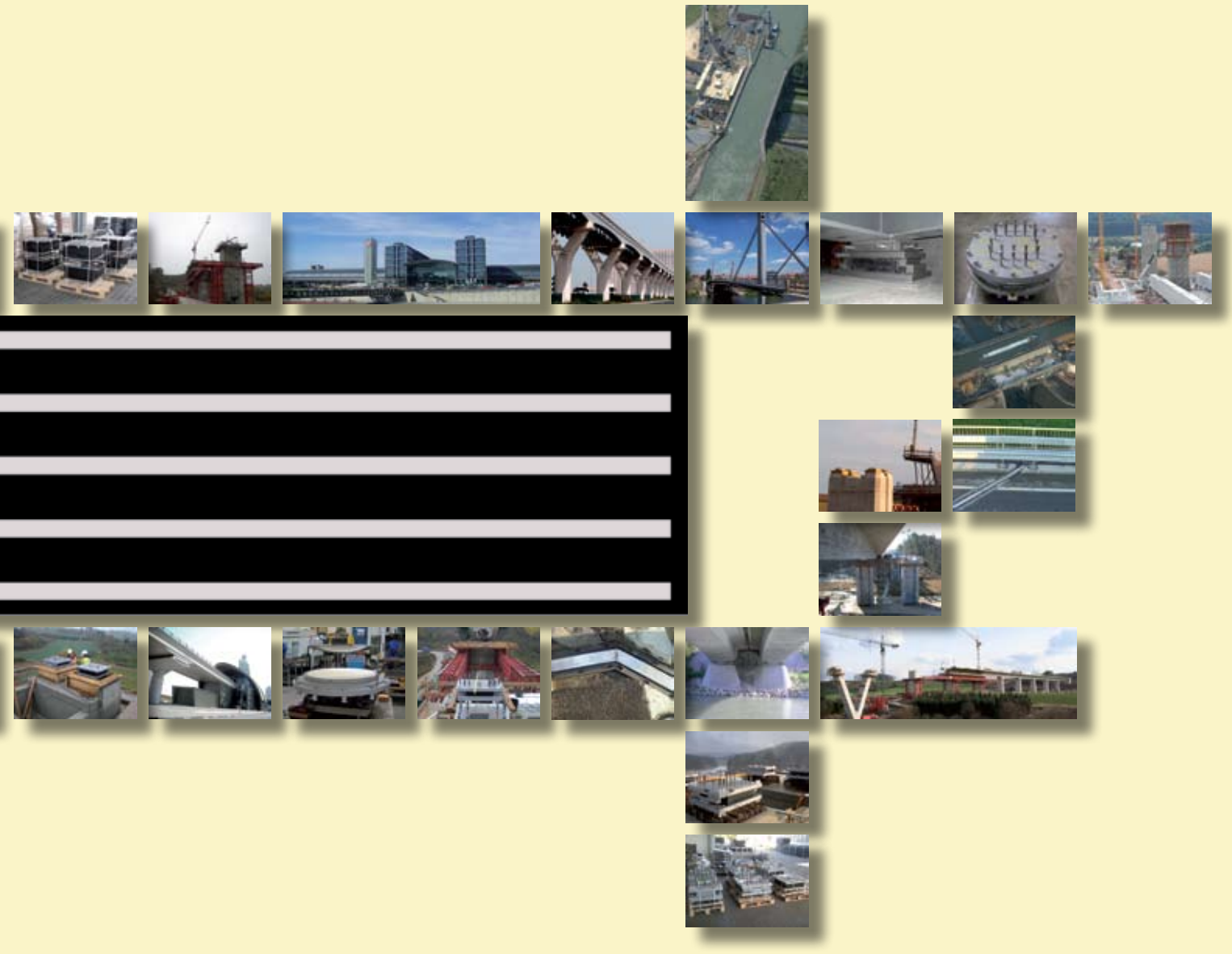
GUMBA®

BRIDGE BEARINGS



BRIDGE EXPANSION JOINTS

GUMBA

Member of **BESAGROUP**

General information about the use of catalogue data

All product descriptions contained in this catalogue provide general information based on our experience and tests. They do not consider the actual application. Please contact our technical department for further information. No claims of compensation can be derived from the data in this catalogue. Individual tests for special characteristics can be arranged upon request.

We reserve the right for technical modifications without notice that might occur from any changes in the current rules and regulations or other new developments.

Technical advice All technical details are not binding and do not replace the current rules and regulations or our general sales and delivery terms in any way.

Dimensions Unless otherwise specified, the reference dimensions in this catalogue are in mm.

Drawings All drawings and illustrations are schematic and may differ from an actual installation situation.

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1. Company profile

1

For more than 40 years the name ?Gumba? is a term for technical competence in the field of bridge bearing applications. Through the dedication of Gumba?s employees it has become a well known trade mark in the world wide construction industry.

Our engineers support our customers, as well as design engineers, authorities and construction companies in both the theoretical and practical selection of the correct bridge bearing, providing a service beyond that of the design and manufacturing of elastomeric bearings.

Our product range includes primarily deformation bearings, pot bearings and spherical bearings. Besides the manufacturing of bearing structures that can take vertical loads up to 20.000 kN and horizontal loads up to 2.000 kN, we are able to perform challenging bearing refurbishments in cooperation with partner companies.

In the field of spherical bearings, we use the expertise of our sister company ELA-Brückenlager. ELA is also a manufacturer for reinforced elastomeric bearings with restraining structures.

Despite a growing internationalisation, the decision to manufacture our products only in Germany has been proven correct. ? Made in Ger m an y ? is still recognised worldwide and appreciated for high quality products. Furthermore, this is an advantage when the customer requests tight delivery times.

Our product portfolio with emphasis on bridge bearings is broadened by the inclusion of expansion joints as part of the bridge equipment, with engine mountings and with fabrications for special applications. Waterstops were part of our product range, but are now available from our sister company BESAPLAST.

On the following pages, we provide information about bearing technology and bridge equipment. Please contact us for further information, as we are always pleased to assist our customers and consulting engineers.


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BESAGROUP
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Certificates and qualifications

1 The following list provides an overview of our certificates and qualifications

EC-Certifcate of conformity - elastomeric bearings 0432 ? CPD ? 223604/1

EC-Certifcate of conformity - elastomeric bearings w. plane sliding part (deformation sliding bearing) 0672 ? BPR ? 002.1

EC-Certifcate of conformity - pot bearings 0672 ? CPD ? 002.2

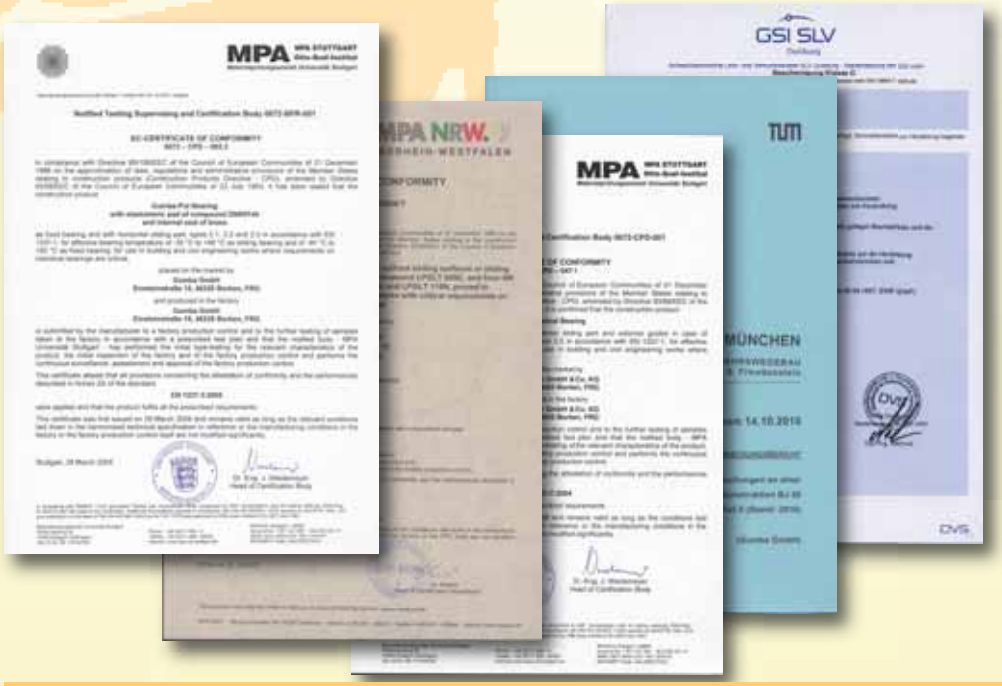
EC-Certifcate of conformity ELA - spherical bearings 0672 ? CPD ? 047.1

EC-Certifcate of conformity - guided bearings and restraint bearings 0672 ? CPD ? 002.3

National technical approval - equipping of bridge bearings with CE marking Z-16.7-452

Certificate for welding of steel constructions according to 18800-7 class D

Test reports TU Munich bridge expansion joints



MATERIALPRÜFUNGSANSTALT UNIVERSITÄT STUTTGART
SUPERVISED
MPA
Universität Stuttgart
MPA STUTTGART
Otto-Graf-Institut (FMPA)

1 Quality management bearings (QML)

Quality and customer satisfaction have highest priority to us. Therefore, all processes in our organisation are defined in our in-house quality management system. Our quality awareness, the current rules and regulations and our technical approvals determine decisively the procedures for our internal and external quality controls.

As a supplier of:

- reinforced elastomeric bearings
- deformation bearings
- pot bearings
- spherical bearings
- restraining structures and guided bearings

We offer our customers to become a part of our QML and enable them to meet their own Quality Management criteria.

In addition to the implemented internal quality control procedures, our bearings also get regular quality reviews and documentation from independent external organisations.

This includes:

- Monitoring of reinforced elastomeric bearings

Elastomeric bearings manufactured according to EN 1337-3 get an external control according to DIN 18200. The supervision is carried out by MPA (materials testing institute) NRW Dortmund.

- Monitoring of the bearing structures

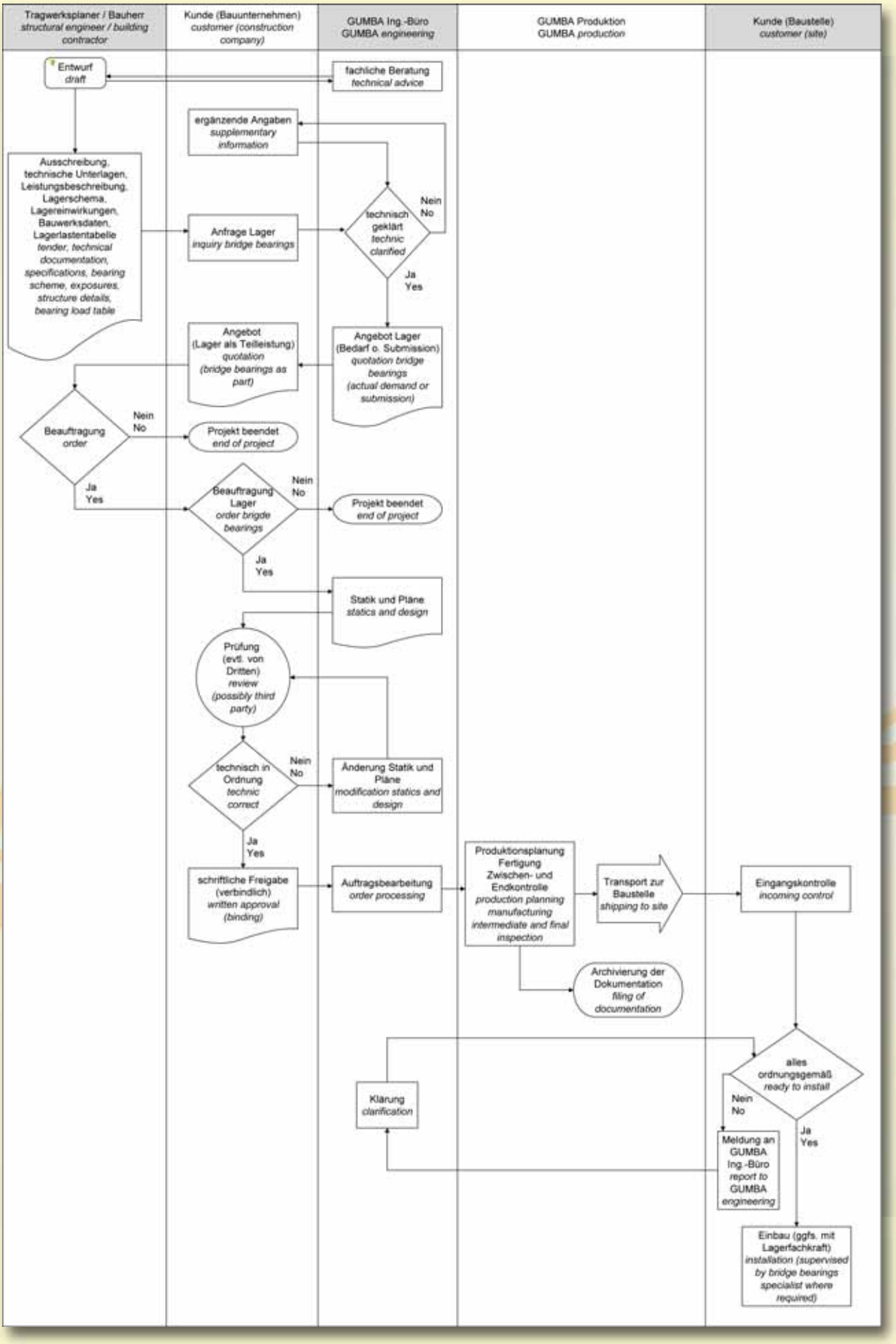
The external controls for all bearing structures (deformation bearings, pot bearings, spherical bearings and restraining structures) are carried out by MPA Stuttgart. These controls are carried out every 3 months as a production control in the factory.

- Verification of suitability according to DIN 18800-7

Restraining structures are load bearing parts made of steel. Therefore we own the certificate for welding of steel constructions according to 18800-7. Our qualified welders are trained and audited by the SLV Duisburg .(The largest of 10 training and educational institutes for welding engineering in Germany and one of the largest and most important welding institutes in the whole of Europe.)

Abläufe im GUMBA QML / *procedures of GUMBA QML*

1



1 Quality assurance bearings (QSL)

Gumba bearings are designed and installed according to the following standards, rules and regulations. In addition, further requirements can be applicable.

Standard Code of Practice

DIN EN 1337 ? ?Structural Bearings? DIN 4141 Part 13 guided bearings sliding material steel-steel DIN 18800- Steel structures (future DIN EN 1090, DIN EN 1993) DIN 18200 Assessment of conformity for construction products DIN EN 10025 ? Products of structural steel DIN EN 10204 ? Metallic products ? Types of inspection documents

Guidelines of the Deutsche Bahn AG (German Railways)

Ril 804

Rules and Regulations of the Federal Ministry of Transport

ZTV ? ING Lag 1-13 TL/TP-KOR Stahlbauten

DIBt approvals (German Institution for Civil Engineering)

Z?16.7?452

Bearings with quality assurance are a controlled building product in accordance with the building regulations of the German Federal States. To ensure that the requirements are met to the full extent, the regulations stipulate a continuous production control. The results of the inhouse quality control have to be documented and analysed.

The internal quality assurance system of Gumba is based on the requirements of these rules and regulations. Our system is regularly reviewed and optimised.

2. General information on bridge bearings

2

The appropriate and suitable bearing of buildings has always been an important subject in construction engineering. Nowadays, the most common bearing types have been employed for about 50 years. Among them are deformation bearings, pot bearings and spherical bearings. Some of the bearings that still can be found in historic buildings, like linear rocker bearings or roller bearings are generally considered out of date technology. Therefore we limit our product range to the three earlier mentioned bearing types and special bearing designs for particular applications.

All three types of bearings meet the general technical requirements for bridge bearings. They transmit vertical forces from the superstructure into the substructure and allow translation (displacement, relative motion between the superstructure and the substructure), unless this is prevented by a special bearing design that transmits horizontal forces into the substructure. Furthermore they allow rotation (twisting) around all spacial axes.



Foto: Störfix

However, not all of the three kind of bearings are equally suitable or economical for each application. The selection of the correct bearing type is done by the structural engineer, who knows all factors of influence and who has to consider them during the selection.

We support our customers and partners during this selection process wherever we can.

Standards and Regulations

The EN 1337 is the relevant standard code of practise for bridge bearings. The EN 1337 is divided into 11 parts, that contain either general specifications or exact specifications for one bearing type. All 11 parts are relevant for us, except for part 4 (roller bearings) and part 6 (rocker bearings). We would like to point out parts 10 and 11 that contain important information about the correct installation and proper handling on site due to the fact, that these parts are very important for our customers, too.

Depending on the specific application, the standards listed in “quality assurance” (page 9) are applied in addition to the main standard code of practice.

Identification Marks

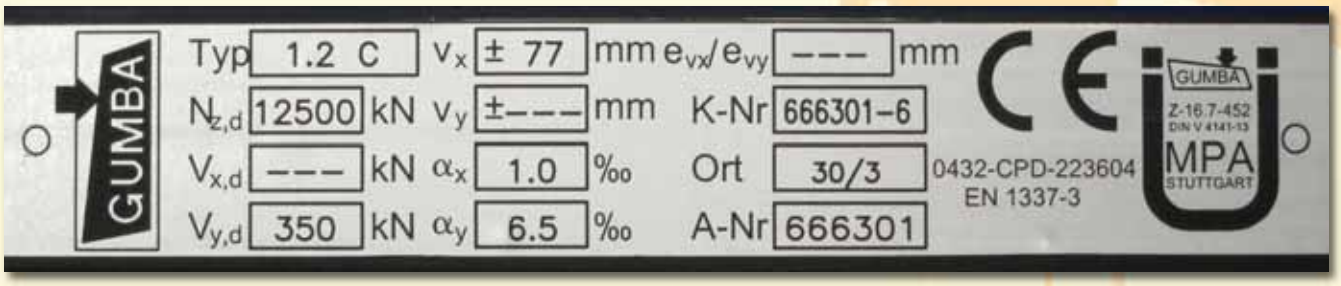
Gumba bridge bearings can be identified by marks. All products must be labelled according to EN 1337 to allow an unambiguous identification. Beyond that, we also mark single components of our product, to ensure the traceability.

Reinforced elastomeric bearings get a vulcanised CE marking and a serial number.





Reinforced elastomeric bearings with restraining structures, as well as pot bearings and spherical bearings get a nameplate. The nameplate contains beside the CE marking, information about the applicable approvals (e.g. Ü – Mark). The following nameplate is an example of Gumba.



Moreover, each bearing gets an inscription on the top bearing plate.

The inscription contains the building axes, the position of the bearing and the positions of the adjacent bearings.

Material qualities:

For Gumba bridge bearings we generally use steel grade S355J2+N with all necessary certificates and tests, unless a different grade is explicitly specified.



The reinforced elastomeric bearings according to EN 1337-3 are made of a chloroprene-rubber that is adapted to the special requirements. Alternatively, we also offer a natural rubber blend (NR) that is in accordance with EN 1337-3.

All components apply at least with the quality requirements of the standards. The quality can be proved by material test certificates for all main components.

Protection against corrosion

Applied are the requirements according to EN 1337-9 (Protection) We generally use the coating system defined in the ZTV-ING Part 4, table A 4.3.2, element 3.2, coating system Nr. 1 for bearings. This consist of:

- *100 µm thermal sprayed zinc coating on SA3 shot-blasted surface*
- *80 µm intermediate coating on epoxy resin basis*
- *80 µm top coating on polyurethane basis*

The coating systems in the table are listed by rank. The system that we employ is well proven with years of experience. Other coating systems are also possible on request.



Securing of assembled bearing

Our bearings are temporary equipped by supplementary bolts that allow a save handling between final assembly in our factory and installation on site. The auxiliary bolt connections secure each bearing component in its correct position. The bolts are coloured red and must be removed before the bearing is put into operation. (see chapter 8 "Installation instructions for bearings")

Measuring points

To determine the horizontal inclination, each bearing base plate or equivalent anchoring plate, is fitted with a measuring plane or stainless steel measuring points. This is not applicable for elastomeric bearings without restraining structures.

Indicator device

Some bridge bearings are equipped with indicator devices, to allow a reliable determination of any translation of the bridge bearing. Such a indicator device consists of a measuring scale and a pointer. These parts are mounted on a well visible area of the bearing.





Dokumentation

Documentation

During the final assembly each bearing gets a monitoring card. All actual measurements, especially the functional dimensions, and all component identification numbers are checked and recorded in the monitoring card. Based on this data we can provide the material test certificates of the components. Reinforced elastomeric bearings without restraining structure do not get a monitoring card. In this case material test certificates can be forwarded according to the serial number on the vulcanised marking.

Furthermore, EN 1337 –11 chapter 7 requires for most bearing types a documentation of the installation.

Caution:

Bridge bearings can only function in a proper way and meet all intended design characteristics when they are correctly installed. Therefore it is particularly important to us that the EN 1337 part 10 and 11 are respected. We summarised the points that are in our view essential in chapter 8 "Installation instructions for bearings". However, this summary is only a rough overview and does not replace the standard.

3. Deformation bearings

Deformation bearings are reinforced elastomeric bearings. If required, they are equipped with restraining structures.

The material specific characteristics of elastomer allows rotation and translation up to a certain degree through deformation. Due to this material characteristic costly structures with stainless steel sliding plates in combination with PTFE are quite often unnecessary, which is a large advantage compared to other bearing types. The design can be altered to a deformation sliding bearing (see page 36) if the permissible displacement of the elastomeric bearing itself is not enough for the actual planned application.



Another positive aspect is, that this is a low maintenance bearing type. Without sliding components it is even maintenance free. In contrast to the other bearing types the component that takes the vertical load is clearly visible for inspections. Elastomeric bearings have been used successfully for decades and have proven their durability. Should a bearing exchange nevertheless become necessary, this task can be realised by lifting the superstructure. Our bearings are designed in a way that allows the exchange of the elastomeric bearing or wearing parts by uplifting the superstructure 10 mm.

Each deformation bearing is designed individually case by case. Typically a range of different dimensions and layer compositions are suitable for the proposed loads. Therefore, we can tailor the design of every bearing structure very flexible according to the specific requirements.

3.1 Reinforced elastomeric bearings acc. EN 1337-3

General information:

Reinforced elastomeric bearings are made of a special rubber blend and are equipped with reinforcement steel sheets during the manufacturing process, the so called vulcanisation. The steel sheets provide the necessary stiffness. Reinforced elastomeric bearings stand out through their low maintenance and durability. Besides that, some types can be used under certain conditions without any additional steel structure (restraining).

The elastomeric part of the bearing is elastically deformable. The deformation rate in vertical direction (deflection) under permanent load is calculable and stays constant. The influences of live loads are generally small and the additional temporary deflections caused by live loads are of a minor degree and will cause no problems for most structures.

There are different types of reinforced elastomeric bearings. The different types are defined in the EN 1337-3. The most common types are described as stated below.

Types of elastomeric bearings



Type B (1) *– reinforced bearing, fully covered with elastomer and comprising at least two steel reinforcing sheets. The permanent load has to be sufficient for slip prevention.*

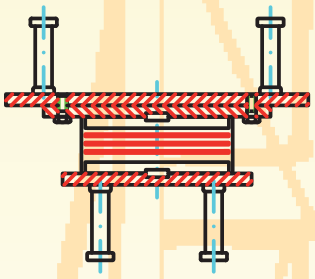


Type B/C (1/2) *- reinforced bearing with one outer steel plate on one surface. The steel plate allows to use almost any means against slip protection like dowels, threaded rods, bolts etc.The single sided slip protection allows an easy bearing installation and exchange. Slip protection is necessary in case of a pressure less than the minimum pressure of the bearing. Type B/C can be installed if the construction is secured in its position e.g. by a bearing that is fixed in all directions or transversely fixed. This bearing type has always to be used on railway bridges in Germany, independently of the actual load situation.*

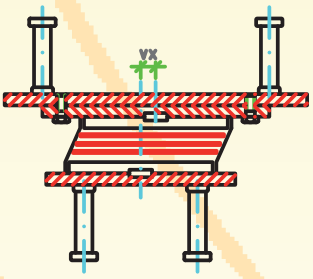
An additional application for this bearing type is the usage as an anchored buffer e.g. for building constructions.

Type C (2) - *reinforced bearing, both bearing surfaces are formed of steel plates to allow a slip protection. Bearing exchanges of this type are difficult to conduct without additional measures. As a floating bearing this bearing type can, depending on the stiffness, transfer horizontal loads (breaking etc.). An example type C (2) bearing exchange is shown below.*

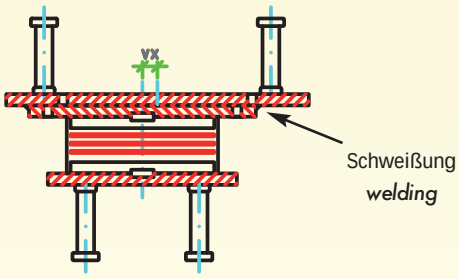




original bearing type C, installation condition



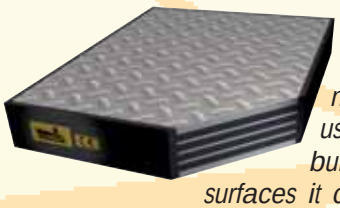
original bearing, condition before exchange (new bearing can not be installed in that way)



Lösung: Lageraustausch ohne Verschiebung mit angeschweißter oberer Platte

solution: bearing exchange in relaxed state with welded top plate

Type C (5) - *reinforced bearing, both bearing surfaces are slip protected by profiled steel plates (e.g. checker plates, non slip steel plates). Due to the fact that the required load can not be defined exactly it should only be used for structures with minor loads or for building constructions. Because of the profiled surfaces it can not be employed between restraining structures.*



Note on slip prevention

The selection of a type B(1) elastomeric bearing according to the pre-dimensioning tables requires a minimum pressure of 3 N / mm² or 5 N / mm respectively, referring to the plan area of the bearing.

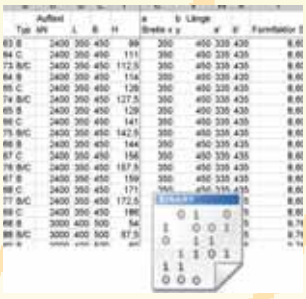
In the standards and regulations it is not defined, when a bearing with single sided or double sided slip protection has to be employed. For the usage of Type C(5) bearings we recommend a minimum pressure of 1 N / mm². The deviating requirements of the Deutsche Bahn AG are to be considered.

Fire behaviour

Elastomeric bearings made of CR rubber are of low flammability. The fire goes out by itself once the flame is removed.

The analysis of elastomeric bearings for the proposed application according to EN 1337-3 differs fundamentally to the requirements of the old DIN 4141, where maximum values for load, displacement and rotation could be used. Due to the complexity, the number of requirements and the missing design values for different loads, it is not possible to provide the designer with accurate, well known tables any more.

However, this catalogue includes tables of reinforced elastomeric bearings that are standardised by GUMBA.



The pre-dimensioning tables allow a rough estimation of the bearing dimensions. The data provided are characteristic values for the service limit state (SLS). For a more detailed analysis we provide a programme on our website www.gumba.de, instructions for use are included. This allows an ideal bearing design as the programme uses a range of more than 3000 bearings. Within this selection there are the established standard GUMBA bearings (according to the old DIN 4141), as well as the standard bearing sizes according to EN 1337-3.

Compared to the analysis according to EN 1337-3, the data of the tables (page 18 – 23) for bearing size 300 x 400 mm provides a roughly similar result in the absence of high rotations. For smaller bearings the limits according to EN 1337 – 3 can be exceeded at a combination of maximum values for displacement and vertical load, while there are still reserve capacities for bearings with larger dimensions.



Pre-dimensioning tables for standard GUMBA bearings

All values are for the serviceability limit state (SLS).



3

Maximal zulässige vertikale Auflast
Permissible vertical load

Maximal zulässiger Drehwinkel
- bei Drehwinkelachse parallel zur größten Grundrißseite und bei runden Lagern
Permissible angle of rotation
-for the axis of rotation parallel to the longer side in plan and for bearings of circular plan

Abmessungen des Lagergrundrisses
Dimension of plan area

Minimale Lagerpressung für Gleitsicherheit
Minimal pressure for safety against sliding

min. Pressung
min. Pressure
≥ 3 N/mm²

min. Pressung
min. Pressure
< 3 N/mm²

			type B (1)			Typ / type C (2) und / and C (5)				Typ / type B/C (1/2)				
Auflast Vertical Load	**Lagerformat** a x b Bearing Dim.	**Schichten** elastomer layers	**Verschiebung +/-** Displacement +/-	**Einbaudicke** Total Thickness	**Elastomerdicke t** Elast. Thickness	**Verschiebung +/-** Displacement +/-	**Einbaudicke Typ 2** Total Thickness Typ 2	**Einbaudicke Typ 5** Total Thickness Typ 5	**Elastomerdicke** Elast. Thickness	**Verschiebung +/-** Displacement +/-	**Einbaudicke** Total Thickness	**Elastomerdicke** Elast. Thickness	**Drehwinkel** Angle of Rotation	**Drehwinkel Ø** Angle of Rotation Ø
MN	**mm**	**Stck**	**mm**			**mm**				**mm**			**rad/1000**	
		1	**7**	14	10	-	-	-	-	-	-	-	4	
		2	**11**	21	15	**7**	42	32	10	**9**	31,5	12,5	8	
0,10	100x100	3	**14**	28	20	**11**	49	39	15	**12**	38,5	17,5	12	
0,15	100x150	4	**16**	35	25	**14**	56	46	20	**15**	45,5	22,5	16	
		5	**18**	42	30	**16**	63	53	25	**17**	52,5	27,5	20	
		6	-	-	-	**18**	70	60	30	-	-	-	24	
		1	**7**	14	10	-	-	-	-	-	-	-	3	
		2	**11**	21	15	**7**	42	32	10	**9**	31,5	12,5	6	
0,30	150x200	3	**14**	28	20	**11**	49	39	15	**12**	28,5	17,5	9	
		4	**18**	35	25	**14**	56	46	20	**16**	45,5	22,5	12	
		5	**21**	42	30	**18**	63	53	25	**19**	52,5	27,5	15	
		6	**23**	49	35	**21**	70	60	30	**22**	59,5	32,5	18	
		7	**25**	56	40	**23**	77	67	35	**24**	66,5	37,5	21	
		8	**27**	63	45	**25**	84	74	40	**26**	73,5	42,5	24	
		9	**28**	70	50	**27**	91	81	45	**28**	80,5	47,5	27	
		10	-	-	-	**28**	98	88	50	-	-	-	30	
		1	**9**	19	13	-	-	-	-	-	-	-	3	4
		2	**15**	30	21	**11**	49	39	16	**13**	39,5	18,5	6	8
0,31	Ø 200	3	**20**	41	29	**17**	60	50	24	**19**	50,5	26,5	9	12
0,63	200x250	4	**26**	52	37	**22**	71	61	32	**24**	61,5	34,5	12	16
0,75	200x300	5	**30**	63	45	**28**	82	72	40	**29**	72,5	42,5	15	20
1,00	200x400	6	**34**	74	53	**32**	93	83	48	**33**	83,5	50,5	18	24
		7	**36**	85	61	**35**	104	94	56	**36**	94,5	58,5	21	28
		8	-	-	-	**37**	115	105	64	-	-	-	24	32

Anzahl der Elastomerschichten
Number of elastomer layers

Maximal zulässige Parallelverschiebung zwischen Lagerober- und Lagerunterseite
Permissible displacement between the superstructure and substructure

Lagerhöhe im unbelasteten Zustand
Thickness of unloaded bearing

Pre-dimensioning tables for standard GUMBA bearings

All values are for the serviceability limit state (SLS).



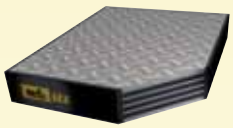



			min. Pressung min. pressure ≥ 3 N/mm²			min. Pressung min. pressure < 3 N/mm²								
			type B (1)			Typ / type C (2) und / and C (5)				Typ / type B/C (1/2)				
Auflast Vertical Load	**Lagerformat a x b** Bearing Dim.	**Schichten** elastomer layers	**Verschiebung +/-** Displacement +/-	**Einbaudicke** Total Thickness	**Elastomerdicket** Elast. Thickness	**Verschiebung +/-** Displacement +/-	**Einbaudicke Typ 2** Total Thickness Typ 2	**Einbaudicke Typ 5** Total Thickness Typ 5	**Elastomerdicke** Elast. Thickness	**Verschiebung +/-** Displacement +/-	**Einbaudicke** Total Thickness	**Elastomerdicke** Elast. Thickness	**Drehwinkel** Angle of Rotation	**Drehwinkel Ø** Angle of Rotation Ø
MN	**mm**	**Stck**	**mm**			**mm**				**mm**			**rad/1000**	
		1	**9**	19	13	-	-	-	-	-	-	-	3	4
		2	**15**	30	21	**11**	49	39	16	**13**	39,5	18,5	5	8
0,60	Ø 250	3	**20**	41	29	**17**	60	50	24	**19**	50,5	26,5	8	12
1,30	250x400	4	**26**	52	37	**22**	71	61	32	**24**	61,5	34,5	10	16
		5	**32**	63	45	**28**	82	72	40	**30**	72,5	42,5	13	20
		6	**37**	74	53	**34**	93	83	48	**35**	83,5	50,5	15	24
		7	**40**	85	61	**38**	104	94	56	**39**	94,5	58,5	18	28
		8	**43**	96	69	**41**	115	105	64	**42**	105,5	66,5	20	32
		9	**46**	107	77	**44**	126	116	72	**45**	116,5	74,5	23	36
		10	-	-	-	**46**	137	127	80	-	-	-	25	40
		1	**9**	19	13	-	-	-	-	-	-	-	2	3
		2	**15**	30	21	**11**	49	39	16	**13**	39,5	18,5	4	6
0,90	Ø 300	3	**20**	41	29	**17**	60	50	24	**19**	50,5	26,5	6	9
1,80	300x400	4	**26**	52	37	**22**	71	61	32	**24**	61,5	34,5	8	12
		5	**32**	63	45	**28**	82	72	40	**30**	72,5	42,5	10	15
		6	**37**	74	53	**34**	93	83	48	**35**	83,5	50,5	12	18
		7	**43**	85	61	**39**	104	94	56	**41**	94,5	28,5	14	21
		8	**46**	96	69	**44**	115	105	64	**45**	105,5	66,5	16	24
		9	**50**	107	77	**48**	126	116	72	**49**	116,5	74,5	18	27
		10	**52**	118	85	**51**	137	127	80	**52**	127,5	82,5	20	30
		11	**55**	129	93	**53**	148	138	88	**54**	138,5	90,5	22	33
		12	-	-	-	**56**	159	149	96	-	-	-	24	36
		1	**11**	24	16	-	-	-	-	-	-	-		4
		2	**19**	39	27	**15**	56	46	22	**17**	47,5	24,5		8
1,20	Ø 350	3	**27**	54	38	**23**	71	61	33	**25**	62,5	33,5		12
		4	**34**	69	49	**31**	86	76	44	**33**	77,5	46,5		16
		5	**42**	84	60	**39**	101	91	55	**40**	92,5	57,5		20
		6	**50**	99	71	**46**	116	106	66	**48**	107,5	68,5		24
		7	**55**	114	82	**52**	131	121	77	**53**	122,5	79,5		28
		8	**59**	129	93	**57**	146	136	88	**58**	137,5	90,5		32
		9	**63**	144	104	**61**	161	151	99	**62**	152,5	101,5		36
		10	**66**	159	115	**64**	176	166	110	**65**	167,5	112,5		40

Pre-dimensioning tables for standard GUMBA bearings

All values are for the serviceability limit state (SLS).






3

			min. Pressung min. pressure ≥ 5 N/mm²			min. Pressung min. pressure < 5 N/mm²								
			type B (1)			Typ / type C (2) und / and C (5)				Typ / type B/C (1/2)				
Auflast Vertical Load	**Lagerformat** a x b Bearing Dim.	**Schichten** elastomer layers	**Verschiebung +/-** Displacement +/-	**Einbaudicke** Total Thickness	**Elastomerdicke** t Elast. Thickness	**Verschiebung +/-** Displacement +/-	**Einbaudicke Typ 2** Total Thickness Typ 2	**Einbaudicke Typ 5** Total Thickness Typ 5	**Elastomerdicke** Elast. Thickness	**Verschiebung +/-** Displacement +/-	**Einbaudicke** Total Thickness	**Elastomerdicke** Elast. Thickness	**Drehwinkel** Angle of Rotation	**Drehwinkel Ø** Angle of Rotation Ø
MN	**mm**	**Stck**	**mm**			**mm**				**mm**			**rad/1000**	
2,40	350x450	3	**27**	54	38	**23**	81	61	33	**25**	67,5	33,5	8	
		4	**34**	69	49	**31**	96	76	44	**33**	82,5	46,5	10	
		5	**42**	84	60	**39**	111	91	55	**40**	97,5	57,5	13	
		6	**50**	99	71	**46**	126	106	66	**48**	112,5	68,5	15	
		7	**55**	114	82	**52**	141	121	77	**53**	127,5	79,5	18	
		8	**59**	129	93	**57**	156	136	88	**58**	142,5	90,5	20	
		9	**63**	144	104	**61**	171	151	99	**62**	157,5	101,5	23	
		10	**66**	159	115	**64**	186	166	110	**65**	172,5	112,5	25	
1,90 **3,00**	Ø 400 400x500	3	**27**	54	38	**23**	81	61	33	**25**	67,5	35,5	6	9
		4	**34**	69	49	**31**	96	76	44	**33**	82,5	46,5	8	12
		5	**42**	84	60	**39**	111	91	55	**40**	97,5	57,5	10	15
		6	**50**	99	71	**46**	126	106	66	**48**	112,5	68,5	12	18
		7	**57**	114	82	**54**	141	121	77	**56**	127,5	79,5	14	21
		8	**62**	129	93	**60**	156	136	88	**61**	142,5	90,5	16	24
		9	**67**	144	104	**65**	171	151	99	**66**	157,5	101,5	18	27
		10	**70**	159	115	**69**	186	166	110	**70**	172,5	112,5	20	30
		11	**74**	174	126	**72**	201	181	121	**73**	187,5	123,5	22	33
		12	**-**	-	-	**75**	216	196	132	**-**	-	-	24	36
2,40 **4,21**	Ø 450 450x600	3	**27**	54	38	**23**	81	61	33	**25**	67,5	33,5	6	9
		4	**34**	69	49	**31**	96	76	44	**33**	82,5	46,5	8	12
		5	**42**	84	60	**39**	111	91	55	**40**	97,5	57,5	10	15
		6	**50**	99	71	**46**	126	106	66	**48**	112,5	68,5	12	18
		7	**57**	114	82	**54**	141	121	77	**56**	127,5	79,5	14	21
		8	**65**	129	93	**62**	156	136	88	**63**	142,5	90,5	16	24
		9	**70**	144	104	**67**	171	151	99	**68**	157,5	101,5	18	27
		10	**74**	159	115	**72**	186	166	110	**73**	172,5	112,5	20	30
		11	**78**	174	126	**76**	201	181	121	**77**	187,5	123,5	22	33
		12	**82**	189	137	**80**	216	196	132	**81**	202,5	134,5	24	36
		13	**85**	204	148	**83**	231	211	143	**84**	217,5	145,5	26	39

Pre-dimensioning tables for standard GUMBA bearings

All values are for the serviceability limit state (SLS).



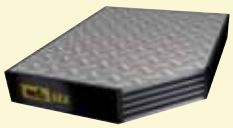



			min. Pressung min. pressure ≥ 5 N/mm²			min. Pressung min. pressure < 5 N/mm²								
			type B (1)			Typ / type C (2) und / and C (5)				Typ / type B/C (1/2)				
Auflast Vertical Load	**Lagerformat** a x b Bearing Dim.	**Schichten** elastomer layers	**Verschiebung +/-** Displacement +/-	**Einbaudicke** Total Thickness	**Elastomerdicke** t Elast. Thickness	**Verschiebung +/-** Displacement +/-	**Einbaudicke Typ 2** Total Thickness Typ 2	**Einbaudicke Typ 5** Total Thickness Typ 5	**Elastomerdicke** Elast. Thickness	**Verschiebung +/-** Displacement +/-	**Einbaudicke** Total Thickness	**Elastomerdicke** Elast. Thickness	**Drehwinkel** Angle of Rotation	**Drehwinkel Ø** Angle of Rotation Ø
MN	**mm**	**Stck**	**mm**			**mm**				**mm**			**rad/1000**	
		3	**27**	54	38	**23**	81	61	33	**25**	67,5	33,5	6	6
		4	**34**	69	49	**31**	96	76	44	**33**	82,5	46,5	8	8
2,90	Ø 500	5	**42**	84	60	**39**	111	91	55	**40**	97,5	57,5	10	10
3,60	Ø 550	6	**50**	99	71	**46**	126	106	66	**48**	112,5	68,5	12	12
4,50	500x600	7	**57**	114	82	**54**	141	121	77	**56**	127,5	79,5	14	14
		8	**65**	129	93	**62**	156	136	88	**63**	142,5	90,5	16	16
		9	**72**	144	104	**69**	171	151	99	**71**	157,5	101,5	18	18
		10	**77**	159	115	**75**	186	166	110	**76**	172,5	112,5	20	20
		11	**82**	174	126	**80**	201	181	121	**81**	187,5	123,5	22	22
		12	**86**	189	137	**84**	216	196	132	**85**	202,5	134,5	24	24
		13	**89**	204	148	**88**	231	211	143	**89**	217,5	145,5	26	26
		14	**93**	219	159	**91**	246	226	154	**92**	232,5	156,5	28	28
		15	**-**	-	-	**94**	261	241	165	**-**	-	-	30	30
		3	**35**	70	50	**32**	95	75	45	**33**	82,5	47,5	6	6
		4	**46**	90	65	**42**	115	95	60	**44**	102,5	62,5	8	8
4,10	Ø 600	5	**56**	110	80	**53**	135	115	75	**54**	122,5	77,5	10	10
5,00	Ø 650	6	**67**	130	95	**63**	155	135	90	**65**	142,5	92,5	12	12
6,30	600x700	7	**77**	150	110	**74**	175	155	105	**75**	162,5	107,5	14	14
		8	**86**	170	125	**84**	195	175	120	**85**	182,5	122,5	16	16
		9	**93**	190	140	**91**	215	195	135	**92**	202,5	137,5	18	18
		10	**99**	210	155	**98**	235	215	150	**98**	222,5	152,5	20	20
		11	**105**	230	170	**103**	255	235	165	**104**	242,5	167,5	22	22
		12	**109**	250	185	**108**	275	255	180	**109**	262,5	182,5	24	24
		13	**113**	270	200	**112**	295	275	195	**113**	282,5	197,5	26	26

Pre-dimensioning tables for standard GUMBA bearings

All values are for the serviceability limit state (SLS).






			min. Pressung min. pressure ≥ 5 N/mm²			min. Pressung min. pressure < 5 N/mm²								
			type B (1)			Typ / type C (2) und / and C (5)				Typ / type B/C (1/2)				
Auflast Vertical Load	**Lagerformat a x b** Bearing Dim.	**Schichten** elastomer layers	**Verschiebung +/-** Displacement +/-	**Einbaudicke** Total Thickness	**Elastomerdicke t** Elast. Thickness	**Verschiebung +/-** Displacement +/-	**Einbaudicke Typ 2** Total Thickness Typ 2	**Einbaudicke Typ 5** Total Thickness Typ 5	**Elastomerdicke** Elast. Thickness	**Verschiebung +/-** Displacement +/-	**Einbaudicke** Total Thickness	**Elastomerdicke** Elast. Thickness	**Drehwinkel** Angle of Rotation	**Drehwinkel Ø** Angle of Rotation Ø
MN	**mm**	**Stck**	**mm**			**mm**				**mm**			**rad/1000**	
		3	**35**	70	50	**32**	95	75	45	**33**	82,5	47,5	6	6
		4	**46**	90	65	**42**	115	95	60	**44**	102,5	62,5	8	8
5,80	Ø 700	5	**56**	110	80	**53**	135	115	75	**54**	122,5	77,5	10	10
6,60	Ø 750	6	**67**	130	95	**63**	155	135	90	**65**	142,5	92,5	12	12
8,40	700x800	7	**77**	150	110	**74**	175	155	105	**75**	162,5	107,5	14	14
		8	**88**	170	125	**84**	195	175	120	**86**	182,5	122,5	16	16
		9	**98**	190	140	**95**	215	195	135	**96**	202,5	137,5	18	18
		10	**105**	210	155	**103**	135	215	150	**104**	222,5	152,5	20	20
		11	**112**	230	170	**110**	255	235	165	**111**	242,5	167,5	22	22
		12	**118**	250	185	**116**	275	255	180	**117**	262,5	182,5	24	24
		13	**123**	270	200	**121**	295	275	195	**122**	282,5	197,5	26	26
		14	**127**	290	215	**126**	315	295	210	**127**	302,5	212,5	28	28
		15	**131**	310	230	**130**	335	315	225	**131**	322,5	227,5	30	30
		3	**41**	79	59	**38**	104	84	54	**40**	91,5	56,5	6	6
		4	**54**	102	77	**50**	127	107	72	**52**	114,5	74,5	8	8
7,50	Ø 800	5	**67**	125	95	**63**	150	130	90	**65**	137,5	92,5	10	10
8,50	Ø 850	6	**79**	148	113	**76**	173	153	108	**77**	160,5	110,5	12	12
9,60	800x800	7	**92**	171	131	**88**	196	176	126	**90**	183,5	128,5	14	14
		8	**104**	194	149	**101**	219	199	144	**103**	206,5	146,5	16	16
		9	**115**	217	167	**113**	242	222	162	**114**	229,5	164,5	18	18
		10	**124**	240	185	**122**	265	245	180	**123**	252,5	182,5	20	20
		11	**131**	263	203	**129**	288	268	198	**130**	275,5	200,5	22	22
		12	**138**	286	221	**136**	311	291	216	**137**	298,5	218,5	24	24
		13	**144**	309	239	**142**	334	314	234	**143**	321,5	236,5	26	26
		14	**149**	332	257	**147**	357	337	252	**148**	344,5	254,5	28	28

Pre-dimensioning tables for standard GUMBA bearings

All values are for the serviceability limit state (SLS).






			min. Pressung min. pressure ≥ 5 N/mm²			min. Pressung min. pressure < 5 N/mm²								
			type B (1)			Typ / type C (2) und / and C (5)				Typ / type B/C (1/2)				
Auflast Vertical Load	**Lagerformat** a x b Bearing Dim.	**Schichten** elastomer layers	**Verschiebung +/-** Displacement +/-	**Einbaudicke** Total Thickness	**Elastomerdicke** t Elast. Thickness	**Verschiebung +/-** Displacement +/-	**Einbaudicke Typ 2** Total Thickness Typ 2	**Einbaudicke Typ 5** Total Thickness Typ 5	**Elastomerdicke** Elast. Thickness	**Verschiebung +/-** Displacement +/-	**Einbaudicke** Total Thickness	**Elastomerdicke** Elast. Thickness	**Drehwinkel** Angle of Rotation	**Drehwinkel Ø** Angle of Rotation Ø
MN	**mm**	**Stck**	**mm**			**mm**				**mm**			**rad/1000**	
		3	**41**	79	59	**38**	104	84	54	**40**	91,5	56,5	5	5
		4	**54**	102	77	**50**	127	107	72	**52**	114,5	74,5	6	6
9,50	Ø 800	5	**67**	125	95	**63**	150	130	90	**65**	137,5	92,5	8	8
12,00	900x900	6	**79**	148	113	**76**	173	153	108	**77**	160,5	110,5	9	9
		7	**92**	171	131	**88**	196	176	126	**90**	183,5	128,5	11	11
		8	**104**	194	149	**101**	219	199	144	**103**	206,5	146,5	12	12
		9	**117**	217	167	**113**	242	222	16	**115**	229,5	164,5	14	14
		10	**128**	240	185	**126**	265	245	180	**127**	252,5	182,5	15	15
		11	**137**	263	203	**135**	288	268	198	**136**	275,5	200,5	17	17
		12	**145**	286	221	**143**	311	291	216	**144**	298,5	218,5	18	18
		13	**152**	309	239	**150**	334	314	234	**151**	321,5	236,5	20	20
		14	**158**	332	257	**156**	357	337	252	**157**	344,5	254,5	21	21
		15	**163**	355	275	**162**	380	360	252	**163**	367,5	272,5	23	23
		16	**168**	378	293	**167**	403	383	270	**391**	390,5	290,5	24	24

Design basics acc. to EN 1337-3

3

The harmonised European standard EN 1337-3 applies exclusively for the manufacturing and the structural analysis of elastomeric bearings. National standards are not valid any more. The EN 1337-3 lays down the rules for reinforced elastomeric bearings with an base area up to 1200 x 1200 mm and for a temperature range of ?25°C up to 50°C, temporary up to 70°C. Particular rules apply for operating temperatures below ?25°C as far as ?40°C. If this service range is applicable they must be agreed separately.

The following summary of the EN 1337-3 shall demonstrate the main design steps for elastomeric bearings. Additional remarks and further information for the application of the calculation can be found in the EN 1337 and the corresponding parts.

The design values (loads incl. safety factors) have to be used for the analysis of elastomeric bearings according to 1337-3. Thus the analysis has to be done in the Ultimate Limit State (ULS).

The limits for the total deformation caused by vertical load, displacement and rotation as well as the limits for the deformation caused by the resulting displacement are specified for the ULS.

The table on page 28 shows exemplary which data is needed for the design acc. to EN 1337-3. It can be used as a template for the collection of the listed parameters. The completed table or a summary in a similar way including all required general conditions is beneficial for a rapid design of a correct and suitable bearing.

Note: Acc. to the EN 1337-3 the relevant design engineer has to provide the required data for the structural analysis of the bearing. A determination of this data by the bearing manufacturer is not possible.

The bearings have to fulfill the following requirements:

2.0 Max. deformation

The sum of the partial deformations results from design loads according to the following equation:

$$\epsilon_{t,d} = K_L (\epsilon_{c,d} + \epsilon_{q,d} + \epsilon_{\alpha,d}) \leq 7$$

$\epsilon_{c,d}$ = deformation resulting from imposed load

$\epsilon_{q,d}$ = distortional deformation

$\epsilon_{\alpha,d}$ = deformation resulting from the angular rotation

K_L = factor for the type of load

2.1 Deformation resulting from pressure

$$\epsilon_{c,d} = \frac{1{,}5 \cdot F_{t,d}}{G \cdot A_r \cdot S}$$

G = modulus of rotation acc. to DIN EN 1337-3, in general 0.9 MPa (N / mm2)

A_r = reduced area due to action.

A_1 = area of the reinforcing sheet minus opening surfaces (drillings etc.)

S = shape coefficient

$$A_r = A_1 \cdot \left(1 - \frac{v_{x,d}}{a'} - \frac{v_{y,d}}{b'} \right)$$

A_1 = $a' \cdot b'$ (for rectangular bearings without opening)

a' = width of reinforced sheets

b' = length of reinforced sheets

$$S = \frac{a' * b'}{2 * t_i * (a' + b')}$$

$v_{x,d}$= max. bearing deformation in the direction of bearing side a

$v_{y,d}$ = max. bearing deformation in the direction of bearing side b

2.2 Distortional deformation

$$\epsilon_{q,d} = \frac{V_{xy,d}}{T_q} \leq 1{,}0$$

T_q = sum of elastomeric layers including the upper and lower layers.

2.3 Deformation resulting from rotation

$$\epsilon_{q,d} = \frac{(a'^2 \cdot \alpha_{a,d} + b'^2 \cdot \alpha_{b,d}) \cdot t_i}{2 \cdot n \, (t_i^3)}$$

$\alpha_{a,d}$ = angle of rotation over width a of the bearing

$\alpha_{b,d}$ = angle of rotation (if applicable) over width b of the bearing

3.0 Maximum tension stress in the reinforcing sheets

3.1 Thickness of the reinforcing sheets

$$t_s = \frac{(K_p \cdot F_{z,d} \cdot (t_1 + t_2) \cdot K_h \cdot \gamma_m}{A_r \cdot f_y} \geq 2mm$$

t_1, t_2 = elastomer thickness on both sides of the elastomer sheet

f_y = tensile yield strength of steel

K_h = 1 without holes

K_h = 2 with holes

γ_m = partial safety factor, standard value = 1.00

K_p = 1.3 correction value

t_s = ≥ 2

4.0 Criteria for stability

4.1 Rotation limit

The following condition must be satisfied for the rotation limit of reinforced bearings:

Rectangular bearings

$$\frac{F_{z,d} \cdot n \cdot t_i}{A_1} \left(\frac{1}{5 \cdot G \cdot S^2} + \frac{1}{E_b} \right) - \frac{(a' \cdot \alpha_{a,d} + b' \alpha_{b,d})}{K_{r,d}} \geq 0$$

Round bearings

$$\frac{F_{z,d} \cdot n \cdot t_i}{A_1} \left(\frac{1}{5 \cdot G \cdot S^2} + \frac{1}{E_b} \right) - \frac{(D' \cdot \alpha_d)}{K_{r,d}} \geq 0$$

K_{td} = rotation coefficient = 3

E_b = 2000 MPa (N / mm2)

4.2 Stability

In case of reinforced elastomeric bearings, the compression F_{zd} / Ar must satisfy the following equation:

$$\frac{F_{z,d} \cdot n \cdot t_i}{A_r} < \frac{2 \cdot a' \cdot G \cdot S}{3 \cdot T_e}$$

T_e = sum of all elastomer layers

4.3 Slide stability

Bearings not anchored have to satisfy the following equation.

$$F_{xy,d} \leq \mu_e \cdot F_{z,d\ min}$$

And under a permanent load, if

$\sigma_{c,d\,min}$ = $F_{z,d\,min}$ / $A_r \geq 3$ (N / mm²)

$F_{xy,d}$ = resulting horizontal force

$F_{z,d\,min}$ = the smallest vertical design force that corresponds with $F_{xy,d}$

μ_e = friction coefficient acc. to the following equation

$$\mu_e = 0.1 + \frac{1.5\ K_f}{\sigma_m}$$

K_f = 0.6 for concrete
0.2 for all other areas including resin-based mortar

σ_m = mean compression stress from $F_{z,d\,min}$ in MPa (N / mm2)

5.0 Forces, moments and deformations acting on the structure

5.1 Compression in the contact surfaces

It is sufficient to check that the mean surface compression does not exceed the strength of the adjoining material.

5.2 Restoring force

$$R_{xy} = \frac{A \cdot G \cdot v_{xy.d}}{T_e}$$

A = total area of bearing

5.3 Rotation resistance (restoring moment)

For rectangular bearings

$$M = G \cdot \frac{\alpha \cdot a'^5 \cdot b'}{n \cdot t_i^3 \cdot K_s}$$

For round bearings

$$M = G \cdot \frac{\alpha \cdot \pi \cdot D'^6}{512 \cdot n \cdot t_i^3}$$

Table: K_s -values

b / a	0.5	0.75	1	1.2	1.25	1.3	1.4	1.5
K_s	137	100	86.2	80.4	79.3	78.4	76.7	75.3
b / a	1.6	1.7	1.8	1.9	2	2.5	10	∞
K_s	74.1	73.1	72.2	71.5	70.8	68.3	61.9	

Bearing load table

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Name der Brücke *bridge name*							
Lagertyp *type of bearing*							
Lagerkennzeichen (Einbauort) *bearing identification mark (position of the bearing)*							
Kontaktflächenmaterial *seating material* (B = Beton, S = Stahl) *(B = concrete, S = steel)*	Lageroberseite *upper surface*						
	Lagerunterseite *lower surface*						
Zulässige mittlere Pressung *allowable average contact pressure* (N/mm²)	Oben *upper face*	SLS	σ_m =				
		ULS	σ_m =				
	Unten *lower face*	SLS	σ_m =				
		ULS	σ_m =				
Bemessungs-lasten *design loads* (kN)	ULS (GZT)	vertikal *vertical*	max.	$F_{z,d}$ =				
			ständig *perman.*	$F_{z,d}$ =				
			min.	$F_{z,d}$ =				
			zugeh.[1] *assoc.*	$v_{y,d}$ / $v_{x,d}$ =	/	/	/	/
			max.[2]	$v_{y,d}$ / $v_{x,d}$ =	/	/	/	/
			zugeh.[3] *assoc.*	$F_{z,d\,min}$ =				
		quer *transverse*		$F_{y,d}$ =				
		längs *longitudinal*		$F_{x,d}$ =				
	SLS (GZG)	vertikal *vertical*	max.	$F_{z,k}$ =				
			min.	$F_{z,k}$ =				
		quer *transverse*		$F_{y,k}$ =				
		längs *longitudinal*		$F_{x,k}$ =				
Verschiebung *translation* (mm)	ULS (GZT)	quer *transverse*		$v_{y,d}$ =				
		längs *longitudinal*		$v_{x,d}$ =				
	SLS (GZG)	quer *transverse*		$v_{y,k}$ =				
		längs *longitudinal*		$v_{x,k}$ =				
Rotation *rotation* (mrad)	ULS (GZT)	quer *transverse*		$\alpha_{y,d}$ =				
		längs *longitudinal*		$\alpha_{x,d}$ =				
Maximale Lagerabmessungen *maximum bearing dimensions* (mm)	quer *transverse*			b =				
	längs *longitudinal*			a =				
	Einbauhöhe *height*			T_b =				

ULS = Grenzzustand der Tragfähigkeit (GZT) / *ultimate limit state*

SLS = Grenzzustand der Gebrauchstauglichkeit (charakteristische Werte) (GZG) /*serviceabiltiy limit state*

=> Angaben zwingend erforderlich / *value declaration necessary*

1) Maximale Verschiebungen $v_{y,d}$ und $v_{x,d}$ - zugehörig zu min. $F_{z,d}$ / *maximum translation* $v_{y,d}$ *and* $v_{x,d}$ - *associated to min.* $F_{z,d}$

2) Maximale Verschiebungen $v_{y,d}$ und $v_{x,d}$ / *maximum translation* $v_{y,d}$ *and* $v_{x,d}$

3) Den maximalen Verschiebungen $v_{y,d}$ und $v_{x,d}$ zugehörige Mindestauflast $F_{z,d\,min}$ / *minimum design load* $F_{z,d\,min}$ *associated to maximum translation* $v_{y,d}$ *and* $v_{x,d}$

Sample of completed bearing load table

GUMBA GmbH
Ismaninger Str. 7A
85609 Aschheim
Tel. +49 (0) 89 / 9452829-0
Fax +49 (0) 89 / 9452829-10

bridge name							
type of bearing					1.1 (V2)	1.2 (V1Q)	1.2 (V1L)	1.6 (V)
bearing identification mark (*position of the bearing*)					10 / 2	20 / 2	10 / 1	20 / 1
seating material (B = concrete, S = steel)	*upper surface*				B	B	B	B
	lower surface				B	B	B	B
allowable average contact pressure (N/mm²)	*upper face*	SLS	σ_m =					
		ULS	σ_m =					
	lower face	SLS	σ_m =					
		ULS	σ_m =					
lasten *design loads* (kN)	ULS (GZT)	vertikal *vertical*	$F_{z,d}$ =		2400	2400	2400	2400
			$F_{z,d}$ =	*perman.*	950	950	950	950
			$F_{z,d}$ =	min.	400	400	400	400
			$v_{y,d}$ / $v_{x,d}$ =	*assoc.*	5 / 15	0 / 15	0 / 5	---
			$v_{y,d}$ / $v_{x,d}$ =		10 / 25	0 / 25	0 / 10	---
			$F_{z,d\,min}$ =	*assoc.*	500	500	500	500
		transverse	$F_{y,d}$ =		---	150	---	150
		longitudinal	$F_{x,d}$ =		---	---	200	200
	SLS (GZG)	vertikal *vertical*	$F_{z,k}$ =		1800	1800	1800	1800
			$F_{z,k}$ =	min.	400	400	400	400
		transverse	$F_{y,k}$ =		---	110	---	110
		longitudinal	$F_{x,k}$ =		---	---	150	150
translation (mm)	ULS (GZT)	*transverse*	$v_{y,d}$ =		10	---	10	---
		longitudinal	$v_{x,d}$ =		25	25	---	---
	SLS (GZG)	*transverse*	$v_{y,k}$ =		10	---	10	---
		longitudinal	$v_{x,k}$ =		20	20	---	---
Rotation *rotation* (mrad)	ULS (GZT)	*transverse*	$\alpha_{y,d}$ =		5	5	5	5
		longitudinal	$\alpha_{x,d}$ =		3	3	3	3
maximum bearing dimensions (mm)		*transverse*	b =					
		longitudinal	a =					
		height	T_b =					

maximum translation vy,d and vx,d - associated to min. Fz,d

maximum translation vy,d and vx,d

minimum design load Fz d min associated to maximum translation vy d and vx d

3.2 Reinforced elastomeric bearings with restraining structures

General information

Restraining structures are steel components that surround reinforced elastomeric bearings. They transmit horizontal loads from the superstructure into the substructure.

Among the horizontal loads that typically occur are wind, reset forces from translation, breaking, friction and centrifugal forces on curved railway bridges.

Depending on the type of restraint, the stoppers on the top and bottom bearing plate can transmit particular loads out of the following:

Fx = longitudinal force [kN] Fy = transverse forces [kN]

vx = displacement in x- direction [mm] vy = displacement in y- direction [mm]

Note: In the practical application ?x? is always the main direction (longitudinal direction) of bridges.

Restraints are distinguished in group I and group II. Restraining structures of group I (with sliding pair ? steel / steel) are designed for displacements ?50 mm (SLS) or railway bridges with an elongated length of ?25 m. Group II restraints (with sliding pair ? stainless steel / sliding material) are applicable for structures where group I restraints can not be used.

The criteria for the dimensioning and the design of restraining structures are regulated by the DIN 4141 part 13 as well as the EN 1337 part 8. The dimensioning is based on the available structural data. The restraining structures are tailored, as far as possible, to the existing building structure (space available, installation height etc.)

The following different types of restraining structures are most common:

- *longitudinally fixed:*

The bearing is fixed in the longitudinal building direction. Forces in this direction are transmitted.

- *transversely fixed:*

The bearing is fixed in the transversal building direction. Forces in this direction are transmitted.

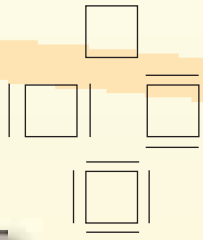
- *fixed in all directions:*

The bearing is fixed in longitudinal and transversal building direction. Forces are transmitted in both directions.

For the selection of the bearing layout, i. e. the type and position of the restraining structures, it has to be considered that the bearing or structure as a whole should be able to expand without restraint.

Symbols and bearing numbers are specified in the EN 1337 part 1 – general design rules, to provide a clear information of the bearing type in the bearing layout.

The most common bearing symbols are:



1.1 – movable in all directions (V2)

1.2 – transversely or longitudinally fixed (V1)

1.6 – fixed in all directions (V)



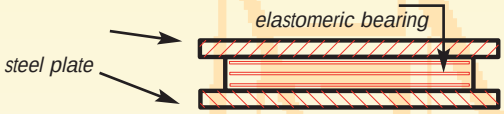


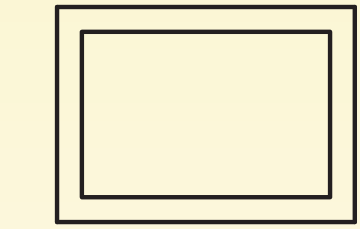
3

front

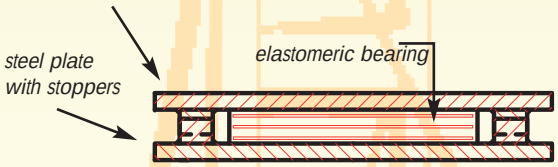
top

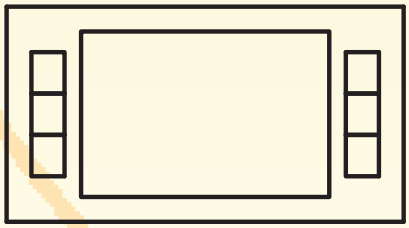
1.1 movable in all directions (V2)





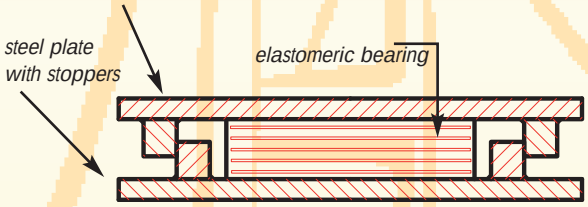
1.2 longitudinally fixed (V1L)

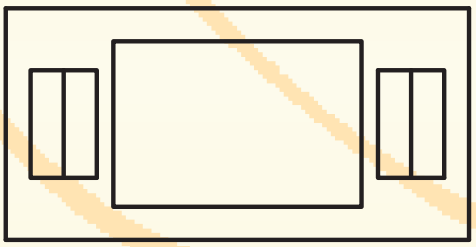




1.2 quer fest (V1Q) Gr. I

1.2 transversely fixed (V1Q) Gr. I

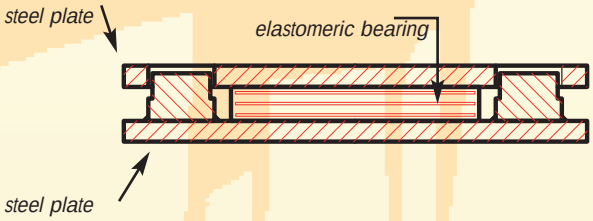


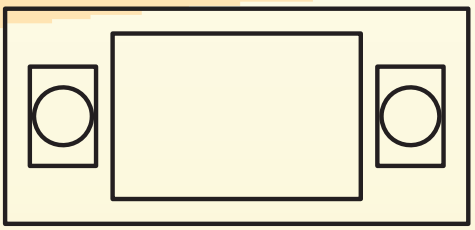


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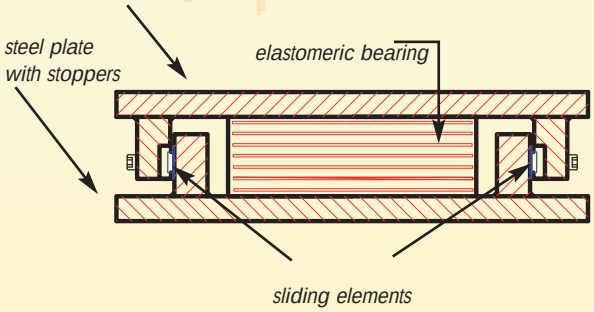
1.6 fixed in all directions (V)

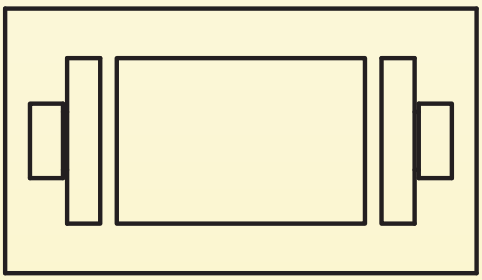




1.2 quer fest (V1Q) Gr. II

1.2 transverely fixed (V1Q) Gr. II

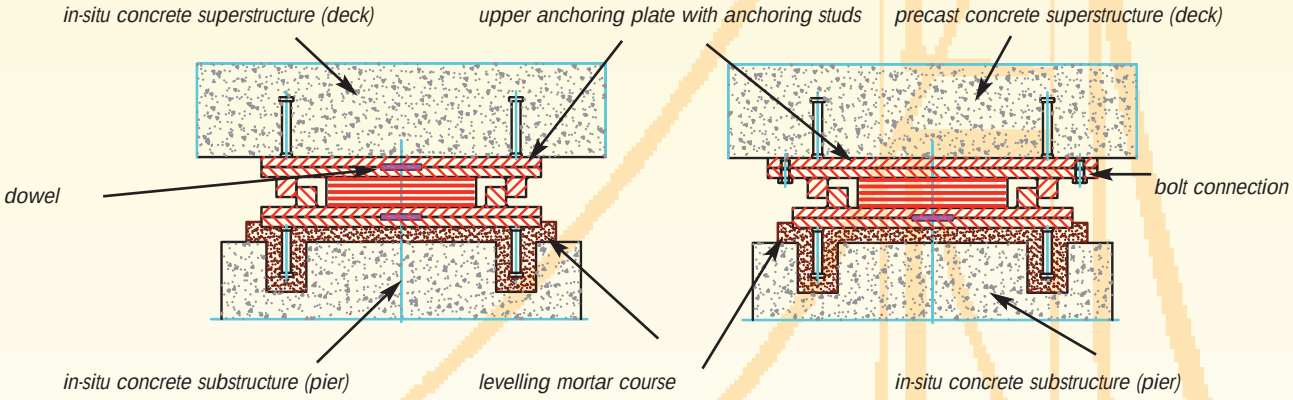




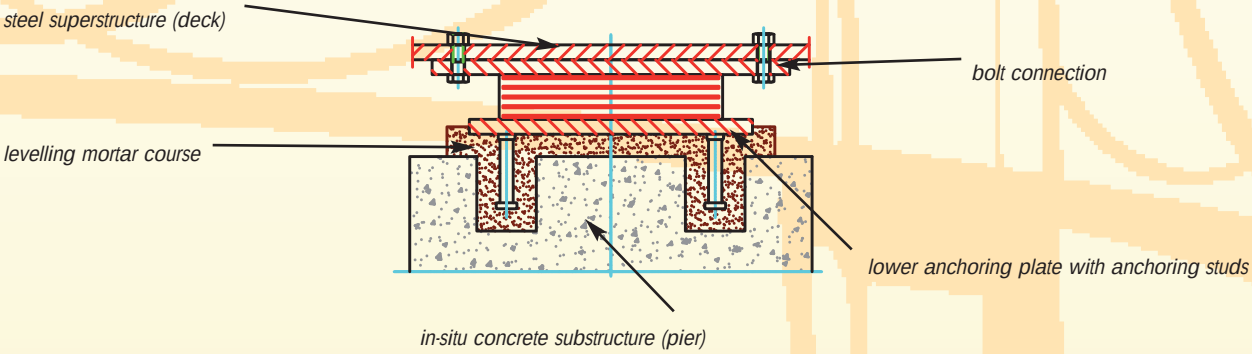
The connection to the superstructure and substructure can be accomplished in various ways. The restraining structure type is irrelevant for the connection method.

examples of connection methods

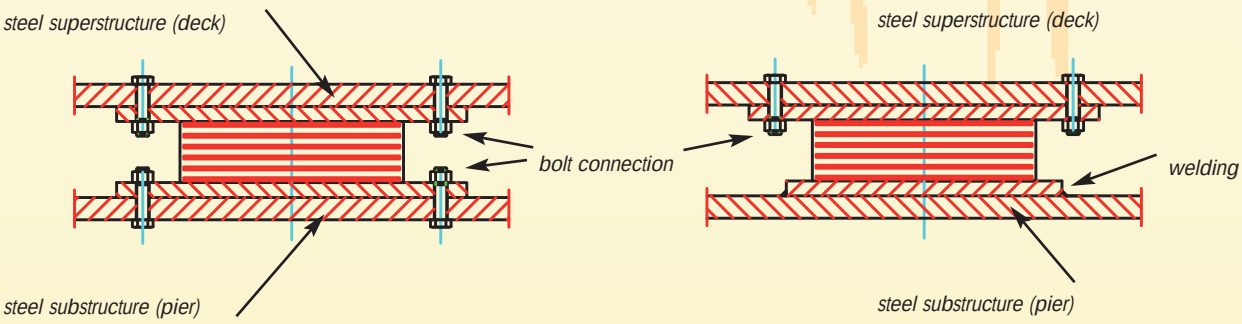
concrete / concrete



steel / concrete



steel / steel



Restraining structures with examples of connection methods to superstructure (deck)
each restraining structure type can be combined with each connection method



B
-
-

concrete superstructure (deck)
- bearing no. 1.6 fixed in all directions (V)
- anchoring plate with anchoring studs



concrete superstructure (deck)
- bearing no. 1.2 longitudinally fixed (V1L)
- anchoring with bolt connected dowels



S
-
-

steel superstructure (deck)
- bearing no. 1.1 movable in all directions (V2)
- bolt connection

Design for elastomeric bearings exposed to tensile strains

visional Rules for the Use of Rubber Bearings in Highway

$$\text{zul } \sigma_m = \frac{G \times (3{,}6 \times S^2 - 3{,}6 \times S + 3)}{2 + 2{,}2 \times S^2}$$

The transfer of tensile forces is not regulated in the EN 1337-3. Furthermore the rules and regulations of the Deutsche Bahn (German railway) and the ZTV-ING do not contain any information on this topic.

Only the British regulation (Ministry of Transport: Provisional Rules for the Use of Rubber Bearings in Highway Bridges, Memo. 802 London 1962) provides a formula for acceptable tensile strains:

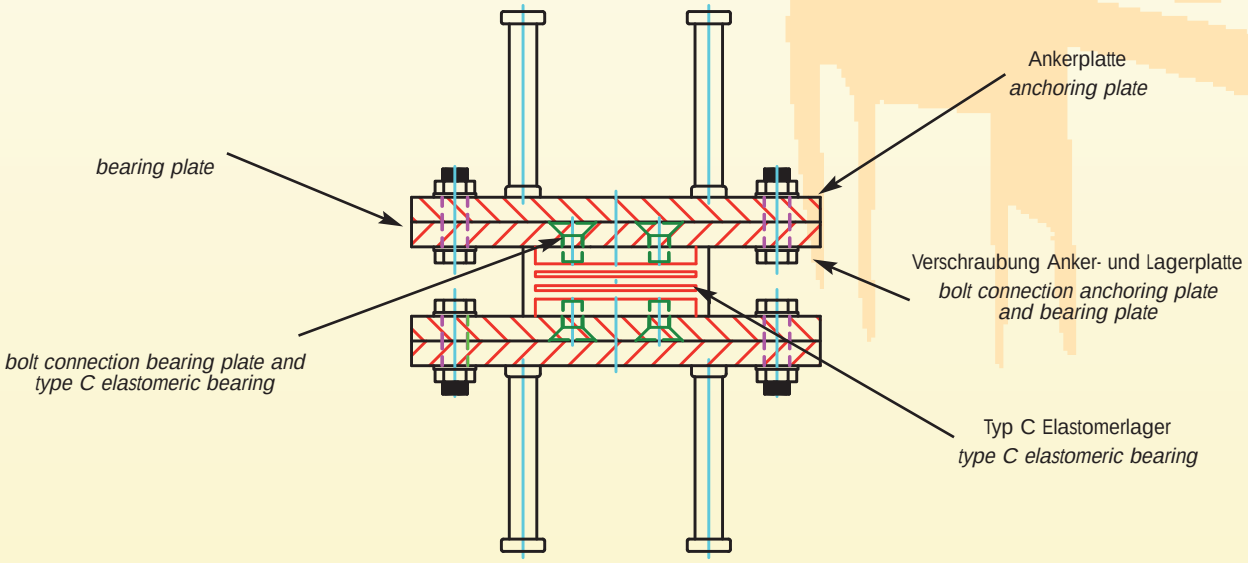
$$\textit{zul } \sigma_m = \frac{G \times (3{,}6 \times S^2 - 3{,}6 \times S + 3)}{2 + 2{,}2 \times S^2}$$

For common shape factors between 8 – 12 the results of the above mentioned formula are approx. 1,4 – 1,5 N / mm².

Tensile tests at TU Munich showed, that elastomeric bearings fail a long term tension exposure of 3,0 N / mm² after a couple of weeks. For a considerably longer exposure period until the failure the tension force must not exceed approx. 2,0 N / mm².

A short term tension exposure, that occurs due to an unfavourable load combination, is harmless for elastomeric bearings if the tensile load is limited to 1,0 N / mm² (SLS).

If elastomeric bearings are used to transfer temporary tensile loads, the interchangeability of the single bearing parts needs to be ensured.



Example of bearing design for tensile strain exposure

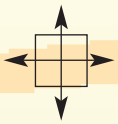
3.3 Deformation sliding bearings

GUMBA deformation sliding bearings enhance the capabilities of horizontal displacements of elastomeric bearings.

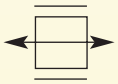
Deformation sliding bearings consist of an elastomeric bearing with sliding elements and, if required restraining structures to transmit horizontal loads. The elastomeric bearing absorbs the micro-displacements caused by live loads and allows for rotation of the horizontal planes. Large single and double axial displacements that go far beyond the deformation ability of pure elastomeric bearings are possible through sliding of a stainless steel sheet against a PTFE layer. The manufacturing of deformation sliding bearings requires a EC certificate of conformity, issued by a notified Insitute for Certification and Testing. The GUMBA EC certificate of conformity has the registration number 0672-BPR-002.1.

The dimensioning of deformation sliding bearings requires a proper coordination between the design engineer and the bearing manufacturer.

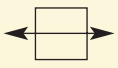
The following three kinds of deformation sliding bearings are usually employed:



1.4 – sliding in all directions (VG2)



1.3 – longitudinally sliding, transversely fixed (VG1)



1.5 – longitudinally sliding, tranversely deforming (VGE2)

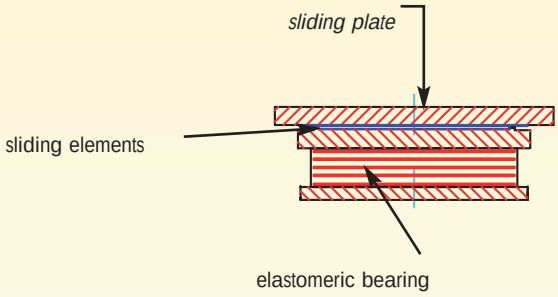


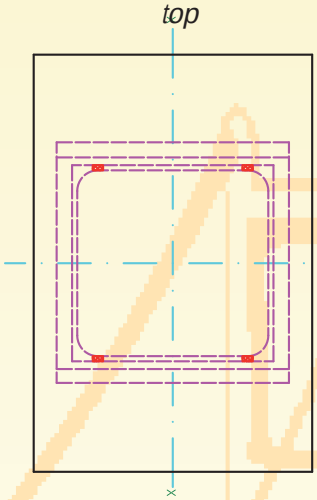


front

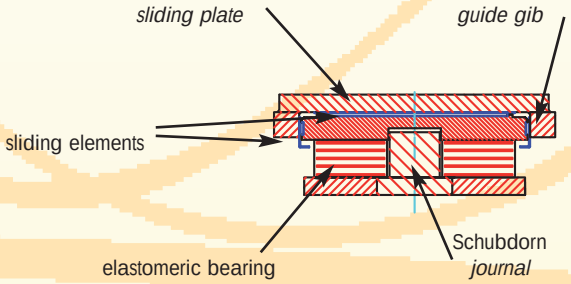
top

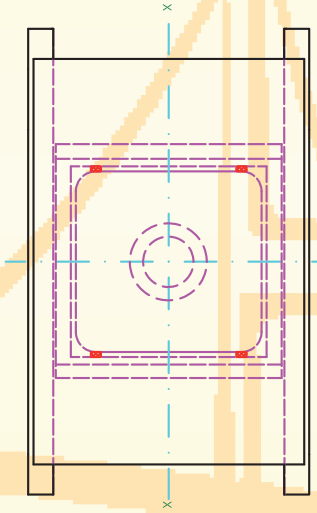
1.4 sliding in all directions (VG2)





1.3 longitudinally sliding, transversely fixed (VG1)

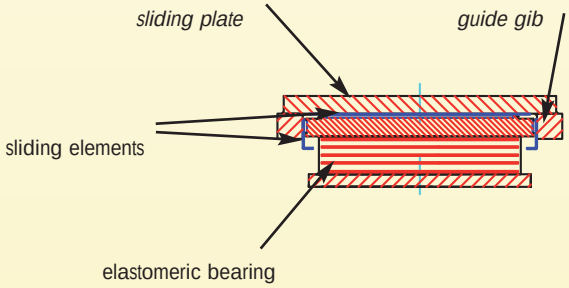


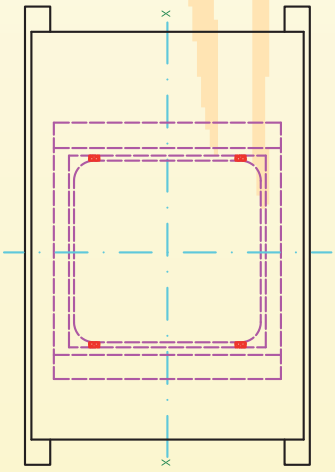


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1.5 longitudinally sliding, transversely deforming (VGE1)



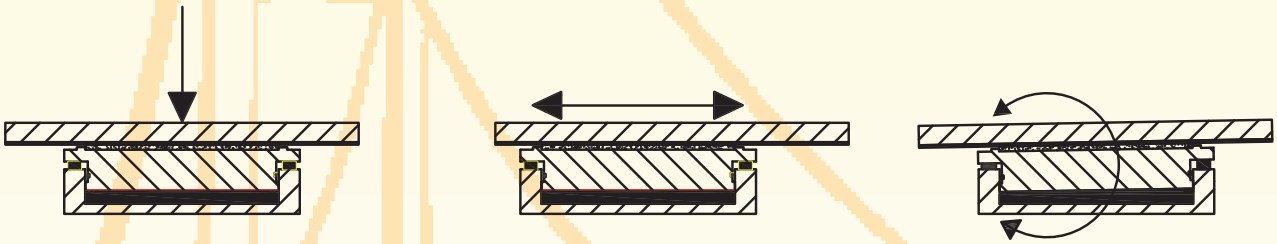


4. Pot bearings

General information

Pot bearings have been used for may years and are a well proven bearing type. Through the combination of a non reinforced elastomeric bearing (natural rubber) in a steel housing, which is closed on all sides (pot), it is possible to transmit high vertical loads on a relative small area. The dimensions of the pot bearing depend on the permissible elastomer pressure as well as especially on the permissible concrete pressure.

Pot bearings are designed and manufactured according to EN 1337-5 and are labelled with the relevant CE marking.



Mode of action

The elastomer pad located in the pot is incompressible and behaves under high pressure like a liquid. The deformability allows tilting of the piston around all axes.

Our 3 way sealing system prevents a penetration by dust and moisture as well as a leaking of the elastomer under pressure.

- A brass seal prevents the leaking of the elastomer between the pot and the piston under high pressure.

- The secondary special synthetic seal above the brass seal prevents the pot to get penetrated by moisture

- An additional outer seal prevents a penetration by dust and water (spray / splashing water)

The difference between the pot bearing types (fixed, unidirectional fixed, sliding in all directions) is the design of the piston.

The sliding members are a dimpled PTFE disk embedded in the piston and a polished austenitic steel plate grade 1.4404.

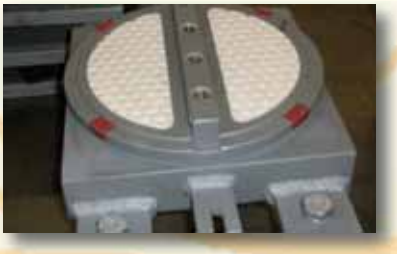
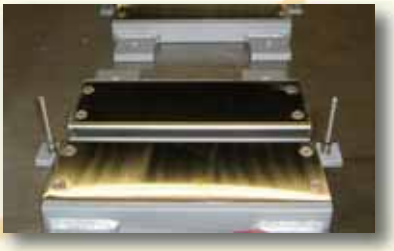
The sliding surface (PTFE disk) is designed and dimensioned according to EN 1337-2.

Pot bearings are generally not anchored to the structure (sufficiently high minimal load).

Should an additional anchoring due to the actual load combinations become necessary, it can be realised with additional anchorplates or dowels.

The standard bearing design does not require anchor plates at simultaneous effects of vertical and horizontal loads.




Note on the design of pot bearings:

Translational displacement:

The data sheets provide the principal bearing dimensions depending on the bearing type corresponding with the minimum displacement (± 50 mm) and the listed horizontal loads.

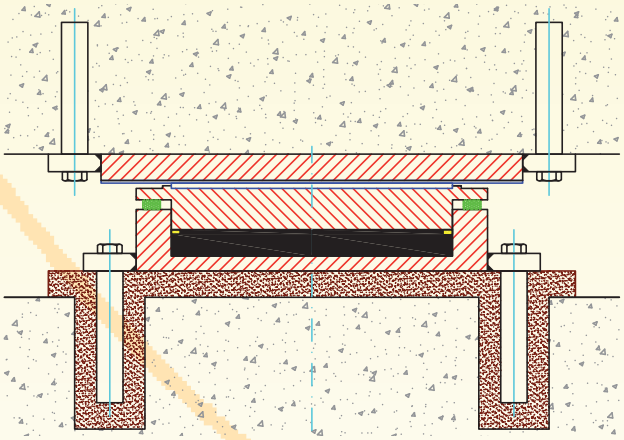
Higher displacements as well as deviating vertical and horizontal loads are possible on request.

Concrete Pressure:

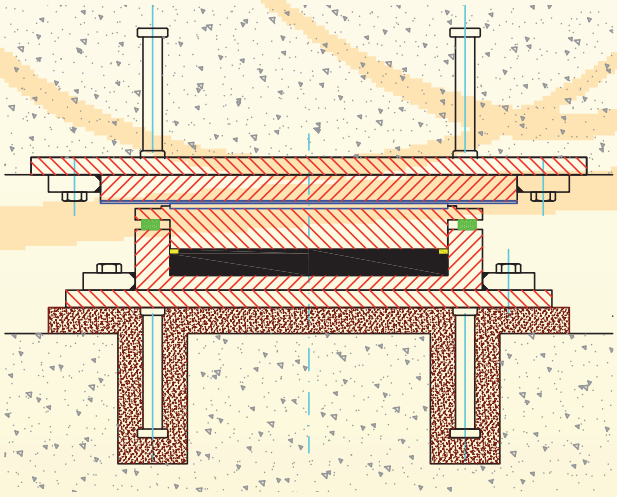
The concrete pressure is analysed according to DIN 1045-1. The design requirements are usually fulfilled at a minimun concrete quality of C30/37 when the load spreading area Ac1 is approx. 1.8 times the pot area (a x b).

Anchoring methods:

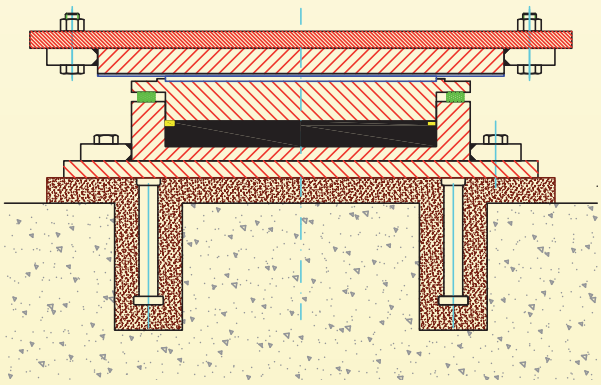
The bearings can take the designated horizontal loads without additional anchorage in the structure if the minimum vertical load is at least 50% of the maximum vertical load and furthermore, the horizontal load does not exceed 10% of the maximum vertical load (with TGe and TF). The necessity of anchoring has to be checked if this load combination is not given. The following examples show some anchoring methods. These methods can also be applied with spherical bearings.



Transfer of horizontal forces by dowels

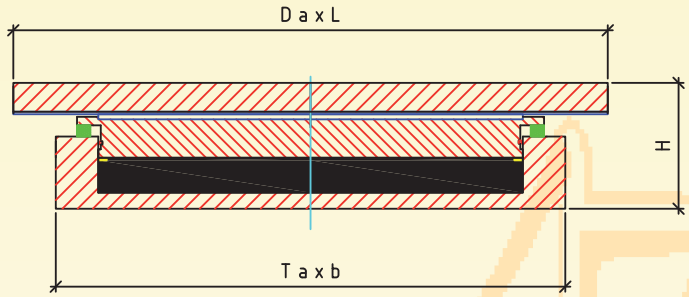


Transfer of horizontal forces by anchoring plates



Transfer of horizontal forces on a steel superstructure

Pot bearings sliding in all directions TGa - Dimensions and weight



Typ *type*	Auflast *vert. load* N kN (SLS)	Höhe *height* $H_{1)}$ mm	T a x b mm	D ex=± 50 a mm	D ex=± 50 L mm	Gewicht *weight* kg
TGa10	1000	107	280	330	420	67
TGa15	1500	115	320	370	460	93
TGa20	2000	117	350	400	490	111
TGa25	2500	119	380	430	520	130
TGa30	3000	128	410	460	550	162
TGa35	3500	128	450	500	580	190
TGa40	4000	132	480	530	610	218
TGa45	4500	137	500	550	630	248
TGa50	5000	139	530	580	660	279
TGa55	5500	141	550	600	680	302
TGa60	6000	144	580	630	700	337
TGa65	6500	151	600	650	720	382
TGa70	7000	152	620	670	740	407
TGa80	8000	154	670	720	780	472
TGa90	9000	162	700	750	810	543
TGa100	10000	166	740	790	850	613
TGa110	11000	173	780	830	880	711
TGa120	12000	176	810	860	910	774
TGa130	13000	178	850	900	940	851
TGa140	14000	187	880	930	970	960
TGa150	15000	190	900	950	990	1014
TGa160	16000	192	940	990	1020	1106
TGa170	17000	192	960	1010	1040	1152
TGa180	18000	200	990	1040	1070	1276
TGa190	19000	202	1020	1070	1090	1365
TGa200	20000	204	1050	1100	1120	1541

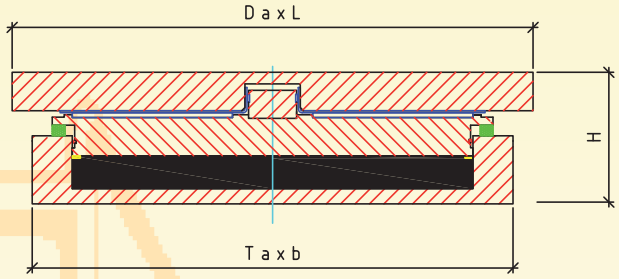
Zu der Tabelle haben wir folgende Voraussetzungen angenommen.
Min. Auflast = 0,5 x max. N
Angenomener Drehwinkel: tan α = 10 ‰
Querverschiebung: ey= ± 20 mm
1) Durch Material- und Fertigungstoleranzen kann die Höhe um bis zu +10 mm ansteigen

Im Bedarfsfall oder statischer Notwendigkeit können die Lager auch mit Ankerplatten oder Dollen ausgestattet werden. Die äußeren Abmessungen ändern sich entsprechend.

The following assumptions are made for this table:
Min. load = 0,5 x max N
Rotation angle: tan α = 10 ‰
Transversal displacement: ey= ± 20 mm
1)The actual height can increase up to +10mm due to material and manufacturing tolerances.

If necessary or structurally required, the bearings can be equipped with anchoring plates or dowels.
The external dimensions change accordingly.

Pot bearings unidirectionally fixed TGe - *Dimensions and weight*



Typ *type*	Auflast *vert. load* N kN (SLS)	H-Last *horiz. load* V_v kN (SLS)	Höhe *height* $H_{1)}$ mm	T a x b mm	D ex=± 50 a mm	D ex=± 50 L mm	Gewicht *weight* kg
TGe10	1000	100	120	280	330	430	85
TGe15	1500	150	128	320	370	470	115
TGe20	2000	200	130	360	410	500	141
TGe25	2500	250	132	390	440	530	163
TGe30	3000	300	141	420	470	560	200
TGe35	3500	350	141	460	510	590	233
TGe40	4000	400	146	500	550	620	274
TGe45	4500	450	146	520	570	640	296
TGe50	5000	500	149	550	600	670	332
TGe55	5500	550	156	590	640	690	395
TGe60	6000	550	159	610	660	710	426
TGe65	6500	610	161	630	680	730	458
TGe70	7000	635	163	650	700	750	489
TGe80	8000	680	170	700	750	790	586
TGe90	9000	720	173	730	780	820	642
TGe100	10000	720	172	770	820	860	694
TGe110	11000	770	175	810	860	890	772
TGe120	12000	780	178	850	900	920	855
TGe130	13000	780	181	890	940	950	941
TGe140	14000	840	185	920	970	980	1020
TGe150	15000	900	193	940	990	1000	1116
TGe160	16000	960	196	980	1030	1030	1218
TGe170	17000	960	201	1010	1060	1050	1332
TGe180	18000	990	205	1040	1090	1080	1428
TGe190	19000	1026	207	1070	1120	1100	1522
TGe200	20000	1060	215	1100	1150	1130	1673

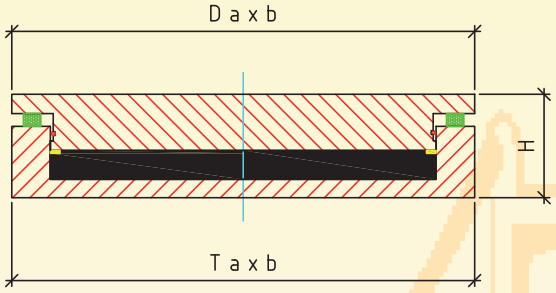
Zu der Tabelle haben wir folgende Voraussetzungen angenommen.
Min. Auflast = 0,5 x max. N
Angenomener Drehwinkel: tan α = 10 ‰
1) Durch Material- und Fertigungstoleranzen kann die Höhe um bis zu +10 mm ansteigen

Im Bedarfsfall oder statischer Notwendigkeit können die Lager auch mit Ankerplatten oder Dollen ausgestattet werden. Die äußeren Abmessungen ändern sich entsprechend.

The following assumptions are made for this table:
Min. load = 0,5 x max N
Rotation angle: tan α = 10 ‰
1)The actual height can increase up to +10mm due to material and manufacturing tolerances.

If necessary or structurally required, the bearings can be equipped with anchoring plates or dowels.
The external dimensions change accordingly.

Pot bearings fixed in all directions TF - *Dimensions and weight*



Typ *type*	Auflast *vert. load* N kN (SLS)	H-Last *horiz. load* V_x kN (SLS)	Höhe *height* H_1 mm	T a x b mm	D a x b mm	Gewicht *weight* kg
TF10	1000	100	86	280	280	46
TF15	1500	150	89	320	320	61
TF20	2000	200	91	360	360	79
TF25	2500	250	93	390	390	94
TF30	3000	300	97	420	420	111
TF35	3500	350	97	460	460	134
TF40	4000	400	101	500	500	162
TF45	4500	450	101	520	520	175
TF50	5000	500	103	550	550	197
TF55	5500	550	105	590	590	232
TF60	6000	600	108	610	610	254
TF65	6500	650	110	630	630	275
TF70	7000	700	111	650	650	293
TF80	8000	800	113	700	700	344
TF90	9000	900	116	730	730	380
TF100	10000	1000	120	770	770	433
TF110	11000	1100	122	810	810	486
TF120	12000	1200	125	850	850	548
TF130	13000	1300	132	890	890	637
TF140	14000	1330	136	920	920	697
TF150	15000	1350	139	940	940	741
TF160	16000	1440	141	980	980	811
TF170	17000	1530	141	1010	1010	864
TF180	18000	1620	144	1040	1040	924
TF190	19000	1710	146	1070	1070	998
TF200	20000	1800	148	1100	1100	1059

Zu der Tabelle haben wir folgende Voraussetzungen angenommen.
Min. Auflast = 0,5 x max. N
Angenomener Drehwinkel: tan α = 10 ‰
1) Durch Material- und Fertigungstoleranzen kann die Höhe um bis zu +10 mm ansteigen

Im Bedarfsfall oder bei statischer Notwendigkeit können die Lager auch mit Ankerplatten oder Dollen ausgestattet werden. Die äußeren Abmessungen ändern sich entsprechend.

The following assumptions are made for this table:
Min. load = 0,5 x max N
Rotation angle: tan α = 10 ‰
1)The actual height can increase up to +10 mm due to material and manufacturing tolerances.

If necessary or structurally required, the bearings can be equipped with anchoring plates or dowels.
The external dimensions change accordingly.

Scheme of the main components of a pot bearing TGa

Sliding plate with polished austenitic steel

Piston with embedded PTFE and additional sealing against moisture

Internal brass seal

4

Elastomerkissen
Elastomer pad

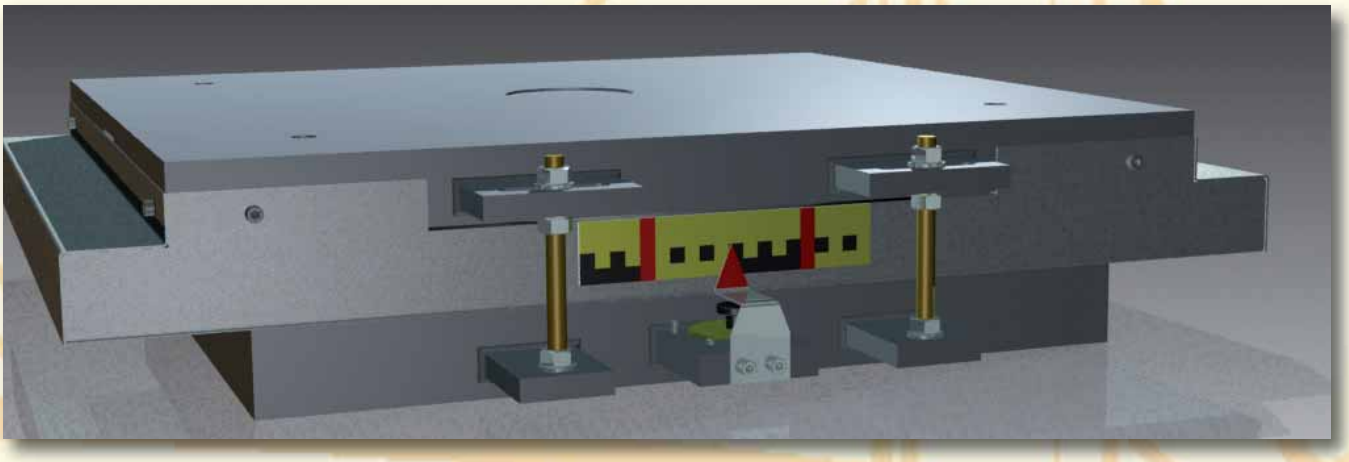
Stahltopf
Steel pot



The design of the sliding plate, piston and pot vary depending on the requirements to transfer horizontal loads.



sectional view pot bearing TF



assembled pot bearing TGe with protection of the sliding elements



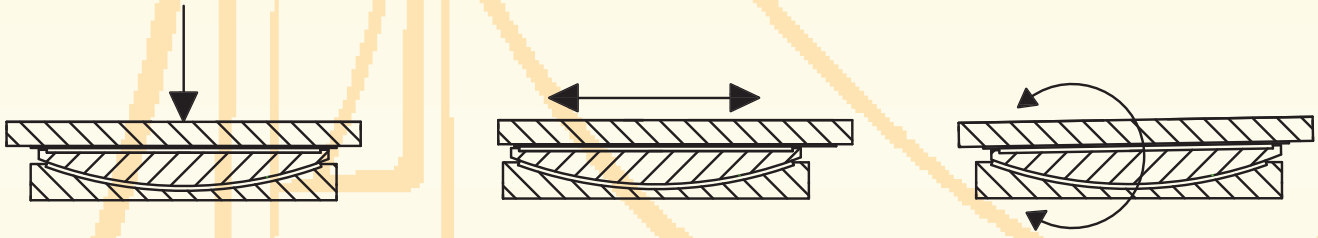
sectional view pot bearing TGe

5. Spherical bearings

General information

ELA spherical bearings are made of a steel, hard chrome plated spherical segment, the so-called calotte (convex), a corresponding, with PTFE equipped calotte receiver (concave) and a sliding unit on the plane side of the calotte, consisting of embedded PTFE and austenitic steel grade 1.4404.

This design is capable to take horizontal displacements as well as rotation through two independent sliding motions. This fulfills the requirement, that the support of a structure should result in limited restrains particularly well. With additional guides or a stop ring it is furthermore possible to transfer horizontal loads.



Significant for this bearing type is a relatively compact design and the quality, that practically no movement in vertical direction takes place. This is an important criteria for some applications.

An anchoring to the structure is generally not required. Should an anchoring become necessary due to unusual impacts, it can be realised through additional anchor plates with suitable anchor means.

The standard bearing design does not require anchor plates at simultaneous effects of vertical and horizontal loads.

Basically the anchoring methods are the same as with pot bearings. See page 40.

ELA spherical bearings are designed and manufactured according to EN 1337 part 7 and are labelled with CE marking accordingly.

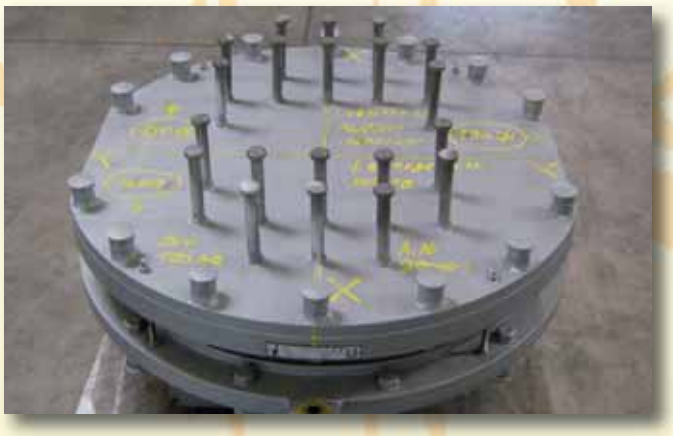












bidirectionally sliding spherical bearing KGa

This kind of bearing can transfer displacements in the longitudinal as well as in the transversal bridge direction. It is not able to transfer horizontal loads, though.

Unidirectionally sliding spherical bearing KGe

Bearings of this kind are movable in one direction and perpendicular fixed by guide gibs that transfer the horizontal loads in that direction. An inclination of the guiding gibs perpendicular to the movable direction caused by rotation is compensated by rollable designed tilting strips. Suitable sliding members are used between the guide gibs and tilting strips.

Unidirectional sliding spherical bearings are divided in two varieties:

- longitudinally fixed spherical bearings KGl can transfer horizontal loads in the longitudinal bridge direction and are movable in the transverse bridge direction - transversely fixed spherical bearings KGq can transfer horizontal loads in the transverse bridge direction and are movable in the longitudinal bridge direction.

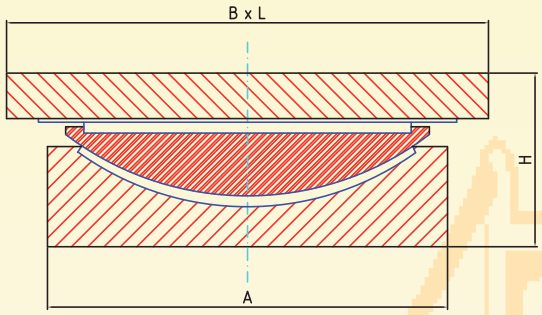
The design table KGe applies for both bearing variations, due to the fact that the principal design of the bearing types KGl and KGq is the same. The movable respectively the fixed direction is only determined by the actual installation position.

Fixed spherical bearing Kf

These bearings can transfer horizontal loads from all directions.

This is achieved by a stop ring that locks the bearing. The stop ring is part of the calotte receiver. A sliding surface between the calotte plane and the top bearing parts is used, to keep horizontal forces away from the calotte.

Spherical bearing sliding in all directions KGa-Dimensions and weight

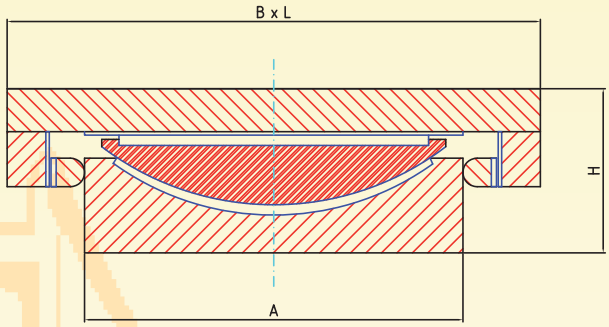


				ex = ± 50			ex = ± 100			ex = ± 150		
Typ *type*	Auflast *vert. load*	A	Breite *width*	Länge *length*	Höhe *height*	Gewicht *weight*	Länge *length*	Höhe *height*	Gewicht *weight*	Länge *length*	Höhe *height*	Gewicht *weight*
	N kN (SLS)	mm	B mm	L mm	H mm	kg	L mm	H mm	kg	L mm	H mm	kg
KGa10	1000	260	320	360	73	45	460	78	56	560	78	63
KGa15	1500	310	370	410	87	70	510	87	78	610	92	95
KGa20	2000	350	410	450	95	94	550	100	112	650	100	122
KGa25	2500	380	440	480	98	117	580	98	133	680	103	147
KGa30	3000	420	480	520	107	150	620	112	174	720	112	188
KGa35	3500	450	510	550	113	181	650	118	207	750	123	237
KGa40	4000	470	530	570	123	216	670	123	232	770	128	263
KGa45	4500	500	560	600	131	196	700	131	273	800	136	307
KGa50	5000	520	580	620	124	258	720	129	291	820	129	310
KGa55	5500	550	610	650	136	324	750	136	344	850	141	384
KGa60	6000	570	630	670	141	350	770	141	371	890	146	414
KGa65	6500	590	650	690	147	389	790	147	410	890	152	454
KGa70	7000	610	670	710	152	426	810	157	474	910	157	498
KGa75	7500	630	690	730	144	426	830	149	471	930	154	522
KGa80	8000	650	710	750	154	497	850	154	523	950	159	575
KGa90	9000	690	750	790	165	588	890	170	541	990	170	672
KGa100	10000	720	780	820	172	667	920	177	724	1020	182	787
KGa110	11000	760	820	860	175	761	960	175	794	1060	180	859
KGa120	12000	790	850	890	184	860	990	189	927	1090	189	967
KGa130	13000	820	880	920	192	963	1020	197	1034	1120	202	1112
KGa140	14000	850	910	950	198	1078	1050	198	1120	1150	203	1201
KGa150	15000	880	940	980	199	1159	1080	204	1241	1180	204	1286
KGa160	16000	900	960	1000	205	1135	1100	210	1219	1200	215	1312
KGa170	17000	930	990	1030	211	1352	1130	211	1414	1230	216	1511
KGa180	18000	960	1020	1060	219	1522	1160	224	1619	1260	224	1673
KGa190	19000	980	1040	1080	217	1582	1180	222	1681	1280	222	1736
KGa200	20000	1000	1060	1100	228	1744	1200	228	1800	1300	233	1910

Zu der Tabelle haben wir folgende Voraussetzungen angenommen:
Min. Auflast = 0,5 x max. N
Angenommener Drehwinkel tan α = 10 ‰
ex = zulässige Längsverschiebung
Querverschiebung ey = ± 20 mm
Durch Material- und Fertigungstoleranzen kann die Höhe um 10 mm differieren
Im Bedarfsfall oder auf Grund statischer Notwendigkeit können die Lager auch mit Ankerplatten und/oder Dollen ausgestattet werden. Die äußeren Abmessungen ändern sich in diesem Fall entsprechend.

The following assumptions are made for this table:
Min. load = 0,5 x max N
Rotation angle: tan α = 10 ‰
ex = permissible longitudinal displacement
Transversal displacement: ey= ± 20 mm
The actual height can increase up to +10mm due to material and manufacturing tolerances.
If necessary or structurally required, the bearings can be equipped with anchoring plates or dowels.

Spherical bearing unidirectionally fixed KGe-*Dimensions and weight*

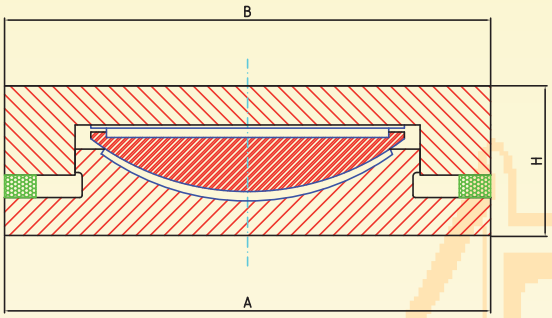


				ex = ± 50			ex = ± 100			ex = ± 150		
Typ *type*	Auflast *vert. load*	A	Breite *width*	Länge *length*	Höhe *height*	Gewicht *weight*	Länge *length*	Höhe *height*	Gewicht *weight*	Länge *length*	Höhe *height*	Gewicht *weight*
	N kN (SLS)	mm	B mm	L mm	H mm	kg	L mm	H mm	kg	L mm	H mm	kg
KGe10	1000	260	420	360	78	60	460	78	69	560	83	86
KGe15	1500	310	470	410	87	83	510	92	102	610	92	113
KGe20	2000	350	530	450	100	123	550	100	135	650	105	161
KGe25	2500	380	560	480	98	141	580	103	167	680	103	182
KGe30	3000	420	600	520	112	188	620	112	205	720	117	238
KGe35	3500	450	640	550	118	226	650	123	260	750	123	280
KGe40	4000	470	660	570	123	252	670	128	287	770	128	308
KGe45	4500	500	690	600	136	310	700	136	332	800	141	375
KGe50	5000	520	720	620	129	318	720	129	340	820	136	386
KGe55	5500	550	760	650	141	374	750	146	420	850	146	447
KGe60	6000	570	780	670	146	422	770	146	450	870	151	504
KGe65	6500	590	810	690	152	469	790	152	498	890	157	555
KGe70	7000	610	830	710	157	513	810	162	568	910	162	601
KGe75	7500	630	850	730	149	513	830	154	570	930	154	604
KGe80	8000	650	870	750	154	566	850	159	625	950	164	692
KGe90	9000	690	920	790	170	695	890	175	763	990	175	803
KGe100	10000	720	960	820	177	782	920	182	854	1020	187	934
KGe110	11000	760	1010	860	180	896	960	180	940	1060	185	1025
KGe120	12000	790	1040	890	189	1001	990	194	1087	1090	194	1136
KGe130	13000	820	1080	920	202	1157	1020	202	1208	1120	207	1306
KGe140	14000	850	1120	950	203	1255	1050	208	1354	1150	208	1411
KGe150	15000	880	1150	980	204	1342	1080	209	1445	1180	209	1504
KGe160	16000	900	1180	1000	215	1375	1100	215	1435	1200	220	1551
KGe170	17000	930	1210	1030	216	1576	1130	221	1691	1230	221	1757
KGe180	18000	960	1240	1060	224	1739	1160	229	1859	1260	229	1927
KGe190	19000	980	1260	1080	227	1857	1180	227	1926	1280	232	2059
KGe200	20000	1000	1290	1100	233	1991	1200	233	2062	1300	238	2198

Zu der Tabelle haben wir folgende Voraussetzungen angenommen:
Min. Auflast = 0,5 x max. N
Angenommener Drehwinkel tan α = 10 ‰
ex = zulässige Längsverschiebung (KGq)
Durch Material- und Fertigungstoleranzen kann die Höhe um 10 mm differieren
Im Bedarfsfall oder auf Grund statischer Notwendigkeit können die Lager auch mit Ankerplatten und/oder Dollen ausgestattet werden. Die äußeren Abmessungen ändern sich in diesem Fall entsprechend.
Das „e“ in der Lagerbezeichnung KGe steht für einseitig fest.
Bei der tatsächlichen Lagerbezeichnung wird das „e“ durch „l“ (längsfest) oder „q“ (querfest) ersetzt.

Min. load = 0,5 x max N
Rotation angle: tan α = 10 ‰
ex = permissible longitudinal displacement (KGq)
The actual height can increase up to +10 mm due to material and manufacturing tolerances.
If necessary or structurally required, the bearings can be equipped with anchoring plates or dowels.
The external dimensions change accordingly.
The „e“ in KGe is replaced with „l“ (longitudinally fixed) or „q“ (transversely fixed).

Spherical bearing fixed in all directions Kf- Dimensions and weight



type	*vert. load*	*length/width*	*height*	*weight*
	N kN (SLS)	A/B mm	H mm	 kg
Kf10	1000	370	98	69
Kf15	1500	440	127	117
Kf20	2000	490	100	158
Kf25	2500	530	133	193
Kf30	3000	580	147	255
Kf35	3500	610	158	303
Kf40	4000	640	163	340
Kf45	4500	680	176	416
Kf50	5000	700	174	432
Kf55	5500	740	181	491
Kf60	6000	760	191	539
Kf65	6500	790	197	584
Kf70	7000	810	207	646
Kf75	7500	830	204	688
Kf80	8000	860	220	742
Kf90	9000	900	225	857
Kf100	10000	940	242	994
Kf110	11000	990	240	1121
Kf120	12000	1020	249	1218
Kf130	13000	1060	262	1363
Kf140	14000	1100	268	1524
Kf150	15000	1130	269	1613
Kf160	16000	1160	280	1775
Kf170	17000	1190	286	1893
Kf180	18000	1220	294	2042
Kf190	19000	1250	297	2196
Kf200	20000	1270	308	2365

Angenommener Drehwinkel tan α = 10 ‰
Durch Material- und Fertigungstoleranzen kann die Höhe um 10 mm differieren

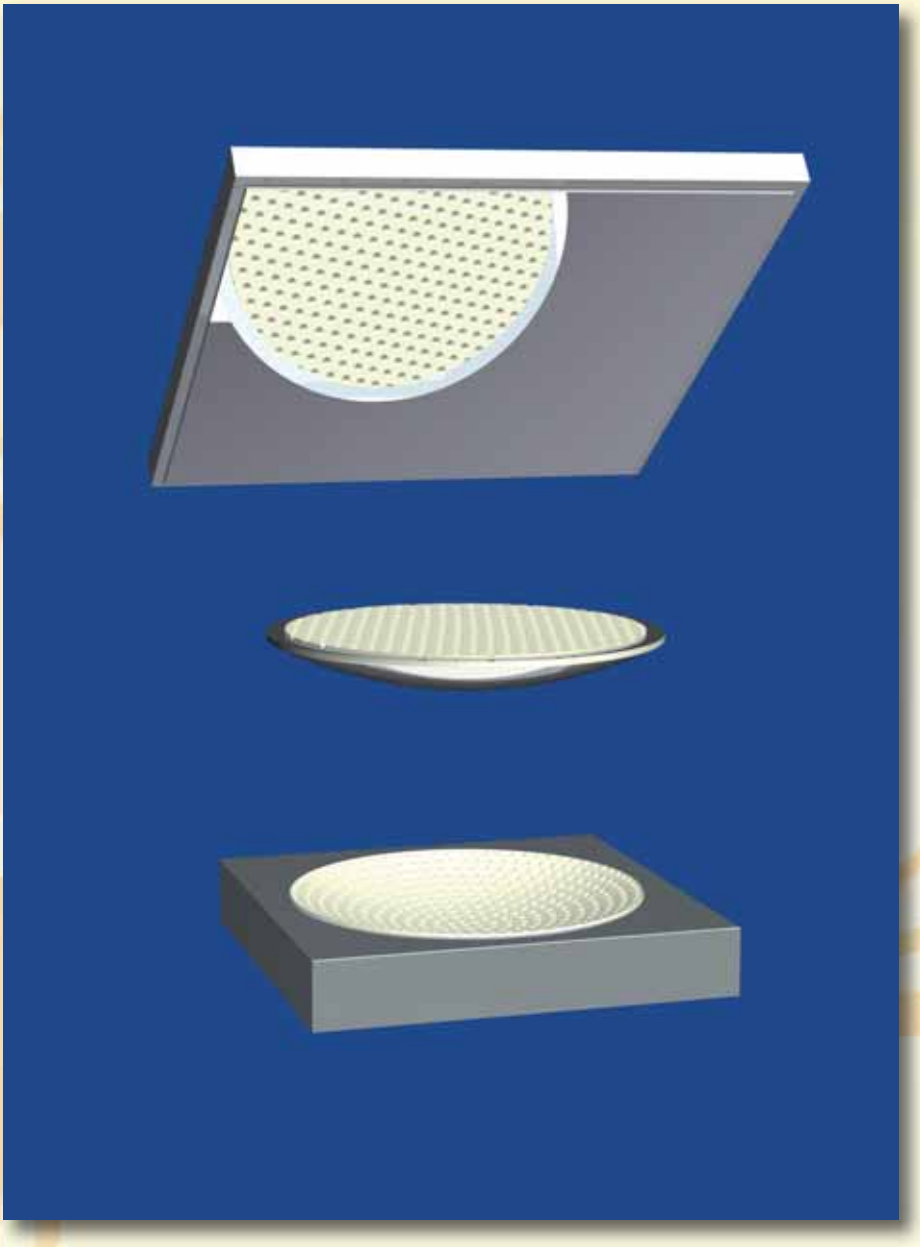
The following assumptions are made for this table:
Min. load = 0,5 x max N
Rotation angle: tan α = 10 ‰
The actual height can increase up to +10mm due to material and manufacturing tolerances.
If necessary or structurally required, the bearings can be equipped with anchoring plates or dowels.
The external dimensions change accordingly.

Scheme of the main components of a spherical bearing KGa

Sliding Plate with polished austenitic steel

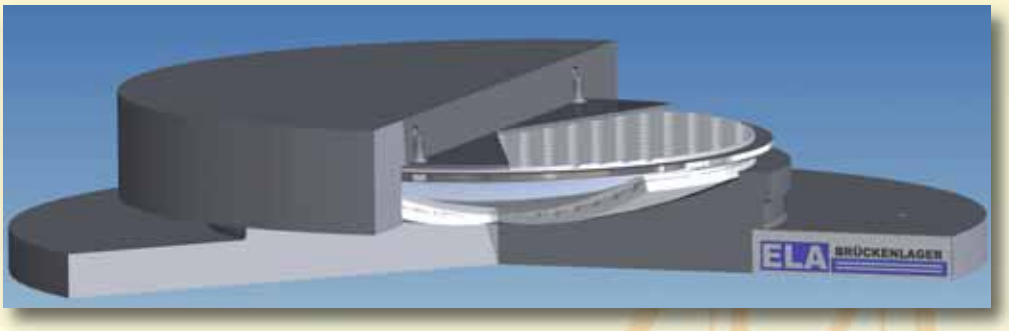
Hard chromium plated calotte with embedded PTFE

Calotte receiver with embedded PTFE

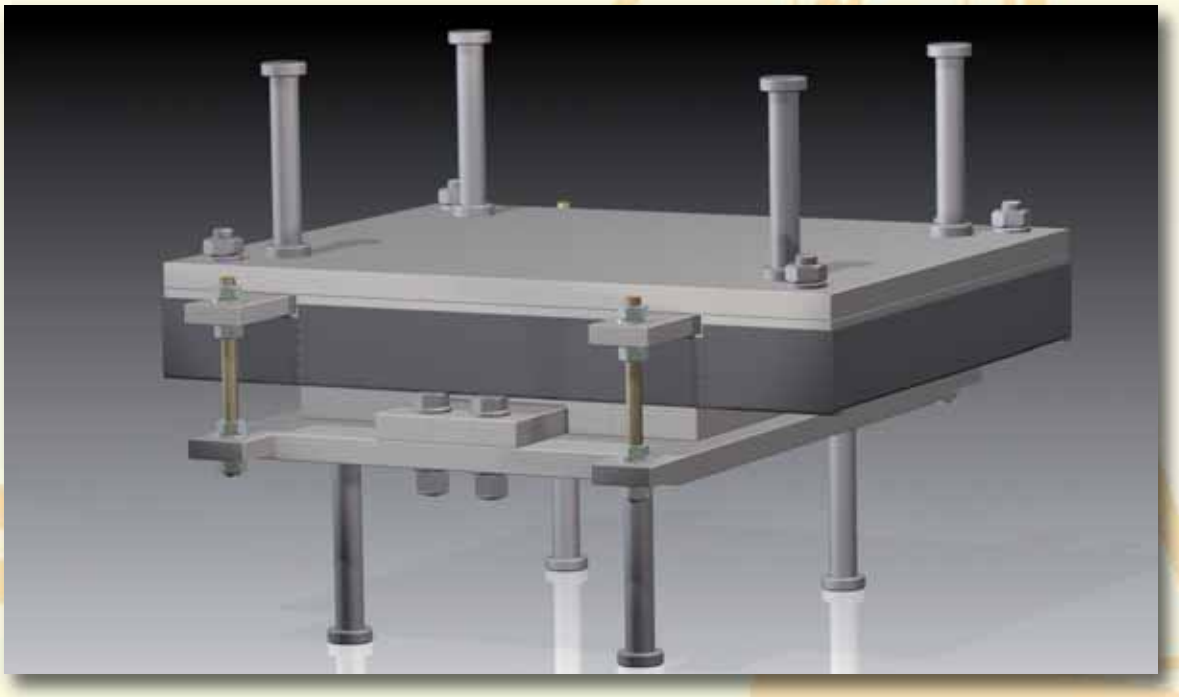


5

The design of the sliding plate and the calotte receiver can vary, depending on the requirements to transfer horizontal loads.



sectional view spherical bearing Kf



assembled spherical bearing KGe with protection of the sliding elements



sectional view spherical bearing KGe

6. Guide bearings and horizontal load bearings

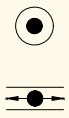
Combined vertical loads and horizontal forces can be transmitted with restraining structures. When horizontal forces are high, it is often more economically efficient to direct the horizontal forces into the substructure by means of horizontal-load bearings and guide bearings.

Horizontal-load bearings transmit longitudinal and/or transverse forces. Guide bearings permit both the bearing of horizontal loads in one axis and horizontal movement in the other axis. In addition, vertical movements can also be optionally absorbed by both bearings to meet specific structural requirements.

One substantial advantage is that horizontal-load bearings absorb the horizontal forces even under changing load conditions, thus dispensing with additional structural measures (position stabilization with wedges etc.).

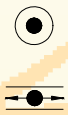
Horizontal-load bearings and guide bearings are manufactured according to EN 1337-8.

Symbole: H 8.1 Horizontalkraftlager,



Symbols: H 8.1 Horizontal-load bearing, fixed on all sides

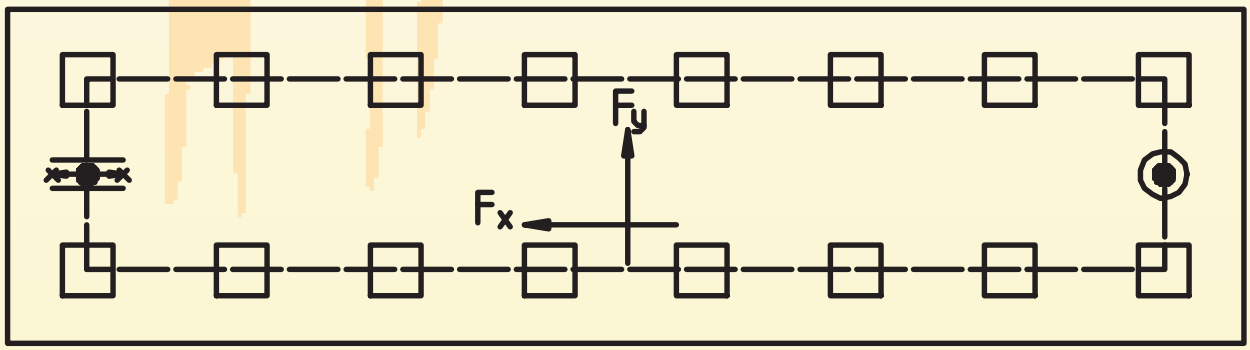
H1 8.2 Guide bearing, fixed in one axis



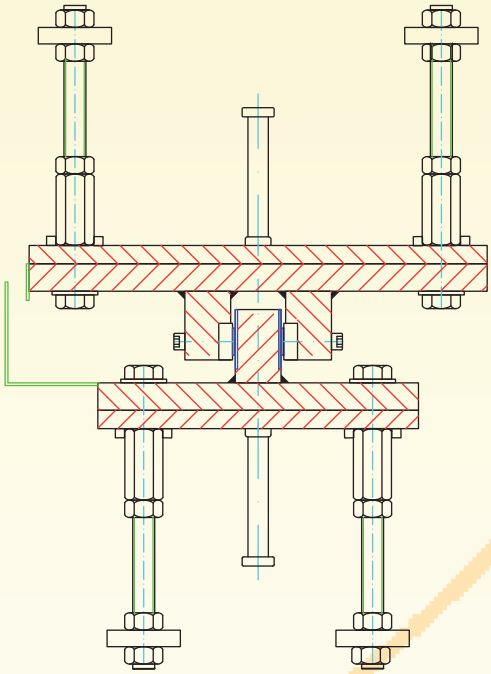
6

Proposal for a modern bearing layout

Bearing layout

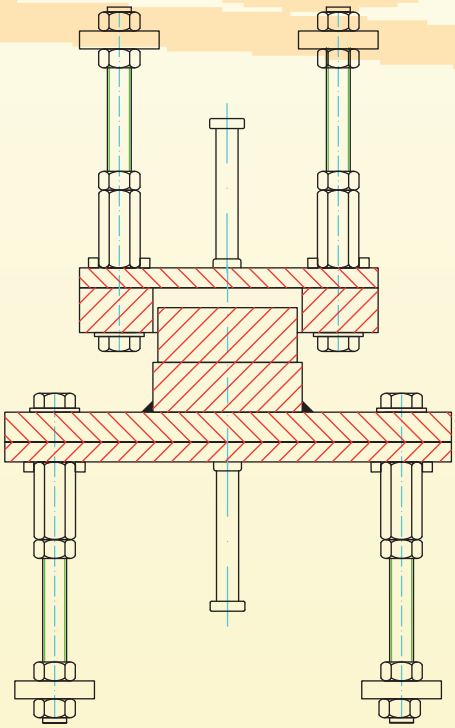


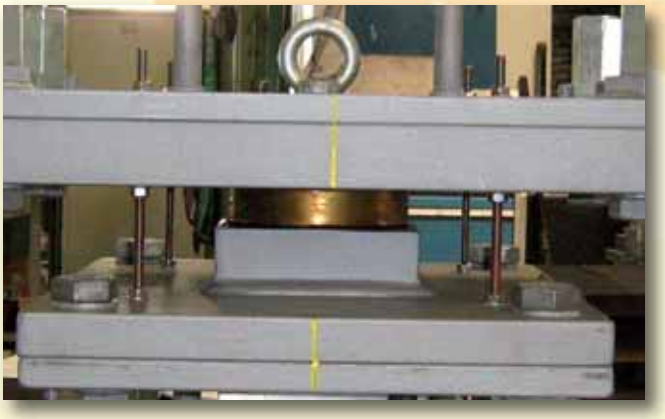
guide bearing





Horizontalkraftlager
horizontal load bearing





7. Sonderlager
7. Special bearings

Justierlager

Adjustable bearings

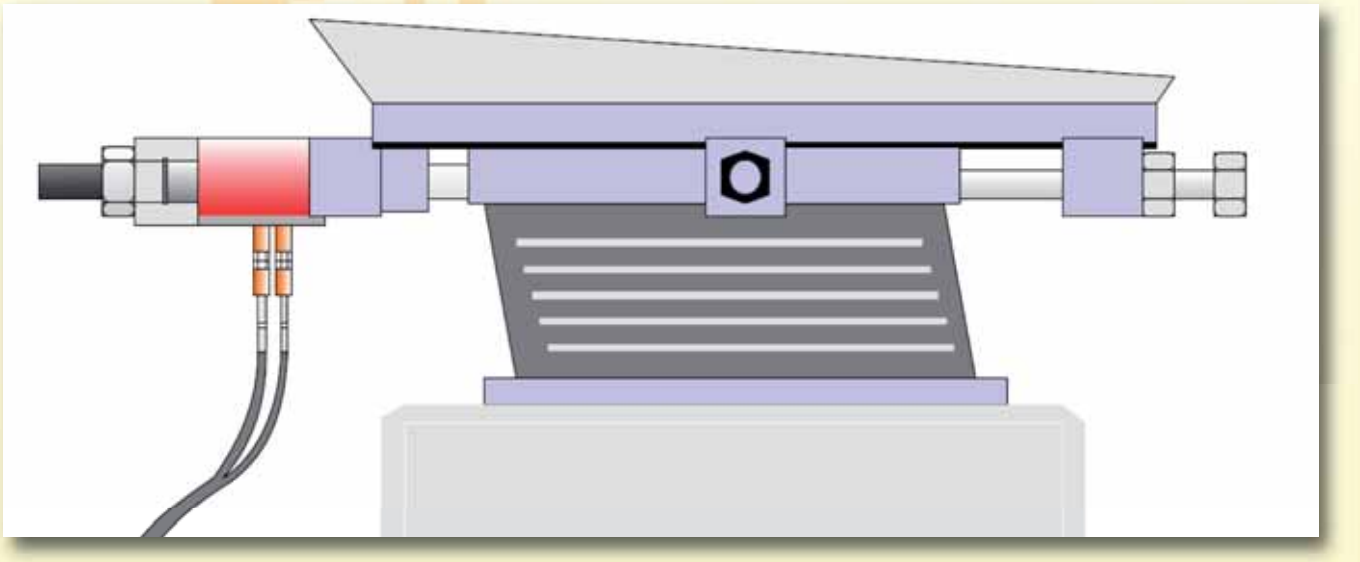
The limits of elastomeric bearings regarding the ability to take rare or unique large horizontal displacements can be improved by the use of an adjustable bearing. This is an elastomeric bearing equipped with and additional adjusting device.

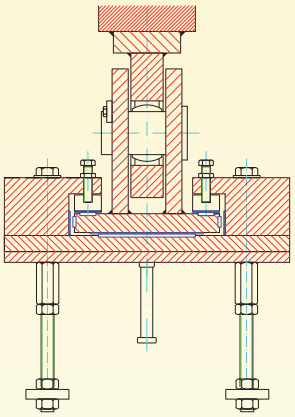
With the adjusting device the elastomeric bearing can be shifted in horizontal direction without lifting the superstructure. Rare or unique building displacements (change of the fix point, creep and shrinkage of concrete, changes in the foundation) are therefore transferable with low elastomeric bearings. The elastomeric bearing just transfers the short- and long-periodic displacements and rotations (wind, traffic, temperature fluctuations, leftover creep and shrinkage)

The separation of the tasks can reduce the bearing heights drastically and under some unfavourable conditions it might be the only way to make it technically or economically possible.

Practically the adjustment of the bearing takes place before the structure is opened to traffic. The pre-adjustment of the bearing (considering the actual current building temperature) is made in accordance with the expected residual displacement.

Over time (within months), a bearing deformation back to the initial position takes place, by which the bearing allows the short term and seasonal displacements and rotations.





Tension-/Pressure-Bearing



These special bearings are used to transfer tension and pressure forces in particular.

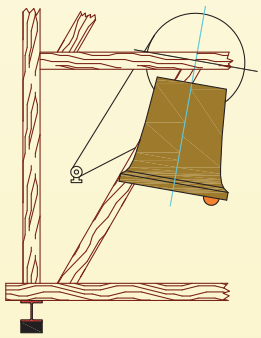
In contrast to the deformation bearings including anchoring (page 35), the tension / pressure bearings are designed for a long-lasting tension and pressure exposure. These bearings are individually designed and pure steel structures, with sliding units where applicable.

Bearings for vibration control

Elastomeric bearings are able to reduce vibrations that occur from machinery, floating train track beds or bell cages e. g. effectively and lasting. The design is similar to that of bridge bearings. The additional loads caused by vibrations need to be considered, though. This kind of bearing is often used for heavy machine tools like e.g. guillotine-shears and forge-hammers.

For the design of the bearing the following data is required:

Max. and min load (SLS)
Generated natural frequency
Displacements if applicable
Proposed bearing layout



GUMBA elastomeric bearing

Example for the employment of special bearings
Project: Extension of the Brenner rail link

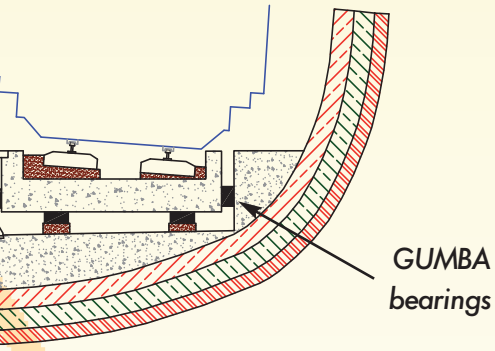
Company: Arge Alptransit Brenner

Task: Development and delivery of bearings for vibration isolation of the access route north to the Brenner Base Tunnel in a spring-mass system.

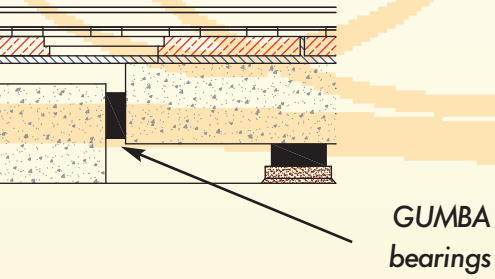
Gumba provided the longitudinal bearings and the side bearings for the vibration isolation of the concrete track foundation at the above mentioned project.

In the run up of the project, the client required extensive tests. The tests have been carried out by the Technical University of Munich, chair and testing institute for traffic route engineering.

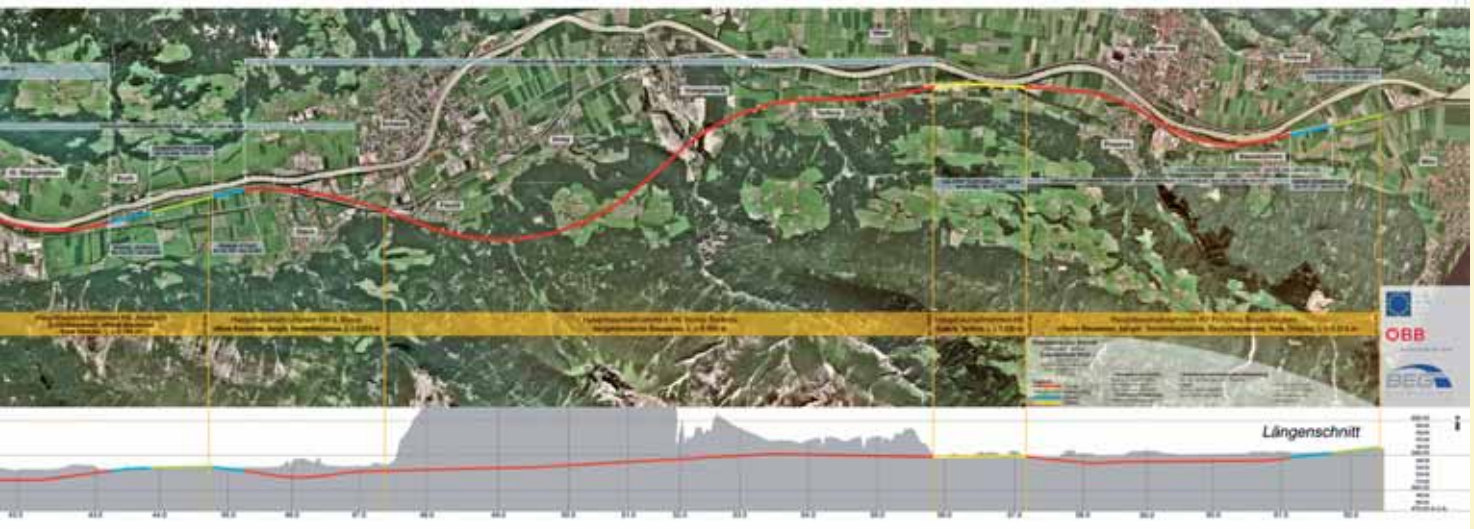
transverse section



longitudinal section



longitudinal bearing	***side bearing***
reinforced elastomer bearing type B 400 x 500 x 107 mm special layering	*reinforced elastomer bearing type B 290 x 300 x 74 mm special layering*
performed tests	
determination of vertical static stiffness	
determination of vertical dynamic stiffness (test frequencies 5 Hz, 10 Hz, 15 Hz, 20 Hz)	
determination of permissible maximum load	
dynamic fatigue test 3 million load cycles (frequency f_{DV} = 1,0 Hz)	*dynamic fatigue test 10 million load cycles (frequency f_{DV} = 1,5 Hz)*
determination of horizontal static stiffness	
quantity	
231 pieces	*634 pieces*



8. Installation instructions for bridge bearings

Bridge bearings are integral elements of a structure and are continuously exposed to large loads. They should fulfill their function reliable and for a long period of time. They are important for the stability of the entire structure and after the installation they are generally difficult to access. Repairs or refurbishments are normally not feasible without great efforts.

For these reasons the EN 1337 sets high standards regarding the quality of the material and the manufacturing of the bridge bearings. As a manufacturer of these products, we implement the requirements daily in our work. Bridge bearings that leave our factory are quality products „Made in Germany", designed for long operating periods under the planned conditions.

As a manufacturer, our influence on the quality of our product ends when it leaves our factory. The actual application can be in different climatic conditions compared to our location and significantly after the despatch date.

To ensure that our products are in the proper condition when they are installed, we summarise in this chapter the most important points that need to be considered. We explicitly refer to the EN1337 part 10 (Inspection and maintenance) and 11 (Transport, storage and installation) that provide detailed information on this topic and that need to be complied.

Transport and packaging:



Bridge bearings are properly prepared for shipment before they leave our factory. Usually we ship our bearings on pallets, secured by strapping tape. The auxiliary bolt connections of the bearing are marked red. Some bearings with sliding devices have an additional temporary protection for the sliding components. Corrosion protected surfaces should not bump into each other to avoid damage of the coating. This is done at the first shipment by us and should be considered with all following shipments by the client.

The load has to be correctly secured. It is important that the corrosion protection and the indicator devices where applicable do not get damaged by lashing straps or other load securing equipment. Also the auxiliary bolt connections of the bearing must not be tensioned by the lashing straps.

Receipt and temporary storage of the bearings

After the bearings arrive on site, the delivery has to be checked for completeness and damages. Missing items have to be reported immediately. The same applies for any obvious damage that go beyond minor corrosions protection damage that occured during transport.

If the bearings are not installed immediately after the delivery, they should be stored on plane and bearing ground. The storage area should be dry and well ventilated. The bridge bearings should be protected against soiling. To cover the bearings with tarpaulines or sheets would support the corrosion and is inappropriate.

Pre-installation measures:

For a correct installation the following documentation is needed:

- Bearing detail drawing
Containing the detailed design of each individual bearing as well as the bearing layout. The bearing detail drawing is prepared by the bearing manufacturer.

8 Bearing installation drawing Contains all the data that is relevant for the installation and is provided by the structural engineer.

Besides the usual tools and lifting equipment used on a construction site, a spirit level or a 3-point level with a tolerance of 0.5 mm / m is required. Suitable are e.g. the model Stabila 81 S respectively the 2 axes spirit level, system MPA Stuttgart.

Due to the fact that a damage to the corrosion protection during the installation can not be fully excluded, the relevant tools and coating materials need to be on site as well. The coating material can be obtained from GUMBA.

General information:

We recommend to have the installation supervised by a certified bearing specialist to ensure a correct conducting. Such a specialist is available on demand from GUMBA. (Please see also ZTV-ING part 8 and EN1337 part 11)

The correct fitting of the auxiliary bolt connections has to be checked before the bearing gets moved. Existing packing material has to be removed from the indicator and sliding devices.

The bearing has to be adjusted according to the inscription on the top bearing plate. The axes are defined as following:

X: Longitudinal bridge direction Y: Transverse bridge direction

Furthermore, the inscription contains information about the actual installation position and the adjacent bearings. The positioning can be carried out and checked in accordance with the bearing layout. The bearing installation must comply with all points of the bearing installation drawing, which provides the levels, inclinations, lateral and longitudinal position. To determine the inclination of bridge bearings, these are equipped with measuring points respectively measuring planes. The inclination can be checked with for this purpose made levels. The maximum allowed deviation from the target is 0,5% (0,3% for deformation sliding bearings).

During the installation of deformation bearings the following points have to be considered for the elastomer:

- do not apply paint or other coatings - no contact with an open flame - no contact with acids or other aggressive agents - do not expose to temperatures above 50°C (short term max. 70°C) - no welding on the bearing - prevent damage of the surface - clean the bearing after installation

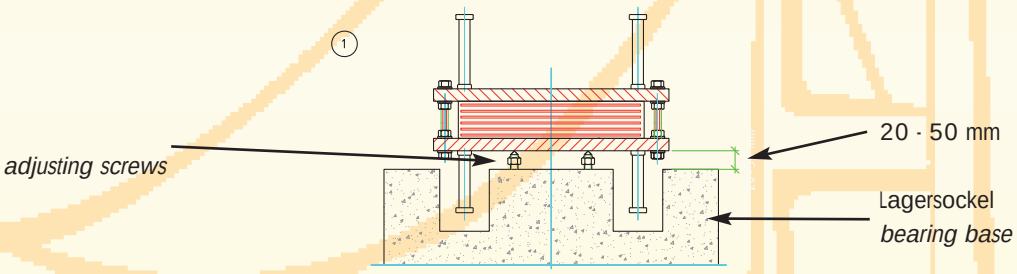
Forms according to "Richtzeichnung Lag 12" can be used for documentation of the bearing installation.

Installation situations

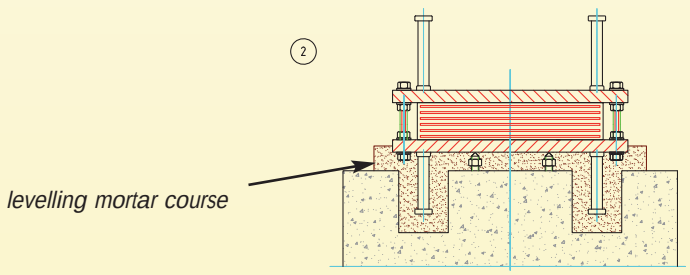
The procedures for the installation vary depending on the material of the superstructure and the substructure

a) in-situ concrete

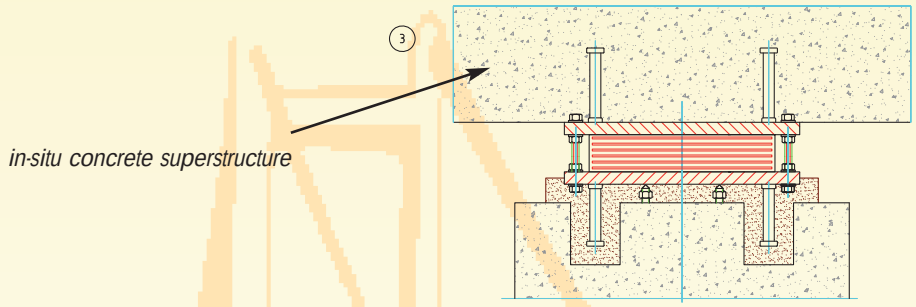
The bearing gets positioned according to the bearing drawing on adjusting screws (can be ordered from GUMBA) or different suitable means on the bearing base. The set bolts (stud shears) have to be in their designated pockets. The inclination can be adjusted with the help of the measuring plane on the bottom bearing plate and a 2 axes spirit level. On bearings with measuring points, a spirit level like the ones described on page 61 can be used.



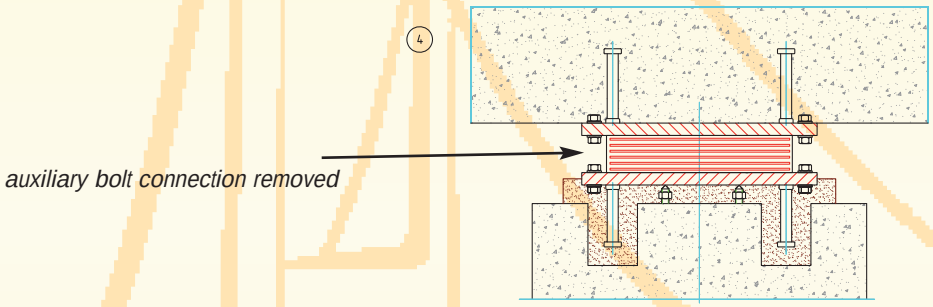
Between the bottom anchor plate and the base a levelling mortar course of min. 20 mm to max. 50 mm thickness has to be implemented. Only use „low-shrink" mortar, which is suitable for use with bearings. The mortar must be used in accordance with the manufacturer's recommendations. The levelling course can be achieved by tamping or pouring. It is important that no cavities occur and the bearing is consistently supported by the levelling course over the whole area. (see picture 2)



The connection to the superstructure is carried out as a traditional in-situ concrete construction. (see picture 3)



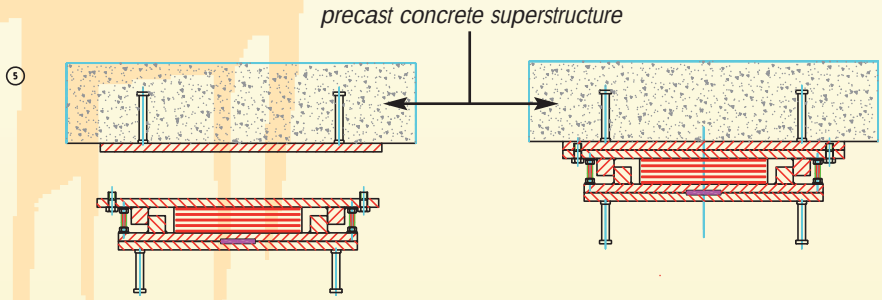
After the mortar cured – but before the bearing is loaded – the auxiliary bolt connections (red marked) get cut through. (see picture 4)



b) precast concrete superstucture

Usually the top anchorplate is cast into the superstructure in the precast concrete plant.

The remaining bearing will be connected with the supplied bolts on site. (See picture 5)

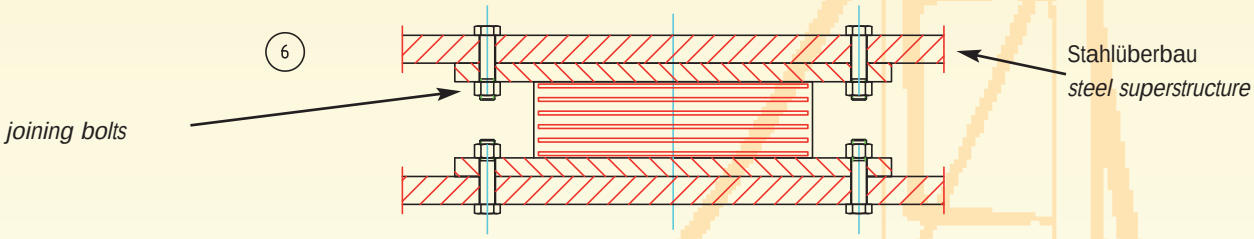


The further installation process is as described in section a).

Note: The precast superstructure incl. the suspended bearing have to be placed on a temporary support (e.g. hydraulic set-collar presses)

c) steel structure:

The bearing plate gets bolted to the superstructure. (see picture 6) The bolts specified in the drawing have to be used and if necessary the intended torque moment needs to be applied with a torque spanner. **The joining bolts are not a part of the bearing delivery.**



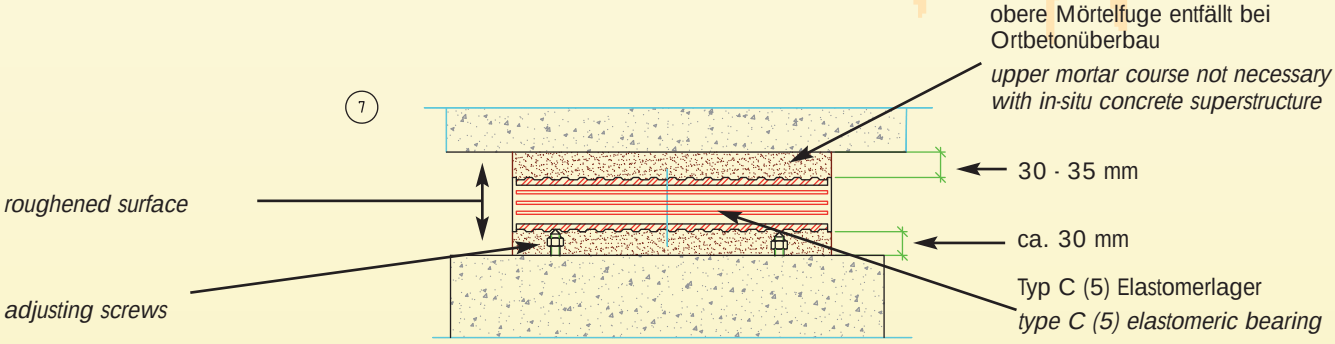
Note: Uneven connecting surfaces (steel structure – bearing plate) need to be levelled. The max. deviation of the theoretically plane surface should not exceed 0,0003 x DLP (diagonal dimension of the bearing plate) or 0,2 mm (the higher value has to be applied). Usually a compensating material like e.g. Diamond- Multi-Metal can be used. The suitable method has to be determined for each individual case.

If in special cases welding becomes necessary, it must be ensured that this is only done by qualified personnel. Heat-sensible parts like elastomeric bearings, sliding materials and plastic parts have to be protected (even of weld spatters). An exposure to temperatures above 70°C will cause a permanent damage and the bearing would be defective.

d) slip protected elastomeric bearing

Elastomeric bearings that are installed without anchoring plates are slip protected either by dowels (type C(2)) or by their profiled steel surface (type C(5)). A later removal of this bearing is not possible, especially type C(2) bearings.

Type C (2) bearings are generally used in combination with restraining structures. Type C (5) bearings, with slip protection realised through a profiled surface, can only be placed in an applied mortar bed.(see picture 7)



Finishing works:

After the installation, an eventual occurred pollution with concerte sludge or mortar has to be cleaned by an suitable detergent. Suitable means harmless for the elastomeric bearing, if an elastomeric bearing is present.

Minor damages at the corrosion protection can be patched up with the top coat paint of the coating system.

The contact of the guides, respectively the restraints and a simultaneous displacement can cause a minor abrasion of the coating system. This abrasion is normally limited to the top coat and is not considered a defect.

Maintenance and inspection

For the bridge bearing types manufactured by us, a regular maintenance regime is not intended.

The bearings are to be checked during the bridge inspection. Amongst the properties that are checked are:

- Position of the elastomeric bearing - Size of the contact area between the elastomeric bearing and the surrounding surfaces - Surface of the elastomeric bearing (cracks, characteristic of the deflection) - horizontal displacement within the permitted tolerances - rotation within the permitted tolerances - condition of the sliding surfaces - condition of the corrosion protection

The professional evaluation of the bridge bearing condition requires a high degree of knowledge and experience and can only be done by a qualified person. We recommend to consult the bearing manufacturer, if deviations occur.

















9. Bearing refurbishment

The lifetime of a structure can sometimes be considerably longer than the service life of the bearings. Nowadays, the bearing design according to EN 1337 allows the exchange of each single bearing component. Therefore, a complete bearing exchange is basically not necessary any more. Earlier bearing designs did not consider this aspect in particular. The previously commonly used roller and rocker bearings need to be exchanged when they are worn out.

Due to the fact that these bearing types are not used any more, despite for preservations of historic interest e.g., they are replaced during a refurbishment with more efficient bearing types. Deformation bearings have proven to be particularly suitable, because they provide in most cases the required function without any difficulties and are an economic solution.

Through our wide experience we are able to provide a comprehensive range of services, which includes the evaluation of the old bearings, the design of a new bearing concept and the bearing exchange including the lift of the superstructure.

Please find attached examples of some realised refurbishments. The pictures were provided by Other Montagen.

before



nachher
after



before **after**
















10. Bridge expansion joints

General information

GUMBA BJ and BJR expansion joints are suitable for longitudinal translations of 50 to 165 mm at bridges, roads and other building constructions. Due to their uncomplicated design, both the assembly as well as the maintenance are simple.

The expansion joints installed between the road surface of the bridge and the road need to absorb movements that occur from temperature, creep and shrinkage of the structure and the traffic load. In special cases they need to absorb transversal displacements and rotations around the three spacial axes and eventually longitudinal gradients need to be considered. GUMBA bridge expansion joints achieve all this and are waterproof.

BJ and BJR are manufactured in the standard length of 1100 mm (despite of the kerbs). The productions of shorter ends or bends is possible. The installation for all types is done with fixings like fischer chemical fixings e.g.

There are 2 types in 4 variations available. The movement joints are basically consisting of an elastomeric body that meets all requirements in respect of expansion, hardness, stability and ozone resistance.

Type GUMBA BJ

This type has a grooved aluminium wear profile that protects the elastomeric body of abrasion caused by traffic. Steel profiles that are vulcanised into the elastomeric body guarantee the stability of the expansion joint

Type GUMBA BJR

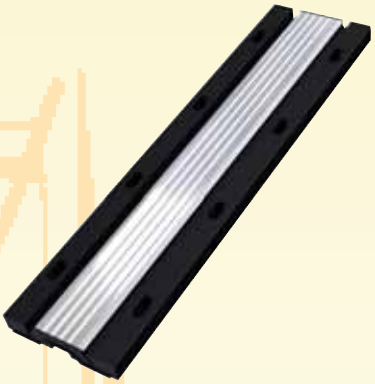
In contrast to the BJ the BJR has a dimpled elastomeric surface. Beneath the dimpled surface are steel sheets for reinforcement vulcanised into the elastomeric body. The remaining design and the load capacities are the same as at type GUMBA BJ.

BJ 50



BJ 75





BJ 100



BJ 165





BJR 50



BJR 75



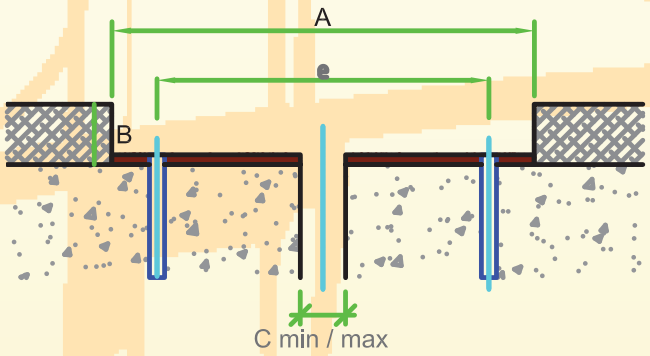
BJR 100

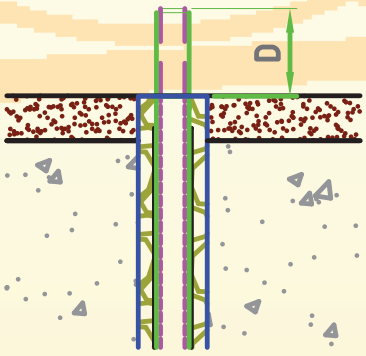


BJR 165



		nach / *according to*
Elastomerart *rubber type*	CR	
Shore A Härte *shore A hardness*	60° ±5°	ISO 48
Reißfestigkeit *tensile strength*	≥ 16 N/mm²	ISO 37
Reißdehnung *elongation at break*	≥ 425 %	ISO 37
Weiterreißwiderstand *tear strength*	≥ 10 N/mm²	ISO 34-1
Druckverformungsrest *compression set*	≤ 15 %	ISO 815
Ozonbeständigkeit *ozone resistance*	Stufe "0", keine Risse *level "0", no cracks*	ISO 1431-1
Bewehrungsstahl *steel reinforcement*	S235/S355	DIN EN 10025
Aluminium	AlMgSi 0,5 F254	EN AW 6063, T66/EN 573
Temperaturbeständigkeit *temperature resistance*	-30° - +100° C	





Abmessungen / *dimensions*						Ankerabstand *bolt distance*	Abmessungen Aussparung *block out dimensions*				
Typ *type*	Bewegungsaufnahme *total movement* [mm]	Länge *length* [mm]	Breite *width* [mm]	Höhe *height* [mm]	Gewicht *weight* [kg]	e [mm]	A [mm]	B [mm]	C min [mm]	C max [mm]	D [mm]
50	50	1100	270	44	26	212	310	54	25	75	39
75	75	1100	410	55	44	340	450	65	35	110	47
100	100	1100	580	60	63	492	620	70	25	125	56
165	165	1100	710	84	104	614	750	94	38	203	66

Other dimensions on request

Installation instructions bridge expansion joints

GUMBA BJ and BJR Expansion Joints

GUMBA expansion joints are easy to install. It is usually not necessary to assign specialised subcontractors with the task.

The installation procedure includes the preparation of a mortar bed, the drilling of holes for chemical fixings at pre-determined positions, the use of chemical fixings, the positioning and fixing of the BJ respectively the BJR parts including a sealing membrane and finally the grouting of the installation pockets.

Required equipment: BJ or BJR (standard length 1100 mm)

Accessories (separately available from GUMBA): Chemical fixings including anchors, washers and nuts. BJ(R) washers Sealing membrane Epoxy repair morter General epoxy resin Elastomeric sealing compound

The following tools are required:

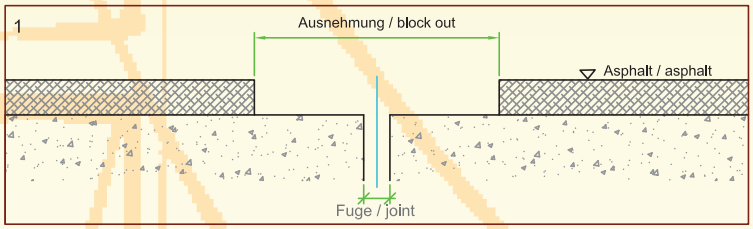
torque wrench blow out pump or bulb, to clean the boreholes of the fixings (i.e. Hilti Hit Blow out pump) floorsaw tool brush hammer-drill concrete grinder paddle mixer

Further tools and equipment that are usually on site. 10

1)

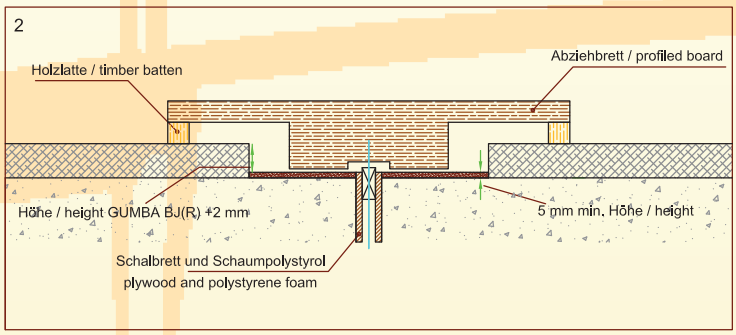
1) (only necessary at refurbishments)

The centre of the joint has to be detected. The road surface needs to be sawn on both sides of the longitudinal direction of the joint over the entire length, with equal distance to the joint on both sides. The width of the created installation block out should be a bid bigger than the complete width of the actual used BJ(R) element (see table on page 72). The surface material between the cuts has to be broken out to reveal the concrete beneath. The exposed concrete surface should be grinded in order to remove bituminous adhesion and to roughen and level the surface. Following this, all loose material should be cleaned away by broom or air pressure, to have a dry and clean surface.



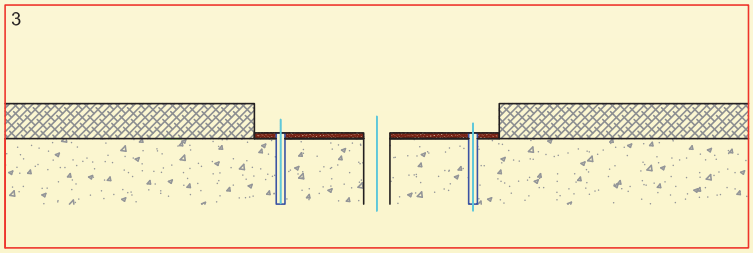
2)

2) The general epoxy resin will be applied on the concrete surface as a bonding agent between the concrete and the mortar and also as a smoothing layer. After that the mortar bed has to be prepared. The levels of the finished road and the height of the BJ(R) and the sealing membrane need to be considered when the mortar bed gets levelled. The best practise to achieve this, is to use timber battens along the installation conduit as guide rails in combination with a profiled board that is used as a float.



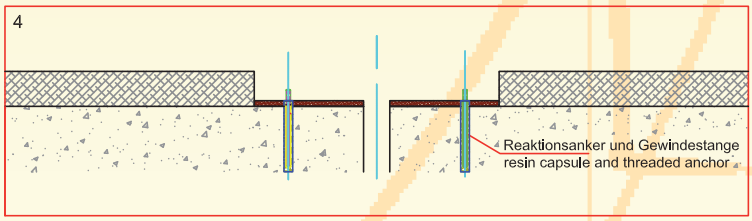
3)

3) After the mortar cured, the holes for the chemical fixings have to be drilled. A BJ(R) element could be used as a template to set out the holes. Remove the BJ(R) element before drilling.



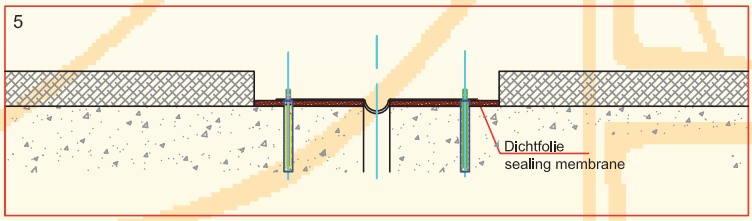
4)

4) The boreholes have to be clean, dry and free of dust. The boreholes get filled with the glass capsules of the chemical fixings and the threaded anchors get hammered in by which the quick-curing mortar is activated. After the chemical fixing cured the threaded anchors have to be shortened to the specified length to avoid that they protrude over the BJ(R) element. Attention: shortening after the installation is very laborious.



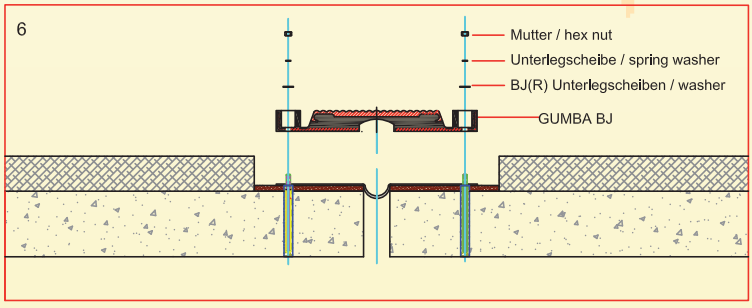
5)

5) The sealing membrane, which is wider than the BJ(R) element, has to be placed on the mortar bed. The margins of the membrane should be in line with the edges of the BJ(R) by creating a loop in the centre of the joint. Small slits have to be cut in the areas of the threaded anchors as a feed-through.



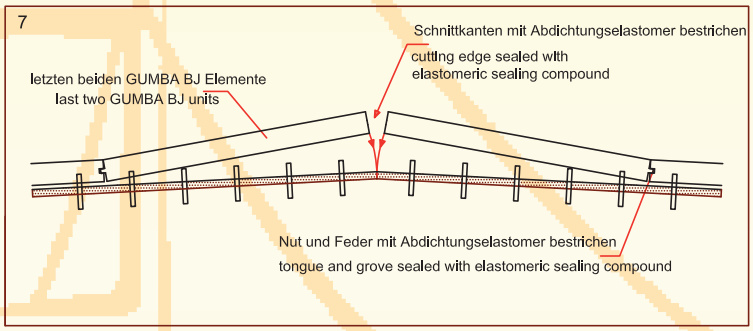
6)

6) The BJ(R) element gets placed in its proposed position, so that the threaded anchors are accessible in the BJ(R) pockets. The BJ(R) gets fixed by using a special BJ(R) washer, a normal washer and a nut. The required torque is applied with a torque wrench. The first element should be installed at the end with the lowest level of the joint. The following BJ(R) element is pressed against the fixed one to close the longitudinal tongue and groove connection before it gets fixed itself.



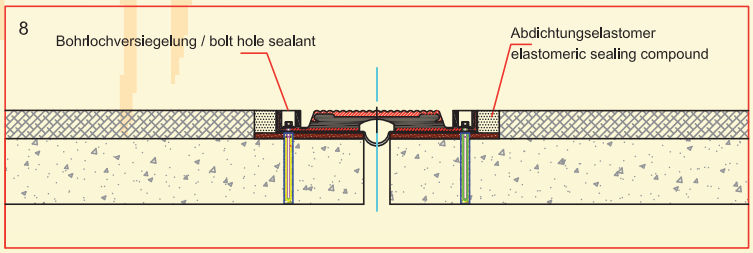
7)

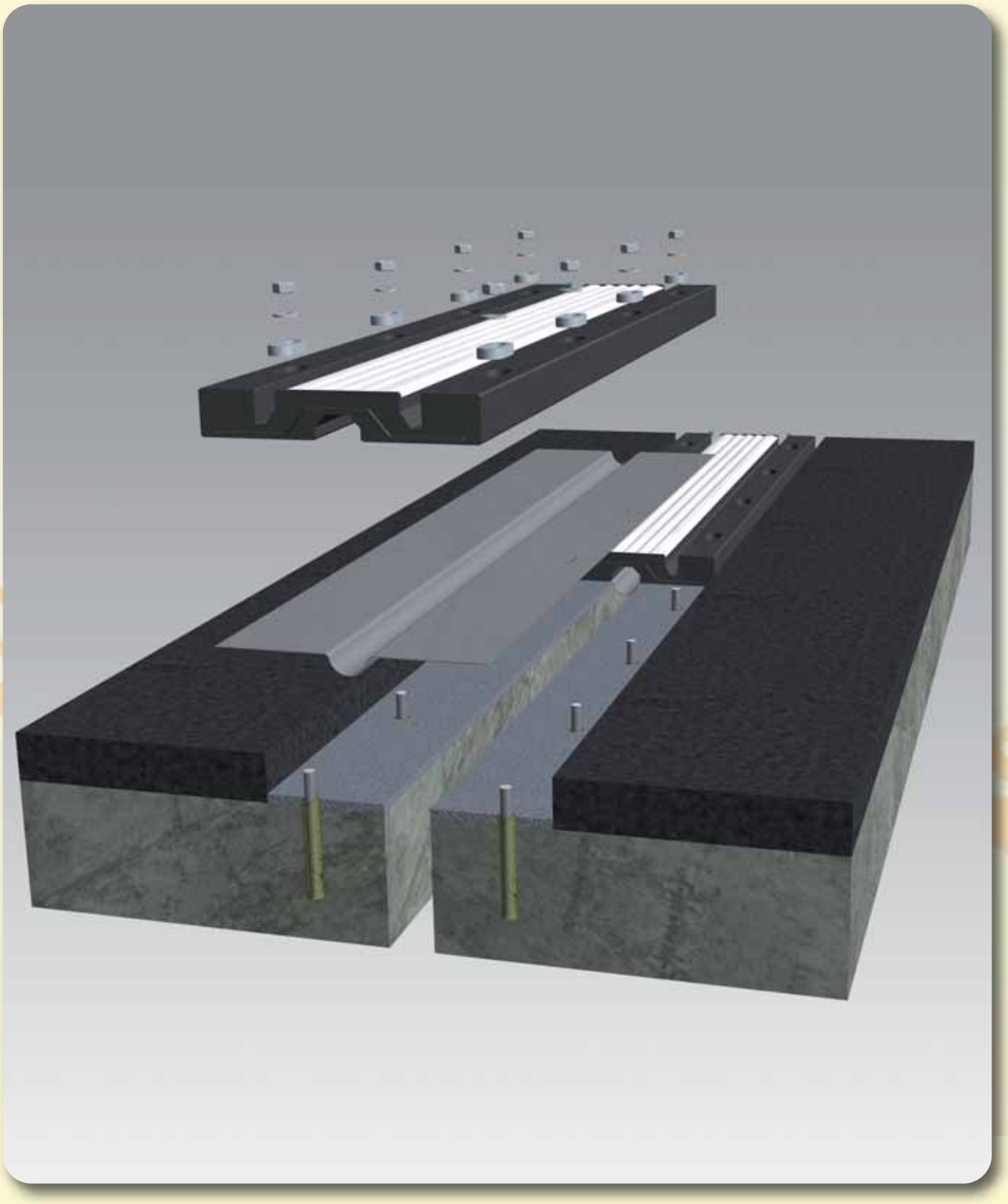
7) In most cases at least 2 BJ(R) elements have to be cut, since the entire length of the joint is rarely the multiple of the single element length. This can be done with the same tools that have been used to cut the surface, it just has to be ensured that the elastomer of the BJ(R) elements does not get too hot. Elastomeric sealing compound will be applied on the cut edges. After that the BJ(R) elements get positioned in a way, that one end will fit into the groove respectively the tongue of the already installed BJ(R) element and the cut ends of the BJ(R)elements are joined moving them from the top down until they seat solid and can get fixed.



8)

8) After a setting time of at least 4 hours fittings have to be checked and if necessary tightened again with a torque wrench. Afterwards, the bolting pockets of the BJ(R) elements can be cleaned and grouted with an epoxy filling compound. Gaps that might occured between the individual BJ(R) elements should be sealed with an elastometric sealing compound. The gap between the road and the BJ(R) edges should also be sealed with an elastomeric sealing compound and levelled.





11. Specifications

Note for the awarding department:
Please mention if the loads are for the ultimate limit state (ULS) or for the serviceability limit state (SLS)

Deformation bearings 1.1, movable in all directions (V2):

Deformation bearings acc. to EN 1337-3, deforming in two axes acc. to drawings
Installation on abutment / column
Bearing rectangular
Vertical load .....MN
Displacement x: ± .....mm; y : ± .....mm
Rotation angles α_x: .....rad; α_y: .....rad
Bearing incl. top and bottom anchoring plates
Coating system for the anchoring plates:
ZTV-ING Part 4, Section 3, Table A 4.3.2, Element No. 3.2 protection system 1
Coatings acc. to TL / TP-KOR-Stahlbauten . Substances: 687.13 and 687.71
Concrete touching surfaces get a 50 mm wide perimeter coated
Contact surface elastomeric bearing / anchoring plate sandblasted and thermal zinc coated

Deformation bearings 1.2, transversely fixed (V1Q)

Deformation bearings acc. To EN 1337-3, unidirectional fixed acc. to drawings
Restraining structure acc. to DIN 4141-13
fixed in transversal direction
Installation on abutment / column
Bearing rectangular, deforming in one direction, rectangular fixed
Vertical load .....MN
Horizontal load in transverse direction .....MN
Displacement x: ± .....mm
Rotation angles α_x: .....rad; α_y: .....rad
Restraining structure exchangeable
Bearing incl. top and bottom anchoring plates
Coating system for the bearing and anchoring plates:
ZTV-ING Part 4, Section 3, Table A 4.3.2, Element No. 3.2 protection system 1 Coatings acc. to TL / TP-KOR-Stahlbauten . Substances: 687.13 and 687.71
Concrete touching surfaces get a 50 mm wide perimeter coated
Contact surface elastomeric bearing / anchoring plate sandblasted and thermal zinc coated

Deformation bearings 1.2, longitudinally fixed (V1Q)

Deformation bearings acc. To EN 1337-3, unidirectional fixed acc. to drawings
Restraining structure acc. to DIN 4141-13
fixed in longitudinal direction
Installation on abutment / column
Bearing rectangular, deforming in one direction, rectangular fixed

Vertical load	.....MN
Horizontal load in longitudinal direction	.....MN
Displacement	y: ± .....mm
Rotation angles	α_x: .....rad; α_y: .....rad

Restraining structure exchangeable
Bearing incl. top and bottom anchoring plates
Coating system for the bearing and anchoring plates:
ZTV-ING Part 4, Section 3, Table A 4.3.2, Element No. 3.2 protection system 1
Coatings acc. to TL / TP-KOR-Stahlbauten . Substances: 687.13 and 687.71
Concrete touching surfaces get a 50 mm wide perimeter coated
Contact surface elastomeric bearing / anchoring plate sandblasted and thermal zinc coated

Deformation bearings 1.6, fixed in all directions (V)

Deformation bearings acc. To EN 1337-3, fixed in all directions acc. to drawings
Restraining structure acc. to DIN 4141-13 / EN 1337-8
Installation on abutment / column
Bearing rectangular, fixed in two directions

Vertical load	.....MN
Horizontal load in longitudinal direction	.....MN
Horizontal load in transversal direction	.....MN
Rotation angles :	α_x: .....rad; α_y: .....rad

Restraining structure exchangeable
Bearing incl. top and bottom anchoring plates
Coating system for the bearing and anchoring plates:
ZTV-ING Part 4, Section 3, Table A 4.3.2, Element No. 3.2 protection system 1
Coatings acc. To TL / TP-KOR-Stahlbauten . Substances: 687.13 and 687.71
Concrete touching surfaces get a 50 mm wide perimeter coated
Contact surface elastomeric bearing / anchoring plate sandblasted and thermal zinc coated

Note:
The texts for tender documents are exemplary for deformation bearings. Pot bearings and spherical bearings can be described in a similar way. For a price calculation it is also necessary to provide the bearing load table (see page 28).

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The companies GUMBA and ELA are members of BESAGROUP. The BESAGROUP stands for a group of companies that focus on the production and the distribution of plastic and rubber products. The head location of the group is Borken. Besides that that there are further production and adminstration facilities in Germany.

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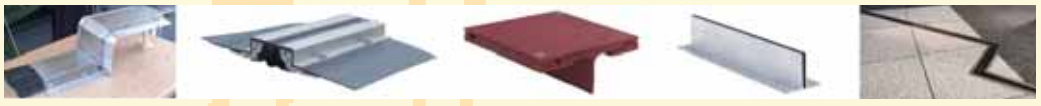
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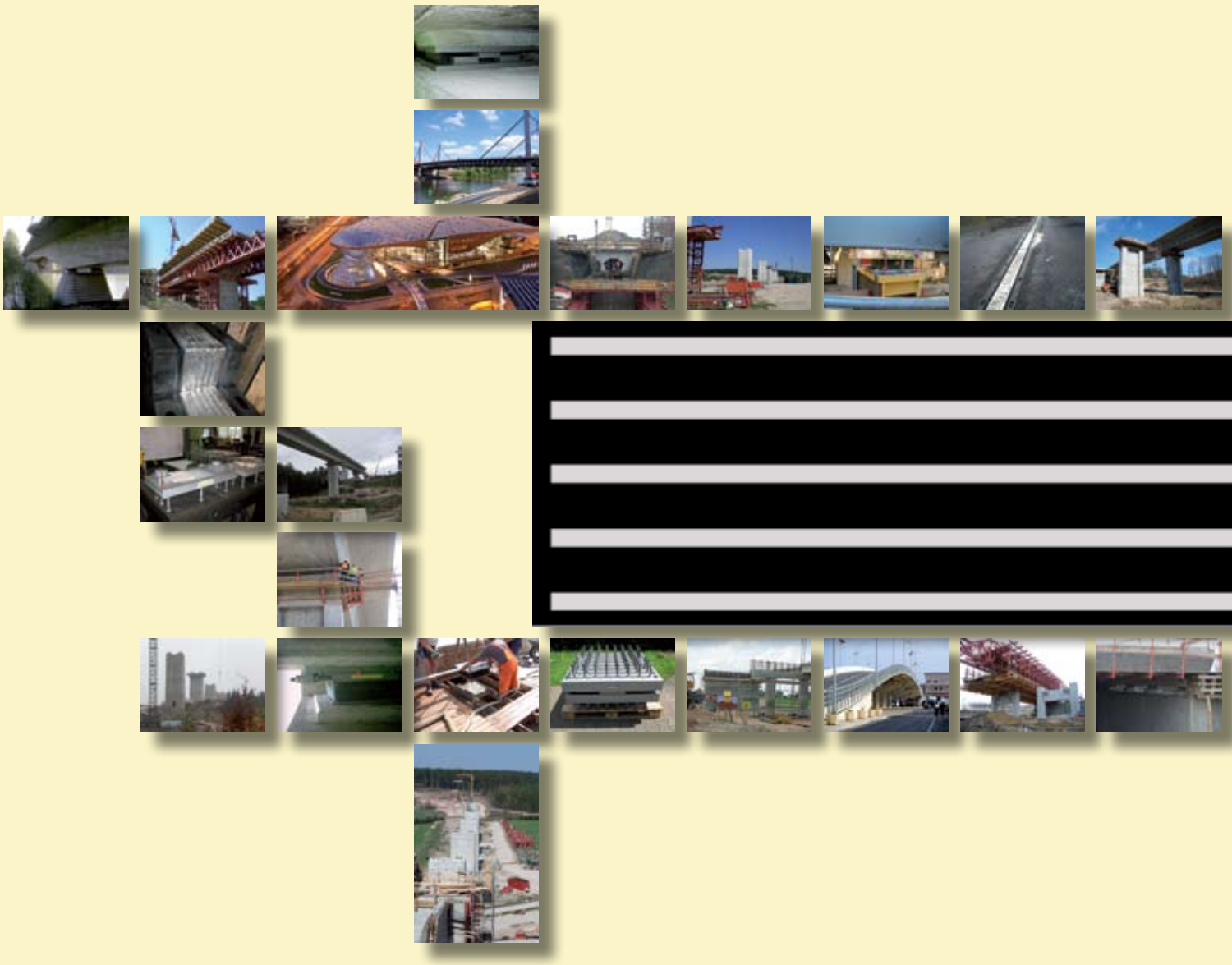
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