

**ASDO**

**M12 – M160  
ARCHITECTURAL  
STRUCTURAL TIE BARS**

in accordance with EN1993-1

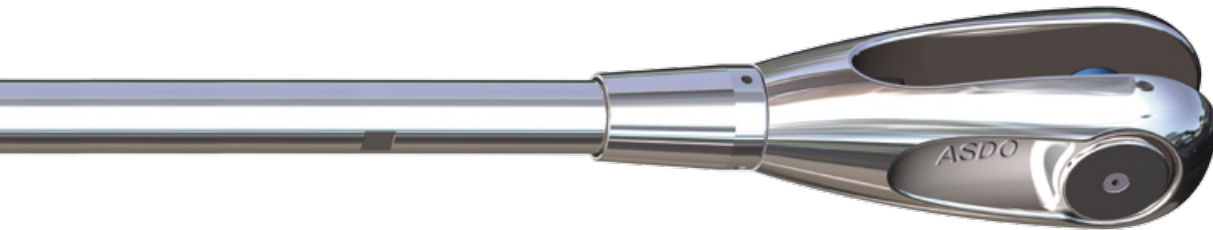


**ANKER  
SCHROEDER**  
ASDO steel tension members



# ASDO STRUCTURAL TIE BAR SYSTEMS

Anker Schroeder manufacture the ASDO structural tie bars for use on all types of structures, whether stadia, bridges or buildings. Our tie bars range in diameter from M12 to M160 and can be supplied in carbon steel grades 355-S & 540-S and stainless steel grade E600-S.



Anker Schroeder have a long history in the manufacture of tie bars having supplied projects the world over with a range of both forged and threaded tie bars since 1920. With more than 90 years of experience in the supply of structural tie bar we offer you a complete package for technically and aesthetically pleasing solutions for your specific applications.

If you have questions or specific project requirements please contact us. We will be happy to develop special proposals with you.

## Key features

- The ASDO system is the only tie-rod and compression-rod system that holds an ETA for nominal sizes up to M160
- Fork connectors of cast steel in conjunction with high-strength tie-rod enable design resistance up to 9,600 kN
- Uniform fork connector design for all nominal sizes
- Identical system components and connection dimensions for carbon steel and stainless steel version
- FEM-supported fork connector design with almost homogeneous tension distribution
- Pin locking cap is flush with the fork connector contour
- Single rod lengths up to 22m possible
- Simple visual checking of minimum thread engagement

The Construction Products Regulation of 2011 (CPR) came into force July 2013 making it mandatory for tension bars supplied within the European Union to be supplied CE marked indicating they meet the requirements of European harmonised design codes and are 'fit for purpose'.

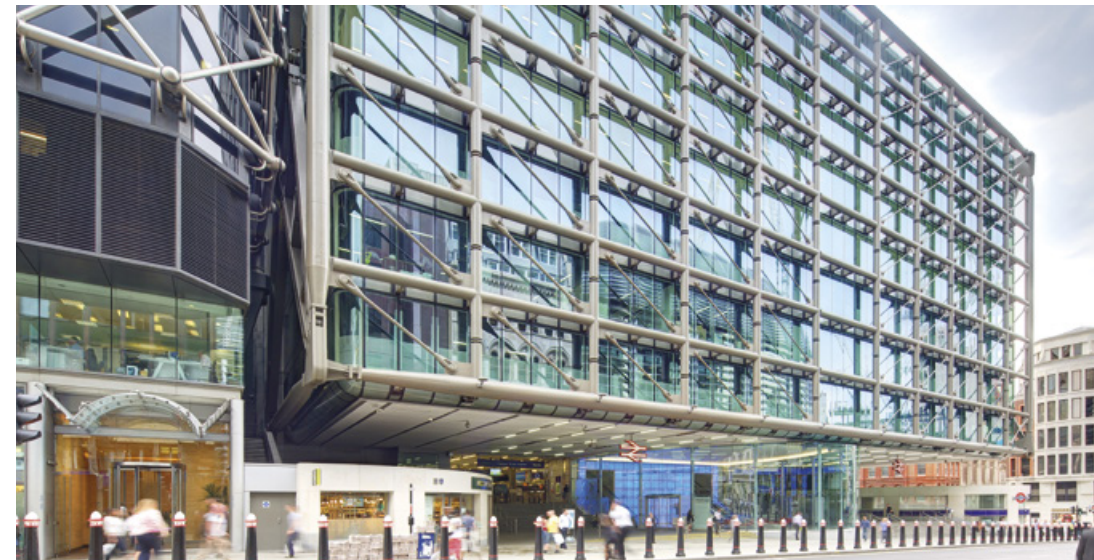
ASDO structural tie bars have met this requirement since 2004 and are manufactured under ISO 9001 and EN1090 independently audited quality systems. This has allowed Anker Schroeder to successfully supply many projects around the world.



## ASDO tie bars for:



Tension structures



Architectural bracing and facades



Bowstring trusses, bridges and timber structures



## PAST PROJECTS



ASD0540-S tie bars were specified for the new stand at Wolverhampton Football Club in the UK as the only system available to support the high loads and be capable of in-situ stressing.



Sheremetyevo airport under construction



ASD0540-S tie bars are used to support the entrance roof to terminal 3 of Sheremetyevo airport in Moscow.



## PAST PROJECTS



ASDO540-S tie bars M76 to M160 were used as the tension elements in the trusses to form part of this unique and structurally demanding London office building at Cannon Place.



ASDO540-S M90 tie bars are used as hangers on this East London Line railway bridge in Shoreditch. As well as undergoing rigorous QA the system was also fatigue tested to 2m cycles.



Tandem ASDO540-S bars were used to brace the new 52 floor headquarters for the New York Times newspaper.



ASDO540-S M56 tie bars were used to form the tension elements for this bowstring truss Kåkenhus footbridge in Norrköping, Sweden.



ASDO TIE BAR DESIGN CAPACITIES

PRODUCT DATA

ASDO tie bars can be supplied in two grades of carbon steel and stainless steel. All components are designed to exceed the capacity of the bar.

Table 1 - ASDO grade

	ASDO350-S	ASDO540-S					ASDOE600-S		
Nominal thread size	M100 - M130	M12	M16-42	M45-85	M90 - M100	M105 - M160*	M12 - M42	M48 - M56	
f <sub>y</sub> [N/mm²]	355	355	540	540	520	630	600	460	
f <sub>ua</sub> [N/mm²]	510	510	700	700	700	710	800	650	

Minimum elongation for all grades 17%; Minimum charpy for all grades 27J @ -20 °C; ASDO350-S M140-M160 differ from above, refer to table 3 for design resistance  
\*ASDO540-S bars M105-M160 are quench and tempered and should not be galvanised

Table 2 - Standard stock bar lengths

Nominal thread size		ASDO350-S	ASDO540-S	ASDOE600-S
M16-M42	m	-	12	6
M45-M100	m	-	16	6
M105-M160	m	16	12	-

For longer system lengths bars are connected using couplers or turnbuckles.  
M12 available in 6m lengths only.

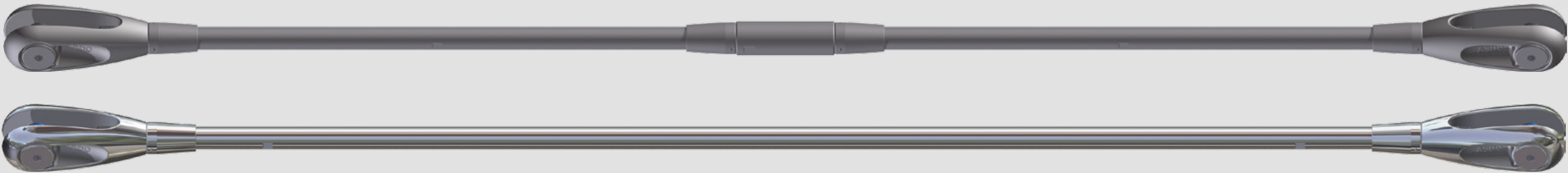


Table 3 - Carbon steel

Dimensional data	Nominal thread size		M12	M16	M20	M24	M27	M30	M36	M42	M45	M48	M52	M56	M60	M64	M68	M72	M76	M80	M85	M90	M95	M100	M105	M110	M115	M120	M130	M140	M150	M160	
	Nominal shaft size		mm	12	16	20	24	27	30	36	42	45	48	52	56	60	64	68	72	76	80	85	90	95	100	105	110	115	120	130	140	150	160
	Shaft area, A <sub>s</sub>		mm <sup>2</sup>	113	201	314	452	573	707	1,018	1,385	1,590	1,810	2,124	2,463	2,827	3,217	3,632	4,072	4,536	5,027	5,675	6,362	7,088	7,854	8,659	9,503	10,387	11,310	13,273	15,394	17,671	20,106
	Thread pitch		mm	1.75	2	2.5	3	3	3.5	4	4.5	4.5	5	5	5.5	5.5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	Thread stress area, A <sub>s</sub>		mm <sup>2</sup>	84	157	245	353	459	561	817	1,121	1,306	1,473	1,758	2,030	2,362	2,676	3,055	3,460	3,889	4,344	4,948	5,591	6,273	6,995	7,755	8,556	9,395	10,274	12,149	14,181	16,370	18,716
	Weight per metre [bar]		kg/m	0.9	1.6	2.5	3.6	4.5	5.5	8.0	10.9	12.5	14.2	16.7	19.3	22.2	25.3	28.5	32.0	35.6	39.5	44.5	49.9	55.6	61.7	68.0	74.6	81.5	88.8	104.2	120.8	138.7	157.8
Load capacities	ASD0350-S	Yield	kN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,483	2,753	3,037	3,335	3,647	4,313	4,183	4,829	5,334	
		Ultimate	kN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,567	3,955	4,363	4,791	5,240	6,196	6,665	7,694	8,422
	ASD0540-S	Yield	kN	30	85	132	190	248	303	441	605	705	795	949	1,096	1,275	1,445	1,650	1,868	2,100	2,346	2,672	2,907	3,262	3,637	4,886	5,390	5,919	6,472	7,654	8,934	10,313	11,791
		Ultimate	kN	43	110	171	247	322	392	572	785	914	1,031	1,230	1,421	1,653	1,873	2,139	2,422	2,723	3,041	3,463	3,914	4,391	4,896	5,506	6,074	6,670	7,294	8,626	10,068	11,623	13,289
Design resistance <sup>1</sup>	ASD0350-S	F <sub>t,Rd</sub>	kN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,535	2,795	3,067	3,352	3,650	4,284	4,128	4,739	5,209	
	ASD0540-S	F <sub>t,Rd</sub>	kN	31	79	123	178	232	283	412	565	658	742	886	1,023	1,190	1,349	1,540	1,744	1,960	2,189	2,494	2,818	3,162	3,525	3,965	4,374	4,803	5,252	6,210	7,249	8,368	9,568

Table 4 - Stainless steel

Dimensional data	Nominal thread size		M12	M16	M20	M24	M27	M30	M36	M42	M48	M56	M60+
	Nominal shaft size		mm	10.8	15	18	22	25	28	34	39	45	52
	Shaft area, A <sub>s</sub>		mm²	92	177	254	380	491	616	908	1,195	1,590	2,124
	Thread pitch		mm	1.75	2	2.5	3	3	3.5	4	4.5	5	5.5
	Thread stress area, A <sub>s</sub>		mm²	84	157	245	353	459	561	817	1,121	1,473	2,030
Load capacities	Weight per metre (bar)		kg/m	0.7	1.4	2.0	3.0	3.9	4.9	7.3	9.6	12.7	17.0
	ASDOE600-S	Yield	kN	51	94	147	212	276	336	490	673	934	Larger diameters available at request
		Ultimate	kN	67	125	196	282	368	448	653	897	1,320	
Design resistance¹	F <sub>t,Rd</sub>		kN	47	87	136	195	255	311	453	621	900	

Notes for tables 3 & 4:  
1. Design tensile resistance F<sub>t,Rd</sub> = min {f<sub>t</sub> x A<sub>s</sub> / γ<sub>M0</sub>; 0.9 x f<sub>ua</sub> x A<sub>s</sub> / γ<sub>M2</sub>} as per EN1993-1-8 with partial factors γ<sub>M0</sub> = 1.0 & γ<sub>M2</sub> = 1.25 for carbon steel and γ<sub>M0</sub> = 1.1 & γ<sub>M2</sub> = 1.25 for stainless steel according EN1993-1-4  
2. For the full design resistance to be utilised connection plates must be fabricated from S355J2 to EN10025 (or equivalent) and to minimum dimensions given in table 5  
3. All threads are cut threads and are not suitable for dynamic loads. Rolled threads with higher fatigue resistance can be made on request - please contact our technical department  
4. For full design capacity threads must be engaged at least 1.2 x thread diameter, see installation guide page 17  
5. Stainless steel bar grades M12-M42 are austenitic 1.4401/4, M48+ are duplex 1.4462.

**Corrosion protection**  
ASDO systems can be supplied self colour or galvanised as stand-ard. Sizes up to M42 are supplied with forks, pins, turnbuckles, couplers and thread-cover sleeves hot dip galvanised as standard. Note ASDO540-S bars M105-M160 are quench and tempered steel and therefore should not be galvanised.  
  
Bar threads can be formed after galvanising or are re-machined to size following galvanizing; repairs to the zinc coating are made in accordance with DIN EN ISO 1461. Spanner flats on the tie-rods are pressed following hot galvanizing to prevent brittle fracture. Note, due to the nature of the galvanising process the visual finish of gal-vanised product is variable. If a high level of aesthetic finish is re-quired systems should be subsequently painted after a suitable primer has been applied. ASDO tie bars cannot be supplied with 'top-coat' finishes, this should be applied by the customer. Please advise us before placing an order if bars are intended to be painted.



Please contact our technical department for more detail.

## ASDO DIMENSIONAL DATA

## PRODUCT DATA

The components shown are generic and the design of pins, couplers and turnbuckles may change dependent on bar diameter. Turnbuckles and couplers from M105 to M160 have a cross bore instead of spanner flats.

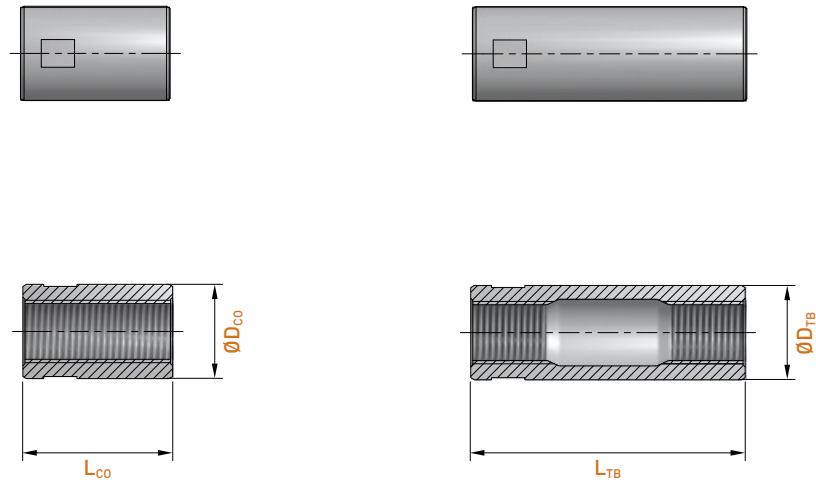
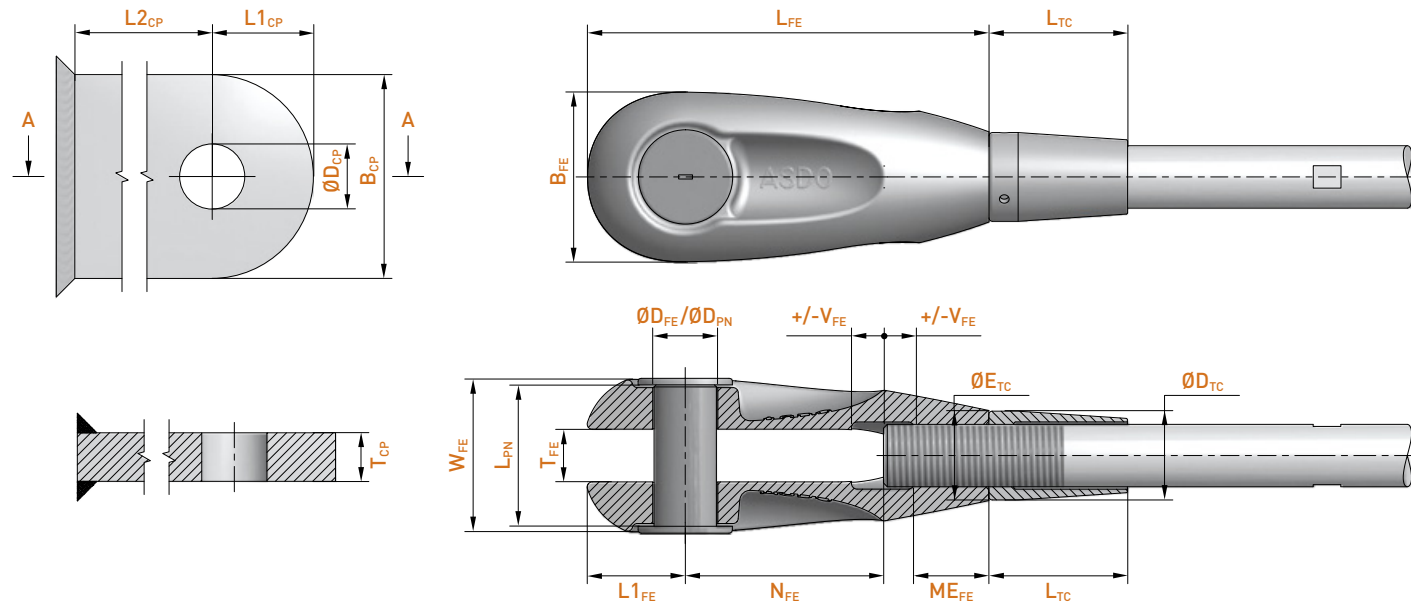


Table 5 - Dimensions for ASDO fittings - all grades (carbon and stainless)

Nominal size		M12	M16	M20	M24	M27	M30	M36	M42	M45	M48	M52	M56	M60	M64	M68	M72	M76	M80	M85	M90	M95	M100	M105	M110	M115	M120	M130	M140	M150	M160
FE Fork end	L <sub>FE</sub>	77	104	129	155	172	193	232	271	290	310	334	361	386	412	438	463	489	516	547	579	610	645	677	709	742	773	837	901	966	1,031
	B <sub>FE</sub>	33	44	53	65	73	81	98	114	122	130	139	150	159	172	182	193	203	219	230	243	258	271	287	301	316	330	354	381	410	436
	W <sub>FE</sub>	31	42	50	61	66	77	90	104	108	119	126	139	149	159	167	179	191	196	211	226	237	248	259	271	284	303	327	351	375	405
	T <sub>FE</sub>	12	17	18	23	23	28	33	38	38	44	44	49	54	59	59	64	69	74	79	84	89	94	96	101	106	116	126	136	146	156
	ØD <sub>FE</sub>	13	17	21	25	28	32	38	44	47	50	54	58	62	66	70	74	78	82	87	92	97	102	108	113	118	123	133	143	153	163
	L <sub>1FE</sub>	19	26	31	38	42	47	57	66	71	76	81	88	93	100	106	112	119	128	133	140	150	160	167	175	184	191	207	222	239	255
	M <sub>FE</sub>	14	19	24	29	32	36	43	50	54	58	62	67	72	77	82	86	91	96	102	108	114	120	126	132	138	144	156	168	180	192
	N <sub>FE</sub>	38	51	64	76	84	95	114	134	143	152	166	181	196	210	225	240	254	267	287	306	321	340	359	377	395	413	449	486	522	559
	+/-V <sub>FE</sub>	6	8	10	12	13,5	15	18	21	23	24	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
	Weight [kg]	0.17	0.42	0.83	1.4	2.0	2.8	4.8	7.6	9.4	11	15	18	22	27	33	39	45	51	63	74	85	100	119	136	156	177	221	277	340	417
Nominal size		M12	M16	M20	M24	M27	M30	M36	M42	M45	M48	M52	M56	M60	M64	M68	M72	M76	M80	M85	M90	M95	M100	M105	M110	M115	M120	M130	M140	M150	M160
PN Pin	ØD <sub>PN</sub>	12	16	20	24	27	30	36	42	45	48	52	56	60	64	68	72	76	80	85	90	95	100	105	110	115	120	130	140	150	160
	L <sub>PN</sub>	30	40	47	57	63	73	85	97	102	111	120	129	140	151	157	166	175	182	195	205	218	229	241	250	261	277	301	323	344	365
	Weight [kg]	0.03	0.07	0.14	0.25	0.34	0.46	0.81	1.2	1.5	2	2	3	4	5	5	6	7	8	11	12	14	16	19	22	25	29	37	46	57	71
Nominal size		M12	M16	M20	M24	M27	M30	M36	M42	M45	M48	M52	M56	M60	M64	M68	M72	M76	M80	M85	M90	M95	M100	M105	M110	M115	M120	M130	M140	M150	M160
CP Connection plate	T <sub>CP</sub>	10	15	15	20	20	25	30	35	35	40	40	45	50	55	55	60	65	70	75	80	85	90	90	95	100	110	120	130	140	150
	B <sub>CP</sub>	42	56	68	80	90	104	122	142	152	160	174	186	200	212	224	238	250	264	280	296	312	328	346	362	378	394	426	458	490	522
	ØD <sub>CP</sub>	13	17	21	25	28	32	38	44	47	50	54	58	62	66	70	74	78	82	87	92	97	102	108	113	118	123	133	143	153	163
	L <sub>1CP</sub>	21	28	34	40	45	52	61	71	76	80	87	93	100	106	112	119	125	132	140	148	156	164	173	181	189	197	213	229	245	261
	L <sub>2CP</sub> (min)	29	36	46	53	57	62	72	81	86	91	101	108	113	120	126	132	139	148	153	160	170	180	192	200	209	216	232	247	264	280
Nominal size		M12	M16	M20	M24	M27	M30	M36	M42	M45	M48	M52	M56	M60	M64	M68	M72	M76	M80	M85	M90	M95	M100	M105	M110	M115	M120	M130	M140	M150	M160
TC Locking thread cover	ØE <sub>TC</sub>	17	23	29	35	39	42	51	60	64	69	75	81	87	92	99	104	110	113	122	129	134	143	152	158	166	173	187	202	216	232
	L <sub>TC</sub>	30	40	50	55	60	70	80	95	100	110	115	120	120	135	135	135	135	140	140	140	140	140	140	140	140	140	140	140	140	140
	Weight [kg]	0.03	0.05	0.09	0.1	0.2	0.3	0.4	0.7	0.8	1.1	1.3	1.6	1.8	2.2	2.7	2.9	3.3	3.6	4.2	4.7	4.9	5.7	6.6	7.0	7.8	8.6	10	12	13	15
Nominal size		M12	M16	M20	M24	M27	M30	M36	M42	M45	M48	M52	M56	M60	M64	M68	M72	M76	M80	M85	M90	M95	M100	M105	M110	M115	M120	M130	M140	M150	M160
TB Turnbuckle	ØD <sub>TB</sub>	20	27	36	42	48	51	60	70	76	83	89	95	102	108	114	121	127	133	140	152	159	171	178	191	194	203	219	241	254	273
	L <sub>TB</sub>	53	70	88	106	119	132	158	185	198	211	225	234	244	254	263	273	282	292	304	326	338	350	387	399	411	423	447	471	495	519
	+/-V <sub>TB</sub>	12	16	20	24	27	30	36	42	45	48	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
	Weight [kg]	0.09	0.16	0.32	0.6	0.9	1.2	1.8	2.8	3.3	3.9	5.4	6.2	8.5	10	12	14	16	18	20	24	30	34	42	49	62	61	82	96	115	147
Nominal size		M12	M16	M20	M24	M27	M30	M36	M42	M45	M48	M52	M56	M60	M64	M68	M72	M76	M80	M85	M90	M95	M100	M105	M110	M115	M120	M130	M140	M150	M160
CO Coupler	ØD <sub>CO</sub>	20	27	36	42	48	51	60	70	76	83	89	95	102	108	114	121	127	133	140	152	159	171	178	191	194	203	219	241	254	273
	L <sub>CO</sub>	29	39	48	58	65	72	87	101	108	116	125	135	144	154	164	173	183	192	204	226	238	250	287	299	311	323	347	371	395	419
	Weight [kg]	0.05	0.09	0.17	0.3	0.5	0.7	1.1	1.7	2.0	2.3	3.2	3.9	5.3	6.3	7.8	9.2	11	12	14	17	22	25	32	37	47	47	65	77	93	119

All dimensions in mm unless noted otherwise

ASDO CROSS BRACING

ASDO tie bars bar can be used for cross bracing in a variety of ways but in all cases are easy to install and allow for In-Situ length adjustment to accommodate construction tolerances. When selecting a bracing system the accessibility for installation and overall cost should be considered as well as the aesthetics. The three most common types are shown opposite:

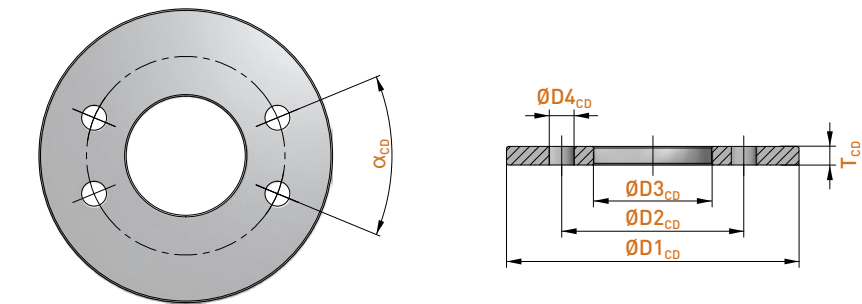


**ASDO bracing with centre disc**  
This is the most common system used as it offers the greatest flexibility and gives the best length adjustment capabilities. It should be considered that double the number of clevises are required compared to the other systems.

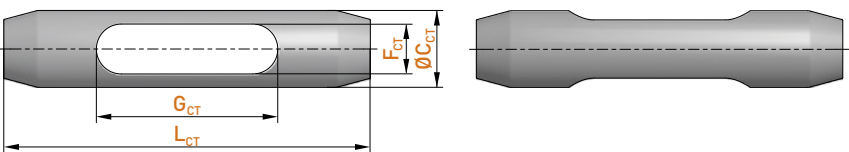
**ASDO bracing with cross turnbuckle**  
The cross turnbuckle can offer a more cost effective alternative to the centre disc, dependent on size, but gives limited in-situ adjustment. Further turnbuckles can be added for greater adjustment. Two angles are offered,  $40^{\circ} \leq \alpha_{CT} \leq 140^{\circ}$  degrees and  $60^{\circ} \leq \alpha_{CT} \leq 120^{\circ}$  degrees

**ASDO bracing with crossed bars**  
If the tie rods can be offset from each other (ie are not in the same plane) then bars can be crossed as above. This is the most cost effective solution requiring the least components but has limited adjustment. Turnbuckles can be added to provide greater adjustment.

CD Centre Disk  $45^{\circ} \leq \alpha_{CD} \leq 135^{\circ}$



CT-40 Cross Turnbuckle  $40^{\circ} \leq \alpha_{CT} \leq 140^{\circ}$



CT-60 Cross Turnbuckle  $60^{\circ} \leq \alpha_{CT} \leq 120^{\circ}$

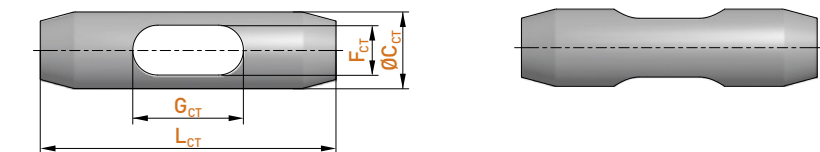


Table 6 - Dimensions for ASDO cross bracing connectors - grades ASD0350-S & ASD0540-S

Nominal size		M12	M16	M20	M24	M27	M30	M36	M42	M45	M48	M52	M56	M60	M64	M68	M72	M76
CD Centere Disk $45^{\circ} \leq \alpha_{CD} \leq 135^{\circ}$	T <sub>CD</sub>	10	15	15	20	20	25	30	35	35	40	40	45	50	55	55	60	65
	ØD1 <sub>CD</sub>	170	215	255	300	335	370	445	520	555	595	635	680	740	785	825	870	930
	ØD2 <sub>CD</sub>	110	140	170	200	225	250	300	350	375	400	430	460	500	530	560	590	630
	ØD3 <sub>CD</sub>	60	80	100	120	135	150	180	210	225	240	260	280	300	320	340	360	380
	ØD4 <sub>CD</sub>	13	17	21	25	28	32	38	44	47	50	54	58	62	66	70	74	78
	Weight [kg]	1.5	3.6	4.9	9.0	11	17	30	47	54	71	80	103	136	168	185	224	279

Nominal size		M12	M16	M20	M24	M27	M30	M36	M42	M45	M48	M52	M56	M60	M64	M68	M72	M76
CT-40 Cross Turnbuckle $40^{\circ} \leq \alpha_{CT} \leq 140^{\circ}$	ØC <sub>CT</sub>	24	36	42	48	52	56	68	80	85	95	100	105	115	125	130	140	145
	L <sub>CT</sub>	111	153	184	221	245	269	324	379	404	438	465	490	518	551	577	606	631
	+/-V <sub>CT</sub>	12	16	20	24	27	30	36	42	46	48	50	50	50	50	50	50	50
	G <sub>CT</sub>	57	81	94	111	123	133	162	189	200	220	235	250	268	289	305	326	341
	F <sub>CT</sub>	16	20	24	30	33	36	44	52	55	58	64	68	72	78	82	88	92
	Weight [kg]	0.2	0.6	1.0	1.6	2.0	2.6	4.5	7.3	8.8	12	14	15	20	25	28	33	37

Nominal size		M12	M16	M20	M24	M27	M30	M36	M42	M45	M48	M52	M56	M60	M64	M68	M72	M76
CT-60 Cross Turnbuckle $60^{\circ} \leq \alpha_{CT} \leq 120^{\circ}$	ØC <sub>CT</sub>	-	-	-	-	-	-	-	80	85	95	100	105	115	125	130	140	145
	L <sub>CT</sub>	-	-	-	-	-	-	-	306	326	352	374	393	414	439	458	479	499
	+/-V <sub>CT</sub>	-	-	-	-	-	-	-	42	46	48	50	50	50	50	50	50	50
	G <sub>CT</sub>	-	-	-	-	-	-	-	116	122	134	144	153	164	177	186	199	209
	F <sub>CT</sub>	-	-	-	-	-	-	-	52	55	58	64	68	72	78	82	88	92
	Weight [kg]	-	-	-	-	-	-	-	6.6	8.0	10	12	14	18	22	25	30	33

All dimensions in mm unless noted otherwise  
Stainless steel connectors available on request - please contact our sales department for more information

ASDO COMPRESSION STRUTS

PRODUCT DATA



ASDO Compression connections for Zürich Airport

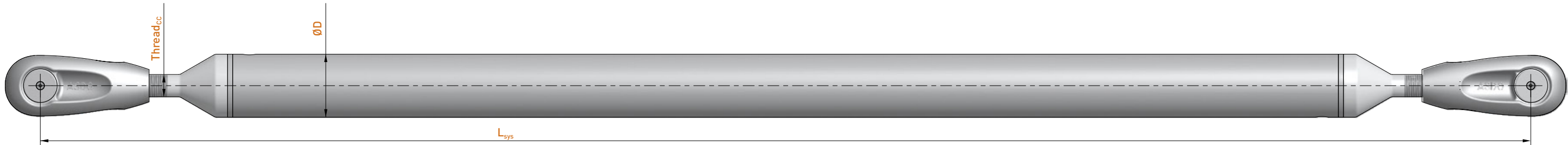
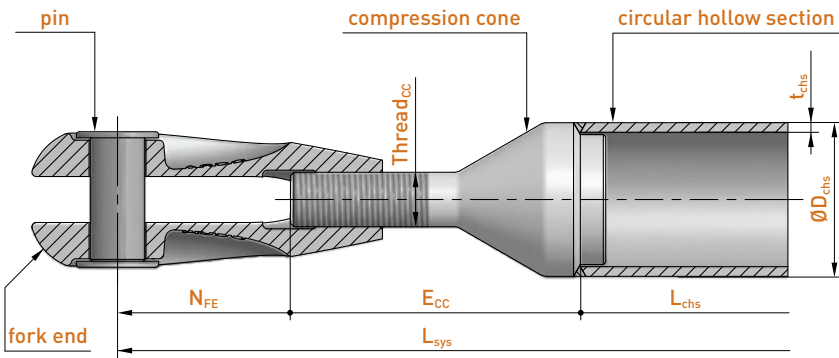


Table 7a - Compression strut connections

Thread <sub>cc</sub>		M12	M16	M20	M24	M27	M30	M36	M42	M45	M48	M52	M56	M60	M64	M68	M72	M76	M80	M85	M90	M95	M100
N <sub>FE</sub>	mm	38	51	64	76	84	95	114	134	143	152	166	181	196	210	225	240	254	267	287	306	321	340
E <sub>CC</sub>	mm	106	121	135	150	161	176	202	223	240	257	260	275	282	301	302	318	336	343	360	362	388	390
N <sub>FE</sub> + E <sub>CC</sub>	mm	144	172	199	226	245	271	316	357	383	409	426	456	478	511	527	558	590	610	647	668	709	730
S355 CHS Size (dia. x thk)	mm	33.7 x 4	44.5 x 4	54 x 5	63.5 x 5	73 x 5	82.5 x 5	101.6 x 6.3	114.3 x 6.3	127 x 8	139.7 x 10	139.7 x 10	152.4 x 10	159 x 10	177.8 x 10	177.8 x 10	193.7 x 12.5	203 x 12.5	219.1 x 12.5	244.5 x 16	244.5 x 16	273 x 16	273 x 16
Max N <sub>c,Rd</sub>	kN	15	30	45	65	90	110	170	240	285	265	325	370	440	500	580	660	740	835	960	1,095	1,240	1,390

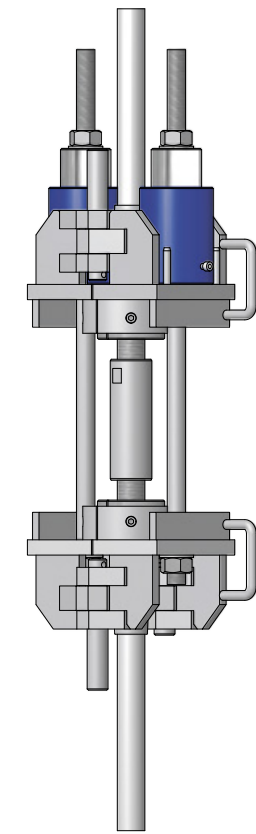
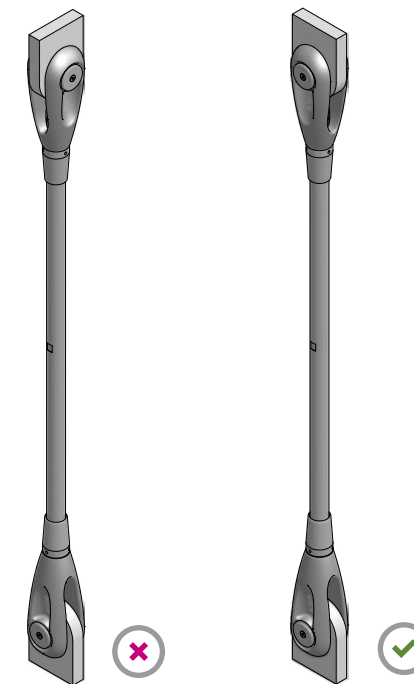
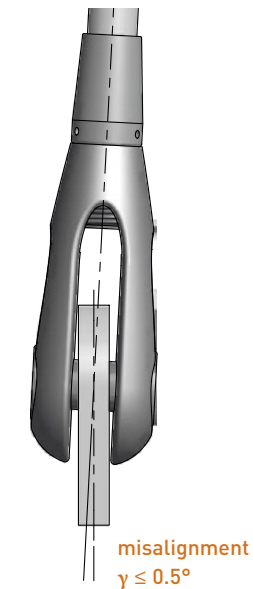
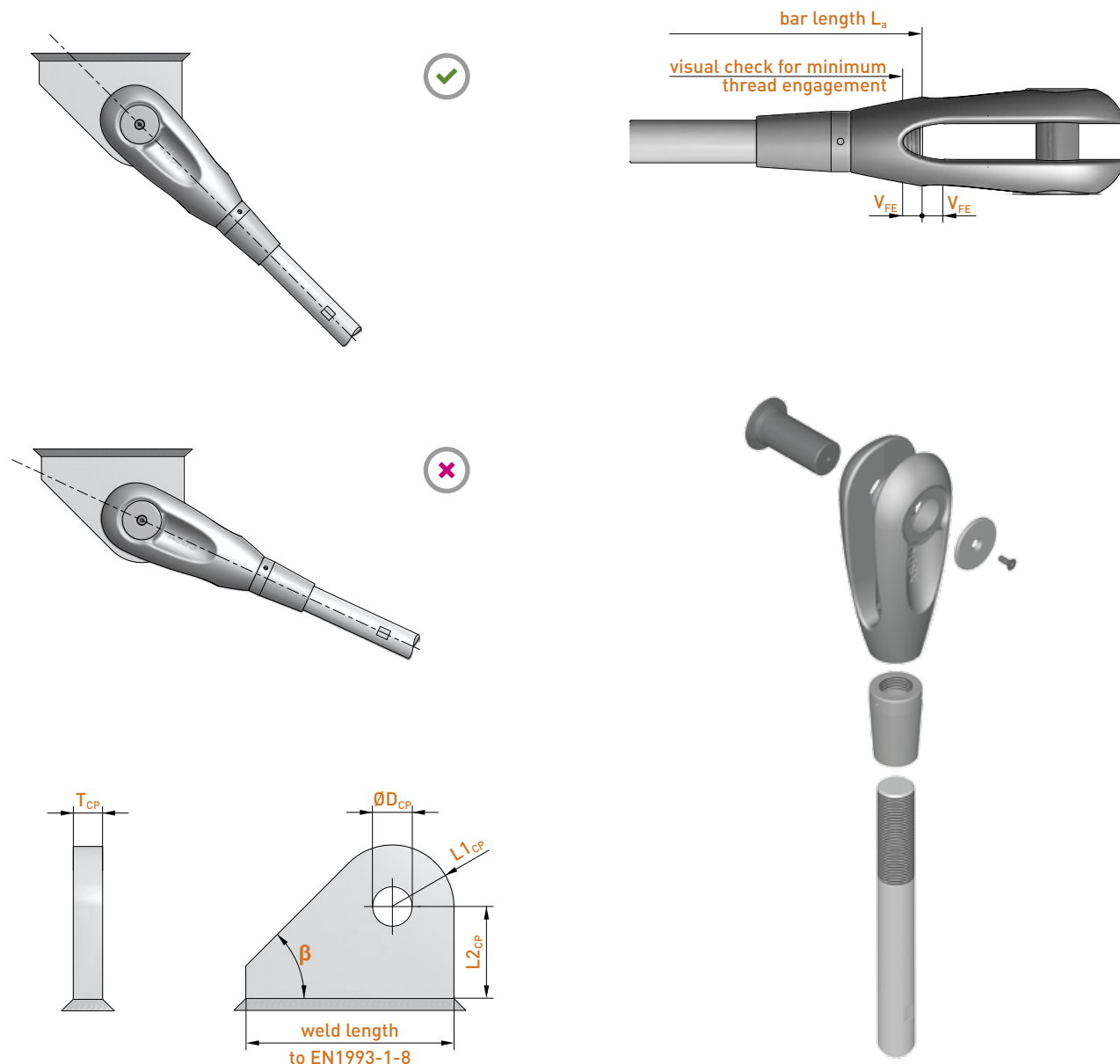
Table 7b - Compression strut design resistance in kN

Pin-Pin Length L <sub>sys</sub> [m]	M12	M16	M20	M24	M27	M30	M36	M42	M45	M48	M52	M56	M60	M64	M68	M72	M76	M80	M85	M90	M95	M100
1	15	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	15	30	45	65	90	110	170	240	285	265	325	370	440	500	580	660	740	-	-	-	-	-
3	8	20	40	65	90	110	170	240	285	265	325	370	440	500	580	660	740	835	960	1,095	1,240	1,390
4	-	-	25	40	65	95	170	240	285	265	325	370	440	500	580	660	740	835	960	1,095	1,240	1,390
5	-	-	15	25	40	60	140	200	285	265	325	370	440	500	580	660	740	835	960	1,095	1,240	1,390
6	-	-	-	15	30	40	100	145	240	265	325	370	440	500	580	660	740	835	960	1,095	1,240	1,390
7	-	-	-	10	20	30	75	105	180	265	295	370	430	500	580	660	740	835	960	1,095	1,240	1,390
8	-	-	-	10	15	25	55	85	140	230	230	300	340	475	475	660	740	835	960	1,095	1,240	1,390
9	-	-	-	-	-	20	45	65	110	180	180	240	270	385	385	595	685	835	960	1,095	1,240	1,390
10	-	-	-	-	-	15	35	55	90	150	150	195	225	315	315	490	565	715	960	1,095	1,240	1,390
11	-	-	-	-	-	10	30	45	75	125	125	160	185	260	260	410	475	600	960	1,020	1,240	1,390
12	-	-	-	-	-	10	25	35	65	105	105	135	155	220	220	350	405	510	870	870	1,210	1,210

Notes:  
1. Approximate design compression resistance N<sub>c,Rd</sub> as per Eurocode EC3 (with partial safety coefficient γ<sub>m0</sub>= 1.0). Capacities given for guidance only - values should be checked by a competent person for each project.  
2. CHS diameters suggested only - any standard section can be used to suit.  
3. Compression systems are also available in stainless steel - please contact our technical department for more information  
4. Full fork end dimensions can be found in table 5



## INSTALLATION

**Connection plates**

The shape of the connection plate is dependent on the load transfer to the supporting structure as shown above. It should be ensured that the correct load path is followed back to the structure.

The plate should be fabricated in S355J2 grade material according EN10025 with minimum dimensions as per Table 5. Minimum plate thickness can be built up using welded bosses if required. Stainless steel connection plates should have a min. 0.2% proof stress equivalent or greater than grade S355 of the same thickness.

Pin holes must be produced mechanically.

Weld lengths and sizes should be designed appropriately to EN1993-1-8.

**Assembly**

The ASDO system is simple to assemble. Generally tie bars less than 6m will be delivered fully assembled (pins are packed separately), longer lengths may be split into transportable lengths. On receipt of goods please check that all components are present and no damage has occurred to any part of the system, please contact our technical department if you suspect damage has occurred.

Prior to installation assemble full lengths and adjust to the correct pin-to-pin length. To install simply place the fork over the connection plates, insert pins and secure and hand tighten the system by either rotating the turnbuckle (if present) or the bar (if no turnbuckle).

The pin design varies depending on the nominal size and steel grade but typically are as shown above. End caps should be screwed tight using Loctite or similar.

**Installation**

When installing the ASDO system ensure that the maximum misalignment does not exceed 0.5° from the plane of line of force as shown above. This prevents bending in the fork connectors and connection plates.

ASDO tie-rod system should be installed with fork ends in the same orientation and not twisted as shown above.

The bar thread end should be visible through the fork to ensure full thread engagement

For detailed information on the installation of our tie rods and the required tools please contact our technical department.

**In-Situ stressing and load measurement**

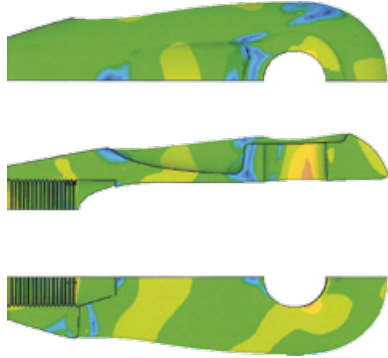
ASDO tie bars can be stressed or have their tensile load measured once installed. Specially designed hydraulic rigs can be hired which allow tie bars to be stressed or have the tensile load they are carrying measured, contact our technical department for more detail.

ASDO tie bars can also be supplied with Strainsonic load measuring pins. Using a portable hand-held device ultrasonic signals are passed through the pin and the time-of-flight is measured using sophisticated on-board electronics. From instant measurements of the changes in the ultrasonic signal due to stress in the pin the 'acoustoelastic' effect of materials is utilised to determine the load in the pin.

This provides a robust and accurate (+/-2.5%) method of load measurement and is self-compensating for temperature effects.



## QUALITY ASSURANCE & DESIGN

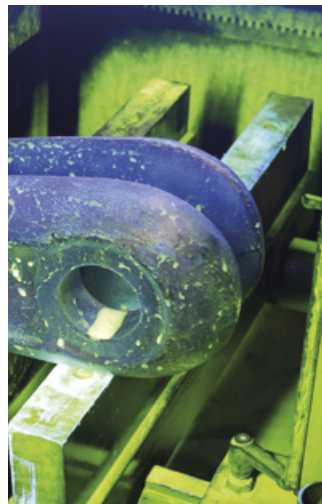


### Dynamic loads

The ASDO system can also be supplied with cold rolled threads that gives bar threads a much greater resistance to fatigue than the standard cut thread.

Fatigue tests have been performed on full scale ASDO systems to over 2m cycles of loading without failing. ASDO do not recommend hot dip galvanising rolled threads due to the increased risk of hydrogen embrittlement and much reduced fatigue resistance.

Please contact our technical department for further information regarding ASDO systems for use on structures subject to fatigue.



### Design and quality assurance

The ASDO system is manufactured under independently audited quality systems to ISO 9001 & EN1090 ensuring the requirements of the ETA and CE marking are met.

The ASDO fork (or clevis) was developed using FEM techniques resulting in a very efficient load carrying design.

As most tension systems on the market ASDO fork connectors are made from cast steel. The ability of castings to transfer load from the structure to the bar is paramount and Anker Schroeder have a stringent quality control regime for the casting process. All castings meet the requirements of EN10340. Enhanced non-destructive testing can be offered by agreement. Please call our technical department for more detail.

### Technical drawings / BIM

To assist you in the design process ASDO can supply component data in CAD and BIM format. Links to files can be found on our website [www.asdo.com](http://www.asdo.com) and a dedicated server ensures the user always downloads the latest information, for BIM this includes quality documents, installation manuals, brochures and design loads.



For CAD users we offer 2D and 3D files which contain most of the components shown in this brochure. Individual components can be arranged into assemblies as required, only the individual tie rod length (see page 9) and restrictions to the angle of cross bracings (see page 12) need to be adapted to your project needs. See [www.asdo.com](http://www.asdo.com) for more detail.

## OTHER PRODUCTS



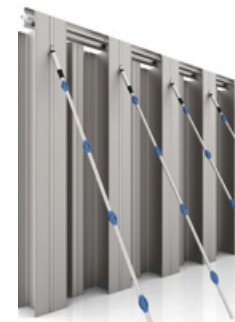
**ASDO Marine**  
Upset forged tie bars to EN1993-5 for use in marine retaining structures

Diameter M64 to M170



**ASDO Structural**  
Tie bars for bridges and dynamic loads

Diameter M64 to M170 with upset forged, threaded or cast end connections



**ASDO Micro-Piles**

Diameters up to M160 and working loads > 4,500 kN



**ASDO Forged Shackles**

Working load capacities up to 1,500 tonnes

This publication provides information and technical details currently used by Anker Schroeder in the manufacture of its products.

Although we have taken great care in the preparation of the data within this publication, we cannot accept responsibility for the completeness and accuracy of all the details given. Each customer should satisfy themselves of the product suitability for their requirements. The publication of this data does not imply a contractual offer.

In line with Anker Schroeder's policy of continuous improvement the company reserves the right to change or amend details. Please contact our technical department for further information or to ensure these details are current.



### Sustainability

Steel is the most recycled material in construction. All anchorage material supplied by Anker Schroeder is sourced from reputable steel mills and, where possible, up to 90% of melt is recycled steel. Once a structure has reached the end of its design life Anker Schroeder bars are 100% recyclable as scrap material.





**Anker Schroeder ASDO GmbH**  
Hannöversche Straße 48  
44143 Dortmund  
Germany

Phone +49 231 51701-0  
Fax +49 231 51701-56  
**[sales@anker.de](mailto:sales@anker.de)**  
**[www.asdo.com](http://www.asdo.com)**

Printed June 2015, see **[www.asdo.com](http://www.asdo.com)** for the latest version