Stretto di Messina

Concessionaria per la progettazione, realizzazione e gestione del collegamento stabile tra la Sicilia e il Continente Organismo di Diritto Pubblico
(Legge n° 1158 del 17 dicembre 1971, modificata dal D.Lgs. n°114 del 24 aprile 2003)

EurolinK

PONTE SULLO STRETTO DI MESSINA

PROGETTO DEFINITIVO

EUROLINK S.C.p.A.

IMPREGILO S.p.A. (MANDATARIA)
SOCIETÀ ITALIANA PER CONDOTTE D'ACQUA S.p.A. (MANDANTE)
COOPERATIVA MURATORI E CEMENTISTI - C.M.C. DI RAVENNA SOC. COOP. A.R.L. (MANDANTE)
SACYR S.A.U. (MANDANTE)
ISHIKAWAJIMA - HARIMA HEAVY INDUSTRIES CO. LTD (MANDANTE)
A.C.I. S.C.P.A. - CONSORZIO STABILE (MANDANTE)

IL PROGETTISTA	IL CONTRAENTE GENERALE	STRETTO DI MESSINA	STRETTO DI MESSINA
Ing E.M.Veje COWI Dott. Ing. E. Pagani Ordine Ingegneri Milano n° 15408 EurolinK	Project Manager (Ing. P.P. Marcheselli)	Direttore Generale e RUP Validazione (Ing. G. Fiammenghi)	Amministratore Delegato (Dott. P. Ciucci)

Unità Funzionale	OPERA DI ATTRAVERSAMENTO	PS0188_F0
Tipo di sistema	SISTEMI SECONDARI	
Raggruppamento di opere/attività	ARTICOLAZIONI	
Opera - tratto d'opera - parte d'opera	APPOGGI	
Titolo del documento	Relazione di progetto - Appoggi del ponte	

CODICE: C G 1 0 0 0 _ P _ C L _ D _ P _ S S _ A 0 _ A P _ 0 0 _ 0 0 _ 0 0 _ 0 1 _ F0

REV	DATA	DESCRIZIONE	REDATTO	VERIFICATO	APPROVATO
F0	20-06-2011	EMISSIONE FINALE	HPJE	SOLA	SOLA

NOME DEL FILE: PS0188_F0_ITA.doc

INDICE

1 Introduzione

La presente relazione descrive la progettazione degli appoggi. Gli appoggi sono basati sul progetto illustrato nei disegni di gara e nella presentazione a 80 giorni, ma per alcuni appoggi si è ritenuto vantaggioso apportare le seguenti modifiche al progetto.

- Gli appoggi A5, A6, A7, A9, A13 e A14 sono soggetti a forti spinte verso l'alto. Nel Progetto Definitivo questi appoggi sono progettati con una struttura di appoggio superiore e inferiore. Nella struttura inferiore è alloggiato l'appoggio normale, mentre la parte superiore ha due appoggi di sollevamento collegati tra di loro da un sistema idraulico che favorisce una spinta costante e uniformemente ripartita sui due appoggi di sollevamento.
- Nella progettazione di gara era incluso l'isolamento sismico in direzione trasversale tramite ammortizzatori idraulici fra la sovrastruttura e lo sottostruttura della struttura terminale. Questo, tuttavia, durante gli eventi sismici provoca nella sovrastruttura terminale movimenti laterali relativamente grandi che potrebbero difficilmente trovare spazio nei viadotti adiacenti in modo da consentire lo svolgimento senza interruzioni del traffico stradale e ferroviario. Nel Progetto Definitivo gli ammortizzatori trasversali sono stati sostituiti da un fissaggio laterale della sovrastruttura terminale sotto forma di una guida locale situata al centro del trasverso della sottostruttura.
- Nella progettazione di gara era incluso l'isolamento sismico in direzione longitudinale tramite ammortizzatori idraulici fra la sovrastruttura e lo sottostruttura della struttura terminale. Questo, tuttavia, non è accettato dalle autorità ferroviarie italiane. Nel Progetto Definitivo gli ammortizzatori longitudinali sono stati sostituiti da un fissaggio laterale della sovrastruttura terminale sostituendo i precedenti appoggi a scorrimento libero A6 e A7 con appoggi guidati.

I calcoli sono stati eseguiti da Mageba e sono riportati nell'Appendice.

1.1 Sommario della relazione

La presente relazione è strutturata nelle seguenti sezioni:

- La Sezione 1 contiene la presente introduzione;
- La Sezione 2 fornisce un elenco dei materiali di riferimento, comprese le specifiche di progetto, i codici di progetto, le specifiche dei materiali e i disegni di riferimento;

- La Sezione 3 fornisce le descrizioni dei materiali che vengono utilizzati per ciascun componente;
- La Sezione 4 descrive l'output di IBDAS e il modo in cui viene utilizzato in relazione agli appoggi;
- Nell'Appendice sono riportate le verifiche dettagliate del progetto.

2 Riferimenti per la progettazione

2.1 Specifiche di progetto

1 CG.10.00-P-RG-D-P-GE-00-00-00-00-00-02 - "Manuale applicativo riferito ai fondamenti progettuali" COWI 2010

2 GCG.F.05.03 "Sviluppo della Progettazione - Requisiti e Linee Guida", Stretto di Messina, 22 Ottobre 2004.

3 GCG.G.03.02 "Costruzioni strutturali in acciaio e rivestimenti protettivi", Stretto di Messina, 30 Luglio 2004.

2.2 Codici di progettazione

4 "Norme tecniche per le costruzioni," 2008 (NTC08).

5 EN 1993 Eurocodice 3: Progettazione di strutture in acciaio - Parte 1-1: Regole generali e regole per gli edifici

6 EN 1993 Eurocodice 3: Progettazione di strutture in acciaio - Parte 1-5: Elementi strutturali tipo piastra

7 EN 1993 Eurocodice 3: Progettazione di strutture in acciaio - Parte 1-8: Progettazione dei giunti

8 EN 1993 Eurocodice 3: Progettazione di strutture in acciaio - Parte 1-9: Fatica

9 EN 1993 Eurocodice 3: Progettazione di strutture in acciaio - Parte 1-10: Scelta dell'acciaio con riferimento alla resistenza alla frattura e alle proprietà attraverso lo spessore

10 EN 1993 Eurocodice 3: Progettazione di strutture in acciaio - Parte 2: Ponti in acciaio

11 EN 1998 Eurocodice 8: Progettazione delle strutture per la resistenza sismica

12 RFI/DIN/IC/PO 002 A: Istruzione Tecnica 44/E

2.3 Specifiche dei materiali

13 EN 10025-1:2004 Prodotti laminati a caldo di acciai per impieghi strutturali – Parte 1: Condizioni generali di fornitura.

14 EN 10025-2:2004 Prodotti laminati a caldo di acciai per impieghi strutturali – Parte 2: Condizioni tecniche di fornitura per acciai strutturali non legati.

15 EN 10025-3:2004 Prodotti laminati a caldo di acciai per impieghi strutturali – Parte 3: Condizioni tecniche di fornitura per acciai strutturali normalizzati / normalizzati saldabili a grano fine.

16 EN 10025-4:2004 Prodotti laminati a caldo di acciai per impieghi strutturali – Parte 4: Condizioni tecniche di fornitura per acciai strutturali saldabili a grano fine ottenuti per laminazione termomeccanica.

17 EN 10164:1993 Prodotti in acciaio con aumentate proprietà di deformazione perpendicolarmente alla superficie del prodotto - Condizioni tecniche di consegna.

18 EN ISO 898-1:2001 Proprietà meccaniche degli elementi di fissaggio in acciaio al carbonio e in acciaio legato - Parte 1: Bulloni, viti e prigionieri (ISO 898-1:1999).

19 EN 20898-2:1994 Proprietà meccaniche degli elementi di fissaggio – Parte 2: Dadi con valori di carico di prova speciali - filettatura grossa (ISO 898-2:1992).

20 UNI EN 14399:2005-3 Bulloneria strutturale ad alta resistenza per pre-caricamento - Parte 3: Sistema HR - Bulloneria e dadi esagonali

2.4 Relazioni complementari

21 CG.10.00-P-RG-D-P-SV-00-00-00-00-00-01 - “Modello globale IBDAS, Descrizione” COWI 2010

22 CG.10.00-P-SP-D-P-SS-A0-AP-00-00-00-01 - “Specifica di prestazione - Appoggi ponte”, COWI 2010

23 CG1000-P-RX-D-P-SS-A0-00-00-00-00-01 - “Sistema di articolazione - Relazione tecnica specialistica”, COWI 2010

2.5 Disegni

I disegni di interesse per la presente relazione sono i seguenti:

24 CG1000-P-AX-D-P-SS-A0-00-00-00-00-01, Sistema di articolazione - Disposizione generale,

25 CG1000-P-AX-D-P-SS-A0-00-00-00-00-02, Sistema di articolazione - Supporto dell'impalcato sospeso in corrispondenza delle torri

26 CG1000-P-DX-D-P-SS-A0-AP-00-00-00-01, Sistema di articolazione - Appoggi ponte, Generale

27 CG1000-P-BX-D-P-SS-A0-AP-00-00-00-01, Sistema di articolazione - Appoggi ponte, Dettagli

3 Materiali

La progettazione degli appoggi è effettuata dai produttori in base alle specifiche di prestazioni tecniche emesse nell’ambito del Progetto Definitivo. Le proprietà meccaniche dei materiali adottati sono riportate nella documentazione dei produttori.

4 Principi di progettazione

4.1 Modello FE

È stato creato un modello 3D computerizzato utilizzando il software interno IBDAS. L’IBDAS (Integrated Bridge Design and Analysis System - Sistema Integrato per l’Analisi e la Progettazione del Ponte) è un pacchetto software generale per l’analisi e la progettazione strutturale sviluppato da COWI. L’IBDAS è basato sulla modellazione logica solida parametrica 3D e mette a disposizione delle procedure per l’analisi e la progettazione completamente integrate delle strutture portanti.

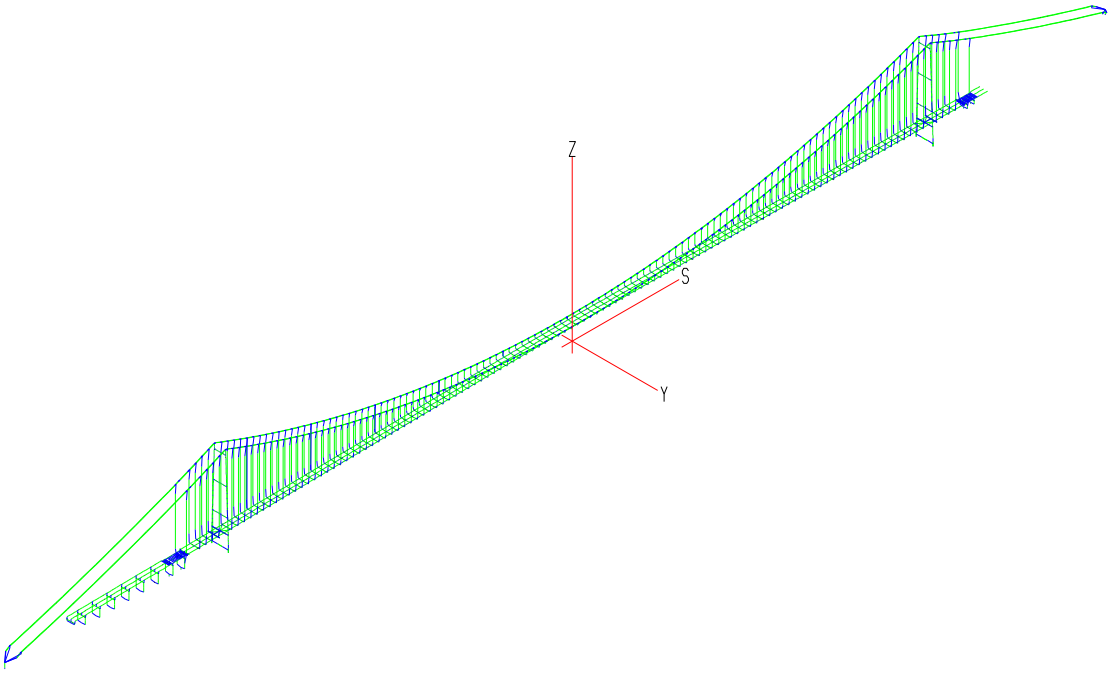

Figura 4-1: Sistema globale di coordinate in IBDAS

Con questo modello vengono determinati il carico, i movimenti e le rotazioni rilevanti per gli appoggi. Per ulteriori informazioni si rimanda a [21].

4.1.1 Output dell'IBDAS

L'IBDAS mette a disposizione i seguenti tipi di analisi:

- Analisi statica (carico fisso, carico mobile, carichi di vento e di temperatura);
- Analisi dello spettro di risposta sismica;
- Analisi dinamica del vento (analisi spettrale);
- Analisi della storia temporale sismica;

L'analisi statica, l'analisi della risposta e l'analisi spettrale sono eseguite per due sistemi statici: "libero-libero"; "fisso-fisso".

Il tipo di sistema statico si riferisce alla condizione dell'incastro longitudinale dell'impalcato sospeso in corrispondenza delle torri. Nel sistema "fisso-fisso" l'incastro longitudinale è bloccato, creando

un collegamento rigido tra l'impalcato e la torre. Nel sistema "libero-libero" l'impalcato può muoversi liberamente rispetto alla torre.

Nel sistema statico "libero-libero" viene implementata una molla in direzione longitudinale corrispondente alle caratteristiche dell'ammortizzatore. La rigidità della molla è di 33 kN/m.

Nei sistemi statici "libero-libero" e "fisso-fisso" gli ammortizzatori trasversali in corrispondenza delle torri sono fissati creando un collegamento rigido trasversale.

In base al tipo di analisi e al sistema statico ci sono quattro stati limite:

- SLS1
- SLS2
- ULS
- SILS

Gli stati limite sono definiti in [1]. Per ulteriori informazioni sul modello IBDAS si rimanda a [21].

4.1.1.1 Analisi dello spettro di risposta sismica

Il movimento del suolo è definito per i quattro stati limite indicati in [1]: la differenza tra gli stati limite è l'accelerazione massima al suolo.

La risposta della struttura sottoposta al movimento del suolo è calcolata con il metodo della sovrapposizione modale con spettro di risposta. Si presuppone un movimento uniforme del suolo, vale a dire che tutti gli appoggi sono eccitati allo stesso modo. Il rapporto di smorzamento dell'intera struttura viene assunto pari al 5% rispetto a quello critico, in considerazione del fatto che durante un terremoto si possono verificare movimenti di grande ampiezza.

La analisi dello spettro di risposta sono eseguite per i 1760 modi di vibrazione più bassi, in modo da ottenere una massa partecipante superiore al 90%.

Sono forniti i risultati per ciascuno dei quattro stati limite. Sono applicati i principi sopra descritti per il contributo del carico di temperatura uniforme.

4.1.1.2 Analisi dinamica del vento

L'analisi dinamica del vento è costituita da otto diverse situazioni di carico per ciascuno stato limite e tra queste viene utilizzata quella più sfavorevole. Le otto situazioni di carico si basano sulla direzione del vento con riferimento al sistema globale di coordinate IBDAS, si veda la Figura 4-2:

- mw 1: y+
- mw 2: s+
- mw 3: y-
- mw 4: s-
- mw 5: s+ y+
- mw 6: s+ y-
- mw 7: s- y+
- mw 8: s- y-

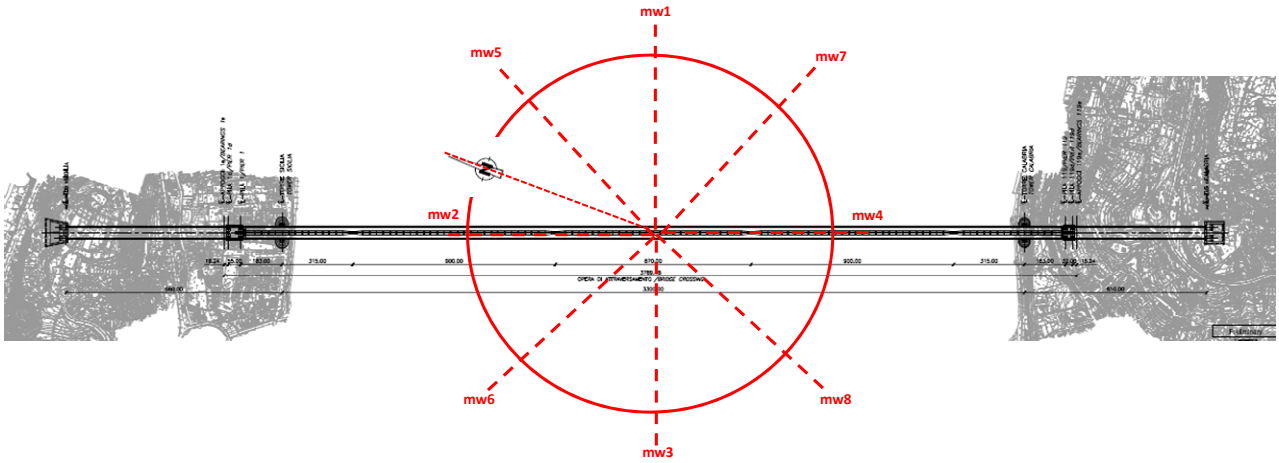

Figura 4-2: Definizione della direzione del vento

4.1.1.3 Analisi della storia temporale sismica

Le serie temporali compatibili con gli spettri di risposta di progetto ULS sono utilizzate come input sismici per l'analisi della storia temporale.

In totale durante la progettazione sono stati analizzati 8 set di serie temporali.

Ogni set è costituito da tre componenti ortogonali: due componenti orizzontali perpendicolari e una componente verticale. Vengono considerate le due combinazioni seguenti:

- Componente longitudinale 1.0 + componente trasversale 0.8 + componente verticale 0.75;
- Componente longitudinale 0.8 + componente trasversale 1.0 + componente verticale 0.75.

Per le due combinazioni i risultati degli 8 set di serie temporali sono mediati in conformità con [1].

Nell'analisi è incluso solamente il carico fisso. Pertanto i risultati vengono combinati con il rispettivo carico rimanente che è indicato nelle seguenti combinazioni di carico:

- Componenti strutturali primari:
  - ULS: 6903
  - SLS1: 6913
  - SLS2: 6923
  - SILS: 6933
- Componenti strutturali secondari
  - ULS: 6568
  - SLS caratteristico: 6668
  - SLS frequente: 6759

Il coefficiente di smorzamento viene attualmente determinato in base ai modi importanti per le torri.

Nell'analisi sismica basata sull'analisi della storia temporale gli ammortizzatori opereranno secondo le loro caratteristiche.

4.1.1.4 Analisi della storia temporale sismica con pre-caricamento

Dal momento che la disposizione degli ammortizzatori sulle torri produce una diversa rigidità della molla a seconda della posizione effettiva dell'ammortizzatore, la sequenza dei carichi influirà sulla risposta degli ammortizzatori. Per tener conto di questo aspetto gli ammortizzatori sono precaricati

prima dell'applicazione delle serie temporali, simulando in tal modo le condizioni di temperatura e di traffico al momento dell'evento sismico. Il traffico viene collocato nella posizione più sfavorevole per un determinato elemento strutturale. Ad esempio, per quanto concerne gli ammortizzatori, il traffico può essere posizionato in modo che gli ammortizzatori ricevano la più alta tensione possibile prodotta dal carico di traffico.

4.1.1.5 Temperatura uniforme

Il contributo dei gradienti di temperatura è incluso nei rispettivi inviluppi in entrambi i sistemi statici. Il contributo della temperatura uniforme non è tuttavia incluso negli inviluppi e può essere individuato solamente come una singola situazione di carico che viene aggiunta manualmente agli inviluppi.

Il contributo della temperatura uniforme è ricavato dal sistema statico "libero-libero". Ciò è dovuto al fatto che il comportamento non lineare degli ammortizzatori può essere modellato correttamente solo nell'analisi della storia temporale. Il carico della temperatura uniforme supererà il valore di soglia degli ammortizzatori, rendendo necessaria una modifica del sistema statico.

4.1.2 Output dell'IBDAS utilizzato per gli appoggi

Il carico sugli appoggi è determinato in base a un inviluppo di tutte le situazioni di carico nell'analisi statica, nell'analisi della risposta e nell'analisi spettrale eseguite rispettivamente nel sistema statico "libero-libero" e "fisso-fisso".

L'analisi sismica basata sull'analisi della storia temporale con pre-caricamento è utilizzata per determinare il movimento negli appoggi. Il pre-caricamento è basato sulle seguenti condizioni:

- Temperatura uniforme massima;
- Fissaggio dei carichi di traffico in modo da avere la massima forza di trazione negli ammortizzatori longitudinali in corrispondenza delle torri.

5 Base per la progettazione degli appoggi

La base per la progettazione degli appoggi, con riferimento al carico, ai movimenti e alle rotazioni, è riportata in [26].

I movimenti e le rotazioni sono moltiplicati per un fattore di 1,10 in conformità con [2] sezione 10.5.

Appendice 1 - Mageba

Nell'Appendice 1 è riportata una valutazione preliminare degli appoggi necessari. Questa valutazione è stata effettuata in base ai carichi sugli appoggi precedentemente calcolati e non è stata aggiornata secondo gli ultimi carichi calcolati che sono riportati nel disegno CG1000-P-DX-D-P-SS-A0-AP-00-00-00-01, Sistema di articolazione - Appoggi ponte, Generale

Le verifiche di progetto dettagliate saranno incluse durante il Progetto Esecutivo.

STATIC CALCULATION
STATISCHER NACHWEIS

Product / *Produkt:* **RESTON®SPHERICAL Bearings**
Type / *Typ:* KE (guided / *geführt*)
Standard / *Norm:* EN 1337/ETA-08/0115

Project / *Projekt:* **Messina Strait Bridge**
Client / *Kunde:* Eurolink
Order No. / *Auftrag:* OF-L-11082

Rev.	Date / *Datum*	Status	Prepared / *Bearb.*	Checked / *Geprüft*	Approved / *Gen.*
05					
04					
03					
02					
01					
00	02.11.2010	Static assessment	OM	BU	NM

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TABLE OF CONTENT

1 General Data / *Allgemeine Daten*

Project / *Objekt*	Messina Strait Bridge
Client / *Kunde*	Eurolink
Issued / *Erstellt am*	02.11.2010
Project no. / *Auftragsnummer*	OF-L-11082
Project manager / *Projektleiter*	NM
Static engineer mageba / *Statiker*	OM
Drawing no. / *Zeichnungsnummer*	KE2.7-1-IT-OF-L-11082
Sheet no. / *Blattnummer*	1

Type of bearing / *Lagertyp*	KE
Size of bearing / *Lagerbezeichnung*	2.7
Location / *Einbauort*	A1
Number of bearings / *Anzahl Lager*	0
Country / *Land (ISO-Code)*	IT
Standard / *Norm/Zulassung*	ETA 08-0115

2 Input Data / *Eingangsdaten*

Load combination A	$N_{Sd,max}$	=	2'700	Distribution angle/*Ausbreitungswinkel* [°]	α	=	60
(Design) [kN]	$V_{y\ Sd,max}$	=	2'000	Anchor plate/*Ankerplatte* [j/n]	upper	=	n
Load combination B	$N_{Sd,min}$	=	300		lower	=	n
(Design) [kN]	$V_{y\ Sd,zugeh}$	=	600				---
Load combination C	$N_{Gk,perm}$	=	1'200	Concrete quality/*Betongüte*	upper	=	Stahl
(Design) [kN]	$N_{Qk,perm}$	=	729		$B_{o,x}$	≥	0
					$B_{o,y}$	≥	0
Movement ± [mm]	v_x	= ±	700		lower	=	Stahl
Bewegung ± [mm]	v_y	= ±	---		$B_{o,x}$	≥	0
					$B_{o,y}$	≥	0
Rotation [rad]	α_y	=	0.035	Shim plate/*Futterplatte*	upper	=	n
Verdrehung [rad]	α_x	=	0.025		lower	=	n
				Friction applicable/*Reibung ansetzbar*			n
					μ_k steel	=	0
					μ_k concrete	=	0
				Dowel/Dollen [j/n]	upper	=	n
					lower	=	n
				Shear stud [j/n]	upper	=	n
					lower	=	n
				Bellows [j/n]			n

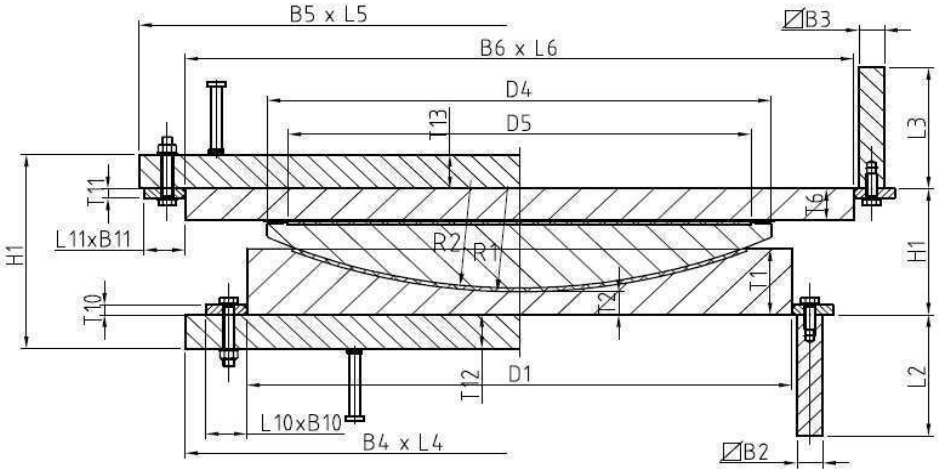
3 Steel stresses acc. to / *Stahlspannungen nach* EN 10025

$\sigma = f_{y,d} = f_{y,k} / (\gamma_m)$ $\gamma_m = 1.1$

Material	S355J2+N	S235JR	S355J2+N	S235JR
[mm]	$f_{y,d}$ [N/mm²]	$f_{y,d}$ [N/mm²]	$f_{y,k}$ [N/mm²]	$f_{y,k}$ [N/mm²]
<= 16	322.7	213.6	355	235
> 16 <= 40	313.6	204.5	345	225
> 40 <= 63	304.5	195.5	335	215
> 63 <= 80	295.5	195.5	325	215
> 80 <= 100	286.4	195.5	315	215
> 100 <= 150	268.2	177.3	295	195
> 150 <= 200	259.1	168.2	285	185
> 200 <= 250	250.0	159.1	275	175

4 Types of bearings and dimensions / *Lagertypen und Abmessungen*

4.1 Free sliding bearing / *allseitig bewegliches Lager* (KA)



4.2 Guided sliding bearing / *einachsig bewegliches Lager* (KE, KEQ)

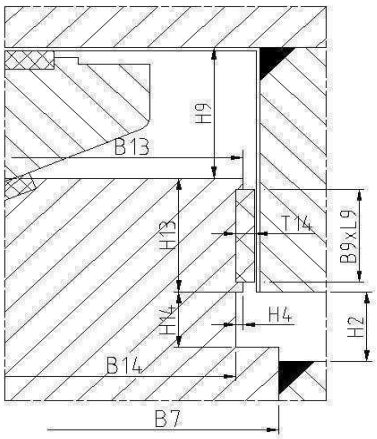
Note:

Beside the guide bars, the KE bearings are identical to the KA-bearing. The designation KE stands for longitudinal (x-axis), the designation KEQ stands for transversal (y-axis) movements.

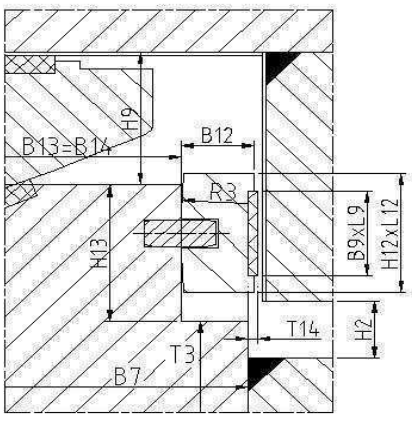
Hinweis:

Abgesehen von den Führungsleisten sind die KE/KEQ-Lager identisch mit den KA-Lagern. Die Bezeichnung KE steht für Längsbewegungen (x-Achse), KEQ für Querbewegungen (y-Achse).

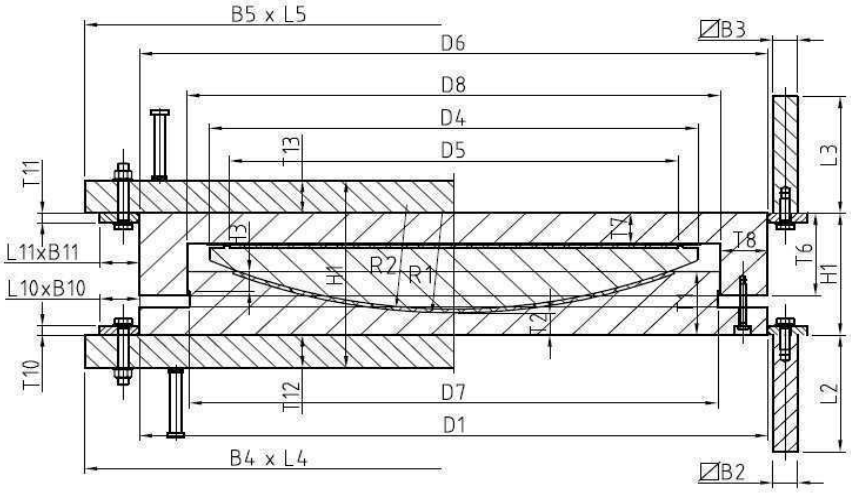
a) Without tilt bar / *ohne Kippleiste*



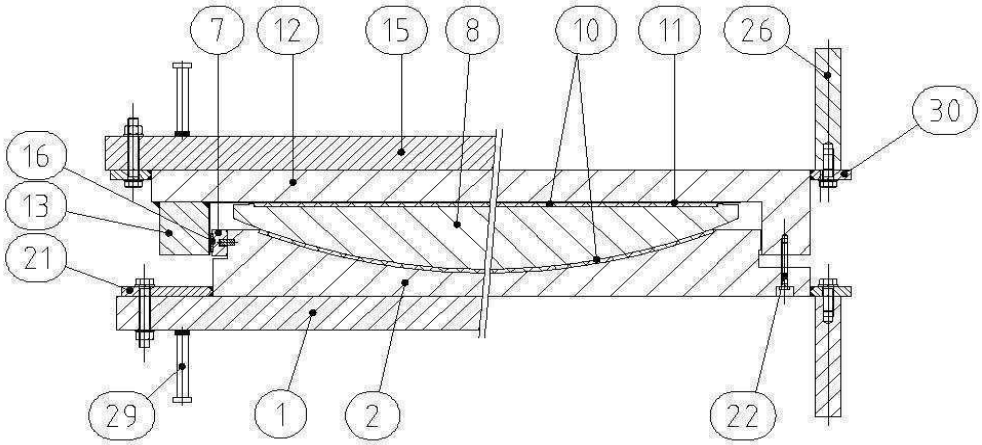
b) With tilt bar / *mit Kippleiste*



4.3 Fixed bearing / *Festes Lager* (KF)



5 Identification of the parts / *Bezeichnungen der Bauteile*



1	Lower anchor plate / *Untere Ankerplatte*	15	Upper anchor plate / *Obere Ankerplatte*
2	Lower part / *Unterteil*	16	Sliding strip / *Gleitstreifen*
7	Tilt bar / *Kippleiste*	21	Lug / *Lasche*
8	Calotte / *Kalotte*	22	Transportation fixation / *Transporthalterung*
10	Sliding disc / *Gleitscheibe*	26	Dowel / *Dollen*
11	Sliding sheet / *Gleitblech*	29	Shear stud / *Kopfbolzen*
12	Sliding plate / *Gleitplatte*	30	Lug / *Lasche*
13	Guide bar / *Führungsleiste*		

6 Summary of relevant Input Data & Results

Type of bearing/standard: ***Lagertyp/Norm:***	**KE2.7**	**(guided sliding)**	**Standard:**	**ETA 08-0115**

6.1 Input data: Loads, movements and rotations / ***Eingangsdaten: Lasten, Bewegungen und Verdrehungen***

acc. / ***nach*** **ENV 1991**

				Movement		Rotation	
$N_{Sd,max}$ =	2700 kN	$V_{ySd,max}$ =	2000 kN	v_x= ± 700 mm	$\alpha_{y,max}$ =	0.035 [rad]
$N_{Sd,min}$ =	2000 kN	$V_{ySd,as}$ =	600 kN	v_y= ± 0 mm	$\alpha_{x,max}$ =	0.025 [rad]

$N_{sGk,perm}$= 1200 kN
$N_{sQk,perm}$= 728.6 kN

6.2 Dimensions of bearing / ***Lagerabmessungen*** [mm]

Lower part / *Unterteil*	L7=550	B7=220	T1=145	T2=119	θ=25.3
Calotte / *Kalotte*	D4=234	T4=45.6	R2=212	H6=5.4	
Sliding disc / *Gleitscheibe*	D5=190	T5=8	Material=ROBO®SLIDE		
Sliding sheet / *Gleitblech*	L1=1980	B1=421	T9=1.5		
Sliding plate / *Gleitplatte*	L6=2020	B6=410	T6=85		
Upper anchor plate / *Obere Ankerplatte*	L5=0	B5=0	T13=0		
Lower anchor plate / *Untere Ankerplatte*	L4=0	B4=0	T12=0		
Sliding strip / *Gleitstreifen*	L9=530	B9=30	T14=8		
Guide bar / *Führungsleisten*	L8=2000	B8=65	H8=100	B15=225	

Height: **267.1** [mm]
Weight: **1034.9** [kg]

6.3 Proof of safety against sliding / ***Nachweis Sicherheit gegen Gleiten***

Friction applicable / *Reibung ansetzbar*: No / *Nein*

Contact gap steel/steel up / *Kontaktfläche oben Stahl-Stahl:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 8 x M36
Restliche Horizontalkraft aufnehmen durch:
Bolt quality 8.8, shear in thread
Schraubenqualität 8.8, Scherung im Gewindequerschnitt

Contact gap steel/steel down/ *Kontaktfläche unten Stahl-Stahl:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 8 x M36
Restliche Horizontalkraft aufnehmen durch:
Bolt quality 8.8, shear in thread
Schraubenqualität 8.8, Scherung im Gewindequerschnitt

Contact gap bearing/anchor plate / *Kontaktfläche Lager/Ankerplatte:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 8 x M36
Restliche Horizontalkraft aufnehmen durch:

6.4 Necessary space / ***Benötigte Bauwerksabmessungen***

Superstructure length / *Länge Überbau* = 0 [mm]
Superstructure width / *Breite Überbau* = 0 [mm]

Substructure length / *Länge Fundament* = 0 [mm]
Substructure width / *Breite Fundament* = 0 [mm]

STATIC CALCULATION

Product: **RESTON®SPHERICAL Bearings**
Type KA (free sliding)
Standard: ETA 08-0115

Project name: **Messina Strait Bridge**
Client name: Eurolink
Order No.: OF-L-11082

Rev.	Date	Status	Prepared	Checked	Approved
05					
04					
03					
02					
01					
00	02.11.2010	Static assessment	OM	BU	NM

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TABLE OF CONTENT

1 General Data / *Allgemeine Daten*

Project / *Objekt*	Messina Strait Bridge
Client / *Kunde*	Eurolink
Issued / *Erstellt am*	02.11.2010
Project no. / *Auftragsnummer*	OF-L-11082
Project manager / *Projektleiter*	NM
Static engineer mageba / *Statiker*	OM
Drawing no. / *Zeichnungsnummer*	KA2.7-1-IT-OF-L-11082
Sheet no. / *Blattnummer*	2

Type of bearing / *Lagertyp*	KA
Size of bearing / *Lagerbezeichnung*	2.7
Location / *Einbauort*	A2
Number of bearings / *Anzahl Lager*	0
Country / *Land (ISO-Code)*	IT
Standard / *Norm/Zulassung*	ETA 08-0115

2 Input Data / *Eingangsdaten*

Load combination A	$N_{Sd,max}$	=	2'700	Distribution angle/*Ausbreitungswinkel* [°]	α	=	60
(Design) [kN]	$V_{xy\ Sd,max}$	=	---	Anchor plate/*Ankerplatte* [j/n]	upper	=	n
Load combination B	$N_{Sd,min}$	=	300		lower	=	n
(Design) [kN]	$V_{xy\ Sd,min}$	=	---				---
Load combination C	$N_{Gk,perm}$	=	1'200	Concrete quality/*Betongüte*	upper	=	Stahl
(Design) [kN]	$N_{Qk,perm}$	=	729		$B_{o,x}$	≥	-
					$B_{o,y}$	≥	-
Movement ± [mm]	v_x	= ±	700		lower	=	Stahl
Bewegung ± [mm]	v_y	= ±	20		$B_{o,x}$	≥	-
					$B_{o,y}$	≥	-
Rotation [rad]	α_y	=	0.035	Shim plate/*Futterplatte*	upper	=	n
Verdrehung [rad]	α_x	=	0.025		lower	=	n
				Friction applicable/*Reibung ansetzbar*			n
					μ_k steel	=	0
					μ_k concrete	=	0
				Dowel/Dollen [j/n]	upper	=	n
					lower	=	n
				Shear stud [j/n]	upper	=	n
					lower	=	n
				Bellows [j/n]			n

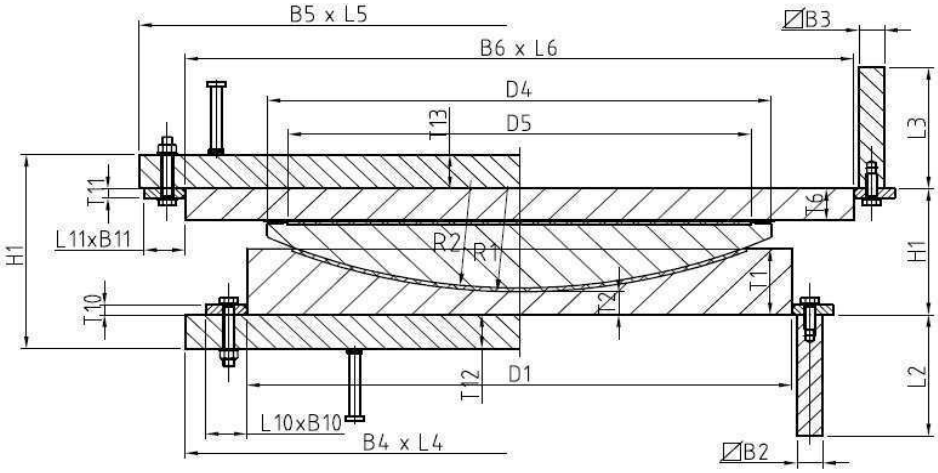
3 Steel stresses acc. to / *Stahlspannungen nach* EN 10025

$\sigma = f_{y,d} = f_{y,k} / (\gamma_m)$ $\gamma_m = 1.1$

Material	S355J2+N	S235JR	S355J2+N	S235JR
[mm]	$f_{y,d}$ [N/mm²]	$f_{y,d}$ [N/mm²]	$f_{y,k}$ [N/mm²]	$f_{y,k}$ [N/mm²]
<= 16	322.7	213.6	355	235
> 16 <= 40	313.6	204.5	345	225
> 40 <= 63	304.5	195.5	335	215
> 63 <= 80	295.5	195.5	325	215
> 80 <= 100	286.4	195.5	315	215
> 100 <= 150	268.2	177.3	295	195
> 150 <= 200	259.1	168.2	285	185
> 200 <= 250	250.0	159.1	275	175

4 Types of bearings and dimensions / *Lagertypen und Abmessungen*

4.1 Free sliding bearing / *allseitig bewegliches Lager* (KA)



4.2 Guided sliding bearing / *einachsig bewegliches Lager* (KE, KEQ)

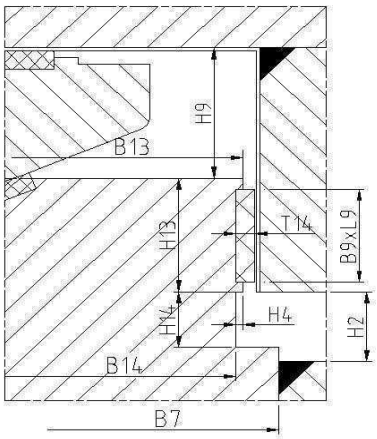
Note:

Beside the guide bars, the KE bearings are identical to the KA-bearing. The designation KE stands for longitudinal (x-axis), the designation KEQ stands for transversal (y-axis) movements.

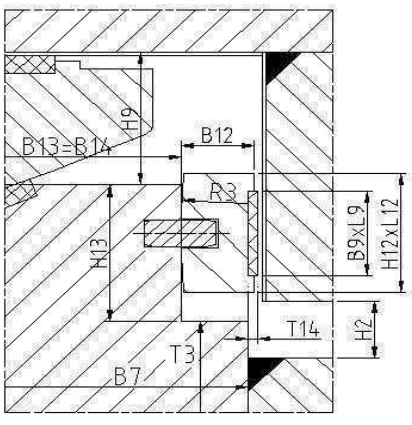
Hinweis:

Abgesehen von den Führungsleisten sind die KE/KEQ-Lager identisch mit den KA-Lagern. Die Bezeichnung KE steht für Längsbewegungen (x-Achse), KEQ für Querbewegungen (y-Achse).

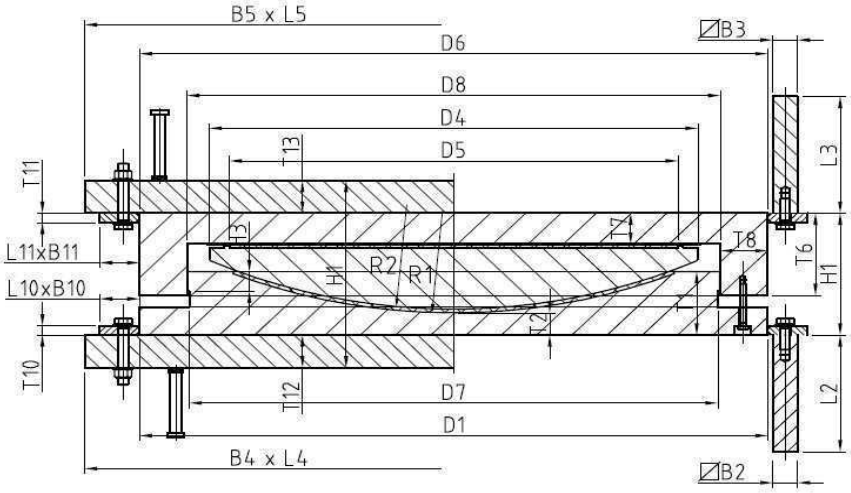
a) Without tilt bar / *ohne Kippleiste*



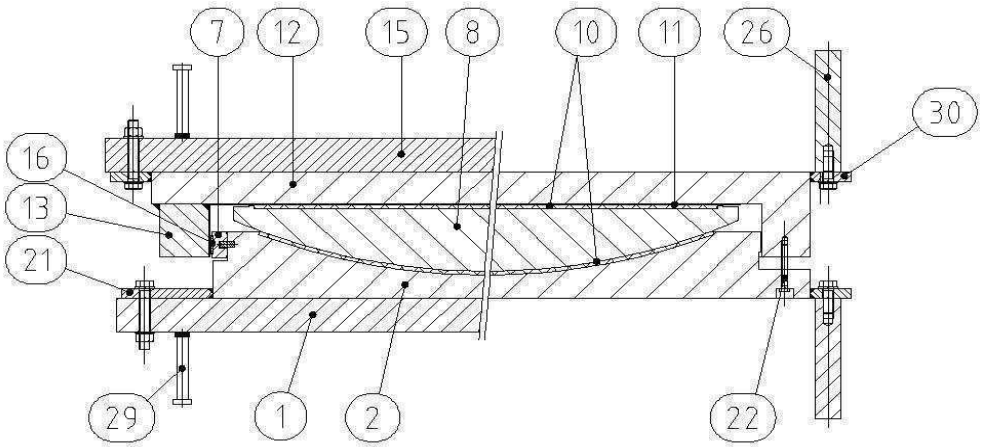
b) With tilt bar / *mit Kippleiste*



4.3 Fixed bearing / *Festes Lager* (KF)



5 Identification of the parts / *Bezeichnungen der Bauteile*



1	Lower anchor plate / *Untere Ankerplatte*	15	Upper anchor plate / *Obere Ankerplatte*
2	Lower part / *Unterteil*	16	Sliding strip / *Gleitstreifen*
7	Tilt bar / *Kippleiste*	21	Lug / *Lasche*
8	Calotte / *Kalotte*	22	Transportation fixation / *Transporthalterung*
10	Sliding disc / *Gleitscheibe*	26	Dowel / *Dollen*
11	Sliding sheet / *Gleitblech*	29	Shear stud / *Kopfbolzen*
12	Sliding plate / *Gleitplatte*	30	Lug / *Lasche*
13	Guide bar / *Führungsleiste*		

6 Summary of relevant Input Data & Results

Type of bearing/standard: ***Lagertyp/Norm:***	**KA2.7**	**(free sliding)**	**Standard:**	**ETA 08-0115**

6.1 Input data: Loads, movements and rotations / *Eingangsdaten: Lasten, Bewegungen und Verdrehungen*

acc. / *nach* ENV 1991

				Movement		Rotation	
$N_{Sd,max}$ =	2700 kN	$V_{xy\ Sd,max}$	54 kN	v_x=	± 700 mm	$\alpha_{y,max}$ =	0.035 [rad]
$N_{Sd,min}$ =	300 kN	$V_{xy\ Sd,min}$	17.891320722	v_y=	± 20 mm	$\alpha_{x,max}$ =	0.025 [rad]

$N_{sGk,perm}$: 1200 kN
$N_{sQk,perm}$: 728.6 kN

6.2 Dimensions of bearing / *Lagerabmessungen* [mm]

Lower part / *Unterteil*	D1=200	T1=36	T2=10.4	R1=213	θ=25.5
Calotte / *Kalotte*	D4=225	T4=45.6	R2=205	H6=5.4	
Sliding disc / *Gleitscheibe*	D5=185	T5=8	Material=ROBO®SLIDE		
Sliding sheet / *Gleitblech*	L1=1635	B1=275	T9=1.5		
Sliding plate / *Gleitplatte*	L6=1670	B6=310	T6=70		
Upper anchor plate / *Obere Ankerplatte*	L5=0	B5=0	T13=0		
Lower anchor plate / *Untere Ankerplatte*	L4=0	B4=0	T12=0		

Height: **143.5** [mm]
Weight: **329** [kg]

6.3 Proof of safety against sliding / *Nachweis Sicherheit gegen Gleiten*

Friction applicable / *Reibung ansetzbar*: No / *Nein*

Contact gap steel/steel up / *Kontaktfläche oben Stahl-Stahl:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 4 M16
Restliche Horizontalkraft aufnehmen durch:
Bolt quality 8.8, shear in thread
Schraubenqualität 8.8, Scherung im Gewindequerschnitt

Contact gap steel/steel down/ *Kontaktfläche unten Stahl-Stahl:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 4 M16
Restliche Horizontalkraft aufnehmen durch:
Bolt quality 8.8, shear in thread
Schraubenqualität 8.8, Scherung im Gewindequerschnitt

Contact gap bearing/anchor plate / *Kontaktfläche Lager/Ankerplatte:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 4 M16
Restliche Horizontalkraft aufnehmen durch:

6.4 Necessary space / *Benötigte Bauwerksabmessungen*

Superstructure length / *Länge Überbau* =	-	[mm]
Superstructure width / *Breite Überbau* =	-	[mm]
Substructure length / *Länge Fundament* =	-	[mm]
Substructure width / *Breite Fundament* =	-	[mm]

STATIC CALCULATION

Product: **RESTON®SPHERICAL Bearings**
Type KF (fixed)
Standard: EN 1337/ETA-08/0115

Project name: **Messina Strait Bridge**
Client name: Eurolink
Order No.: OF-L-11082

Rev.	Date	Status	Prepared	Checked	Approved
05					
04					
03					
02					
01					
00	02.11.2010	Static assessment	OM	BU	NM

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mageba	**RESTON®SPHERICAL Bearings** Static calculation acc. to ETA 08-0115	Prepared: OM Checked: MT Approved: NM	Revision: 00 Date: 02.11.2010
Project name:	**Messina Strait Bridge**	Order-No.:	OF-L-11082
Location of bearing:	A3	Drawing-No.:	KF3.7-1-IT-OF-L-11082

1 General Data / *Allgemeine Daten*

Project / *Objekt*	Messina Strait Bridge
Client / *Kunde*	Eurolink
Issued / *Erstellt am*	02.11.2010
Project no. / *Auftragsnummer*	OF-L-11082
Project manager / *Projektleiter*	NM
Static engineer mageba / *Statiker*	OM
Drawing no. / *Zeichnungsnummer*	KF3.7-1-IT-OF-L-11082
Sheet no. / *Blattnummer*	3

Type of bearing / *Lagertyp*	KF
Size of bearing / *Lagerbezeichnung*	3.7
Location / *Einbauort*	A3
Number of bearings / *Anzahl Lager*	0
Country / *Land (ISO-Code)*	IT
Standard / *Norm/Zulassung*	ETA 08-0115

2 Input Data / *Eingangsdaten*

Load combination A	$N_{Sd,max}$	=	3700	Distribution angle/*Ausbreitungswinkel* [°]	α	=	60
(Design) [kN]	$V_{x\ Sd,max}$		3'000	Anchor plate/*Ankerplatte* [j/n]	upper	=	n
	$V_{y\ Sd,max}$	=	1'800		lower	=	n
	$V_{xy\ Sd,max}$	=	3'499				
Load combination B	$N_{Sd,min}$	=	-800	Concrete quality/*Betongüte*	upper	=	Stahl
(Design) [kN]	$V_{x\ Sd,zugeh}$	=	1'500		$B_{o,x}$	≥	0
	$V_{y\ Sd,zugeh}$	=	900		$B_{o,y}$	≥	0
	$V_{xy\ Sd,zugeh}$	=	1'749		lower	=	Stahl
Load combination C	$N_{Gk,perm}$	=	1'586		$B_{o,x}$	≥	0
(Design) [kN]	$N_{Qk,perm}$	=	1'057		$B_{o,y}$	≥	0
				Shim plate/*Futterplatte*	upper	=	n
Movement ± [mm]	v_x	= ±	---		lower	=	n
Bewegung ± [mm]	v_y	= ±	---	Friction applicable/*Reibung ansetzbar*			n
					μ_k steel	=	0
Rotation [rad]	α_y	=	0.040		μ_k concrete	=	0
Verdrehung [rad]	α_x	=	0.010	Dowel/Dollen [j/n]	upper	=	n
					lower	=	n
				Shear stud [j/n]	upper	=	n
					lower	=	n
				Bellows [j/n]			n

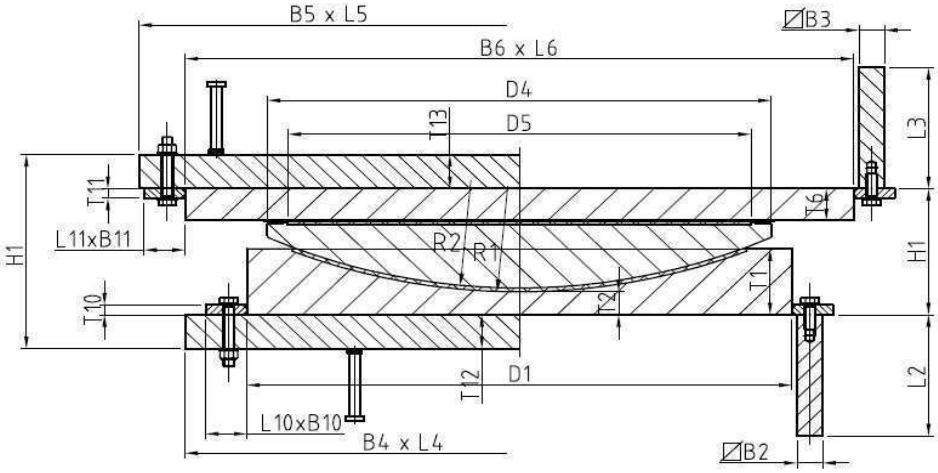
3 Steel stresses acc. to / *Stahlspannungen nach* EN 10025

$\sigma = f_{y,d} = f_{y,k} / (\gamma_m)$ $\gamma_m = 1.1$

Material	S355J2+N	S235JR	S355J2+N	S235JR
[mm]	$f_{y,d}$ [N/mm²]	$f_{y,d}$ [N/mm²]	$f_{y,k}$ [N/mm²]	$f_{y,k}$ [N/mm²]
<= 16	322.7	213.6	355	235
> 16 <= 40	313.6	204.5	345	225
> 40 <= 63	304.5	195.5	335	215
> 63 <= 80	295.5	195.5	325	215
> 80 <= 100	286.4	195.5	315	215
> 100 <= 150	268.2	177.3	295	195
> 150 <= 200	259.1	168.2	285	185
> 200 <= 250	250.0	159.1	275	175

4 Types of bearings and dimensions / *Lagertypen und Abmessungen*

4.1 Free sliding bearing / *allseitig bewegliches Lager* (KA)



4.2 Guided sliding bearing / *einachsig bewegliches Lager* (KE, KEQ)

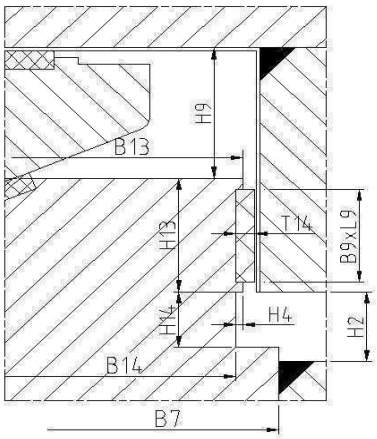
Note:

Beside the guide bars, the KE bearings are identical to the KA-bearing. The designation KE stands for longitudinal (x-axis), the designation KEQ stands for transversal (y-axis) movements.

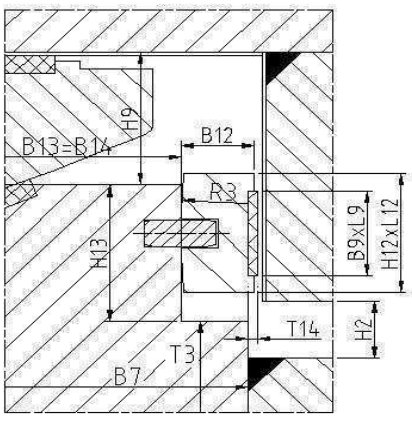
Hinweis:

Abgesehen von den Führungsleisten sind die KE/KEQ-Lager identisch mit den KA-Lagern. Die Bezeichnung KE steht für Längsbewegungen (x-Achse), KEQ für Querbewegungen (y-Achse).

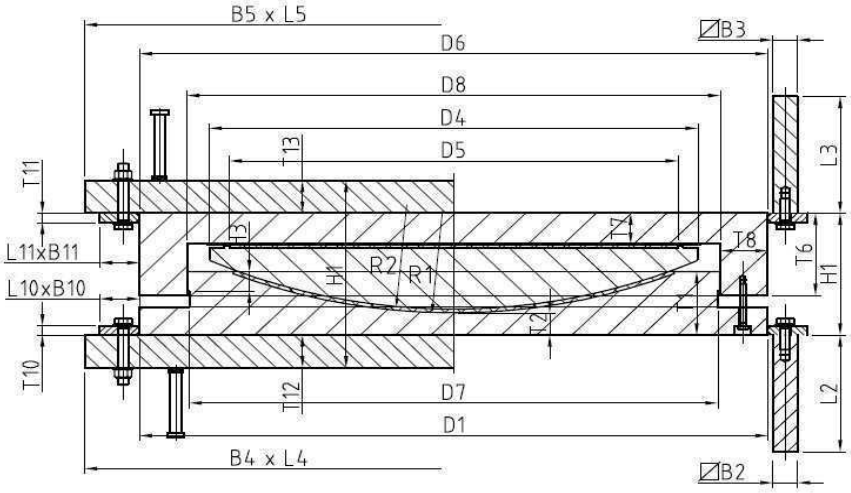
a) Without tilt bar / *ohne Kippleiste*



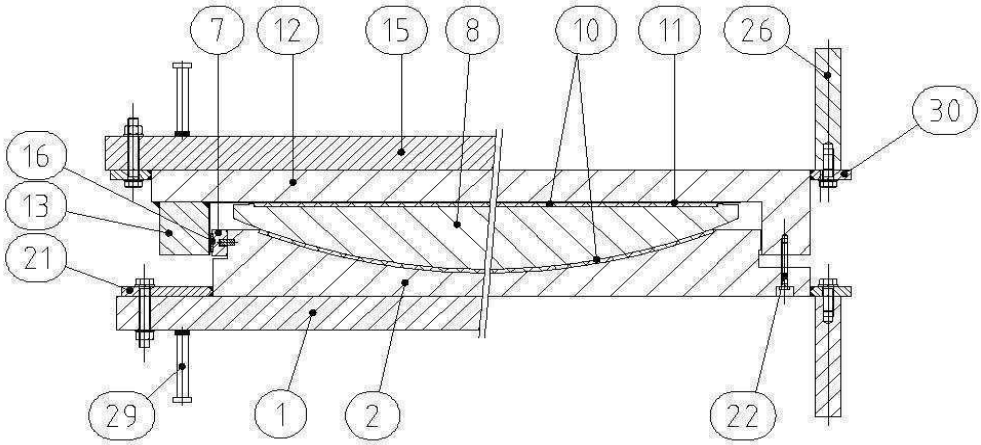
b) With tilt bar / *mit Kippleiste*



4.3 Fixed bearing / *Festes Lager* (KF)



5 Identification of the parts / *Bezeichnungen der Bauteile*



1	Lower anchor plate / *Untere Ankerplatte*	15	Upper anchor plate / *Obere Ankerplatte*
2	Lower part / *Unterteil*	16	Sliding strip / *Gleitstreifen*
7	Tilt bar / *Kippleiste*	21	Lug / *Lasche*
8	Calotte / *Kalotte*	22	Transportation fixation / *Transporthalterung*
10	Sliding disc / *Gleitscheibe*	26	Dowel / *Dollen*
11	Sliding sheet / *Gleitblech*	29	Shear stud / *Kopfbolzen*
12	Sliding plate / *Gleitplatte*	30	Lug / *Lasche*
13	Guide bar / *Führungsleiste*		

6 Summary of relevant Input Data & Results

Type of bearing/standard: ***Lagertyp/Norm:***	**KF3.7**	**(fixed)**	**Standard:**	**ETA 08-0115**

6.1 Input data: Loads, movements and rotations / *Eingangsdaten: Lasten, Bewegungen und Verdrehungen*

acc. / *nach* ENV 1991

				Movement		Rotation	
$N_{Sd,max}$ =	3700 kN	$V_{xySd,max}$=	3498.6 kN	v_x=	± 0 mm	$\alpha_{y,max}$ =	0.04 [rad]
$N_{Sd,min}$ =	-800 kN	$V_{xySd,as}$=	1749.3 kN	v_y=	± 0 mm	$\alpha_{x,max}$ =	0.01 [rad]

$N_{sGk,perm}$= 1585.7 kN
$N_{sQk,perm}$= 1057.1 kN

6.2 Dimensions of bearing / *Lagerabmessungen* [mm]

Lower part / *Unterteil*	D1=428	D7=413	T1=115	T2=82.1	θ=29.3
	D3=423	H3=55	R3=550	R1=220	
Calotte / *Kalotte*	D4=255	T4=55.6	R2=212	H6=5.4	
Sliding disc / *Gleitscheibe*	D5=220	T5=8	Material=ROBO®SLIDE		
Sliding sheet / *Gleitblech*	L1=360	B1=360	T9=1.5		
Upper part / *Lageroberteil*	D6=705	D8=425	T6=140	T7=40	T8=140
Upper anchor plate / *Obere Ankerplatte*	L5=0	B5=0	T13=0		
Lower anchor plate / *Untere Ankerplatte*	L4=0	B4=941	T12=0		

Height: **195.2** [mm]
Weight: **583.1** [kg]

6.3 Proof of safety against sliding / *Nachweis Sicherheit gegen Gleiten*

Friction applicable / *Reibung ansetzbar*: No / *Nein*

Contact gap steel/concrete up / *Kontaktfläche oben Stahl-Beton:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 12 x M36
Restliche Horizontalkraft aufnehmen durch:
Bolt quality 8.8, shear in thread
Schraubenqualität 8.8, Scherung im Gewindequerschnitt

Contact gap steel/concrete down/ *Kontaktfläche unten Stahl-Beton:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 12 x M36
Restliche Horizontalkraft aufnehmen durch:
Bolt quality 8.8, shear in thread
Schraubenqualität 8.8, Scherung im Gewindequerschnitt

Contact gap bearing/anchor plate / *Kontaktfläche Lager/Ankerplatte:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 8 x M36
Restliche Horizontalkraft aufnehmen durch:

6.4 Necessary space / *Benötigte Bauwerksabmessungen*

Superstructure length / *Länge Überbau* = 0 [mm]
Superstructure width / *Breite Überbau* = 0 [mm]

Substructure length / *Länge Fundament* = 0 [mm]
Substructure width / *Breite Fundament* = 0 [mm]

STATIC CALCULATION

Product: **RESTON®SPHERICAL Bearings**
Type KA (free sliding)
Standard: ETA 08-0115

Project name: **Messina Strait Bridge**
Client name: Eurolink
Order No.: OF-L-11082

Rev.	Date	Status	Prepared	Checked	Approved
05					
04					
03					
02					
01					
00	02.11.2010	Static assessment	OM	BU	NM

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1 General Data / *Allgemeine Daten*

Project / *Objekt*	Messina Strait Bridge
Client / *Kunde*	Eurolink
Issued / *Erstellt am*	02.11.2010
Project no. / *Auftragsnummer*	OF-L-11082
Project manager / *Projektleiter*	NM
Static engineer mageba / *Statiker*	OM
Drawing no. / *Zeichnungsnummer*	KA3.7-1-IT-OF-L-11082
Sheet no. / *Blattnummer*	4

Type of bearing / *Lagertyp*	KA
Size of bearing / *Lagerbezeichnung*	3.7
Location / *Einbauort*	A4
Number of bearings / *Anzahl Lager*	0
Country / *Land (ISO-Code)*	IT
Standard / *Norm/Zulassung*	ETA 08-0115

2 Input Data / *Eingangsdaten*

Load combination A	$N_{Sd,max}$	=	3'700	Distribution angle/*Ausbreitungswinkel* [°]	α	=	60
(Design) [kN]	$V_{xy\ Sd,max}$	=	---	Anchor plate/*Ankerplatte* [j/n]	upper	=	n
Load combination B	$N_{Sd,min}$	=	-800		lower	=	n
(Design) [kN]	$V_{xy\ Sd,min}$	=	---				---
Load combination C	$N_{Gk,perm}$	=	1'600	Concrete quality/*Betongüte*	upper	=	Stahl
(Design) [kN]	$N_{Qk,perm}$	=	1'043		$B_{o,x}$	≥	-
					$B_{o,y}$	≥	-
Movement ± [mm]	v_x	= ±	100		lower	=	Stahl
Bewegung ± [mm]	v_y	= ±	20		$B_{o,x}$	≥	-
					$B_{o,y}$	≥	-
Rotation [rad]	α_y	=	0.040	Shim plate/*Futterplatte*	upper	=	n
Verdrehung [rad]	α_x	=	0.010		lower	=	n
				Friction applicable/*Reibung ansetzbar*			n
					μ_k steel	=	0
					μ_k concrete	=	0
				Dowel/Dollen [j/n]	upper	=	n
					lower	=	n
				Shear stud [j/n]	upper	=	n
					lower	=	n
				Bellows [j/n]			n

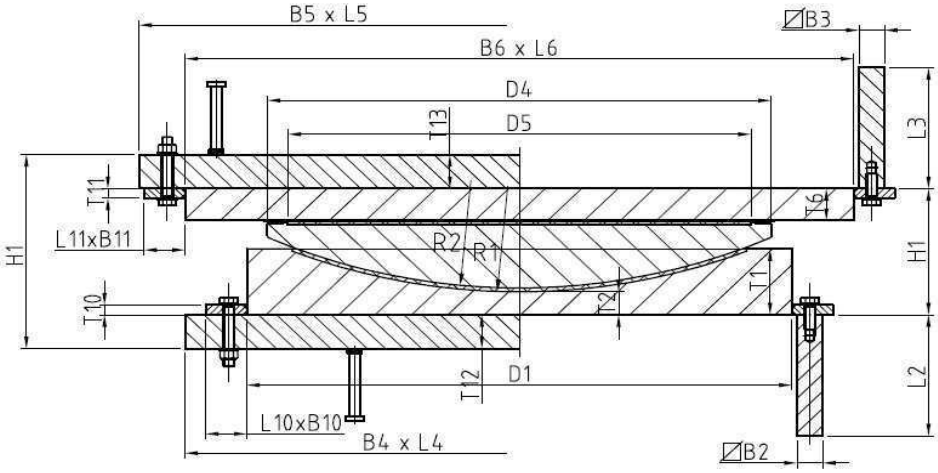
3 Steel stresses acc. to / *Stahlspannungen nach* EN 10025

$\sigma = f_{y,d} = f_{y,k} / (\gamma_m)$ $\gamma_m = 1.1$

Material	S355J2+N	S235JR	S355J2+N	S235JR
[mm]	$f_{y,d}$ [N/mm²]	$f_{y,d}$ [N/mm²]	$f_{y,k}$ [N/mm²]	$f_{y,k}$ [N/mm²]
<= 16	322.7	213.6	355	235
> 16 <= 40	313.6	204.5	345	225
> 40 <= 63	304.5	195.5	335	215
> 63 <= 80	295.5	195.5	325	215
> 80 <= 100	286.4	195.5	315	215
> 100 <= 150	268.2	177.3	295	195
> 150 <= 200	259.1	168.2	285	185
> 200 <= 250	250.0	159.1	275	175

4 Types of bearings and dimensions / *Lagertypen und Abmessungen*

4.1 Free sliding bearing / *allseitig bewegliches Lager* (KA)



4.2 Guided sliding bearing / *einachsig bewegliches Lager* (KE, KEQ)

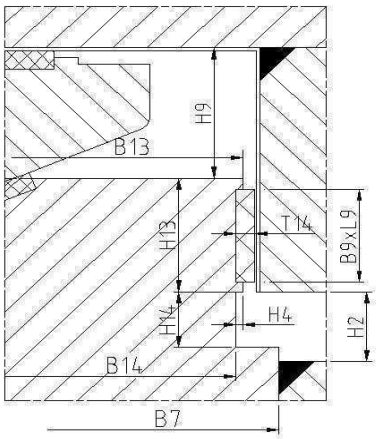
Note:

Beside the guide bars, the KE bearings are identical to the KA-bearing. The designation KE stands for longitudinal (x-axis), the designation KEQ stands for transversal (y-axis) movements.

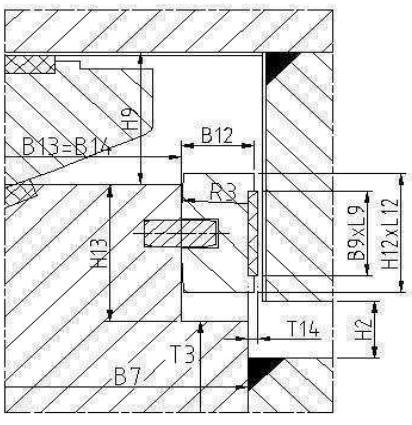
Hinweis:

Abgesehen von den Führungsleisten sind die KE/KEQ-Lager identisch mit den KA-Lagern. Die Bezeichnung KE steht für Längsbewegungen (x-Achse), KEQ für Querbewegungen (y-Achse).

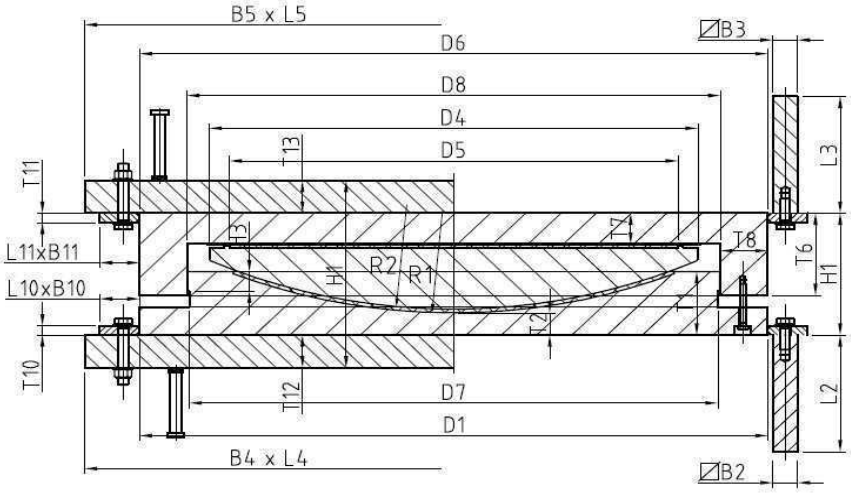
a) Without tilt bar / *ohne Kippleiste*



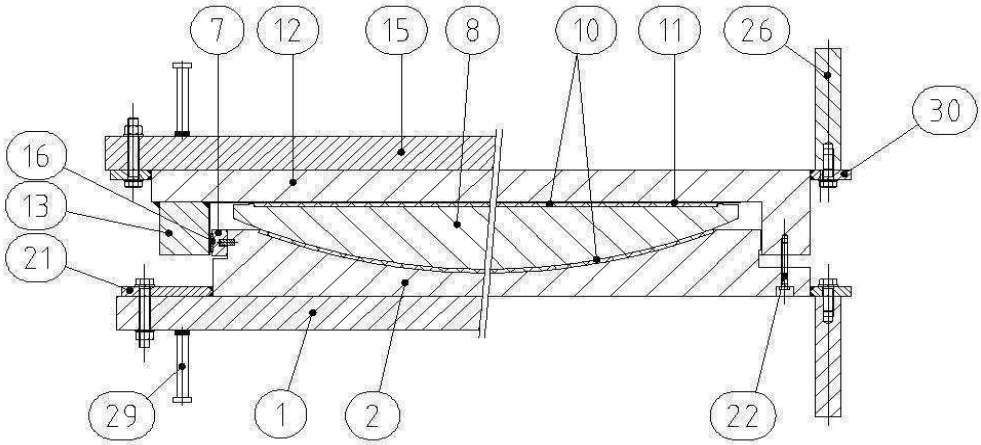
b) With tilt bar / *mit Kippleiste*



4.3 Fixed bearing / *Festes Lager* (KF)



5 Identification of the parts / *Bezeichnungen der Bauteile*



1	Lower anchor plate / *Untere Ankerplatte*	15	Upper anchor plate / *Obere Ankerplatte*
2	Lower part / *Unterteil*	16	Sliding strip / *Gleitstreifen*
7	Tilt bar / *Kippleiste*	21	Lug / *Lasche*
8	Calotte / *Kalotte*	22	Transportation fixation / *Transporthalterung*
10	Sliding disc / *Gleitscheibe*	26	Dowel / *Dollen*
11	Sliding sheet / *Gleitblech*	29	Shear stud / *Kopfbolzen*
12	Sliding plate / *Gleitplatte*	30	Lug / *Lasche*
13	Guide bar / *Führungsleiste*		

6 Summary of relevant Input Data & Results

Type of bearing/standard: ***Lagertyp/Norm:***	**KA3.7**	**(free sliding)**	**Standard:**	**ETA 08-0115**

6.1 Input data: Loads, movements and rotations / *Eingangsdaten: Lasten, Bewegungen und Verdrehungen*

acc. / *nach* ENV 1991

				Movement		Rotation	
$N_{Sd,max}$ =	3700 kN	$V_{xy\ Sd,max}$	74 kN	v_x=	± 100 mm	$\alpha_{y,max}$ =	0.04 [rad]
$N_{Sd,min}$ =	-800 kN	$V_{xy\ Sd,min}$ =	144.78478076	v_y=	± 20 mm	$\alpha_{x,max}$ =	0.01 [rad]

$N_{SGk,perm}$ = 1600 kN
$N_{SQk,perm}$ = 1042.9 kN

6.2 Dimensions of bearing / *Lagerabmessungen* [mm]

Lower part / *Unterteil*	D1=227	T1=45	T2=12.4	R1=213	θ=29.6
Calotte / *Kalotte*	D4=253	T4=55.6	R2=205	H6=5.4	
Sliding disc / *Gleitscheibe*	D5=215	T5=8	Material=ROBO®SLIDE		
Sliding sheet / *Gleitblech*	L1=465	B1=305	T9=1.5		
Sliding plate / *Gleitplatte*	L6=500	B6=340	T6=27		
Upper anchor plate / *Obere Ankerplatte*	L5=0	B5=0	T13=0		
Lower anchor plate / *Untere Ankerplatte*	L4=0	B4=463	T12=0		

Height: **112.5** [mm]
Weight: **92** [kg]

6.3 Proof of safety against sliding / *Nachweis Sicherheit gegen Gleiten*

Friction applicable / *Reibung ansetzbar*: No / *Nein*

Contact gap steel/steel up / *Kontaktfläche oben Stahl-Stahl:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 4 M16
Restliche Horizontalkraft aufnehmen durch:
Bolt quality 8.8, shear in thread
Schraubenqualität 8.8, Scherung im Gewindequerschnitt

Contact gap steel/steel down/ *Kontaktfläche unten Stahl-Stahl:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 4 M16
Restliche Horizontalkraft aufnehmen durch:
Bolt quality 8.8, shear in thread
Schraubenqualität 8.8, Scherung im Gewindequerschnitt

Contact gap bearing/anchor plate / *Kontaktfläche Lager/Ankerplatte:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 4 M16
Restliche Horizontalkraft aufnehmen durch:

6.4 Necessary space / *Benötigte Bauwerksabmessungen*

Superstructure length / *Länge Überbau* =	-	[mm]
Superstructure width / *Breite Überbau* =	-	[mm]
Substructure length / *Länge Fundament* =	-	[mm]
Substructure width / *Breite Fundament* =	-	[mm]

STATIC CALCULATION

Product: **RESTON®SPHERICAL Bearings**
Type KA (free sliding)
Standard: ETA 08-0115

Project name: **Messina Strait Bridge**
Client name: Eurolink
Order No.: OF-L-11082

Rev.	Date	Status	Prepared	Checked	Approved
05					
04					
03					
02					
01					
00	02.11.2010	Static assessment	OM	BU	NM

Prepared by:

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mageba	**RESTON®SPHERICAL Bearings** Static calculation acc. to ETA 08-0115	Prepared: OM Checked: MT Approved: NM	Revision: 00 Date: 02.11.2010
Project name:	**Messina Strait Bridge**	Order-No.:	OF-L-11082
Location of bearing:	A5	Drawing-No.:	KA25-1-IT-OF-L-11082

1 General Data / *Allgemeine Daten*

Project / *Objekt*	Messina Strait Bridge
Client / *Kunde*	Eurolink
Issued / *Erstellt am*	02.11.2010
Project no. / *Auftragsnummer*	OF-L-11082
Project manager / *Projektleiter*	NM
Static engineer mageba / *Statiker*	OM
Drawing no. / *Zeichnungsnummer*	KA25-1-IT-OF-L-11082
Sheet no. / *Blattnummer*	5

Type of bearing / *Lagertyp*	KA
Size of bearing / *Lagerbezeichnung*	25
Location / *Einbauort*	A5
Number of bearings / *Anzahl Lager*	0
Country / *Land (ISO-Code)*	IT
Standard / *Norm/Zulassung*	ETA 08-0115

2 Input Data / *Eingangsdaten*

Load combination A	$N_{Sd,max}$	=	25'000	Distribution angle/*Ausbreitungswinkel* [°]	α	=	60
(Design) [kN]	$V_{xy\ Sd,max}$	=	---	Anchor plate/*Ankerplatte* [j/n]	upper	=	n
Load combination B	$N_{Sd,min}$	=	-8'000		lower	=	n
(Design) [kN]	$V_{xy\ Sd,min}$	=	---				---
Load combination C	$N_{Gk,perm}$	=	14'000	Concrete quality/*Betongüte*	upper	=	Stahl
(Design) [kN]	$N_{Qk,perm}$	=	3'857		$B_{o,x}$	≥	-
					$B_{o,y}$	≥	-
Movement ± [mm]	v_x	= ±	2'000		lower	=	Stahl
Bewegung ± [mm]	v_y	= ±	20		$B_{o,x}$	≥	-
					$B_{o,y}$	≥	-
Rotation [rad]	α_y	=	0.025	Shim plate/*Futterplatte*	upper	=	n
Verdrehung [rad]	α_x	=	0.010		lower	=	n
				Friction applicable/*Reibung ansetzbar*			n
					μ_k steel	=	0
					μ_k concrete	=	0
				Dowel/Dollen [j/n]	upper	=	n
					lower	=	n
				Shear stud [j/n]	upper	=	n
					lower	=	n
				Bellows [j/n]			n

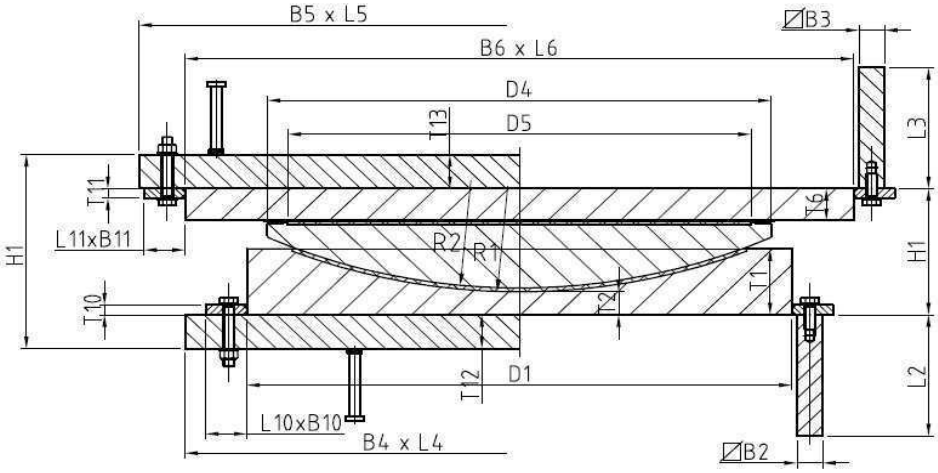
3 Steel stresses acc. to / *Stahlspannungen nach* EN 10025

$\sigma = f_{y,d} = f_{y,k} / (\gamma_m)$ $\gamma_m = 1.1$

Material	S355J2+N	S235JR	S355J2+N	S235JR
[mm]	$f_{y,d}$ [N/mm²]	$f_{y,d}$ [N/mm²]	$f_{y,k}$ [N/mm²]	$f_{y,k}$ [N/mm²]
<= 16	322.7	213.6	355	235
> 16 <= 40	313.6	204.5	345	225
> 40 <= 63	304.5	195.5	335	215
> 63 <= 80	295.5	195.5	325	215
> 80 <= 100	286.4	195.5	315	215
> 100 <= 150	268.2	177.3	295	195
> 150 <= 200	259.1	168.2	285	185
> 200 <= 250	250.0	159.1	275	175

4 Types of bearings and dimensions / *Lagertypen und Abmessungen*

4.1 Free sliding bearing / *allseitig bewegliches Lager* (KA)



4.2 Guided sliding bearing / *einachsig bewegliches Lager* (KE, KEQ)

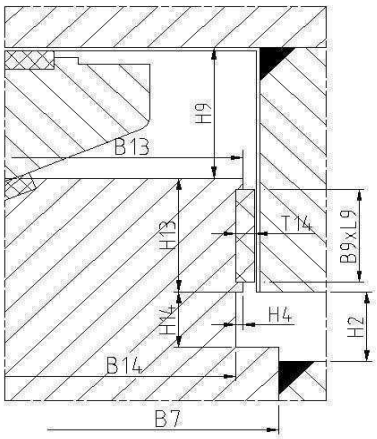
Note:

Beside the guide bars, the KE bearings are identical to the KA-bearing. The designation KE stands for longitudinal (x-axis), the designation KEQ stands for transversal (y-axis) movements.

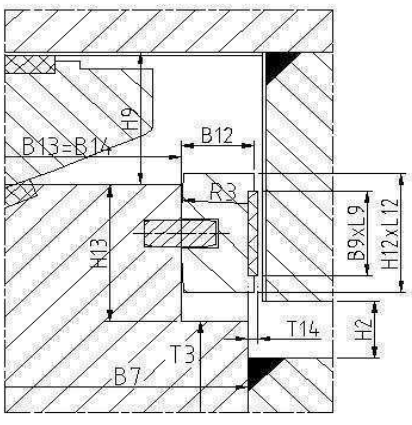
Hinweis:

Abgesehen von den Führungsleisten sind die KE/KEQ-Lager identisch mit den KA-Lagern. Die Bezeichnung KE steht für Längsbewegungen (x-Achse), KEQ für Querbewegungen (y-Achse).

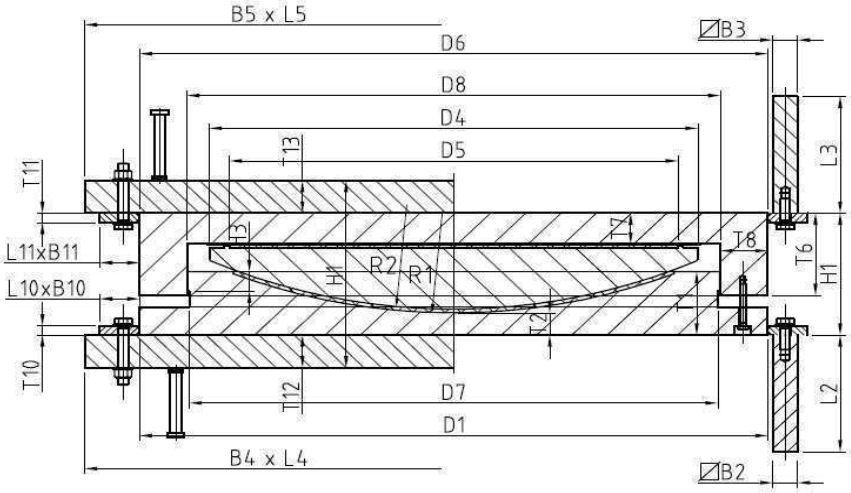
a) Without tilt bar / *ohne Kippleiste*



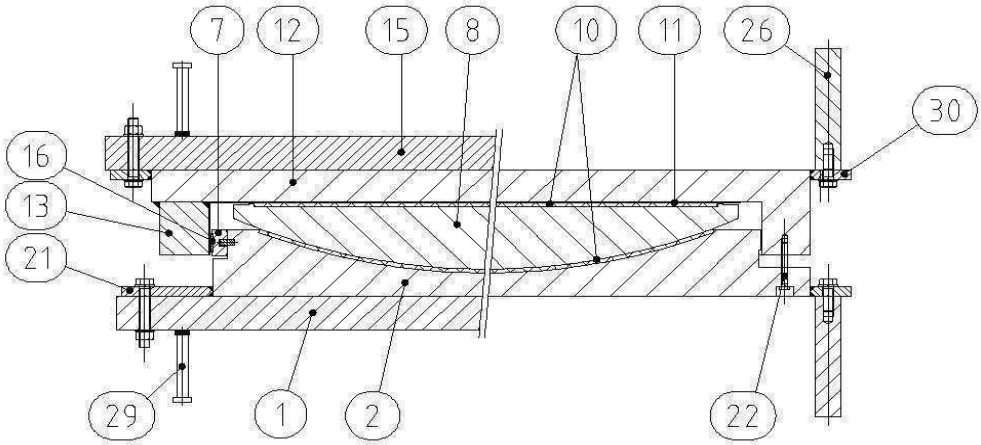
b) With tilt bar / *mit Kippleiste*



4.3 Fixed bearing / *Festes Lager* (KF)



5 Identification of the parts / *Bezeichnungen der Bauteile*



1	Lower anchor plate / *Untere Ankerplatte*	15	Upper anchor plate / *Obere Ankerplatte*
2	Lower part / *Unterteil*	16	Sliding strip / *Gleitstreifen*
7	Tilt bar / *Kippleiste*	21	Lug / *Lasche*
8	Calotte / *Kalotte*	22	Transportation fixation / *Transporthalterung*
10	Sliding disc / *Gleitscheibe*	26	Dowel / *Dollen*
11	Sliding sheet / *Gleitblech*	29	Shear stud / *Kopfbolzen*
12	Sliding plate / *Gleitplatte*	30	Lug / *Lasche*
13	Guide bar / *Führungsleiste*		

6 Summary of relevant Input Data & Results

Type of bearing/standard: ***Lagertyp/Norm:***	**KA25**	**(free sliding)**	**Standard:**	**ETA 08-0115**

6.1 Input data: Loads, movements and rotations / *Eingangsdaten: Lasten, Bewegungen und Verdrehungen*

acc. / *nach* ENV 1991

				Movement		Rotation	
$N_{Sd,max}$ =	25000 kN	$V_{xy\ Sd,max}$	500 kN	v_x=	± 2000 mm	$\alpha_{y,max}$ =	0.025 [rad]
$N_{Sd,min}$ =	-8000 kN	$V_{xy\ Sd,min}$ =	609.43329644(	v_y=	± 20 mm	$\alpha_{x,max}$ =	0.01 [rad]

$N_{sGk,perm}$ = 14000 kN
$N_{sQk,perm}$ = 3857.1 kN

6.2 Dimensions of bearing / *Lagerabmessungen* [mm]

Lower part / *Unterteil*	D1=552	T1=81	T2=11.2	R1=583	θ=27.3
Calotte / *Kalotte*	D4=590	T4=91.7	R2=575	H6=5.3	
Sliding disc / *Gleitscheibe*	D5=550	T5=8	Material=ROBO®SLIDE		
Sliding sheet / *Gleitblech*	L1=4600	B1=640	T9=1.5		
Sliding plate / *Gleitplatte*	L6=4630	B6=670	T6=195		
Upper anchor plate / *Obere Ankerplatte*	L5=0	B5=0	T13=0		
Lower anchor plate / *Untere Ankerplatte*	L4=0	B4=788	T12=0		

Height: **315.4** [mm]
Weight: **5142** [kg]

6.3 Proof of safety against sliding / *Nachweis Sicherheit gegen Gleiten*

Friction applicable / *Reibung ansetzbar*: No / *Nein*

Contact gap steel/steel up / *Kontaktfläche oben Stahl-Stahl:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 4 M24
Restliche Horizontalkraft aufnehmen durch:
Bolt quality 8.8, shear in thread
Schraubenqualität 8.8, Scherung im Gewindequerschnitt

Contact gap steel/steel down/ *Kontaktfläche unten Stahl-Stahl:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 4 M27
Restliche Horizontalkraft aufnehmen durch:
Bolt quality 8.8, shear in thread
Schraubenqualität 8.8, Scherung im Gewindequerschnitt

Contact gap bearing/anchor plate / *Kontaktfläche Lager/Ankerplatte:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 4 M24
Restliche Horizontalkraft aufnehmen durch:

6.4 Necessary space / *Benötigte Bauwerksabmessungen*

Superstructure length / *Länge Überbau* =	-	[mm]
Superstructure width / *Breite Überbau* =	-	[mm]
Substructure length / *Länge Fundament* =	-	[mm]
Substructure width / *Breite Fundament* =	-	[mm]

STATIC CALCULATION

Product: **RESTON®SPHERICAL Bearings**
Type KA (free sliding)
Standard: ETA 08-0115

Project name: **Messina Strait Bridge**
Client name: Eurolink
Order No.: OF-L-11082

Rev.	Date	Status	Prepared	Checked	Approved
05					
04					
03					
02					
01					
00	02.11.2010	Static assessment	OM	BU	NM

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mageba	**RESTON®SPHERICAL Bearings** Static calculation acc. to ETA 08-0115	Prepared: OM Checked: MT Approved: NM	Revision: 00 Date: 02.11.2010
Project name:	**Messina Strait Bridge**	Order-No.:	OF-L-11082
Location of bearing:	A6	Drawing-No.:	KA84.8-1-IT-OF-L-11082

1 General Data / *Allgemeine Daten*

Project / *Objekt*	Messina Strait Bridge
Client / *Kunde*	Eurolink
Issued / *Erstellt am*	02.11.2010
Project no. / *Auftragsnummer*	OF-L-11082
Project manager / *Projektleiter*	NM
Static engineer mageba / *Statiker*	OM
Drawing no. / *Zeichnungsnummer*	KA84.8-1-IT-OF-L-11082
Sheet no. / *Blattnummer*	6

Type of bearing / *Lagertyp*	KA
Size of bearing / *Lagerbezeichnung*	84.8
Location / *Einbauort*	A6
Number of bearings / *Anzahl Lager*	0
Country / *Land (ISO-Code)*	IT
Standard / *Norm/Zulassung*	ETA 08-0115

2 Input Data / *Eingangsdaten*

Load combination A	$N_{Sd,max}$	=	84'800	Distribution angle/*Ausbreitungswinkel* [°]	α	=	60
(Design) [kN]	$V_{xy\ Sd,max}$	=	---	Anchor plate/*Ankerplatte* [j/n]	upper	=	n
Load combination B	$N_{Sd,min}$	=	0		lower	=	j
(Design) [kN]	$V_{xy\ Sd,min}$	=	---				---
Load combination C	$N_{Gk,perm}$	=	36'343	Concrete quality/*Betongüte*	upper	=	Stahl
(Design) [kN]	$N_{Qk,perm}$	=	24'229		$B_{o,x}$	≥	-
					$B_{o,y}$	≥	-
Movement ± [mm]	v_x	= ±	600		lower	=	C60/75
Bewegung ± [mm]	v_y	= ±	20		$B_{o,x}$	≥	0
					$B_{o,y}$	≥	0
Rotation [rad]	α_y	=	0.015	Shim plate/*Futterplatte*	upper	=	n
Verdrehung [rad]	α_x	=	0.010		lower	=	n
				Friction applicable/*Reibung ansetzbar*			n
					μ_k steel	=	0
					μ_k concrete	=	0
				Dowel/Dollen [j/n]	upper	=	n
					lower	=	n
				Shear stud [j/n]	upper	=	n
					lower	=	j
				Bellows [j/n]			n

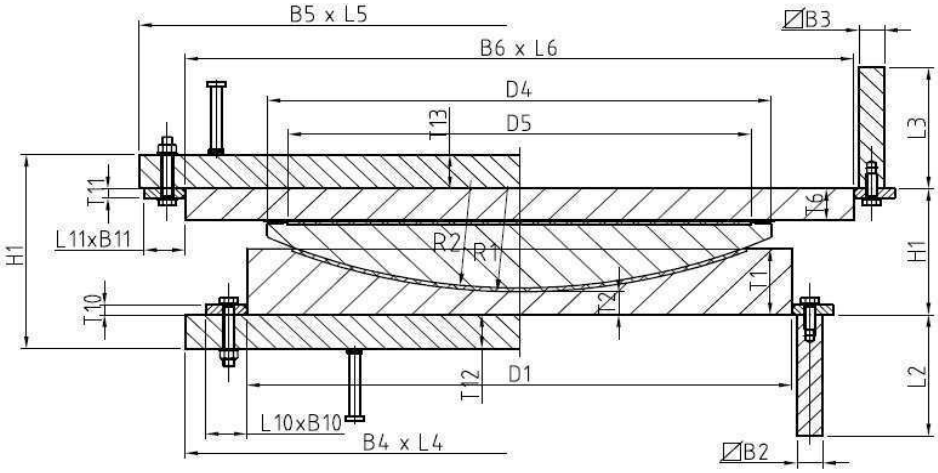
3 Steel stresses acc. to / *Stahlspannungen nach* EN 10025

$\sigma = f_{y,d} = f_{y,k} / (\gamma_m)$ $\quad \gamma_m = 1.1$

Material	S355J2+N	S235JR	S355J2+N	S235JR
[mm]	$f_{y,d}$ [N/mm^2]	$f_{y,d}$ [N/mm^2]	$f_{y,k}$ [N/mm^2]	$f_{y,k}$ [N/mm^2]
<= 16	322.7	213.6	355	235
> 16 <= 40	313.6	204.5	345	225
> 40 <= 63	304.5	195.5	335	215
> 63 <= 80	295.5	195.5	325	215
> 80 <= 100	286.4	195.5	315	215
> 100 <= 150	268.2	177.3	295	195
> 150 <= 200	259.1	168.2	285	185
> 200 <= 250	250.0	159.1	275	175

4 Types of bearings and dimensions / *Lagertypen und Abmessungen*

4.1 Free sliding bearing / *allseitig bewegliches Lager* (KA)



4.2 Guided sliding bearing / *einachsig bewegliches Lager* (KE, KEQ)

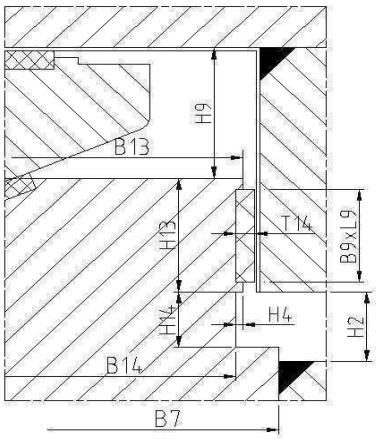
Note:

Beside the guide bars, the KE bearings are identical to the KA-bearing. The designation KE stands for longitudinal (x-axis), the designation KEQ stands for transversal (y-axis) movements.

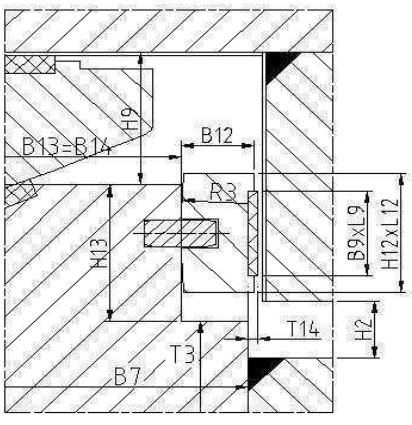
Hinweis:

Abgesehen von den Führungsleisten sind die KE/KEQ-Lager identisch mit den KA-Lagern. Die Bezeichnung KE steht für Längsbewegungen (x-Achse), KEQ für Querbewegungen (y-Achse).

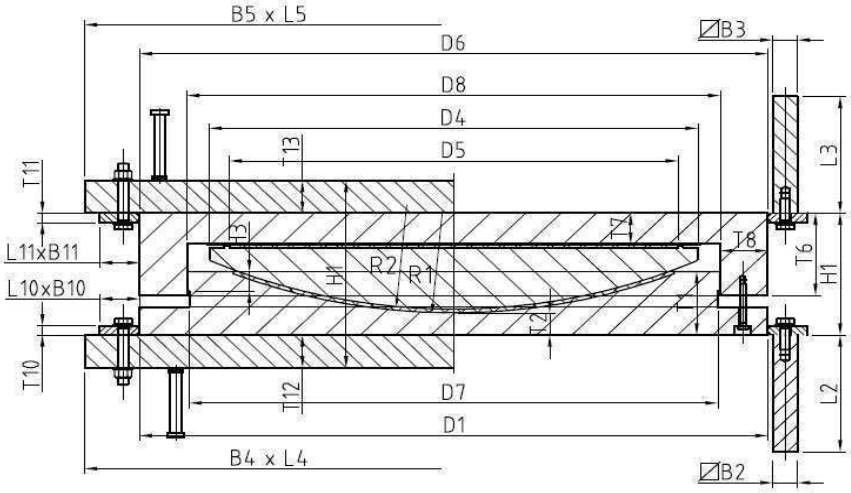
a) Without tilt bar / *ohne Kippleiste*



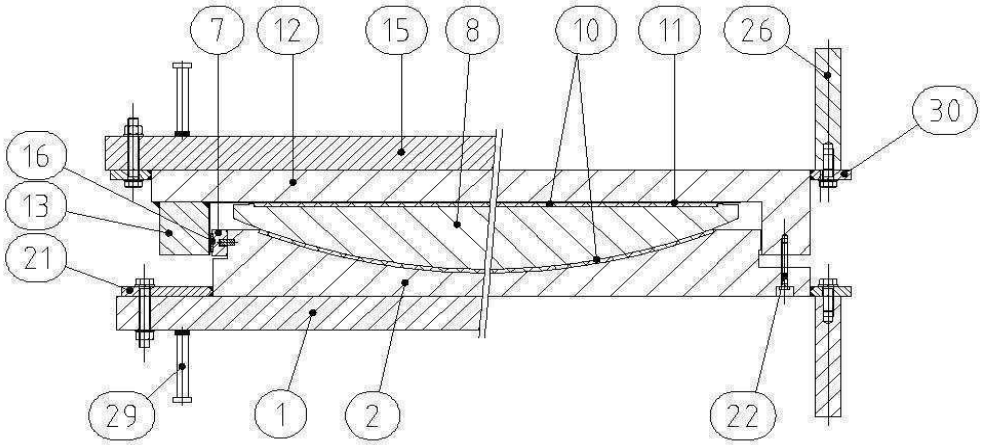
b) With tilt bar / *mit Kippleiste*



4.3 Fixed bearing / *Festes Lager* (KF)



5 Identification of the parts / *Bezeichnungen der Bauteile*



1	Lower anchor plate / *Untere Ankerplatte*	15	Upper anchor plate / *Obere Ankerplatte*
2	Lower part / *Unterteil*	16	Sliding strip / *Gleitstreifen*
7	Tilt bar / *Kippleiste*	21	Lug / *Lasche*
8	Calotte / *Kalotte*	22	Transportation fixation / *Transporthalterung*
10	Sliding disc / *Gleitscheibe*	26	Dowel / *Dollen*
11	Sliding sheet / *Gleitblech*	29	Shear stud / *Kopfbolzen*
12	Sliding plate / *Gleitplatte*	30	Lug / *Lasche*
13	Guide bar / *Führungsleiste*		

6 Summary of relevant Input Data & Results

Type of bearing/standard: ***Lagertyp/Norm:***	**KA84.8**	**(free sliding)**	**Standard:**	**ETA 08-0115**

6.1 Input data: Loads, movements and rotations / *Eingangsdaten: Lasten, Bewegungen und Verdrehungen*

acc. / *nach* ENV 1991		Movement	Rotation	
$N_{Sd,max}$ = 84800 kN	$V_{xy\ Sd,max}$ 1696 kN	v_x= ± 600 mm	$\alpha_{y,max}$ =	0.015 [rad]
$N_{Sd,min}$ = 0 kN	$V_{xy\ Sd,min}$ = 0 kN	v_y= ± 20 mm	$\alpha_{x,max}$ =	0.01 [rad]

$N_{sGk,perm}$ = 36342.9 kN
$N_{sQk,perm}$ = 24228.6 kN

6.2 Dimensions of bearing / *Lagerabmessungen* [mm]

Lower part / *Unterteil*	D1=995	T1=126	T2=10.6	R1=1128 θ=25.6
Calotte / *Kalotte*	D4=1035	T4=139.8	R2=1120	H6=5.2
Sliding disc / *Gleitscheibe*	D5=1000	T5=8	Material=ROBO®SLIDE	
Sliding sheet / *Gleitblech*	L1=2250	B1=1090	T9=1.5	
Sliding plate / *Gleitplatte*	L6=2280	B6=1120	T6=105	
Upper anchor plate / *Obere Ankerplatte*	L5=0	B5=0	T13=0	
Lower anchor plate / *Untere Ankerplatte*	L4=1100	B4=1115	T12=55	

Height: **327.9** [mm]
Weight: **3842** [kg]

6.3 Proof of safety against sliding / *Nachweis Sicherheit gegen Gleiten*

Friction applicable / *Reibung ansetzbar*: No / *Nein*

Contact gap steel/steel up / *Kontaktfläche oben Stahl-Stahl:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 4 M36
Restliche Horizontalkraft aufnehmen durch:
Bolt quality 8.8, shear in thread
Schraubenqualität 8.8, Scherung im Gewindequerschnitt

Contact gap steel/concrete down/ *Kontaktfläche unten Stahl-Beton:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 25 D=22 x 150
Restliche Horizontalkraft aufnehmen durch:

Contact gap bearing/anchor plate / *Kontaktfläche Lager/Ankerplatte:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 4 M36
Restliche Horizontalkraft aufnehmen durch:
Bolt quality 10.9, shear in shaft
Schraubenqualität 10.9, Scherung im Schaftquerschnitt

6.4 Necessary space / *Benötigte Bauwerksabmessungen*

Superstructure length / *Länge Überbau* = - [mm]
Superstructure width / *Breite Überbau* = - [mm]

Substructure length / *Länge Fundament* = 0 [mm]
Substructure width / *Breite Fundament* = 0 [mm]

STATIC CALCULATION

Product: **RESTON®SPHERICAL Bearings**
Type KA (free sliding)
Standard: ETA 08-0115

Project name: **Messina Strait Bridge**
Client name: Eurolink
Order No.: OF-L-11082

Rev.	Date	Status	Prepared	Checked	Approved
05					
04					
03					
02					
01					
00	02.11.2010	Static assessment	OM	BU	NM

Prepared by: **mageba sa**
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TABLE OF CONTENT

mageba	**RESTON®SPHERICAL Bearings** Static calculation acc. to ETA 08-0115	Prepared: OM Checked: MT Approved: NM	Revision: 00 Date: 02.11.2010
Project name:	**Messina Strait Bridge**	Order-No.:	OF-L-11082
Location of bearing:	A7	Drawing-No.:	KA91-1-IT-OF-L-11082

1 General Data / *Allgemeine Daten*

Project / *Objekt*	Messina Strait Bridge
Client / *Kunde*	Eurolink
Issued / *Erstellt am*	02.11.2010
Project no. / *Auftragsnummer*	OF-L-11082
Project manager / *Projektleiter*	NM
Static engineer mageba / *Statiker*	OM
Drawing no. / *Zeichnungsnummer*	KA91-1-IT-OF-L-11082
Sheet no. / *Blattnummer*	7

Type of bearing / *Lagertyp*	KA
Size of bearing / *Lagerbezeichnung*	91
Location / *Einbauort*	A7
Number of bearings / *Anzahl Lager*	0
Country / *Land (ISO-Code)*	IT
Standard / *Norm/Zulassung*	ETA 08-0115

2 Input Data / *Eingangsdaten*

Load combination A	$N_{Sd,max}$	=	91'000	Distribution angle/*Ausbreitungswinkel* [°]	α	=	60
(Design) [kN]	$V_{xy\ Sd,max}$	=	---	Anchor plate/*Ankerplatte* [j/n]	upper	=	n
Load combination B	$N_{Sd,min}$	=	0		lower	=	j
(Design) [kN]	$V_{xy\ Sd,min}$	=	---				---
Load combination C	$N_{Gk,perm}$	=	39'500	Concrete quality/*Betongüte*	upper	=	Stahl
(Design) [kN]	$N_{Qk,perm}$	=	25'500		$B_{o,x}$	≥	-
					$B_{o,y}$	≥	-
Movement ± [mm]	v_x	= ±	600		lower	=	C60/75
Bewegung ± [mm]	v_y	= ±	20		$B_{o,x}$	≥	0
					$B_{o,y}$	≥	0
Rotation [rad]	α_y	=	0.015	Shim plate/*Futterplatte*	upper	=	n
Verdrehung [rad]	α_x	=	0.010		lower	=	n
				Friction applicable/*Reibung ansetzbar*			n
					μ_k steel	=	0
					μ_k concrete	=	0
				Dowel/Dollen [j/n]	upper	=	n
					lower	=	n
				Shear stud [j/n]	upper	=	n
					lower	=	j
				Bellows [j/n]			n

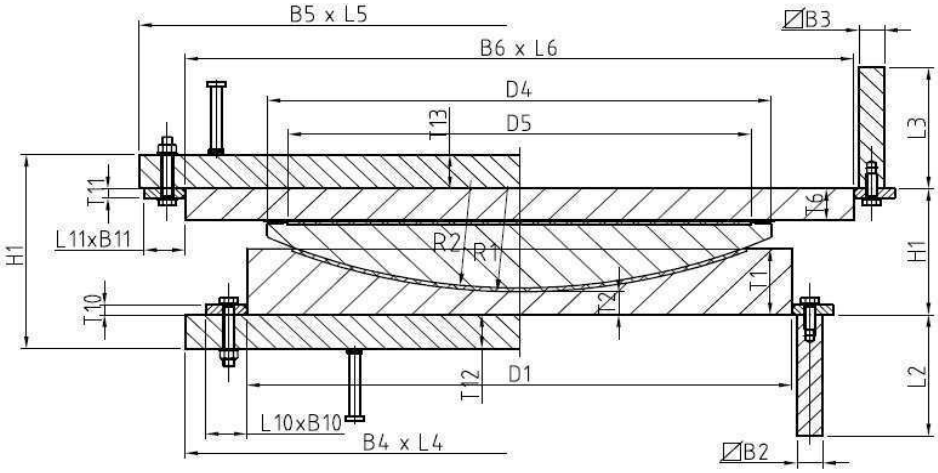
3 Steel stresses acc. to / *Stahlspannungen nach* EN 10025

$\sigma = f_{y,d} = f_{y,k} / (\gamma_m)$ $\gamma_m = 1.1$

Material	S355J2+N	S235JR	S355J2+N	S235JR
[mm]	$f_{y,d}$ [N/mm²]	$f_{y,d}$ [N/mm²]	$f_{y,k}$ [N/mm²]	$f_{y,k}$ [N/mm²]
<= 16	322.7	213.6	355	235
> 16 <= 40	313.6	204.5	345	225
> 40 <= 63	304.5	195.5	335	215
> 63 <= 80	295.5	195.5	325	215
> 80 <= 100	286.4	195.5	315	215
> 100 <= 150	268.2	177.3	295	195
> 150 <= 200	259.1	168.2	285	185
> 200 <= 250	250.0	159.1	275	175

4 Types of bearings and dimensions / *Lagertypen und Abmessungen*

4.1 Free sliding bearing / *allseitig bewegliches Lager* (KA)



4.2 Guided sliding bearing / *einachsig bewegliches Lager* (KE, KEQ)

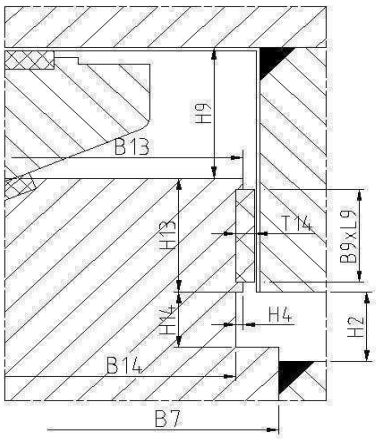
Note:

Beside the guide bars, the KE bearings are identical to the KA-bearing. The designation KE stands for longitudinal (x-axis), the designation KEQ stands for transversal (y-axis) movements.

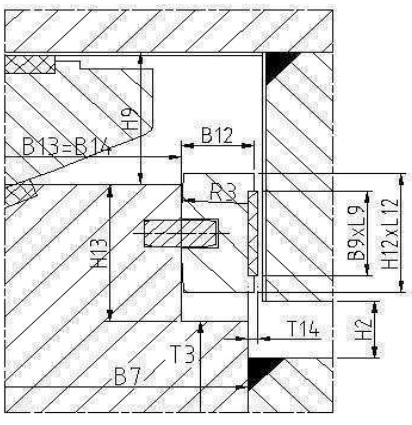
Hinweis:

Abgesehen von den Führungsleisten sind die KE/KEQ-Lager identisch mit den KA-Lagern. Die Bezeichnung KE steht für Längsbewegungen (x-Achse), KEQ für Querbewegungen (y-Achse).

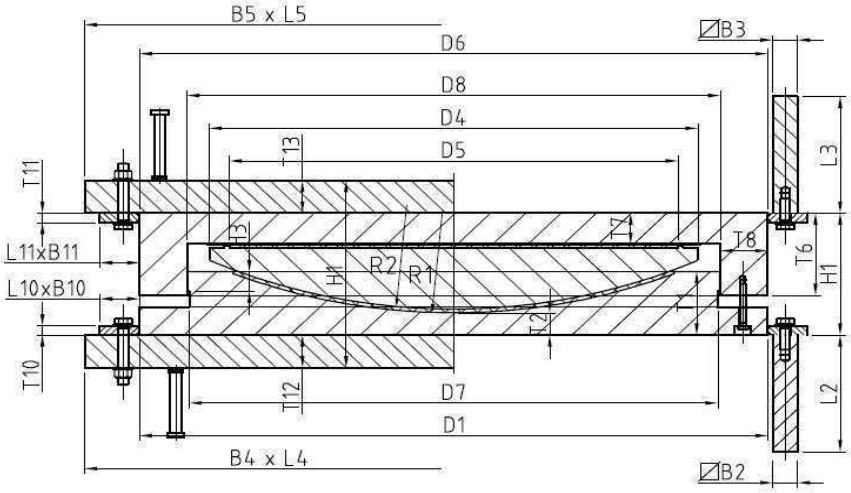
a) Without tilt bar / *ohne Kippleiste*



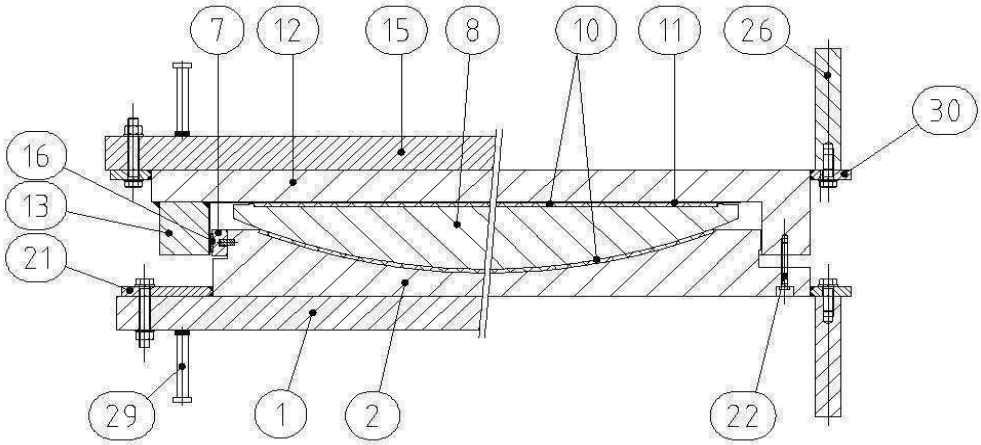
b) With tilt bar / *mit Kippleiste*



4.3 Fixed bearing / *Festes Lager* (KF)



5 Identification of the parts / *Bezeichnungen der Bauteile*



1	Lower anchor plate / *Untere Ankerplatte*	15	Upper anchor plate / *Obere Ankerplatte*
2	Lower part / *Unterteil*	16	Sliding strip / *Gleitstreifen*
7	Tilt bar / *Kippleiste*	21	Lug / *Lasche*
8	Calotte / *Kalotte*	22	Transportation fixation / *Transporthalterung*
10	Sliding disc / *Gleitscheibe*	26	Dowel / *Dollen*
11	Sliding sheet / *Gleitblech*	29	Shear stud / *Kopfbolzen*
12	Sliding plate / *Gleitplatte*	30	Lug / *Lasche*
13	Guide bar / *Führungsleiste*		

6 Summary of relevant Input Data & Results

Type of bearing/standard: ***Lagertyp/Norm:***	**KA91**	**(free sliding)**	**Standard:**	**ETA 08-0115**

6.1 Input data: Loads, movements and rotations / *Eingangsdaten: Lasten, Bewegungen und Verdrehungen*

acc. / *nach* ENV 1991

				Movement		Rotation	
$N_{Sd,max}$ =	91000 kN	$V_{xy\ Sd,max}$	1820 kN	v_x=	± 600 mm	$\alpha_{y,max}$ =	0.015 [rad]
$N_{Sd,min}$ =	0 kN	$V_{xy\ Sd,min}$ =	0 kN	v_y=	± 20 mm	$\alpha_{x,max}$ =	0.01 [rad]

$N_{sGk,perm}$ = 39500 kN
$N_{sQk,perm}$ = 25500 kN

6.2 Dimensions of bearing / *Lagerabmessungen* [mm]

Lower part / *Unterteil*	D1=1039	T1=126	T2=11.5	R1=1243	θ=24.3
Calotte / *Kalotte*	D4=1085	T4=139.8	R2=1235	H6=5.2	
Sliding disc / *Gleitscheibe*	D5=1045	T5=8	Material=ROBO®SLIDE		
Sliding sheet / *Gleitblech*	L1=2295	B1=1135	T9=1.5		
Sliding plate / *Gleitplatte*	L6=2330	B6=1170	T6=105		
Upper anchor plate / *Obere Ankerplatte*	L5=0	B5=0	T13=0		
Lower anchor plate / *Untere Ankerplatte*	L4=1150	B4=1165	T12=37		

Height: **310.8** [mm]
Weight: **3951** [kg]

6.3 Proof of safety against sliding / *Nachweis Sicherheit gegen Gleiten*

Friction applicable / *Reibung ansetzbar*: No / *Nein*

Contact gap steel/steel up / *Kontaktfläche oben Stahl-Stahl:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 4 M36
Restliche Horizontalkraft aufnehmen durch:
Bolt quality 8.8, shear in thread
Schraubenqualität 8.8, Scherung im Gewindequerschnitt

Contact gap steel/concrete down/ *Kontaktfläche unten Stahl-Beton:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 25 D=22 x 150
Restliche Horizontalkraft aufnehmen durch:

Contact gap bearing/anchor plate / *Kontaktfläche Lager/Ankerplatte:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 4 M36
Restliche Horizontalkraft aufnehmen durch:
Bolt quality 10.9, shear in shaft
Schraubenqualität 10.9, Scherung im Schaftquerschnitt

6.4 Necessary space / *Benötigte Bauwerksabmessungen*

Superstructure length / *Länge Überbau* = - [mm]
Superstructure width / *Breite Überbau* = - [mm]

Substructure length / *Länge Fundament* = 0 [mm]
Substructure width / *Breite Fundament* = 0 [mm]

mageba Switzerland www.mageba.ch	**Static calculation acc. to ETA-08/0115 and EN1337** **Project / *Objekt*:** Messina Strait **Structural member / *Bauteil*:** F 12 **Location / *Einbauort*:** A8	

A: DIMENSIONING PARAMETER / *EINGANGSPARAMETER*

1. General Data / *Allgemeine Daten*

Project / *Objekt*	Messina Strait
Client / *Kunde*	Eurolink
Issued / *Erstellt am*	02.11.2010
Project no. / *Auftragsnummer*	VO11082
Project manager mageba / *Projektleiter*	NM
Static engineer mageba / *Statiker*	OM
Drawing no. / *Zeichnungsnummer*	F12-1-IT-VO11082
Sheet no. / *Blattnummer*	8

Type of bearing / *Lagertyp*	F
Size of bearing / *Lagerbezeichnung*	12
Location / *Einbauort*	A8
Number of bearing / *Anzahl Lager*	1
Country / *Land (ISO-Code)*	IT
Standard / *Norm/Zulassung*	EN1337/ETA 08-0115

2. Input Data / *Eingangsdaten*

2.1 Loads / *Lasten (Design - Niveau)*:

$V_{ysd,max}$ = 12'000 [kN]

Movements / *Verschiebungen:*

vx= ± 2'000 [mm]

Rotations / *Verdrehungen:*

αy= 0.025 [rad]

αx= 0.010 [rad]

2.2 Connecting material and dimensions / *Anschlussmaterial und Abmessungen*:

Superstructure / *obere Lagerseite:*

Concrete quality / *Betongüte* = Stahl

$B_{o,x}$ = - [mm]

$B_{o,y}$ = - [mm]

Substructure / *untere Lagerseite*:

Concrete quality / *Betongüte* = Stahl

$B_{u,x}$ = - [mm]

$B_{u,y}$ = - [mm]

2.3 Anchoring / *Verankerung*:

Upper anchor plate / *Ankerplatte oben*: No / *Nein*

Upper connection / *Anschluss oben*: Bolt / *Schrauben*

Lower anchor plate / *Ankerplatte unten*: No / *Nein*

Lower connection / *Anschluss unten*: Bolt / *Schrauben*

B: DIMENSIONING RESULTS / *RESULTAT DER LAGERBEMESSUNG*

Bearing height/weight / *Lagerhöhe/Lagergewicht:*

Height / *Höhe* H1 =	388.0	[mm]
Weight / *Gewicht* G =	12'359	[kg]

Dimensions sliding plate / *Abmessungen Gleitplatte*:

Length x Width / *Länge x Breite* L6 x B6 =	5660 x 840	[mm]
Thickness / *Dicke* T6 =	155	[mm]

Dimensions sliding sheet / *Abmessungen Gleitblech*:

Length / *Länge* L1 =	5620	[mm]
Stretched width / *Abwicklung* B1 =	806	[mm]
Thickness / *Dicke* T9 =	1.5	[mm]

Dimensions lower part / *Abmessungen Lagerunterteil*:

Length x Width / *Länge x Breite* L7 x B7 =	1590 x 490	[mm]
Height / *Höhe* T1 =	218.0	[mm]

Lower plate / *Lagerplatte unten*:

Length x Width / *Länge x Breite* L x B =	1690 x 840	[mm]
Thickness / *Dicke* T =	240	[mm]

Dimensions sliding strip / *Abmessungen Gleitstreifen*:

Length / *Länge* L9 =	1570.0	[mm]
Width / *Breite* B9 =	60.0	[mm]
Thickness / *Dicke* T14 =	8.0	[mm]

Dimensions guide bars / *Abmessungen Führungsleisten*:

Length x Width / *Länge x Breite* L8 x B8 =	5640 x 110	[mm]
Height / *Höhe* H8 =	155.0	[mm]
Weld seam / *Schweissnaht* =	40.0	[mm]

Upper anchor plate / *Ankerplatte oben*:

Length x Width / *Länge x Breite* L5 x B5 =	0 x 0	[mm]
Thickness / *Dicke* T13 =	0	[mm]

Lower anchor plate / *Ankerplatte unten*:

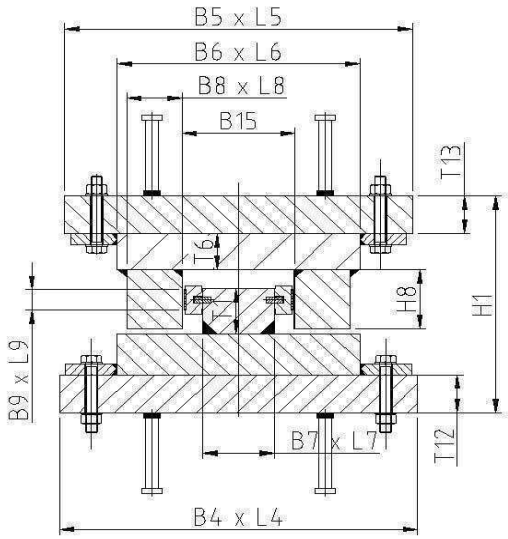
Length x Width / *Länge x Breite* L4 x B4 =	0 x 0	[mm]
Thickness / *Dicke* T12 =	0	[mm]

Upper connection / *Anschluss oben*:

Bolt /	*Schrauben*	26 x M36

Lower connection / *Anschluss unten*:

Bolt /	*Schrauben*	26 x M36



STATIC CALCULATION

Product: **RESTON®SPHERICAL Bearings**
Type KA (free sliding)
Standard: ETA 08-0115

Project name: **Messina Strait Bridge**
Client name: Eurolink
Order No.: OF-L-11082

Rev.	Date	Status	Prepared	Checked	Approved
05					
04					
03					
02					
01					
00	02.11.2010	Static assessment	OM	BU	NM

Prepared by:

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TABLE OF CONTENT

mageba	**RESTON®SPHERICAL Bearings** Static calculation acc. to ETA 08-0115	Prepared: OM Checked: MT Approved: NM	Revision: 00 Date: 02.11.2010
Project name:	**Messina Strait Bridge**	Order-No.:	OF-L-11082
Location of bearing:	A9	Drawing-No.:	KA13-1-IT-OF-L-11082

1 General Data / *Allgemeine Daten*

Project / *Objekt*	Messina Strait Bridge
Client / *Kunde*	Eurolink
Issued / *Erstellt am*	02.11.2010
Project no. / *Auftragsnummer*	OF-L-11082
Project manager / *Projektleiter*	NM
Static engineer mageba / *Statiker*	OM
Drawing no. / *Zeichnungsnummer*	KA13-1-IT-OF-L-11082
Sheet no. / *Blattnummer*	9

Type of bearing / *Lagertyp*	KA
Size of bearing / *Lagerbezeichnung*	13
Location / *Einbauort*	A9
Number of bearings / *Anzahl Lager*	0
Country / *Land (ISO-Code)*	IT
Standard / *Norm/Zulassung*	ETA 08-0115

2 Input Data / *Eingangsdaten*

Load combination A	$N_{Sd,max}$	=	13'000	Distribution angle/*Ausbreitungswinkel* [°]	α	=	60
(Design) [kN]	$V_{xy\ Sd,max}$	=	---	Anchor plate/*Ankerplatte* [j/n]	upper	=	n
Load combination B	$N_{Sd,min}$	=	-2'800		lower	=	n
(Design) [kN]	$V_{xy\ Sd,min}$	=	---				---
Load combination C	$N_{Gk,perm}$	=	7'500	Concrete quality/*Betongüte*	upper	=	Stahl
(Design) [kN]	$N_{Qk,perm}$	=	1'786		$B_{o,x}$	≥	-
					$B_{o,y}$	≥	-
Movement ± [mm]	v_x	= ±	2'000		lower	=	Stahl
Bewegung ± [mm]	v_y	= ±	20		$B_{o,x}$	≥	-
					$B_{o,y}$	≥	-
Rotation [rad]	α_y	=	0.025	Shim plate/*Futterplatte*	upper	=	n
Verdrehung [rad]	α_x	=	0.010		lower	=	n
				Friction applicable/*Reibung ansetzbar*			n
					μ_k steel	=	0
					μ_k concrete	=	0
				Dowel/Dollen [j/n]	upper	=	n
					lower	=	n
				Shear stud [j/n]	upper	=	n
					lower	=	n
				Bellows [j/n]			n

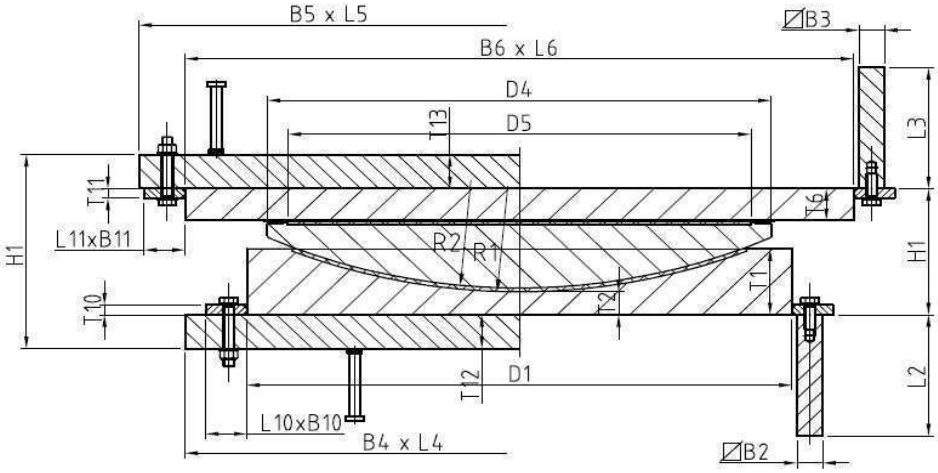
3 Steel stresses acc. to / *Stahlspannungen nach* EN 10025

$\sigma = f_{y,d} = f_{y,k} / (\gamma_m)$ $\gamma_m = 1.1$

Material	S355J2+N	S235JR	S355J2+N	S235JR
[mm]	$f_{y,d}$ [N/mm^2]	$f_{y,d}$ [N/mm^2]	$f_{y,k}$ [N/mm^2]	$f_{y,k}$ [N/mm^2]
<= 16	322.7	213.6	355	235
> 16 <= 40	313.6	204.5	345	225
> 40 <= 63	304.5	195.5	335	215
> 63 <= 80	295.5	195.5	325	215
> 80 <= 100	286.4	195.5	315	215
> 100 <= 150	268.2	177.3	295	195
> 150 <= 200	259.1	168.2	285	185
> 200 <= 250	250.0	159.1	275	175

4 Types of bearings and dimensions / *Lagertypen und Abmessungen*

4.1 Free sliding bearing / *allseitig bewegliches Lager* (KA)



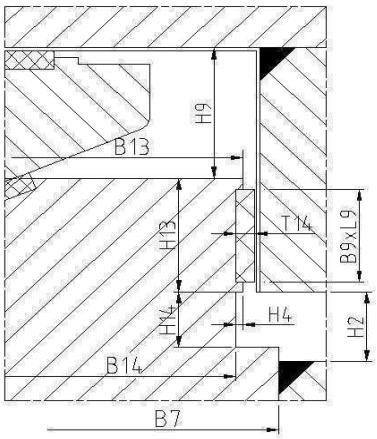
4.2 Guided sliding bearing / *einachsig bewegliches Lager* (KE, KEQ)

Note:

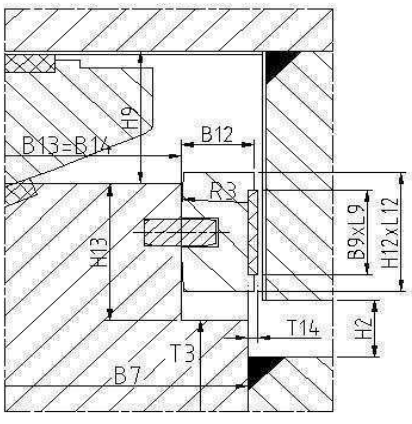
Hinweis:

Abgesehen von den Führungsleisten sind die KE/KEQ-Lager identisch mit den KA-Lagern. Die Bezeichnung KE steht für Längsbewegungen (x-Achse), KEQ für Querbewegungen (y-Achse).

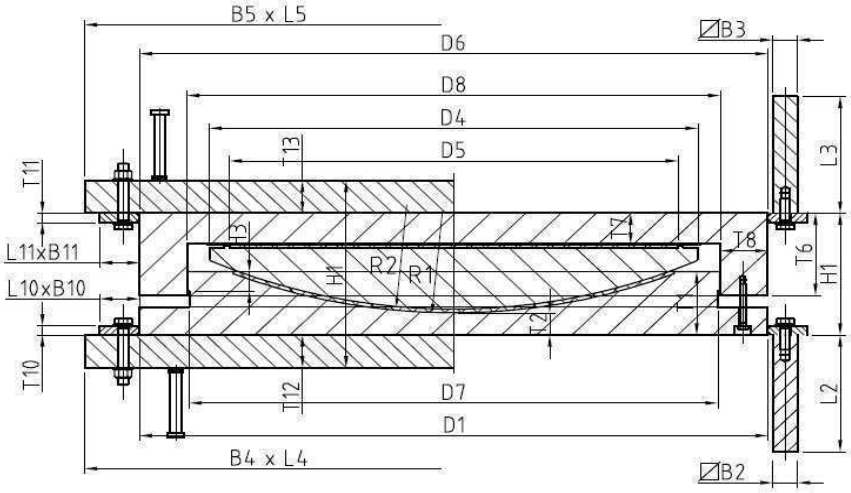
a) Without tilt bar / *ohne Kippleiste*



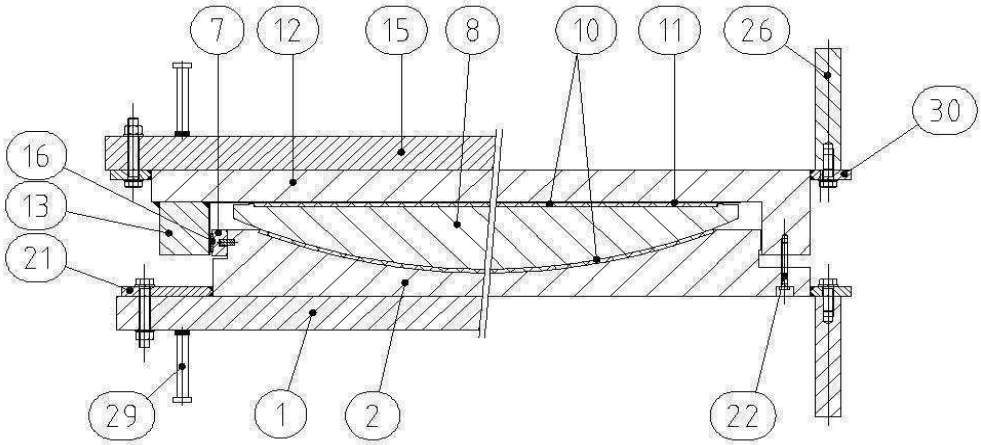
b) With tilt bar / *mit Kippleiste*



4.3 Fixed bearing / *Festes Lager* (KF)



5 Identification of the parts / *Bezeichnungen der Bauteile*



1	Lower anchor plate / *Untere Ankerplatte*	15	Upper anchor plate / *Obere Ankerplatte*
2	Lower part / *Unterteil*	16	Sliding strip / *Gleitstreifen*
7	Tilt bar / *Kippleiste*	21	Lug / *Lasche*
8	Calotte / *Kalotte*	22	Transportation fixation / *Transporthalterung*
10	Sliding disc / *Gleitscheibe*	26	Dowel / *Dollen*
11	Sliding sheet / *Gleitblech*	29	Shear stud / *Kopfbolzen*
12	Sliding plate / *Gleitplatte*	30	Lug / *Lasche*
13	Guide bar / *Führungsleiste*		

6 Summary of relevant Input Data & Results

Type of bearing/standard: ***Lagertyp/Norm:***	**KA13**	**(free sliding)**	**Standard:**	**ETA 08-0115**

6.1 Input data: Loads, movements and rotations / *Eingangsdaten: Lasten, Bewegungen und Verdrehungen*

acc. / *nach* ENV 1991

				Movement		Rotation	
$N_{Sd,max}$ =	13000 kN	$V_{xy\ Sd,max}$	260 kN	v_x=	± 2000 mm	$\alpha_{y,max}$ =	0.025 [rad]
$N_{Sd,min}$ =	-2800 kN	$V_{xy\ Sd,min}$ =	517.50869656	v_y=	± 20 mm	$\alpha_{x,max}$ =	0.01 [rad]

$N_{sGk,perm}$ = 7500 kN
$N_{sQk,perm}$ = 1785.7 kN

6.2 Dimensions of bearing / *Lagerabmessungen* [mm]

Lower part / *Unterteil*	D1=409	T1=60	T2=10.1	R1=448	θ=25.9
Calotte / *Kalotte*	D4=440	T4=69.6	R2=440	H6=5.4	
Sliding disc / *Gleitscheibe*	D5=400	T5=8	Material=ROBO®SLIDE		
Sliding sheet / *Gleitblech*	L1=4450	B1=490	T9=1.5		
Sliding plate / *Gleitplatte*	L6=4480	B6=520	T6=185		
Upper anchor plate / *Obere Ankerplatte*	L5=0	B5=0	T13=0		
Lower anchor plate / *Untere Ankerplatte*	L4=0	B4=645	T12=0		

Height: **282.2** [mm]
Weight: **3605** [kg]

6.3 Proof of safety against sliding / *Nachweis Sicherheit gegen Gleiten*

Friction applicable / *Reibung ansetzbar*: No / *Nein*

Contact gap steel/steel up / *Kontaktfläche oben Stahl-Stahl:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 4 M20
Restliche Horizontalkraft aufnehmen durch:
Bolt quality 8.8, shear in thread
Schraubenqualität 8.8, Scherung im Gewindequerschnitt

Contact gap steel/steel down/ *Kontaktfläche unten Stahl-Stahl:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 4 M24
Restliche Horizontalkraft aufnehmen durch:
Bolt quality 8.8, shear in thread
Schraubenqualität 8.8, Scherung im Gewindequerschnitt

Contact gap bearing/anchor plate / *Kontaktfläche Lager/Ankerplatte:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 4 M20
Restliche Horizontalkraft aufnehmen durch:

6.4 Necessary space / *Benötigte Bauwerksabmessungen*

Superstructure length / *Länge Überbau* =	-	[mm]
Superstructure width / *Breite Überbau* =	-	[mm]
Substructure length / *Länge Fundament* =	-	[mm]
Substructure width / *Breite Fundament* =	-	[mm]

STATIC CALCULATION

Product: **RESTON®SPHERICAL Bearings**
Type KA (free sliding)
Standard: ETA 08-0115

Project name: **Messina Strait Bridge**
Client name: Eurolink
Order No.: OF-L-11082

Rev.	Date	Status	Prepared	Checked	Approved
05					
04					
03					
02					
01					
00	02.11.2010	Static assessment	OM	BU	NM

Prepared by:

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mageba@mageba.ch – www.mageba.ch

TABLE OF CONTENT

1 General Data / *Allgemeine Daten*

Project / *Objekt*	Messina Strait Bridge
Client / *Kunde*	Eurolink
Issued / *Erstellt am*	02.11.2010
Project no. / *Auftragsnummer*	OF-L-11082
Project manager / *Projektleiter*	NM
Static engineer mageba / *Statiker*	OM
Drawing no. / *Zeichnungsnummer*	KA6.2-1-IT-OF-L-11082
Sheet no. / *Blattnummer*	10

Type of bearing / *Lagertyp*	KA
Size of bearing / *Lagerbezeichnung*	6.2
Location / *Einbauort*	A10
Number of bearings / *Anzahl Lager*	2
Country / *Land (ISO-Code)*	IT
Standard / *Norm/Zulassung*	ETA 08-0115

2 Input Data / *Eingangsdaten*

Load combination A	$N_{Sd,max}$	=	6'200	Distribution angle/*Ausbreitungswinkel* [°]	α	=	60
(Design) [kN]	$V_{xy\ Sd,max}$	=	---	Anchor plate/*Ankerplatte* [j/n]	upper	=	n
Load combination B	$N_{Sd,min}$	=	200		lower	=	n
(Design) [kN]	$V_{xy\ Sd,min}$	=	---				---
Load combination C	$N_{Gk,perm}$	=	2'657	Concrete quality/*Betongüte*	upper	=	Stahl
(Design) [kN]	$N_{Qk,perm}$	=	1'771		$B_{o,x}$	≥	-
					$B_{o,y}$	≥	-
Movement ± [mm]	v_x	= ±	2'000		lower	=	Stahl
Bewegung ± [mm]	v_y	= ±	20		$B_{o,x}$	≥	-
					$B_{o,y}$	≥	-
Rotation [rad]	α_y	=	0.010	Shim plate/*Futterplatte*	upper	=	n
Verdrehung [rad]	α_x	=	0.010		lower	=	n
				Friction applicable/*Reibung ansetzbar*			n
					μ_k steel	=	0
					μ_k concrete	=	0
				Dowel/Dollen [j/n]	upper	=	n
					lower	=	n
				Shear stud [j/n]	upper	=	n
					lower	=	n
				Bellows [j/n]			n

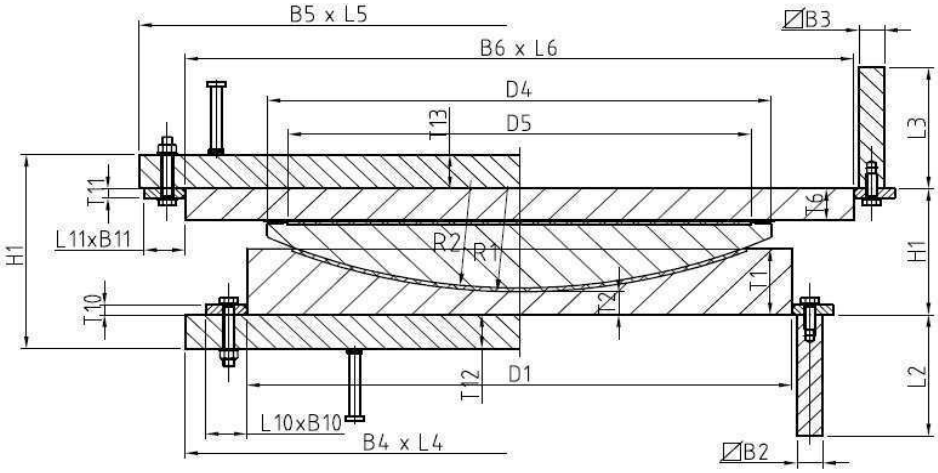
3 Steel stresses acc. to / *Stahlspannungen nach* EN 10025

$\sigma = f_{y,d} = f_{y,k} / (\gamma_m)$ $\gamma_m = 1.1$

Material	S355J2+N	S235JR	S355J2+N	S235JR
[mm]	$f_{y,d}$ [N/mm²]	$f_{y,d}$ [N/mm²]	$f_{y,k}$ [N/mm²]	$f_{y,k}$ [N/mm²]
<= 16	322.7	213.6	355	235
> 16 <= 40	313.6	204.5	345	225
> 40 <= 63	304.5	195.5	335	215
> 63 <= 80	295.5	195.5	325	215
> 80 <= 100	286.4	195.5	315	215
> 100 <= 150	268.2	177.3	295	195
> 150 <= 200	259.1	168.2	285	185
> 200 <= 250	250.0	159.1	275	175

4 Types of bearings and dimensions / *Lagertypen und Abmessungen*

4.1 Free sliding bearing / *allseitig bewegliches Lager* (KA)

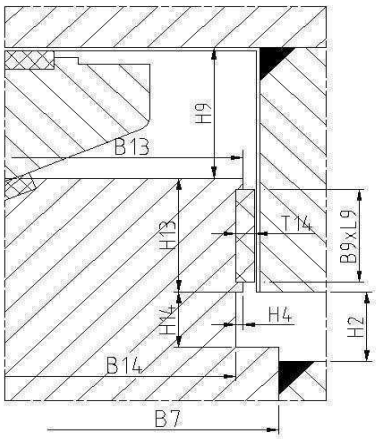


4.2 Guided sliding bearing / *einachsig bewegliches Lager* (KE, KEQ)

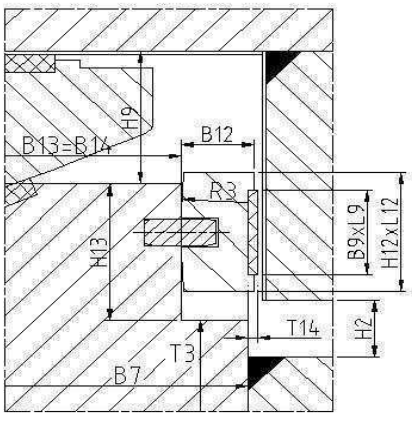
Note:

Hinweis:

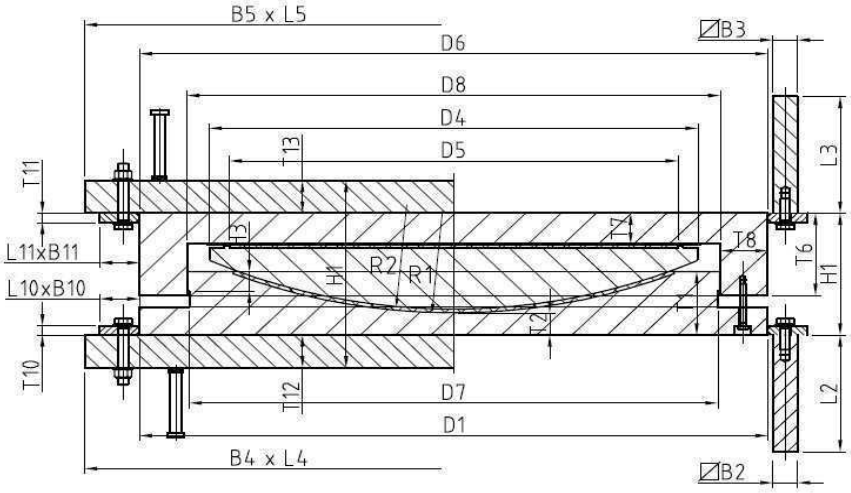
a) Without tilt bar / *ohne Kippleiste*



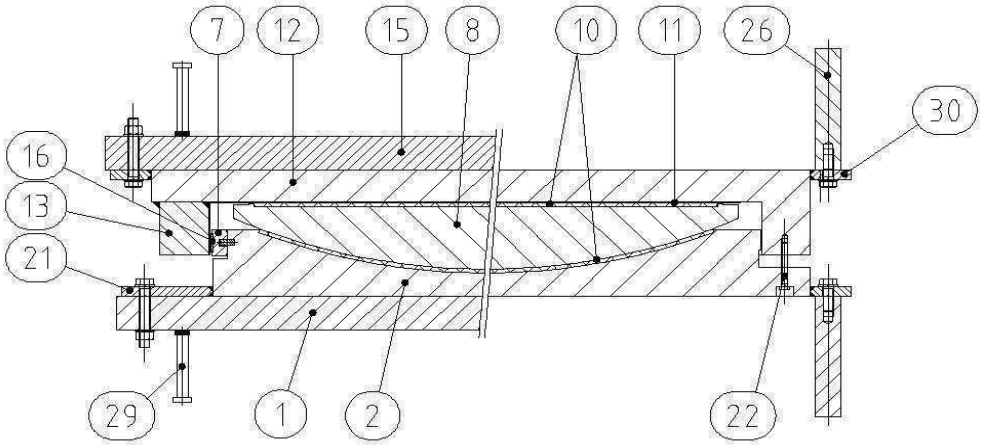
b) With tilt bar / *mit Kippleiste*



4.3 Fixed bearing / *Festes Lager* (KF)



5 Identification of the parts / *Bezeichnungen der Bauteile*



1	Lower anchor plate / *Untere Ankerplatte*	15	Upper anchor plate / *Obere Ankerplatte*
2	Lower part / *Unterteil*	16	Sliding strip / *Gleitstreifen*
7	Tilt bar / *Kippleiste*	21	Lug / *Lasche*
8	Calotte / *Kalotte*	22	Transportation fixation / *Transporthalterung*
10	Sliding disc / *Gleitscheibe*	26	Dowel / *Dollen*
11	Sliding sheet / *Gleitblech*	29	Shear stud / *Kopfbolzen*
12	Sliding plate / *Gleitplatte*	30	Lug / *Lasche*
13	Guide bar / *Führungsleiste*		

6 Summary of relevant Input Data & Results

Type of bearing/standard: ***Lagertyp/Norm:***	**KA6.2**	**(free sliding)**	**Standard:**	**ETA 08-0115**

6.1 Input data: Loads, movements and rotations / *Eingangsdaten: Lasten, Bewegungen und Verdrehungen*

acc. / *nach* ENV 1991

			Movement	Rotation	
$N_{Sd,max}$ =	6200 kN	$V_{xy\ Sd,max}$	124 kN	v_x = ± 2000 mm	$\alpha_{y,max}$ = 0.01 [rad]
$N_{Sd,min}$ =	200 kN	$V_{xy\ Sd,min}$	16 kN	v_y = ± 20 mm	$\alpha_{x,max}$ = 0.01 [rad]

$N_{sGk,perm}$: 2657.1 kN
$N_{sQk,perm}$: 1771.4 kN

6.2 Dimensions of bearing / *Lagerabmessungen* [mm]

Lower part / *Unterteil*	D1=290	T1=46	T2=15.6	R1=379	θ=21.1
Calotte / *Kalotte*	D4=309	T4=45.6	R2=371	H6=5.4	
Sliding disc / *Gleitscheibe*	D5=275	T5=8	Material=ROBO®SLIDE		
Sliding sheet / *Gleitblech*	L1=4325	B1=365	T9=1.5		
Sliding plate / *Gleitplatte*	L6=4350	B6=390	T6=175		
Upper anchor plate / *Obere Ankerplatte*	L5=0	B5=0	T13=0		
Lower anchor plate / *Untere Ankerplatte*	L4=0	B4=0	T12=0		

Height: **253.7** [mm]
Weight: **2450** [kg]

6.3 Proof of safety against sliding / *Nachweis Sicherheit gegen Gleiten*

Friction applicable / *Reibung ansetzbar*: No / *Nein*

Contact gap steel/steel up / *Kontaktfläche oben Stahl-Stahl:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 4 M16
Restliche Horizontalkraft aufnehmen durch:
Bolt quality 8.8, shear in thread
Schraubenqualität 8.8, Scherung im Gewindequerschnitt

Contact gap steel/steel down/ *Kontaktfläche unten Stahl-Stahl:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 4 M16
Restliche Horizontalkraft aufnehmen durch:
Bolt quality 8.8, shear in thread
Schraubenqualität 8.8, Scherung im Gewindequerschnitt

Contact gap bearing/anchor plate / *Kontaktfläche Lager/Ankerplatte:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 4 M16
Restliche Horizontalkraft aufnehmen durch:

6.4 Necessary space / *Benötigte Bauwerksabmessungen*

Superstructure length / *Länge Überbau* =	-	[mm]
Superstructure width / *Breite Überbau* =	-	[mm]
Substructure length / *Länge Fundament* =	-	[mm]
Substructure width / *Breite Fundament* =	-	[mm]

STATIC CALCULATION
STATISCHER NACHWEIS

Product / *Produkt:* **RESTON®SPHERICAL Bearings**
Type / *Typ:* KE (guided / *geführt*)
Standard / *Norm:* EN 1337/ETA-08/0115

Project / *Projekt:* **Messina Strait Bridge**
Client / *Kunde:* Eurolink
Order No. / *Auftrag:* OF-L-11082

Rev.	Date / *Datum*	Status	Prepared / *Bearb.*	Checked / *Geprüft*	Approved / *Gen.*
05					
04					
03					
02					
01					
00	02.11.2010	Static assessment	OM	BU	NM

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TABLE OF CONTENT

1 General Data / *Allgemeine Daten*

Project / *Objekt*	Messina Strait Bridge
Client / *Kunde*	Eurolink
Issued / *Erstellt am*	02.11.2010
Project no. / *Auftragsnummer*	OF-L-11082
Project manager / *Projektleiter*	NM
Static engineer mageba / *Statiker*	OM
Drawing no. / *Zeichnungsnummer*	KE6.2-1-IT-OF-L-11082
Sheet no. / *Blattnummer*	11

Type of bearing / *Lagertyp*	KE
Size of bearing / *Lagerbezeichnung*	6.2
Location / *Einbauort*	A11
Number of bearings / *Anzahl Lager*	2
Country / *Land (ISO-Code)*	IT
Standard / *Norm/Zulassung*	ETA 08-0115

2 Input Data / *Eingangsdaten*

Load combination A	$N_{Sd,max}$	=	6'200	Distribution angle/*Ausbreitungswinkel* [°]	α	=	60
(Design) [kN]	$V_{y\ Sd,max}$	=	4'500	Anchor plate/*Ankerplatte* [j/n]	upper	=	n
Load combination B	$N_{Sd,min}$	=	-2'300		lower	=	n
(Design) [kN]	$V_{y\ Sd,zugeh}$	=	4'500				---
Load combination C	$N_{Gk,perm}$	=	4'000	Concrete quality/*Betongüte*	upper	=	Stahl
(Design) [kN]	$N_{Qk,perm}$	=	429		$B_{o,x}$	≥	0
					$B_{o,y}$	≥	0
Movement ± [mm]	v_x	= ±	2'000		lower	=	Stahl
Bewegung ± [mm]	v_y	= ±	---		$B_{o,x}$	≥	0
					$B_{o,y}$	≥	0
Rotation [rad]	α_y	=	0.010	Shim plate/*Futterplatte*	upper	=	n
Verdrehung [rad]	α_x	=	0.010		lower	=	n
				Friction applicable/*Reibung ansetzbar*			n
					μ_k steel	=	0
					μ_k concrete	=	0
				Dowel/Dollen [j/n]	upper	=	n
					lower	=	n
				Shear stud [j/n]	upper	=	n
					lower	=	n
				Bellows [j/n]			n

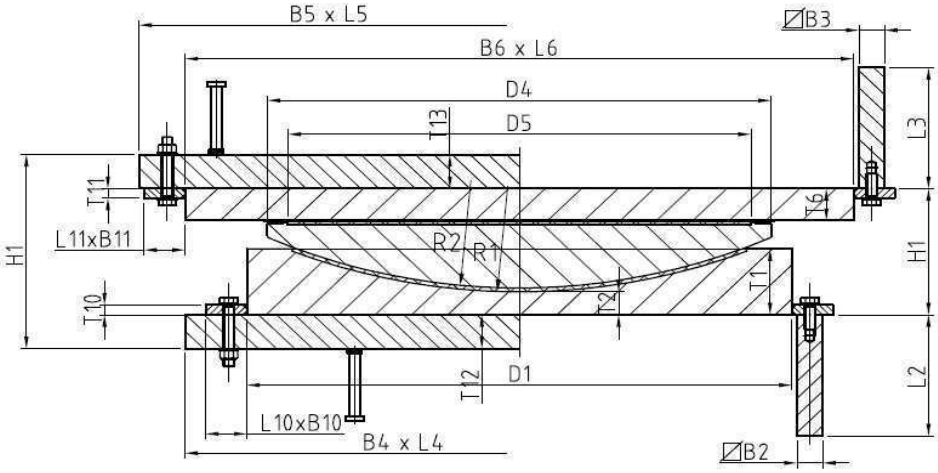
3 Steel stresses acc. to / *Stahlspannungen nach* EN 10025

$\sigma = f_{y,d} = f_{y,k} / (\gamma_m)$ $\gamma_m = 1.1$

Material	S355J2+N	S235JR	S355J2+N	S235JR
[mm]	$f_{y,d}$ [N/mm²]	$f_{y,d}$ [N/mm²]	$f_{y,k}$ [N/mm²]	$f_{y,k}$ [N/mm²]
<= 16	322.7	213.6	355	235
> 16 <= 40	313.6	204.5	345	225
> 40 <= 63	304.5	195.5	335	215
> 63 <= 80	295.5	195.5	325	215
> 80 <= 100	286.4	195.5	315	215
> 100 <= 150	268.2	177.3	295	195
> 150 <= 200	259.1	168.2	285	185
> 200 <= 250	250.0	159.1	275	175

4 Types of bearings and dimensions / *Lagertypen und Abmessungen*

4.1 Free sliding bearing / *allseitig bewegliches Lager* (KA)



4.2 Guided sliding bearing / *einachsig bewegliches Lager* (KE, KEQ)

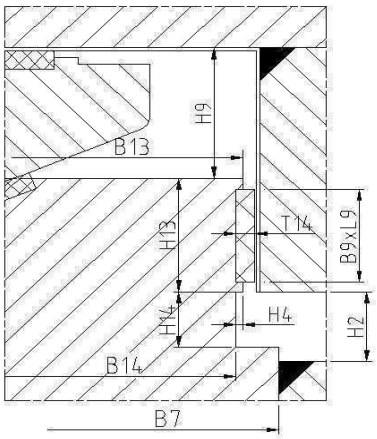
Note:

Beside the guide bars, the KE bearings are identical to the KA-bearing. The designation KE stands for longitudinal (x-axis), the designation KEQ stands for transversal (y-axis) movements.

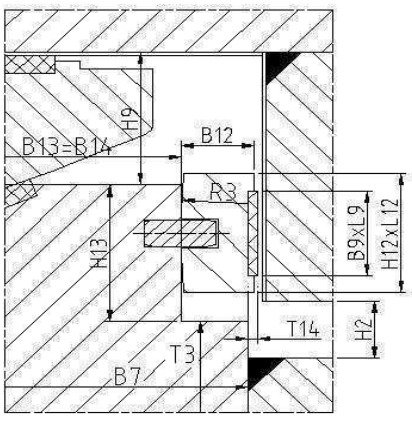
Hinweis:

Abgesehen von den Führungsleisten sind die KE/KEQ-Lager identisch mit den KA-Lagern. Die Bezeichnung KE steht für Längsbewegungen (x-Achse), KEQ für Querbewegungen (y-Achse).

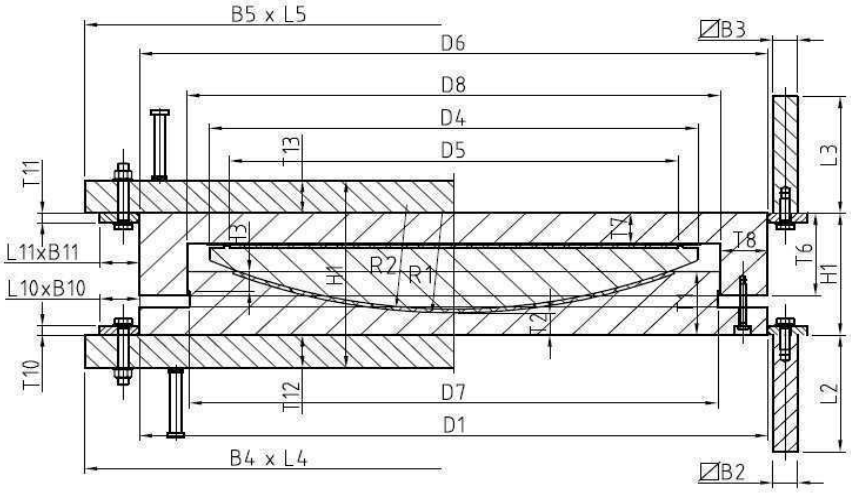
a) Without tilt bar / *ohne Kippleiste*



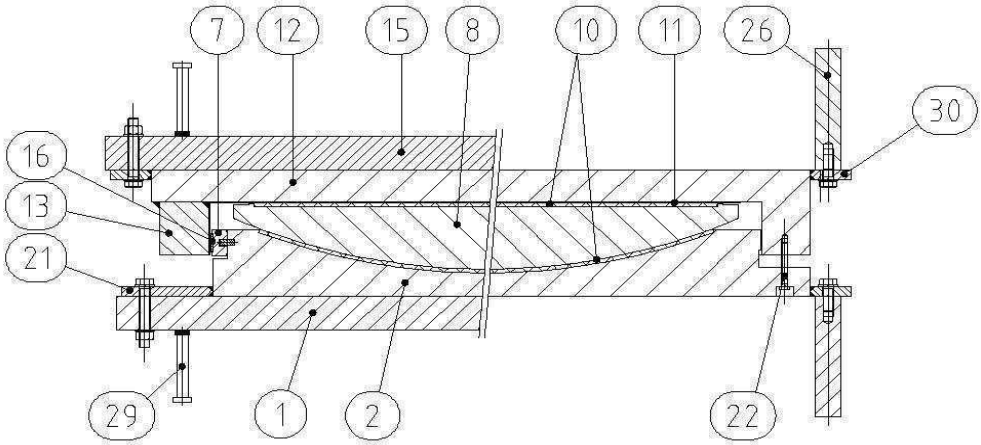
b) With tilt bar / *mit Kippleiste*



4.3 Fixed bearing / *Festes Lager* (KF)



5 Identification of the parts / *Bezeichnungen der Bauteile*



1	Lower anchor plate / *Untere Ankerplatte*	15	Upper anchor plate / *Obere Ankerplatte*
2	Lower part / *Unterteil*	16	Sliding strip / *Gleitstreifen*
7	Tilt bar / *Kippleiste*	21	Lug / *Lasche*
8	Calotte / *Kalotte*	22	Transportation fixation / *Transporthalterung*
10	Sliding disc / *Gleitscheibe*	26	Dowel / *Dollen*
11	Sliding sheet / *Gleitblech*	29	Shear stud / *Kopfbolzen*
12	Sliding plate / *Gleitplatte*	30	Lug / *Lasche*
13	Guide bar / *Führungsleiste*		

6 Summary of relevant Input Data & Results

Type of bearing/standard: ***Lagertyp/Norm:***	**KE6.2**	**(guided sliding)**	**Standard:**	**ETA 08-0115**

6.1 Input data: Loads, movements and rotations / *Eingangsdaten: Lasten, Bewegungen und Verdrehungen*

acc. / *nach* ENV 1991

				Movement	Rotation	
$N_{Sd,max}$ =	6200 kN	$V_{ySd,max}$ =	4500 kN	v_x= ± 2000 mm	$\alpha_{y,max}$ =	0.01 [rad]
$N_{Sd,min}$ =	-2300 kN	$V_{ySd,as}$ =	4500 kN	v_y= ± 0 mm	$\alpha_{x,max}$ =	0.01 [rad]

$N_{sGk,perm}$= 4000 kN
$N_{sQk,perm}$= 428.6 kN

6.2 Dimensions of bearing / *Lagerabmessungen* [mm]

Lower part / *Unterteil*	L7=910	B7=410	T1=145	T2=112.7	θ=22.7
Calotte / *Kalotte*	D4=309	T4=50.6	R2=343.75	H6=5.4	
Sliding disc / *Gleitscheibe*	D5=275	T5=8	Material=ROBO®SLIDE		
Sliding sheet / *Gleitblech*	L1=4940	B1=621	T9=1.5		
Sliding plate / *Gleitplatte*	L6=4980	B6=660	T6=203		
Upper anchor plate / *Obere Ankerplatte*	L5=0	B5=0	T13=0		
Lower anchor plate / *Untere Ankerplatte*	L4=0	B4=710	T12=0		
Sliding strip / *Gleitstreifen*	L9=890	B9=40	T14=8		
Guide bar / *Führungsleisten*	L8=4960	B8=83	H8=105	B15=415	

Height: **383.8** [mm]
Weight: **8057.3** [kg]

6.3 Proof of safety against sliding / *Nachweis Sicherheit gegen Gleiten*

Friction applicable / *Reibung ansetzbar*: No / *Nein*

Contact gap steel/steel up / *Kontaktfläche oben Stahl-Stahl:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 12 x M36
Restliche Horizontalkraft aufnehmen durch:
Bolt quality 8.8, shear in thread
Schraubenqualität 8.8, Scherung im Gewindequerschnitt

Contact gap steel/steel down/ *Kontaktfläche unten Stahl-Stahl:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 12 x M36
Restliche Horizontalkraft aufnehmen durch:
Bolt quality 8.8, shear in thread
Schraubenqualität 8.8, Scherung im Gewindequerschnitt

Contact gap bearing/anchor plate / *Kontaktfläche Lager/Ankerplatte:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 12 x M36
Restliche Horizontalkraft aufnehmen durch:

6.4 Necessary space / *Benötigte Bauwerksabmessungen*

Superstructure length / *Länge Überbau* = 0 [mm]
Superstructure width / *Breite Überbau* = 0 [mm]

Substructure length / *Länge Fundament* = 0 [mm]
Substructure width / *Breite Fundament* = 0 [mm]

STATIC CALCULATION

Product: **RESTON®SPHERICAL Bearings**
Type KA (free sliding)
Standard: ETA 08-0115

Project name: **Messina Strait Bridge**
Client name: Eurolink
Order No.: OF-L-11082

Rev.	Date	Status	Prepared	Checked	Approved
05					
04					
03					
02					
01					
00	02.11.2010	Static assessment	OM	BU	NM

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TABLE OF CONTENT

1 General Data / *Allgemeine Daten*

Project / *Objekt*	Messina Strait Bridge
Client / *Kunde*	Eurolink
Issued / *Erstellt am*	02.11.2010
Project no. / *Auftragsnummer*	OF-L-11082
Project manager / *Projektleiter*	NM
Static engineer mageba / *Statiker*	OM
Drawing no. / *Zeichnungsnummer*	KA122.8-1-IT-OF-L-11082
Sheet no. / *Blattnummer*	13

Type of bearing / *Lagertyp*	KA
Size of bearing / *Lagerbezeichnung*	122.8
Location / *Einbauort*	A13
Number of bearings / *Anzahl Lager*	0
Country / *Land (ISO-Code)*	IT
Standard / *Norm/Zulassung*	ETA 08-0115

2 Input Data / *Eingangsdaten*

Load combination A	$N_{Sd,max}$	=	122'800	Distribution angle/*Ausbreitungswinkel* [°]	α	=	60
(Design) [kN]	$V_{xy\ Sd,max}$	=	---	Anchor plate/*Ankerplatte* [j/n]	upper	=	n
Load combination B	$N_{Sd,min}$	=	0		lower	=	j
(Design) [kN]	$V_{xy\ Sd,min}$	=	---				---
Load combination C	$N_{Gk,perm}$	=	70'500	Concrete quality/*Betongüte*	upper	=	Stahl
(Design) [kN]	$N_{Qk,perm}$	=	17'214		$B_{o,x}$	≥	-
					$B_{o,y}$	≥	-
Movement ± [mm]	v_x	= ±	600		lower	=	C60/75
Bewegung ± [mm]	v_y	= ±	20		$B_{o,x}$	≥	0
					$B_{o,y}$	≥	0
Rotation [rad]	α_y	=	0.010	Shim plate/*Futterplatte*	upper	=	n
Verdrehung [rad]	α_x	=	0.010		lower	=	n
				Friction applicable/*Reibung ansetzbar*			n
					μ_k steel	=	0
					μ_k concrete	=	0
				Dowel/Dollen [j/n]	upper	=	n
					lower	=	n
				Shear stud [j/n]	upper	=	n
					lower	=	j
				Bellows [j/n]			n

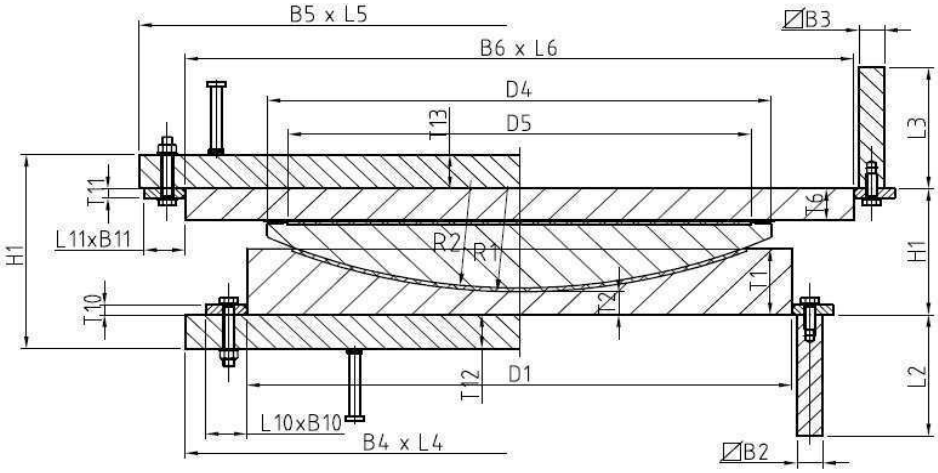
3 Steel stresses acc. to / *Stahlspannungen nach* EN 10025

$\sigma = f_{y,d} = f_{y,k} / (\gamma_m)$ $\quad \gamma_m = 1.1$

Material	S355J2+N	S235JR	S355J2+N	S235JR
[mm]	$f_{y,d}$ [N/mm^2]	$f_{y,d}$ [N/mm^2]	$f_{y,k}$ [N/mm^2]	$f_{y,k}$ [N/mm^2]
<= 16	322.7	213.6	355	235
> 16 <= 40	313.6	204.5	345	225
> 40 <= 63	304.5	195.5	335	215
> 63 <= 80	295.5	195.5	325	215
> 80 <= 100	286.4	195.5	315	215
> 100 <= 150	268.2	177.3	295	195
> 150 <= 200	259.1	168.2	285	185
> 200 <= 250	250.0	159.1	275	175

4 Types of bearings and dimensions / *Lagertypen und Abmessungen*

4.1 Free sliding bearing / *allseitig bewegliches Lager* (KA)



4.2 Guided sliding bearing / *einachsig bewegliches Lager* (KE, KEQ)

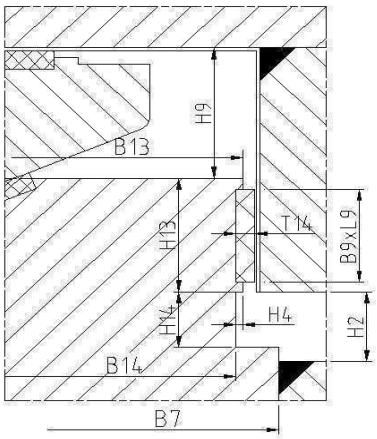
Note:

Beside the guide bars, the KE bearings are identical to the KA-bearing. The designation KE stands for longitudinal (x-axis), the designation KEQ stands for transversal (y-axis) movements.

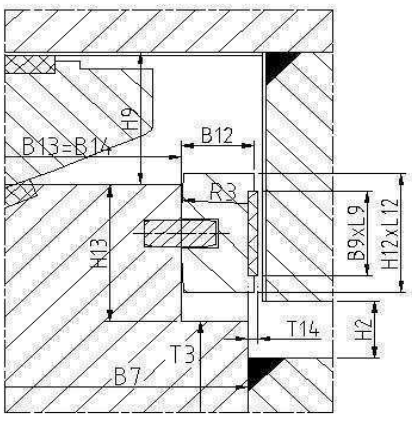
Hinweis:

Abgesehen von den Führungsleisten sind die KE/KEQ-Lager identisch mit den KA-Lagern. Die Bezeichnung KE steht für Längsbewegungen (x-Achse), KEQ für Querbewegungen (y-Achse).

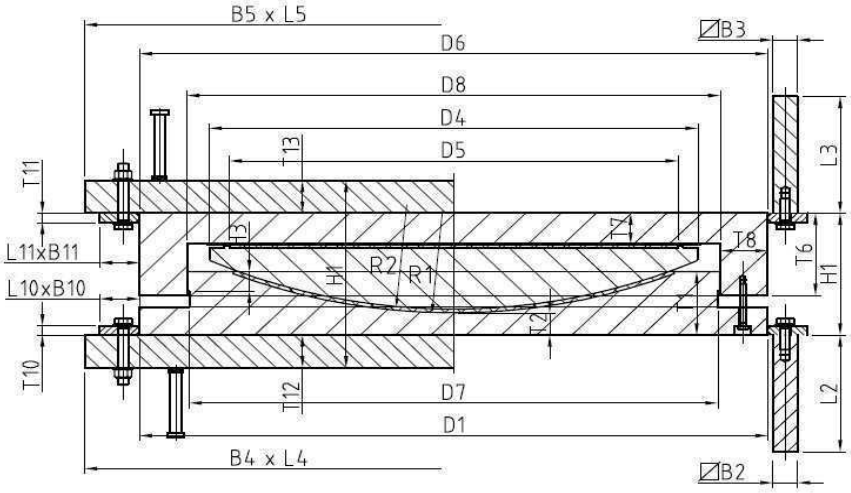
a) Without tilt bar / *ohne Kippleiste*



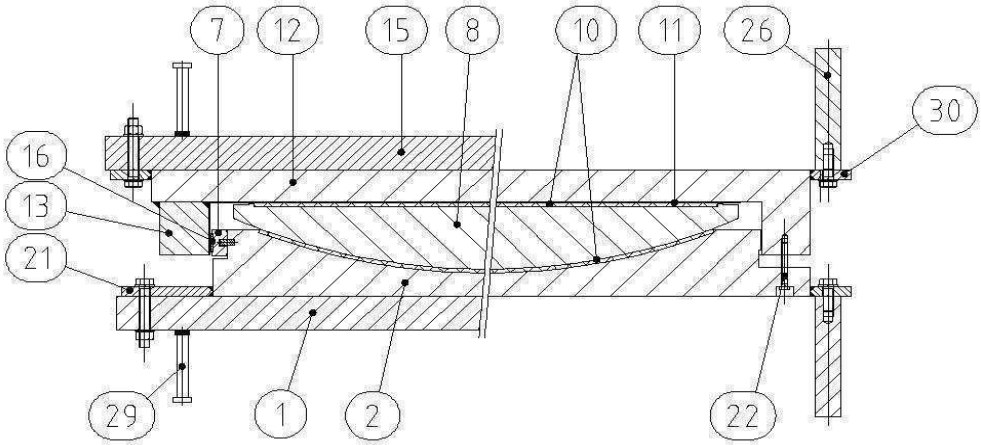
b) With tilt bar / *mit Kippleiste*



4.3 Fixed bearing / *Festes Lager* (KF)



5 Identification of the parts / *Bezeichnungen der Bauteile*



1	Lower anchor plate / *Untere Ankerplatte*	15	Upper anchor plate / *Obere Ankerplatte*
2	Lower part / *Unterteil*	16	Sliding strip / *Gleitstreifen*
7	Tilt bar / *Kippleiste*	21	Lug / *Lasche*
8	Calotte / *Kalotte*	22	Transportation fixation / *Transporthalterung*
10	Sliding disc / *Gleitscheibe*	26	Dowel / *Dollen*
11	Sliding sheet / *Gleitblech*	29	Shear stud / *Kopfbolzen*
12	Sliding plate / *Gleitplatte*	30	Lug / *Lasche*
13	Guide bar / *Führungsleiste*		

6 Summary of relevant Input Data & Results

Type of bearing/standard: ***Lagertyp/Norm:***	**KA122.8**	**(free sliding)**	**Standard:**	**ETA 08-0115**

6.1 Input data: Loads, movements and rotations / *Eingangsdaten: Lasten, Bewegungen und Verdrehungen*

acc. / *nach* ENV 1991

				Movement		Rotation	
$N_{Sd,max}$ =	122800 kN	$V_{xy\ Sd,max}$	2456 kN	v_x=	± 600 mm	$\alpha_{y,max}$ =	0.01 [rad]
$N_{Sd,min}$ =	0 kN	$V_{xy\ Sd,min}$ =	0 kN	v_y=	± 20 mm	$\alpha_{x,max}$ =	0.01 [rad]

$N_{sGk,perm}$ = 70500 kN
$N_{sQk,perm}$ = 17214.3 kN

6.2 Dimensions of bearing / *Lagerabmessungen* [mm]

Lower part / *Unterteil*	D1=1192	T1=146	T2=10.5	R1=1384	θ=25.1
Calotte / *Kalotte*	D4=1230	T4=159.9	R2=1376	H6=5.1	
Sliding disc / *Gleitscheibe*	D5=1205	T5=8	Material=ROBO®SLIDE		
Sliding sheet / *Gleitblech*	L1=2455	B1=1295	T9=1.5		
Sliding plate / *Gleitplatte*	L6=2470	B6=1310	T6=115		
Upper anchor plate / *Obere Ankerplatte*	L5=0	B5=0	T13=0		
Lower anchor plate / *Untere Ankerplatte*	L4=1320	B4=1320	T12=155		

Height: **457.9** [mm]
Weight: **6969** [kg]

6.3 Proof of safety against sliding / *Nachweis Sicherheit gegen Gleiten*

Friction applicable / *Reibung ansetzbar*: No / *Nein*

Contact gap steel/steel up / *Kontaktfläche oben Stahl-Stahl:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 6 M36
Restliche Horizontalkraft aufnehmen durch:
Bolt quality 8.8, shear in thread
Schraubenqualität 8.8, Scherung im Gewindequerschnitt

Contact gap steel/concrete down/ *Kontaktfläche unten Stahl-Beton:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 36 D=22 x 150
Restliche Horizontalkraft aufnehmen durch:

Contact gap bearing/anchor plate / *Kontaktfläche Lager/Ankerplatte:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 6 M36
Restliche Horizontalkraft aufnehmen durch:
Bolt quality 10.9, shear in shaft
Schraubenqualität 10.9, Scherung im Schaftquerschnitt

6.4 Necessary space / *Benötigte Bauwerksabmessungen*

Superstructure length / *Länge Überbau* = - [mm]
Superstructure width / *Breite Überbau* = - [mm]

Substructure length / *Länge Fundament* = 0 [mm]
Substructure width / *Breite Fundament* = 0 [mm]

STATIC CALCULATION

Product: **RESTON®SPHERICAL Bearings**
Type KA (free sliding)
Standard: ETA 08-0115

Project name: **Messina Strait Bridge**
Client name: Eurolink
Order No.: OF-L-11082

Rev.	Date	Status	Prepared	Checked	Approved
05					
04					
03					
02					
01					
00	02.11.2010	Static assessment	OM	BU	NM

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TABLE OF CONTENT

1 General Data / *Allgemeine Daten*

Project / *Objekt*	Messina Strait Bridge
Client / *Kunde*	Eurolink
Issued / *Erstellt am*	02.11.2010
Project no. / *Auftragsnummer*	OF-L-11082
Project manager / *Projektleiter*	NM
Static engineer mageba / *Statiker*	OM
Drawing no. / *Zeichnungsnummer*	KA103.7-1-IT-OF-L-11082
Sheet no. / *Blattnummer*	14

Type of bearing / *Lagertyp*	KA
Size of bearing / *Lagerbezeichnung*	103.7
Location / *Einbauort*	A14
Number of bearings / *Anzahl Lager*	0
Country / *Land (ISO-Code)*	IT
Standard / *Norm/Zulassung*	ETA 08-0115

2 Input Data / *Eingangsdaten*

Load combination A	$N_{Sd,max}$	=	103'700	Distribution angle/*Ausbreitungswinkel* [°]	α	=	60
(Design) [kN]	$V_{xy\ Sd,max}$	=	---	Anchor plate/*Ankerplatte* [j/n]	upper	=	n
Load combination B	$N_{Sd,min}$	=	0		lower	=	j
(Design) [kN]	$V_{xy\ Sd,min}$	=	---				---
Load combination C	$N_{Gk,perm}$	=	56'700	Concrete quality/*Betongüte*	upper	=	Stahl
(Design) [kN]	$N_{Qk,perm}$	=	17'371		$B_{o,x}$	≥	-
					$B_{o,y}$	≥	-
Movement ± [mm]	v_x	= ±	600		lower	=	C60/75
Bewegung ± [mm]	v_y	= ±	20		$B_{o,x}$	≥	0
					$B_{o,y}$	≥	0
Rotation [rad]	α_y	=	0.010	Shim plate/*Futterplatte*	upper	=	n
Verdrehung [rad]	α_x	=	0.010		lower	=	n
				Friction applicable/*Reibung ansetzbar*			n
					μ_k steel	=	0
					μ_k concrete	=	0
				Dowel/Dollen [j/n]	upper	=	n
					lower	=	n
				Shear stud [j/n]	upper	=	n
					lower	=	j
				Bellows [j/n]			n

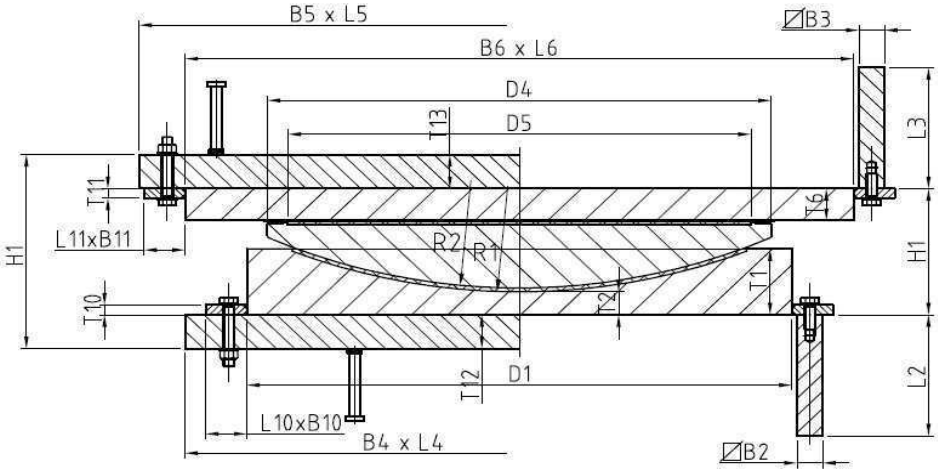
3 Steel stresses acc. to / *Stahlspannungen nach* EN 10025

$\sigma = f_{y,d} = f_{y,k} / (\gamma_m)$ $\gamma_m = 1.1$

Material	S355J2+N	S235JR	S355J2+N	S235JR
[mm]	$f_{y,d}$ [N/mm²]	$f_{y,d}$ [N/mm²]	$f_{y,k}$ [N/mm²]	$f_{y,k}$ [N/mm²]
<= 16	322.7	213.6	355	235
> 16 <= 40	313.6	204.5	345	225
> 40 <= 63	304.5	195.5	335	215
> 63 <= 80	295.5	195.5	325	215
> 80 <= 100	286.4	195.5	315	215
> 100 <= 150	268.2	177.3	295	195
> 150 <= 200	259.1	168.2	285	185
> 200 <= 250	250.0	159.1	275	175

4 Types of bearings and dimensions / *Lagertypen und Abmessungen*

4.1 Free sliding bearing / *allseitig bewegliches Lager* (KA)



4.2 Guided sliding bearing / *einachsig bewegliches Lager* (KE, KEQ)

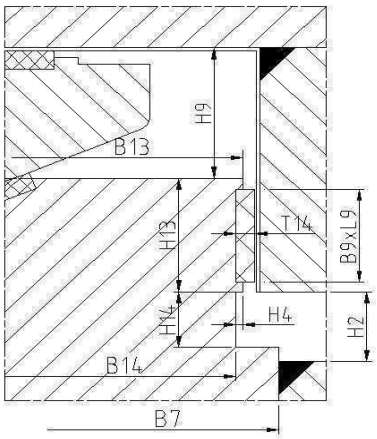
Note:

Beside the guide bars, the KE bearings are identical to the KA-bearing. The designation KE stands for longitudinal (x-axis), the designation KEQ stands for transversal (y-axis) movements.

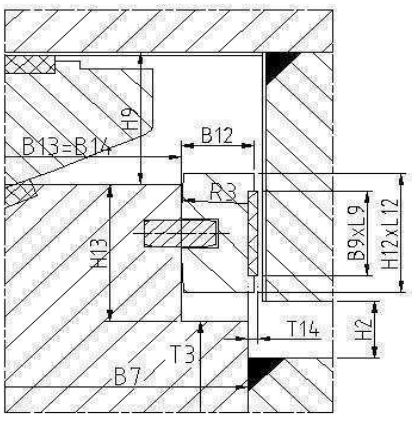
Hinweis:

Abgesehen von den Führungsleisten sind die KE/KEQ-Lager identisch mit den KA-Lagern. Die Bezeichnung KE steht für Längsbewegungen (x-Achse), KEQ für Querbewegungen (y-Achse).

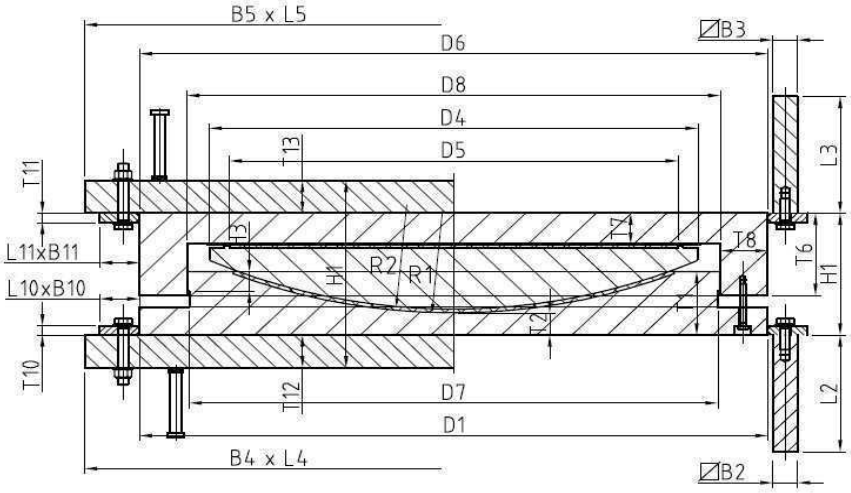
a) Without tilt bar / *ohne Kippleiste*



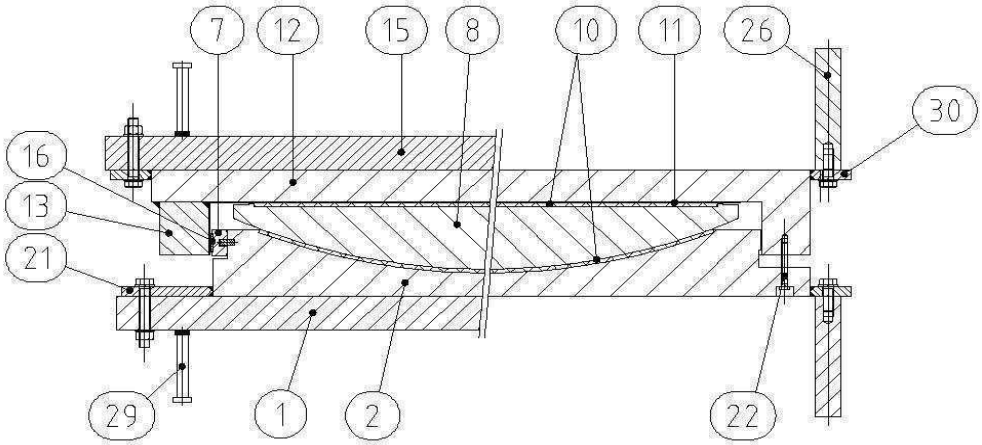
b) With tilt bar / *mit Kippleiste*



4.3 Fixed bearing / *Festes Lager* (KF)



5 Identification of the parts / *Bezeichnungen der Bauteile*



1	Lower anchor plate / *Untere Ankerplatte*	15	Upper anchor plate / *Obere Ankerplatte*
2	Lower part / *Unterteil*	16	Sliding strip / *Gleitstreifen*
7	Tilt bar / *Kippleiste*	21	Lug / *Lasche*
8	Calotte / *Kalotte*	22	Transportation fixation / *Transporthalterung*
10	Sliding disc / *Gleitscheibe*	26	Dowel / *Dollen*
11	Sliding sheet / *Gleitblech*	29	Shear stud / *Kopfbolzen*
12	Sliding plate / *Gleitplatte*	30	Lug / *Lasche*
13	Guide bar / *Führungsleiste*		

6 Summary of relevant Input Data & Results

Type of bearing/standard: ***Lagertyp/Norm:***	**KA103.7**	**(free sliding)**	**Standard:**	**ETA 08-0115**

6.1 Input data: Loads, movements and rotations / *Eingangsdaten: Lasten, Bewegungen und Verdrehungen*

acc. / *nach* ENV 1991

				Movement		Rotation	
$N_{Sd,max}$ =	103700 kN	$V_{xy\ Sd,max}$	2074 kN	v_x=	± 600 mm	$\alpha_{y,max}$ =	0.01 [rad]
$N_{Sd,min}$ =	0 kN	$V_{xy\ Sd,min}$ =	0 kN	v_y=	± 20 mm	$\alpha_{x,max}$ =	0.01 [rad]

$N_{sGk,perm}$ = 56700 kN
$N_{sQk,perm}$ = 17371.4 kN

6.2 Dimensions of bearing / *Lagerabmessungen* [mm]

Lower part / *Unterteil*	D1=1104	T1=126	T2=10.1	R1=1383	θ=23.1
Calotte / *Kalotte*	D4=1142	T4=139.9	R2=1375	H6=5.1	
Sliding disc / *Gleitscheibe*	D5=1110	T5=8	Material=ROBO®SLIDE		
Sliding sheet / *Gleitblech*	L1=2360	B1=1200	T9=1.5		
Sliding plate / *Gleitplatte*	L6=2390	B6=1230	T6=115		
Upper anchor plate / *Obere Ankerplatte*	L5=0	B5=0	T13=0		
Lower anchor plate / *Untere Ankerplatte*	L4=1230	B4=1230	T12=115		

Height: **397.5** [mm]
Weight: **5508** [kg]

6.3 Proof of safety against sliding / *Nachweis Sicherheit gegen Gleiten*

Friction applicable / *Reibung ansetzbar*: No / *Nein*

Contact gap steel/steel up / *Kontaktfläche oben Stahl-Stahl:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 6 M36
Restliche Horizontalkraft aufnehmen durch:
Bolt quality 8.8, shear in thread
Schraubenqualität 8.8, Scherung im Gewindequerschnitt

Contact gap steel/concrete down/ *Kontaktfläche unten Stahl-Beton:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 25 D=22 x 150
Restliche Horizontalkraft aufnehmen durch:

Contact gap bearing/anchor plate / *Kontaktfläche Lager/Ankerplatte:*
Horizontal load can not only be transfered by fricition!
Horizontalkraft kann mittels Reibung nicht alleine übertragen werden!
Rest of horizontal load take up by: 6 M36
Restliche Horizontalkraft aufnehmen durch:
Bolt quality 10.9, shear in shaft
Schraubenqualität 10.9, Scherung im Schaftquerschnitt

6.4 Necessary space / *Benötigte Bauwerksabmessungen*

Superstructure length / *Länge Überbau* = - [mm]
Superstructure width / *Breite Überbau* = - [mm]

Substructure length / *Länge Fundament* = 0 [mm]
Substructure width / *Breite Fundament* = 0 [mm]

