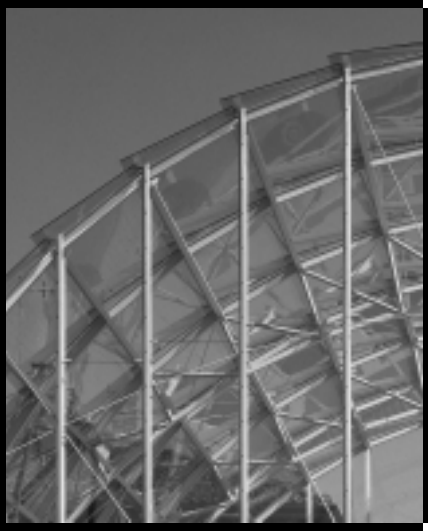


Planning Manual for Glass Clamp Mountings/Ties

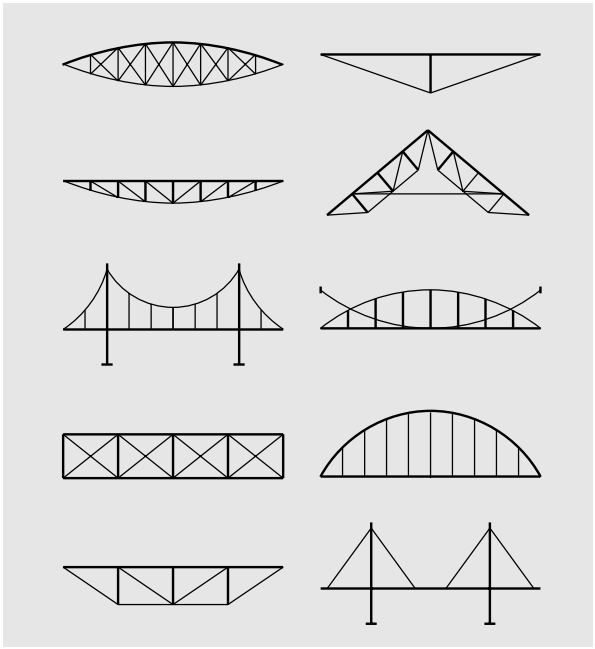
DORMA RODAN

Load-bearing Transparency

List of contents

Tie system

The RODAN tie system is often used for lightweight constructions and to create aesthetically elegant support structures.
The high standard of quality achieved through the use of the very latest cast materials, shaping processes and optimised volume utilisation has resulted in a component offering outstanding design and functional capabilities.



With the RODAN tie system, it is possible to create lightweight constructions of an elegance previously unknown. Despite their small cross sections, they are capable of bridging very large spans. The structural systems produced offer a unique intricacy of appearance that is bound to fascinate.

Hall 4 of Hannover Fair
Architects: Von Gerkan, Marg + Partner

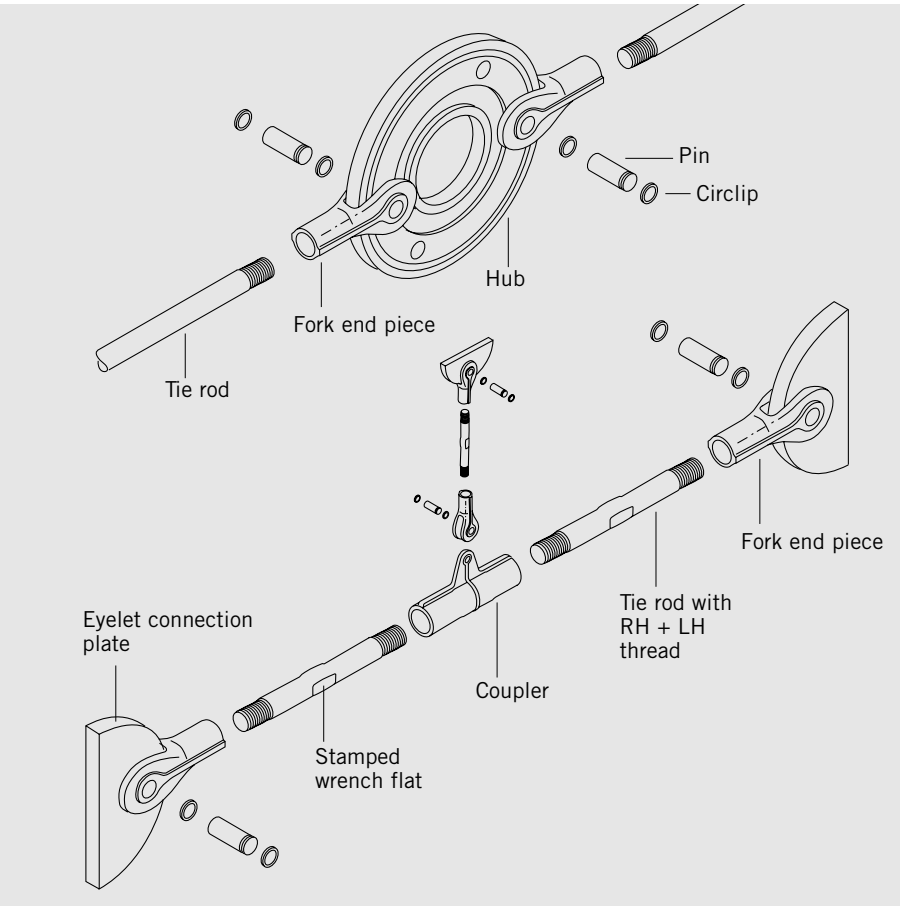
The RODAN tie system is a mass-produced product which received building approval from the DIBt in Berlin. It is certified and subjected to third-party quality verification by the Research Institute for Steel, Timber, Brick and Non-metallic Materials of the University of Karlsruhe.

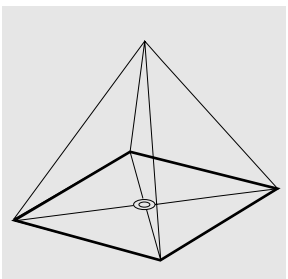
Design Center Stuttgart Design Award 1992

The lattice girder offers the ideal configuration for a visually pleasing arrangement of tension and compression members. RODAN ties are also the ideal tension element owing to their optimum design and ease of installation.

System elements

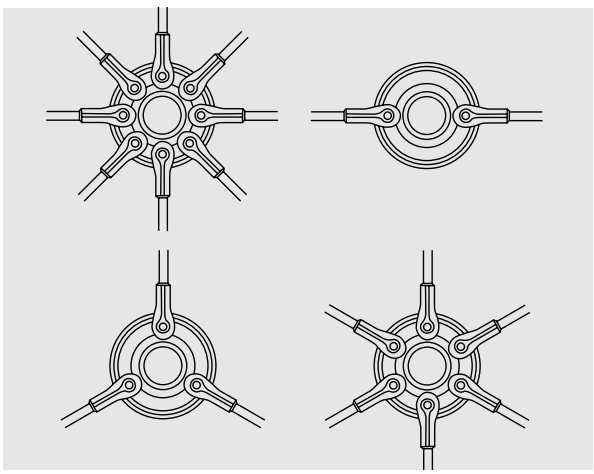
The RODAN tie system consists of just a few individual components which can be combined to produce simple yet effective assemblies.
The main component comprises a tie rod and two fork ends with left-hand or right-hand thread, a pin and two circlips.
Couplers and hubs ideally complement the system in terms of both function and design.
The materials of the cast components are spheroidal graphite or stainless steel.
The hub can be used for wind bracing or pyramid-shaped roofs with horizontal bracing.
The coupler serves to connect two tie rods. With an eyelet, it can be attached to a further, lateral tie rod.
The tolerance compensation capability of the tie rod system doubles when combined with a coupler.



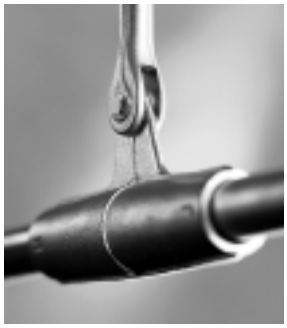


The hub can be used for wind bracing or pyramid-shaped canopies/roofs with horizontal bracing.

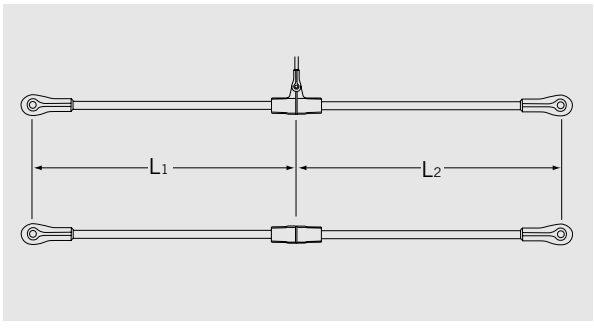
A hub can serve to connect up to eight fork end pieces where required.



The coupler serves to connect two tie rods. With an eyelet, it can be attached to a further, lateral tie rod.



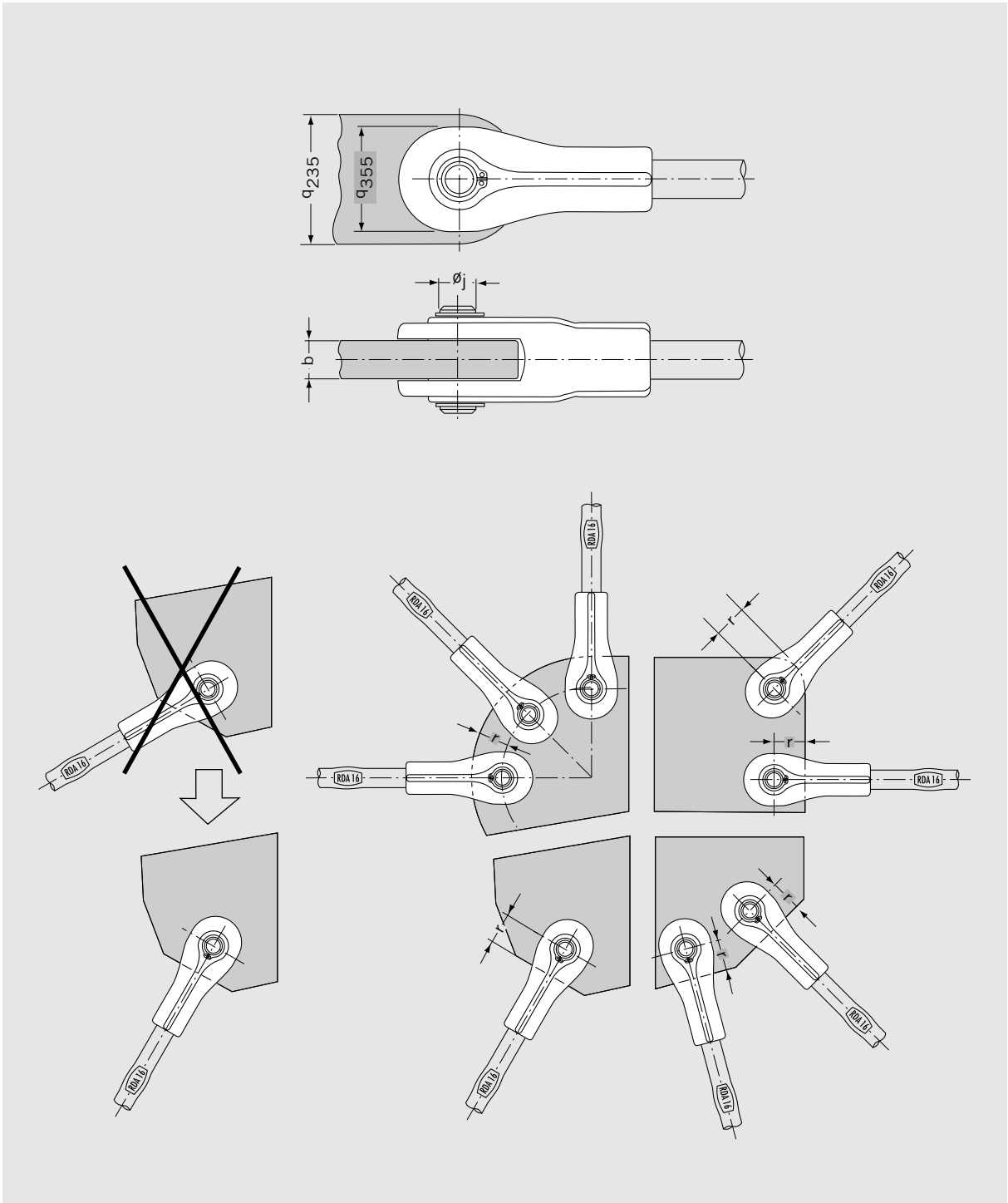
The tolerance compensation capability of the tie rod system doubles when combined with a coupler.



Dimensions and technical data

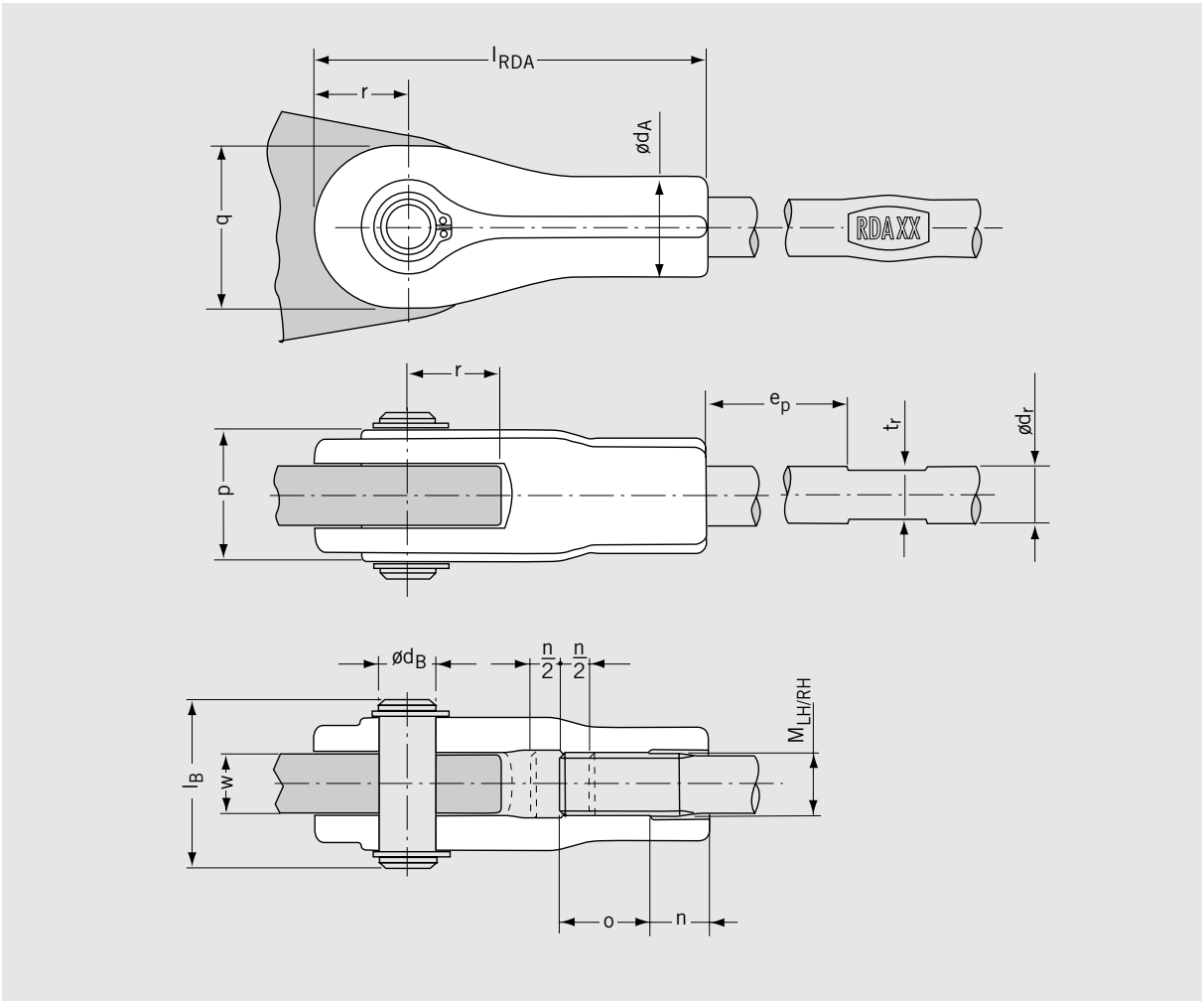
Connection examples (Dimensions in mm)

	RDA5	RDA6	RDA8	RDA10	RDA12	RDA16	RDA20	RDA24	RDA27	RDA30	RDA36	RDA42	RDA48	RDA52	RDA56	RDA60
r	8	9	12	15	18	24	29	35	39	43	51	60	69	75	81	88
$b^{+0.5}_{-0}$	4.5	5	7	8	10	15	18	20	22	25	30	35	40	45	50	55
q_{355}	14	16.7	21.3	25.5	30	40	49	58	64.5	71.5	84.5	100	116	124	134.5	146
q_{235}	14	18	21	28	33	42	54	66	76	82	97	108	127	141	152	158
$ø_j$	5.5	6.5	7.5	9.5	11.5	14.5	18.5	21.5	24.5	26.5	30.5	35.5	42.5	45.5	50.5	52.5



Fork end piece and tie rods (Dimensions in mm) ⊗ Available ◯ On application

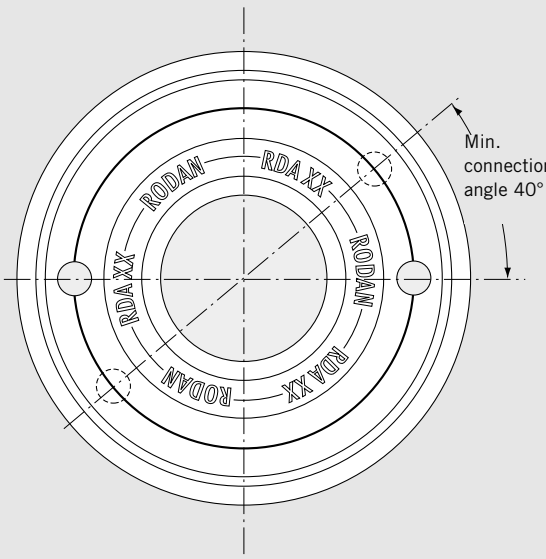
	RDA 5	RDA 6	RDA 8	RDA 10	RDA 12	RDA 16	RDA 20	RDA 24	RDA 27	RDA 30	RDA 36	RDA 42	RDA 48	RDA 52	RDA 56	RDA 60
l_{RDA}	36.5	44	52	64	78	100	122	150	167	185	220	255	290	315	341	374
ød$_A$	8	9.6	12.6	15.7	18.7	25	30.7	37.2	42	46.6	53.4	62.8	74	80.2	86	91
r	8	10	11.8	14.8	17.8	23.8	29.3	34.8	39.3	43.3	51.3	59.8	69.3	74.8	81.3	88
p	10	12	16	19.6	23.6	33	40	46.2	50.9	57.1	68	79.1	90	98.2	107	116
q	14	16.7	21.3	25.5	30	40	49	58	64.5	71.5	84.5	100	116	124	134.5	146
w	5	5.6	7.7	8.7	10.7	16	19	21	23	26	31	36	41	46	51	56
o	7	9	11	13.5	16.5	22	27	33.5	37	40.5	49	56.5	65	70	75	80
n	7	9	9	10	13	15	16	22	25	25	28	30	35	40	45	50
$M_{LH/RH}$	5x0.5	6x0.5	8x1.25	10x1.5	12x1.75	16x2	20x2.5	24x3	27x3	30x3.5	36x4	42x4.5	48x5	52x5	56x5.5	60x5.5
ød$_r$		5.21	7.04	8.86	10.86	14.5	18.16	21.8	24.8	27.46	33.12	38.78	44.43	48.43	52.09	56.09
t_r		4	5	7	8	12	13	17	19	22	27	32	36	41	46	50
l_B	14	18	22	27	32	42	50	58	63	70	82	95	109	117	128	137
ød$_B$	5	6	7	9	11	14	18	21	24	26	30	35	42	45	50	52
e_p		100.5	98.5	95	88.5	82.5	157	144	137.5	125	121	215	202.5	190	177.5	175
Standard		◯	◯	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	◯
Stainless steel	⊗	⊗	⊗	⊗	⊗	⊗	⊗	◯		◯	◯					

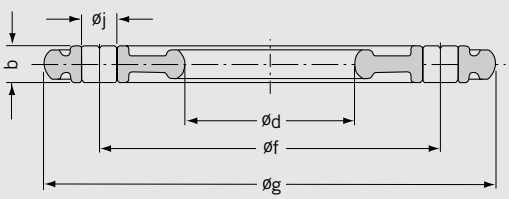


Hub (Dimensions in mm) ⊗ Available ◯ On application

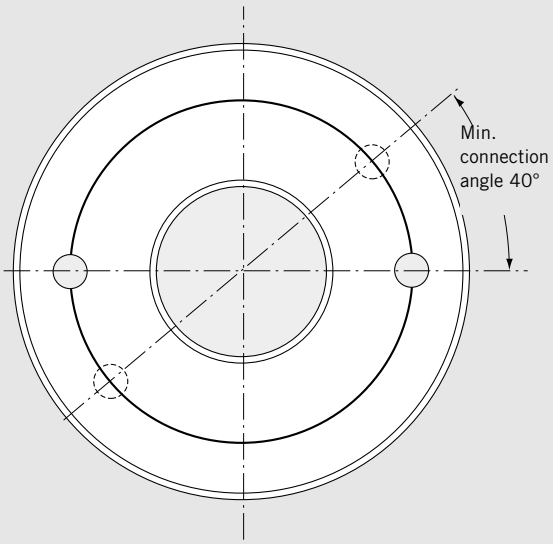
	RDA6	RDA8	RDA10	RDA12	RDA16	RDA20	RDA24	RDA27	RDA30	RDA36	RDA42	RDA48	RDA52	RDA56	RDA60
b	5	7	8	10	15	18	20	22	25	30	35	40	45	50	55
ød	27	37	46	56	70	94	106	120	132	156	182	212	228	248	262
øf	55	75	90	110	140	180	210	240	260	310	360	420	460	490	520
øg	73	99	120	146	186	238	280	318	346	412	480	558	600	652	692
øj	6.5	7.5	9.5	11.5	14.5	18.5	21.5	24.5	26.5	30.5	35.5	42.5	45.5	50.5	52.5
Cast hub S			⊗	⊗	⊗	⊗	⊗	⊗	⊗						
Turned hub S	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Turned hub E	◯	◯	◯	◯	◯	◯	◯		◯	◯					

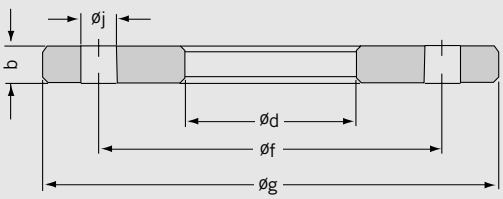
Cast hub





Turned hub





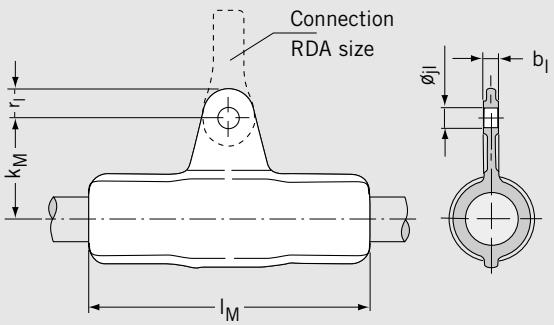
System design loads (KN)

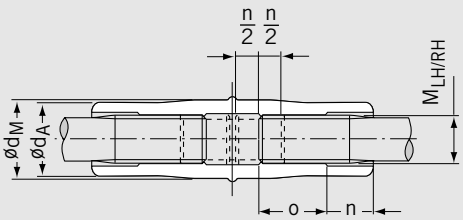
	RDA6	RDA8	RDA10	RDA12	RDA16	RDA20	RDA24	RDA27	RDA30	RDA36	RDA42	RDA48	RDA52	RDA56
$Z_{d,S355\ roll\text{-}bent}$	6.98	12.74	20.18	29.31	54.04	84.76	122.2	157.9	193.8	281	359.7	472.2	561	649
$V_{I,R,d\ cast\ hub}$			18.56	26.98	50.24	78.4	113	146.9	179.5	264.4				

Coupler (Dimensions in mm) ⊗ Available ◯ On application

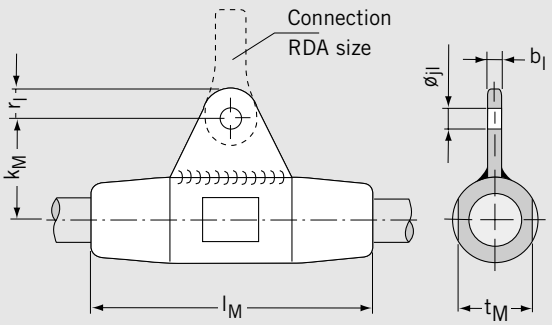
	RDA6	RDA8	RDA10	RDA12	RDA16	RDA20	RDA24	RDA27	RDA30	RDA36	RDA42	RDA48	RDA52	RDA56	RDA60
l_M	46	52	60	75	92	110	138	154	170	196	218	250	275	300	315
$ød_A$	9	12	15	18	24	30	36	41	45	54	63	73	79	85	90
Cast coupler $ød_M$	11	14	17	20	26	32	38	43	48	56	65	75	81	87	92
Turned coupler $ød_M$	12	15	20	22	28	35	42	47	53	63.5	75	87	93	99	104
o	9	11	13.5	16.5	22	27	33.5	37	40.5	49	56.5	65	70	75	80
n	9	9	10	13	15	16	22	25	25	28	30	35	40	45	50
$M_{LH/RH}$	6x0.5	8x1.25	10x1.5	12x1.75	16x2	20x2.5	24x3	27x3	30x3.5	36x4	42x4.5	48x5	52x5	56x5.5	60x5.5
$ø_{jl}$	6.5	6.5	6.5	6.5	6.5	7.5	7.5	9.5	9.5	9.5	9.5	11.5	11.5	11.5	11,5
b_l	5	5	5	5	5	7	7	8	8	8	8	10	10	10	10
r_l	9.3	9.3	9.3	9.3	9.3	11.8	11.8	14.8	14.8	14.8	14.8	17.8	17.8	17.8	17.8
k_M	19	21	23	27.5	33	37	44	50.5	57.5	72	86.5	98.5	111.5	124.5	137
r_M	10	13	17	19	24	30	36	41	46	55	65	75	80	85	90
Connection	RDA6	RDA6	RDA6	RDA6	RDA6	RDA8	RDA8	RDA10	RDA10	RDA10	RDA10	RDA12	RDA12	RDA12	RDA12
Cast coupler S					⊗	⊗	⊗		⊗	⊗					
Turned coupler S	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
Turned coupler E	◯	◯	◯	◯	◯	◯	◯		◯	◯					

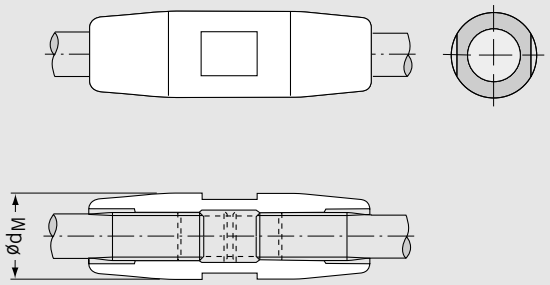
Cast coupler



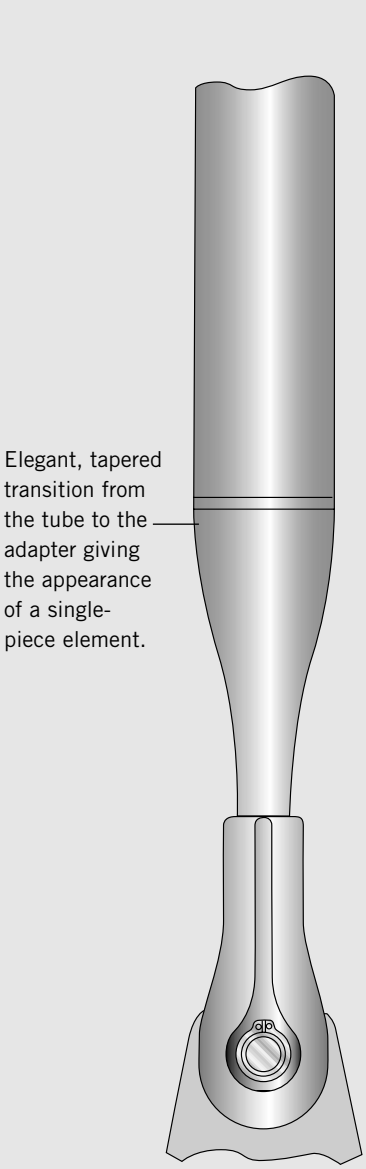


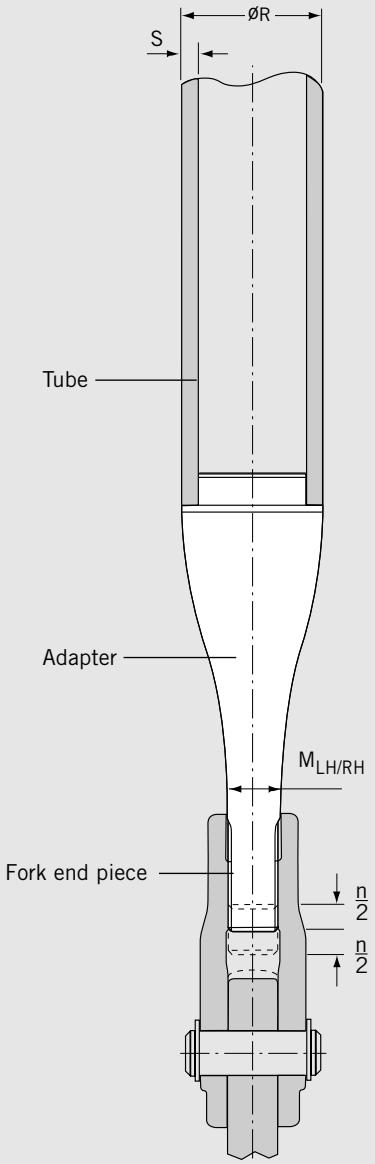
Turned coupler

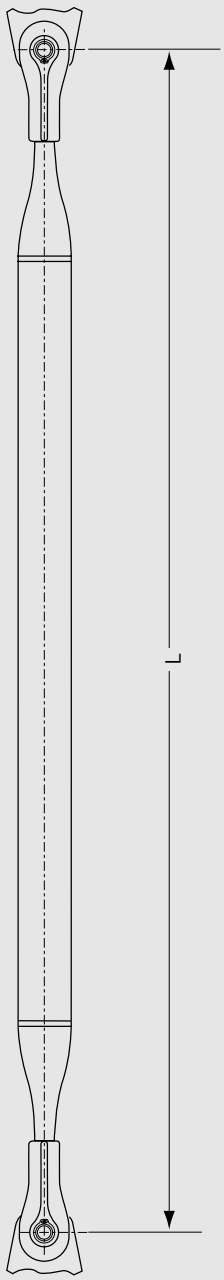




Compression members
Complex structures require compression members as well as tie rods.
RODAN steel adapters provide the perfect connection between the RODAN fork end pieces and the required compression elements. The adapters, which like the tie rods feature a tapered transition, can be inserted via guide pieces in round tube sections defined and dimensioned for the load in question, such that their outside diameters coincide precisely. Following welding and grinding, the resultant appearance harmonises perfectly with the RODAN ties - so giving an elegant yet stable element able to withstand the specified loads.
Attachment to the substructure is usually effected by fork end pieces and connecting bolts.



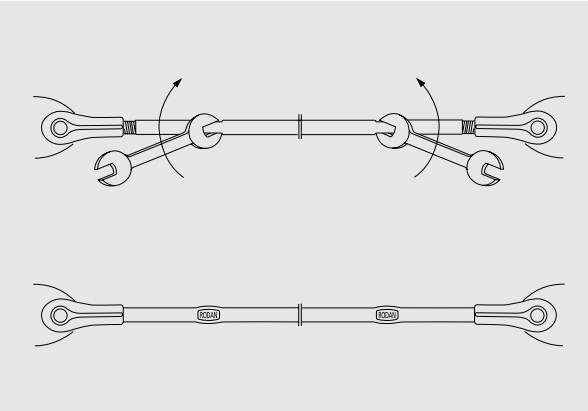




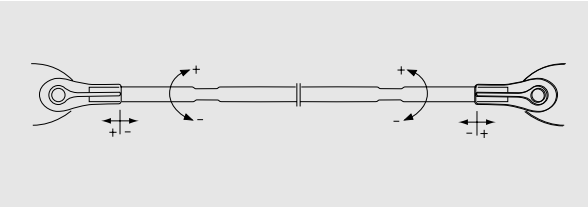
In order to ensure a perfect fit of the adapters, we need the following information from you:
-RDA system size
-Tube diameter øR
-Wall thickness S

Guidelines

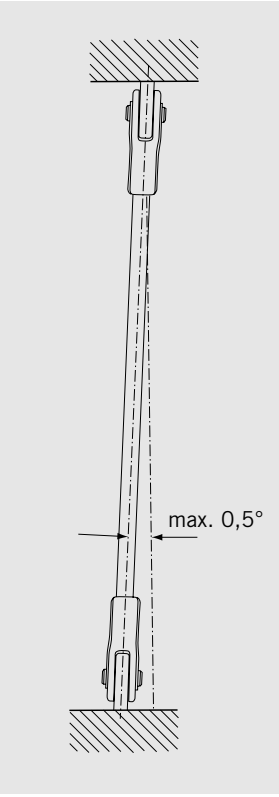
When installing the RODAN ties, ensure compliance with the following safety requirements.
When installing the pins, the supplied circlips should only be mounted onto the pins using circlip pliers of the appropriate size.
When fitting the ties to the system components, ensure that no deformation occurs, e.g. due to an offset between opposing connection plates. Ensure also that there are no inadmissible deflections in the system axes.

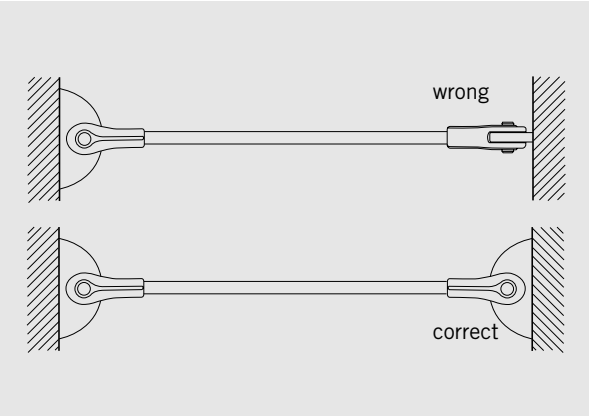


The tie rods should only be tightened using the integral flats provided on the tie rod and an appropriate open-jaw wrench as per the technical description. The tie rods must be screwed down to their minimum fitting depth in the anchor components. This is achieved once the thread at both ends is no longer visible.



If, for installation reasons, plus or minus tolerance compensation is necessary, then the zero position should be marked on the tie rod and the tie rod then wound in up to this mark. The resultant rod elongation must be indicated on ordering.



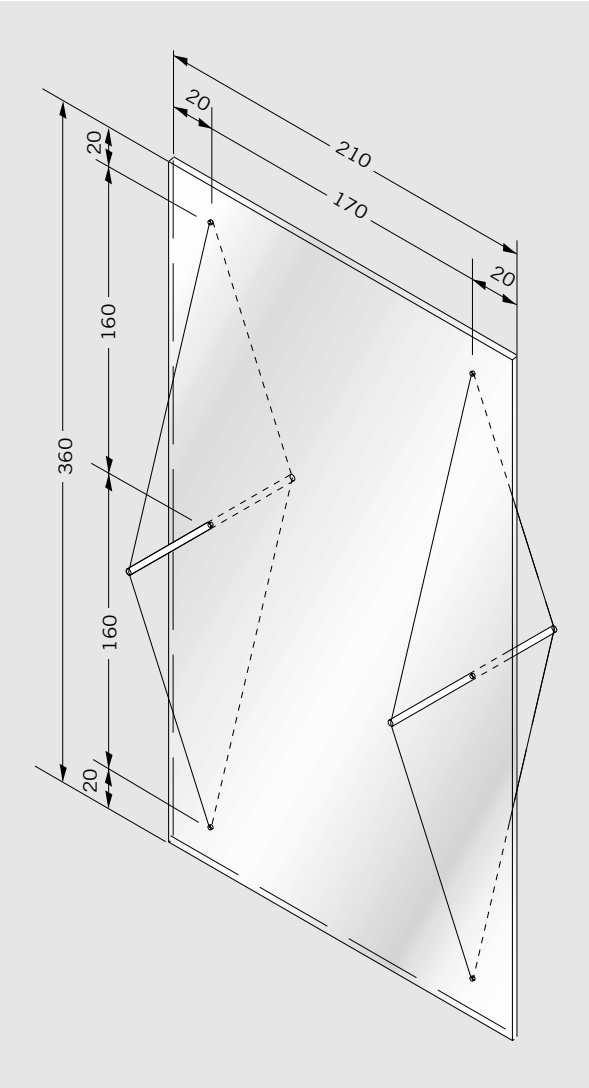


When fitting and installing, ensure that the system ends are able to absorb a bending load in the same direction. Any degree of twist between the two ends can lead to inadmissible loads.

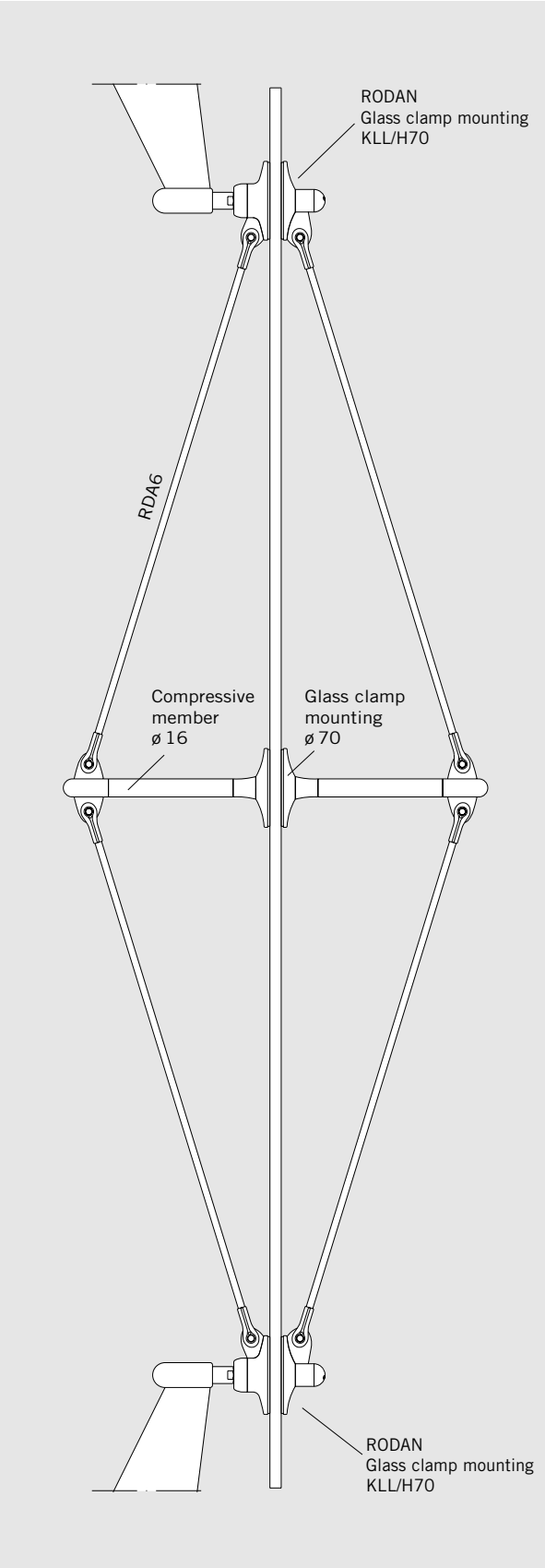
Point-supported roof glazing systems

With this patented system of bottom- and rear-trussed glass panels, transparent and cost-efficient solutions can be implemented for glass façades. The deadweight and wind loads are transmitted via the glass clamp mountings to the substructure.
For float-effect glazing constructions, glass panels provided with bottom or rear trussing with RODAN ties can be used for the load-bearing structure itself.

Indeed, utilising the load-bearing capacity of the glass panel is actually indispensable in the case of structures that are subjected to tensile and compressive loading.
The RODAN glass clamp mountings used are the types featuring welded eyelets for connection to the RODAN tie rods.
The eyelet constitutes a stable and visually unobtrusive mounting for the tie elements.
Glass clamp mountings with welded eyelets on both sides are also available for certain applications.



Sketch of a glass panel trussed on both faces



A pair of compressive members in the middle of a glass panel

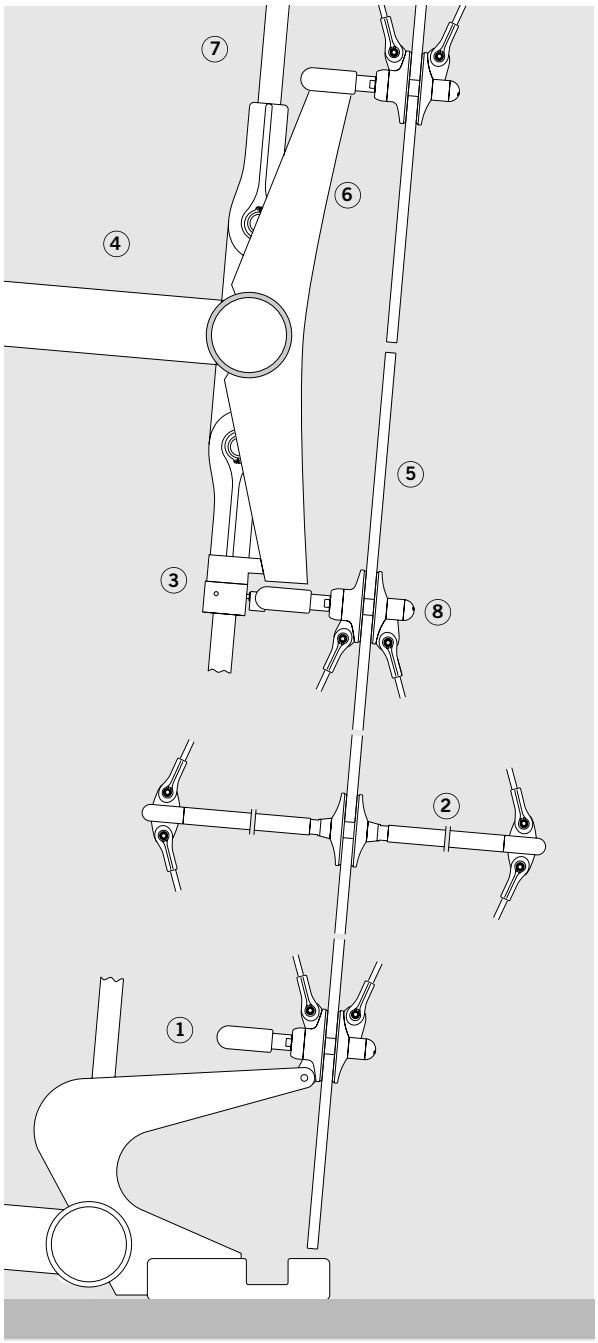
Glass façades in the City Centre of Kirchberg in Luxembourg

The 250 m long and 16.8 m wide shopping mall in Luxembourg's banking district on the Kirchberg plateau lies between two five-storey blocks under a glass canopy roof.
The side buildings are composite structures in steel and concrete with a wide-spanning panel grid of 8.40 x 16.80 m. The design is thus significantly more yielding than encountered in conventional concrete structures with stiffening walls. This "ductile" building complex, which can give rise to deformations in the magnitude of 4 cm at parapet level under the influence of wind and temperature fluctuations, had a decisive influence on the design of the two gable end façades. The original plan provided for toughened safety glass panels measuring 2.10 x 1.80 m and 15 mm thick.

Kirchberg shopping mall in Luxembourg.
Façade of glass and steel

Coordination and site management:
Stefan Jeromin
Design and consultancy:
Robert Danz

However, even at the preliminary dimensioning stage, it became apparent that trussed glass panels would constitute a more cost-effective solution. The panel size could be doubled to 2.10 x 3.60 m, using a toughened safety glass thickness of 10 mm up to a height of 20 m, and a thickness of 12 mm at heights above 20 m. For reasons of the construction sequence, the wind suction loads had to be assumed to be of the same magnitude as the wind pressure forces. This meant that the glass panels had to be trussed on both faces. The horizontal lattice-beam girders which were originally required at intervals of 1.80 m could instead now be installed at double spacing value. RODAN ties were used as they both facilitated erection and provided a more aesthetically stylish solution. With these ties it was possible to compensate for tolerances and deformations at every stage of installation by simply modifying the rod tensions via their screwed fittings.



The deadweight and wind loads are transmitted to the substructure via four RODAN glass clamp mountings per panel. The compression members used are manufactured from A4 stainless steel tubes, diameter 14/2, with laser-welded lugs for fitting tie rods of A4 stainless steel, diameter 5 mm, featuring a precision-rolled thread.

1 Pivot bearing for collapsible leaf
2 Compressive member for straddling
3 Chain drive
4 Compressive member
5 Collapsible leaf
6 V2A-fork
7 Main hanger with RODAN-anchor 22
8 RODAN glass clamp mounting with anchor for trussed glass panel

Glass roof for Juval Castle in southern Tyrol

The shape of the roof extensively matches that of the original structure. With an overhang of 25-40 cm beyond the ruins of the masonry walls and just a few bearing points on the gable wall, the glass roof appears to float above the castle structure.

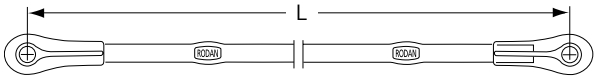
The dimensioning and design of the steel and glass construction were based on a static analysis prepared in accordance with the relevant building regulations.
A network of ties in the roof plane was deemed unnecessary as the plate effect of the glass panels ensures sufficient stiffness.
The glass panels are laid in the direction of the roof slope and arranged with tile-like overlap joints in the axis of the steel girders.
As the plan of the roof area is trapezoidal, the glass panels were divided between the lines of a radial grid. This means that there are no identical glass panels anywhere in the roof system.
In order to avoid errors during the planning and production phases, all the data were determined by CAD.
The dimensioning of the glass panels and the steel girders is based on a design load of 185 kg/m^2 to allow for snow plus deadweight.
Laminated safety glass was used comprising 2 x 8 mm toughened safety glass sheets with a 1.56 mm PVB film interlayer.
With RODAN glass clamp mountings, the glass panels are provided with a statically defined bearing system and can be installed as stress-free elements. The glass clamp mountings allow tolerance equalisation during installation in the x, y and z directions. Corner rotation is also accommodated by ball-and-socket articulated joints.
The larger drilled hole in the glass panel is sealed after installation with a defined two-pack epoxy resin in order to produce a combined positive and frictional lock between the glass panel and mounting.

Juval Castle in southern Tyrol · Owner: Reinhold Messner, Meran
Design and construction: Robert Danz Dipl.-Ing., architect and structural engineer, Schönaich

☐ Enquiry ☐ Order

Sender's address/Stamp	Delivery address

Contact name/Phone extension	Purchase order number



The system length L is measured from the pin centres and indicated in mm.

Maximum system length

	ø 6 - 12 mm	ø 16 - 56 mm	ø 5 - 24 mm
Zinc electroplated	up to 3 m	up to 3 m	—
Non-galvanised	up to 6 m	up to 12 m	—
Hot-dip galvanised	up to 6 m	up to 12 m	—
Stainless steel	—	—	up to 3 m

	1. Material	2. RODAN size			3. System parts			4. Surface
Ordering example	S	1	6	—	0	0	—	3

Article number system

1. S = Standard, E = Stainless steel

2. RODAN sizes
RDA = 06, 08, 10, 12, 16, 20, 24, 27, 30, 36, 42, 48, 52, 56

3. 00 = RODAN tie rod system complete (rod, fork end pieces, pin, circlips)
10 = RODAN fork end piece with left hand thread including pin and circlips
20 = RODAN fork end piece with right hand thread including pin and circlips
30 = RODAN pin
40 = RODAN circlip
50 = RODAN tie rod with left hand and right hand threads
60 = RODAN cast hub
65 = RODAN turned hub
70 = RODAN coupler with cast-integral lug
75 = RODAN coupler with turned lug

4. Standard: 1 = non-galvanised, 2 = zinc electroplated, 3 = hot-dip galvanised
Stainless steel: 2 = electro-polished

Item	Article No.								Qty	System length	Price	Delivery time
1				—			—					
2				—			—					
3				—			—					
4				—			—					
5				—			—					
6				—			—					
7				—			—					
8				—			—					
9				—			—					
10				—			—					
11				—			—					
12				—			—					
13				—			—					
14				—			—					
15				—			—					

Date/Signature

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