1
200 - 400	1,5	1,5
> 400	2	2

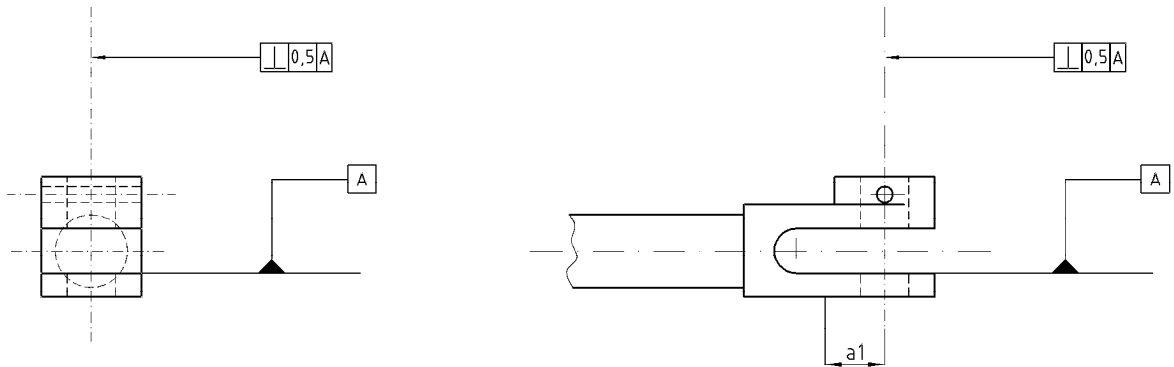
	Toleranz	
	+	-
Bohrungsdurchmesser	1	0,5

Annex 5

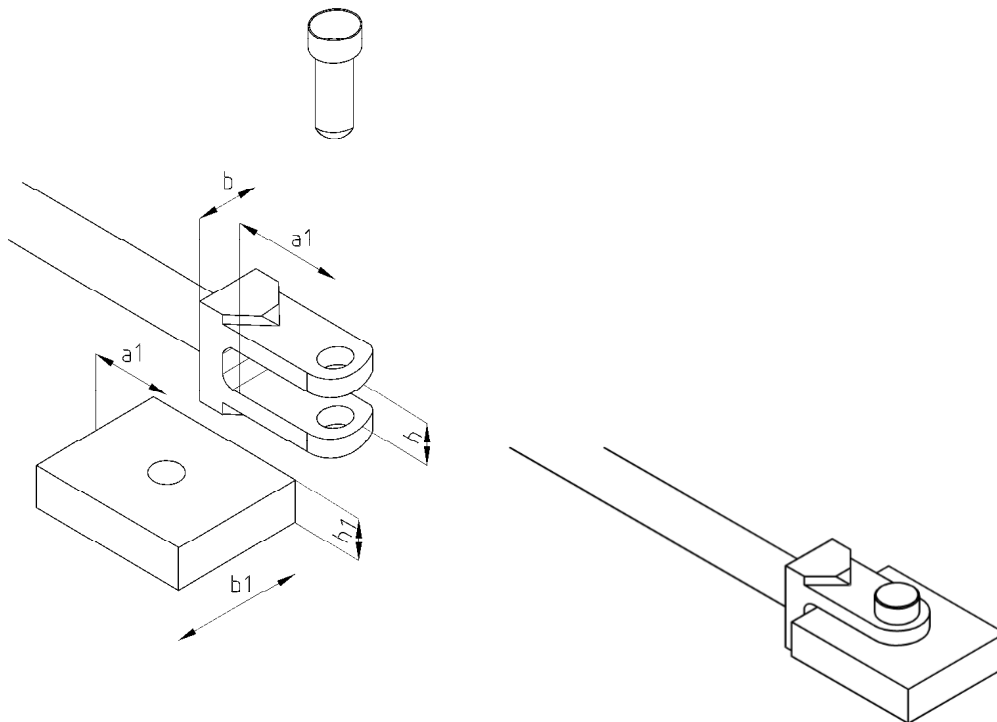
5.1 Tolerances of the parallelism of the fork bores



5.2 Alignment of the bore with the mounting slot of the fork head



Alternative: mounting test with test specimen as per section 6:



5.3 Alignment of the detector rod eyelet

Deviation of the middle of the bore

Abweichung Mitte Bohrung < $l/150$

